GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University)
VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A$^+$ Grade

REGULATIONS AND SYLLABUS

OF

B. Tech Computer Science and Engineering with Specialization in
Artificial Intelligence and Machine Learning(AI&ML)
Data Science(DS)
Internet of Things(IoT)
Cyber Security(CS)

(w.e.f. 2020-21 admitted batch)

Vision and Mission of university

Vision

To become a global leader in higher education.

Mission

To impart futuristic and comprehensive education of global standards with high sense of discipline and social relevance in a serene and invigorating environment.

Vision and Mission of the department

Vision

Excel in computer science and engineering education with international standards for global employment and research.

Mission

- *Create an excellent academic ambience that promotes innovation and research.*
- *Impart quality education through well designed curriculum experiential learning in tune with the changing needs of the industry.*
- *Collaborate with world class academic institutions and software industries for mutual benefit.*
- *Produce competent and socially committed graduates having creative skills and ethical values.*

Program Educational Objectives:

The Program Educational Objectives of the B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning) program are:

1. The graduates will show technical expertise in the area of Artificial Intelligence and Machine Learning to pursue a successful yet conscientious career in engineering using AIML.
2. The graduates will exhibit commitment to developing sustainable solutions that satisfy the current societal needs.
3. The graduates will adapt to and aid in technological advances by life-long learning and innovation.

The Program Educational Objectives of the B.Tech. Computer Science and Engineering (Data Science) program are:

1. The graduates will demonstrate proficiency in Data Science leading to successful careers as Data Scientists.
2. The graduates will exhibit commitment to developing sustainable solutions that satisfy the current societal needs.
3. The graduates will adapt to and aid in technological advances by life-long learning and innovation.

The Program Educational Objectives of the B.Tech. Computer Science and Engineering (Cyber Security) program are:

1. The graduates will apply their knowledge and skills to become professionals who secure cyberspace from threats of all kinds.
2. The graduates will exhibit commitment to developing sustainable solutions that satisfy the current societal needs.
3. The graduates will adapt to and aid in technological advances by life-long learning and innovation.

The PEOs of the B.Tech. Computer Science and Engineering(Internet of Things) program are:

1. The graduates will utilize their subject knowledge to pursue a successful career in developing and maintaining the Internet of Things.
2. The graduates will exhibit commitment to developing sustainable solutions that satisfy the current societal needs.
3. The graduates will adapt to and aid in technological advances by life-long learning and innovation.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

Upon successful completion of **B.Tech.(Artificial Intelligence and Machine Learning)** Program, student will be able to:

1. identify, formulate and solve engineering problems to provide efficient solutions.

2. design and develop computer-based applications of varying complexities in emerging areas of Computer Science and Engineering.

3. design and develop intelligent systems to solve real world problems.

Upon successful completion of **B.Tech.(Data Science)** Program, student will be able to:

1. identify, formulate and solve engineering problems to provide efficient solutions.

2. design and develop computer-based applications of varying complexities in emerging areas of Computer Science and Engineering.

3. apply the principles and techniques of mathematical and statistical models for data analysis to extract the insights in supporting business and scientific processes.

Upon successful completion of **B.Tech.(Cyber Security)** Program, student will be able to:

1. identify, formulate and solve engineering problems to provide efficient solutions.

2. design and develop computer-based applications of varying complexities in emerging areas of Computer Science and Engineering.

3. research and design new algorithms for the enhancing the security of the enterprise applications.

Upon successful completion of **B.Tech.(IoT)** Program, student will be able to:

1. identify, formulate and solve engineering problems to provide efficient solutions.
2. design and develop computer-based applications of varying complexities in emerging areas of Computer Science and Engineering.
3. design and devise end-to-end systems in the area of IoT to benefit the environment and the society.

B.Tech

Artificial Intelligence and Machine Learning(AI&ML)

Data Science(DS)

Cyber Security(CS)

Internet of Things(IoT)

REGULATIONS
(w.e.f. 2020-21 admitted batches)

1. ADMISSION

1.1 Admission into B. Tech. in Computer Science and Engineering program with a specialization in Artificial Intelligence and Machine Learning(AI&ML), Data Science(DS), Internet of Things(IoT), Cyber Security(CS) of GITAM (Deemed to be University) is governed by GITAM admission regulations.

2. ELIGIBILITY CRITERIA

2.1 A first class in 10+2 or equivalent examination approved by GITAM (Deemed to be University) with subjects Physics, Chemistry and Mathematics.

2.2 Admission into B.Tech. will be based on an All India Entrance Test (GITAM Admission Test - GAT) conducted by GITAM/Specified rank holders of JEE mains/EAMCET(AP & TS) are considered. For Bengaluru CET and COMEDK instead of EAMCET (AP & TS) are considered. The rules of reservation of statutory bodies, wherever applicable, will be followed.

3. CHOICE BASED CREDIT SYSTEM

3.1 Choice Based Credit System (CBCS) was introduced with effect from the academic year of 2015-16 admitted batch and revised in 2019-20 academic year, based on guidelines of the statutory bodies in order to promote:

- Activity-based learning
- Student-centric learning
- Cafeteria approach
- Learning at their own pace
- Interdisciplinary learning

3.2 Course Objectives, Learning Outcomes, and Course Outcomes are specified, focusing on what a student should be able to do at the end of the course and program.

4. STRUCTURE OF THE PROGRAM

4.1 The Program consists of courses based on humanities and social sciences, basic sciences, basic engineering, program core, program electives, open electives, interdisciplinary electives, industry internship, laboratory, mandatory courses, and project work.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses	Basic Sciences	Mathematics, physics, chemistry and life sciences.
		Engineering Sciences	Fundamental engineering Courses
		Humanities and Social Sciences	Related to English, humanities, social sciences, and management
2	Core Courses	Program Core	Branch specific and mandatory core courses
3	Elective Courses	Program Electives	Supportive to the discipline with expanded scope in a chosen track of specialization or cross-track courses
		Interdisciplinary Electives	Interdisciplinary exposure to nurture the interest of a student in other department courses
		Open Electives	Common to all disciplines that nurtures general interest of a student
4	Core Activities	Project Work	University or industry
		Internship	Training in industry or research organization
5	Mandatory Courses		Non-credit mandatory courses on Induction Program, Environmental Sciences, Indian Constitution, Essence of Indian Traditional Knowledge.

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week.

- One credit for each Lecture/Tutorial hour per week.
- One credit for two hours of Practical's per week.

5. MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6. REGISTRATION

Every student has to register for the courses in each semester at the time specified in the academic calendar.

7. ATTENDANCE REQUIREMENTS

7.1 A student whose attendance is less than 85% in all the courses put together in any semester will not be permitted to attend the end semester examination and will not be allowed to register for the subsequent semesterof study. He/she has to repeat the same semester along with his/her juniors.

7.2 However, the Vice-Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance of the students whose attendance is between 75% and 84% on medical grounds and on payment of prescribed fee.

8. EVALUATION

8.1 Assessment of the performance of a student in theory courses shall be based on two components: Continuous Evaluation (40 marks) and Semester-end Examination (60 marks).

8.2 A candidate has to secure a minimum of 40% in any theory course in the two components (ref 8.1) put together to be declared to have passed the course, subject to the condition that the student must have secured a minimum of 24 marks out of 60 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical courses are assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure pass grade.

8.4 For courses having both theory and practical components, 70% of the weightage will be given for theory component and 30% weightage for practical component. The student has to acquire 40% in the semester end theory examination. However, student must have secured overall 40% (Theory + Practical) to secure pass grade.

8.5 Project Work/ Industrial internship courses are assessed under continuous evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure pass grade.

8.6 Mandatory courses are assessed for PASS or FAIL only. No credits will be assigned to these courses. If a student secures more than 40 out of 100 marks, he / she will be declared PASS, else FAIL. PASS grade is necessary to be eligible to get the degree.

8.7 Mandatory courses Induction Program/Environmental Sciences/Indian Constitution/Essence of Indian Traditional Knowledge are assessed for satisfactory or not satisfactory only. No grade will be assigned. A student has to undergo two hours training per week in any one of the above in both I and II semesters and should obtain satisfactory grade to be eligible to get degree.

The details of Assessment Procedure are furnished in Table 1.

Table 1: Assessment Procedure

S.No	**Component of Assessment**	**Types of Assessment**	**Marks Allotted**	**Scheme of Evaluation**
1	Theory courses	Continuous Evaluation	40	(i) Thirty (30) marks for mid semester examinations. Three mid examinations shall be conducted for 15 marks each; performance in best two shall be taken into consideration. ii) Ten (10) marks for Quizzes, Assignments and Presentations.
		Semester End Examinations	60	Sixty (60) marks for semester-end Examinations.
		Total	100	
2	Practical courses	Continuous Evaluation	100	(i) Fifty (50) marks for regularity and performance, records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the semester. ii) Ten (10) marks for case studies. iii) Forty (40) marks for two tests of 20 marks each (one at the mid-term and the other towards the end of the semester) conducted by the concerned lab teacher.

3	Theory and Practical combined courses	(a) Theory component: continuous evaluation and semester end examination. (b)Practical component: continuous evaluation Total	100 100 200	70% of the weightage will be given for theory component. Evaluation for theory component shall be same as S. No 1 as above. 30% weightage for practical components. Evaluation for practical component shall be same as S. No 2 as above
4	Project work (VII & VIII Semesters)	Continuous Evaluation	100	i) Forty (40) marks for periodic evaluation on originality, innovation, sincerity and progress of the work assessed by the project supervisor. ii) Thirty (30) marks for mid-term evaluation by a panel of examiners. iii) Thirty (30) marks for final report, presentation and Viva-voce by a panel of examiners.
5	Industrial Internship (VI&VII Semester)	Continuous Evaluation	100	i) Thirty (30) marks for performance assessed by the Supervisor of the host Industry/ Organization. Submission of Project Completion Certificate from host organization is mandatory. ii) Forty (40) marks for Report and Seminar presentation on the training, assessed by the Teacher Coordinator.

				iii) Thirty (30) marks for presentation on the training, before a panel of examiners.
6	Mandatory Courses	Continuous Evaluation	100	Sixty (60) marks for midterm semester examinations. Three midterm examinations shall be conducted for 30 marks each; performance in best two shall be taken into consideration. Forty (40) marks for Quizzes, Assignments and Presentations.

*Disclaimer: The Scheme of Evaluation and consideration of the performance for mid examinations may vary, and the variations if any would be announced during the semester.

9. RETOTALING & REVALUATION

9.1 Retotaling / revaluation of any theory answer script of the semester-end examination is permitted on request by a student by paying the prescribed fee within one week after the announcement of the results.

9.2 Revaluation of the theory answer scripts of the semester-end examination is permitted on request by student by paying the prescribed fee within one week after the announcement of the results.

9.3 A student who has secured ‘F’ grade in a theory course shall have to reappear at the subsequent examination held in that course. A student who has secured ‘F’ grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

9.4 A student who has secured ‘F’ grade in a practical course shall have to attend special instruction classes held during summer.

9.5 A candidate who has secured ‘F’ grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examinations held in that course. A student who has secured ‘F’ grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

9.6 A student who has secured ‘F’ Grade in project work / Industrial Training shall be permitted to submit the report only after satisfactory completion of the work and viva-voce examination.

10. PROVISION FOR VERIFICATION OF ANSWER BOOK AND CHALLENGE EVALUATION

10.1 If a student is not satisfied with his/her grade after revaluation, the student can apply for verification of answer book on payment of the prescribed fee for each course within one week after the announcement of revaluation results.

10.2 After verification, if a student is not satisfied with revaluation marks/grade, he/she can apply for challenge valuation within one week after announcement of answer book verification result or two weeks after the announcement of revaluation results, which will be valued by the two examiners i.e., one Internal and one External examiner on payment of prescribed fee. The challenge valuation fee will be refunded, if the student is successful in the appeal by securing a better grade.

11. SUPPLEMENTARYAND SPECIAL EXAMINATIONS

11.1 The odd (I, III, V, VII) semester supplementary examinations will be conducted after conducting regular even semester examinations during April/May.

11.2 The even (II, IV, VI, VIII) semester supplementary examinations will be conducted after conducting regular odd semester examinations during October/November.

11.3 A student who has completed period of study and still has "F" grade in final semester courses is eligible to appear for special examination.

12. PROMOTION TO THE NEXT YEAR OF STUDY

12.1 A student shall be promoted to the next academic year only if he/she passes60% of the credits till that academic year.

12.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new syllabus and regulations after detention as per the equivalency established by the BoS to continue his/her further studies.

13. MASSIVE OPEN ONLINE COURSES

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (MOOCs) during the period of study. Students without any backlog courses upto fourth semester are permitted to register for MOOCs from fifth semester onwards up to a maximum of 15 credits from program elective/ interdisciplinary elective/ open elective courses. However the Departmental Committee (DC) of the respective campuses has to approve the courses under MOOCs. The grade equivalency for these courseswill be decided by the respective Board of Studies (BoS).

14. ELIGIBILITY FOR AWARD OF THE B. Tech. DEGREE

14.1 The curriculum of the eight semesters B.Tech. program is designed to have a total of 162 credits for the award of B.Tech. degree.

14.2 Duration of the program: A student is ordinarily expected to complete the B. Tech program in eight semesters of four years. However, a student may complete the program in not more than eight years including study period.

14.3 However, the above regulation may be relaxed by the Vice- Chancellor in individual cases for cogent and sufficient reasons.

14.4 A student shall be eligible for award of the B.Tech. Degree if he / she fulfils the following conditions:

i) Registered and successfully completed all the courses and project as per the curriculum.

ii) Successfully acquired the minimum required credits as specified in the curriculum in the branch of his/her study within the stipulated time.

iii) Has no dues to the Institute, Hostels, Libraries, NCC/NSS etc., and no disciplinary action is pending.

15. B. Tech (HONORS)

A student who secured 8.0 CGPA or above up to IV semester is eligible to register for B. Tech (Honors) degree. The student has to complete additional 20 credits (six theory courses + seminar) as approved by the respective DC to secure B. Tech (Honors). The courses will be approved by DC of respective campuses.

16 GRADING SYSTEM

16.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

Table 2: Grades and Grade Points

S.No.	Grade	Grade Points	Absolute Marks
1	O (Outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab. (Absent)	0	-

16.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, subject to securing CGPA of 5.0 at the end of the program to declare pass in the B. Tech program.

17. GRADE POINT AVERAGE

17.1 A Grade Point Average (GPA) for a semester is calculated as follows:

$$GPA = \frac{\Sigma[\, C^* G \,]}{\Sigma\, C}$$

where,

C = number of credits for the course.

G =grade points obtained by the student in the course.

17.2 The Cumulative Grade Point Average (CGPA), is calculated using the above formula considering the grades obtained in all the courses, in all the semesters up to that particular semester, in all the semesters upto that particular semester.

17.3 CGPA required for classification of class after the successful completion of the

program is shown in Table 3.

Table 3: CGPA required for award of Class

Class	CGPA Required
First Class with Distinction	$\geq$8.0*
First Class	$\geq$ 6.5
Second Class	$\geq$ 5.5
Pass Class	$\geq$ 5.0

* In addition to the required CGPA of 8.0 or more, the student must have necessarilypassed all the courses in the first attempt.

18. BETTERMENT OF GRADES

18.1 A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations for only upto eight theory courses of his/her choice, conducted in summer vacation along with the special examinations.

18.2 Betterment of Grades is permitted ‘only once’, immediately after completion of the program of study.

19. DISCRETIONARY POWER

Notwithstanding anything contained in the above sections, the Vice-Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

Department of Computer Science and Engineering(CSE)

Common Structure for CSE Specializations (AI&ML, DS, IoT, CS)

(Effective from the academic year 2019-20 admitted batch)

Semester I

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA101	Engineering Mathematics I (Calculus and Algebra)	BS	3	0	0	0	3	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2	0	3	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics / Engineering Chemistry	BS/BS	3	0	3	0	4.5	Common to all
4.	19EID131	Problem Solving and Programming	ES	3	1	3	0	5.5	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES/ES	0/1	0	3	0	1.5/2.5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/National Cadet Corps/National Sports Organization/YOGA	MC	0	0	2	0	0	Common to all
7.	VDC111	Venture Discovery	PW	0	0	4	0	2	Common to all
						Total		**19.5/20.5**	

Semester II

S. No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	0	3	Common with CSE
2.	19EID134/ 19EID234	AI Tools/ Life Sciences for Engineers	ES/BS	2	0	2	0	3	Common to all
3.	19ECY131/ 19EPH131	Engineering Chemistry / Engineering Physics	BS	3	0	3	0	4.5	Common to CSE/ECE/EEE
4.	19EEE131	Basic Electrical and Electronics Engineering	ES	3	1	3	0	5.5	Common to all
5.	19EME131/ 19EME121	Engineering Graphics / Workshop	ES	1/0	0	3	0	2.5/ 1.5	Common to all
6.	19ECS134	Data Structures with Python	PC	2	0	3	0	3.5	Common with CSE
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/National Cadet Corps/National Sports Organization/YOGA	MC	0	0	2	0	0	Common to all
8.	19EHS122	Comprehensive Skill Development I	HS	0	0	0	6	1	Common to all
						Total	**23/22**		

Semester III

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA205	Engineering Mathematics III (Discrete Mathematical Structures)	BS	3	0	0	0	3	Common with CSE
2.	19EID234/ 19EID134	Life Sciences for Engineers/AI tools	BS/ES	2	0	2	0	3	Common to all
3.	19EID132	Design Thinking	ES	2	0	2	0	3	Common to all
4.	19ECS201	Fundamentals of Digital Logic Circuits	PC	3	0	0	0	3	Common with CSE
5.	19ECS231	Object Oriented Programming Through Java	PC	2	0	3	0	3.5	Common with CSE
6.	19ECS203	Data Communications	PC	2	0	0	0	2	Common with CSE
7.	19ECS221	Computer Engineering Workshop	PC	0	0	4	0	2	Common with CSE
8.	19EMC281/ 19EMC282	Constitution of India/ Environmental Sciences	MC	3	0	0	0	0	Common to all
9.	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	Common to all
						Total	20.5		

Semester IV

S.No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EMA212	Engineering Mathematics IV (Differential equations)	BS	3	0	0	0	3	AI&ML
	19EMA206	Engineering Mathematics IV (Number Theory and its Applications)	BS	3	0	0	0	3	CS
	19EMA214/ 19EMA216	Engineering Mathematics IV (Descriptive Statistics/ Applied Statistics)	BS	3	0	0	0	3	DS/IoT
2	19EID232	Internet of Things	ES	2	0	2	0	3	Common to all
3	19ECS202	Computer Organization and Architecture	PC	3	0	0	0	3	Common with CSE
4.	19ECS204	Operating Systems	PC	3	0	0	0	3	Common with CSE
5.	19ECS232	Computer Networks	PC	3	0	2	0	4	Common with CSE
6.	19EAI232	Introduction to Artificial Intelligence and its Applications	PC	3	0	2	0	4	Common to AI&ML/ CS/ DS
	19EIO232	Sensor Technology and Instrumentation	PC	3	0	2	0	4	IoT
7.	19EMC282/ 19EMC281	Environmental Sciences / Constitution of India	MC	3	0	0	0	0	Common to all
8.	19ECS292	Comprehensive Skill Development III	PW	0	0	0	6	1	Common to all
						Total		**21**	

Semester V

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECS333	Database Management Systems	PC	3	0	2	0	4	Common with CSE
2.	19EAI331	Artificial Neural Networks	PC	2	0	2	0	3	AI&ML/DS
	19ECS305	Cryptography and Network Security	PC	3	0	0	0	3	CSE /CS
	19EIO331	Interfacing through Microprocessors & Microcontrollers	PC	2	0	2	0	3	IoT
3.	19ECS234	Design and Analysis of Algorithms	PC	3	0	2	0	4	Common with CSE
4.	19ECS3XX/ 19EAI3XX/ 19ECF3XX/ 19EDS3XX/ 19EIO3XX	Program Elective I	PE	2	0	2	0	3	Program Specific
5.	19EOE3XX	Open Elective I	OE	3	0	0	0	3	Common to all
6.	19EID3XX	Interdisciplinary Elective I	ID	x	x	x	x	3	
7.	19ECS391	Comprehensive Skill Development IV	PW	0	0	0	6	1	Common to all
						Total	21		

Semester VI

S.No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EAI332	Automata Theory and Compiler Design	PC	3	1	0	0	4	Common for AI&ML/ CS/ DS/ IoT
2	19EAI334	OOSE based Application Development	PC	2	0	2	0	3	Common for AI&ML/ CS/ DS/ IoT
3	19EAI336	Machine Learning and its Applications	PC	3	0	2	0	4	AI&ML
	19ECF332	Ethical Hacking	PC	3	0	2	0	4	CS
	19EDS332	Data Visualization And Exploration with R	PC	3	0	2	0	4	DS
	19EIO332	Wireless Sensor Networks	PC	3	0	2	0	4	IoT
4	19ECS3XX/ 19EAI3XX/ 19ECF3XX/ 19EDS3XX/ 19EIO3XX	Program Elective II	PE	2	0	2	0	3	Program Specific
5	19EOE3XX	Open Elective II	OE	3	0	0	0	3	Common to all
6	19EHS302	Engineering Economics and Management	HS	3	0	0	0	3	Common with CSE
7	19EMC382	Engineering Ethics	MC	3	0	0	0	0	Mandatory Course
8	19ECS392	Comprehensive Skill Development V	PW	0	0	0	6	1	Department Specific
9	HSMCH102	Universal Human Values: Understanding Harmony	HS	2	1	0	0	3	Common to all
Total							**24**		

Semester VII

S. No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EAI431	Deep Learning	PC	3	0	2	0	4	Common to AI&ML/ DS
	19ECF431	Digital Forensics	PC	3	1	0	0	4	CS
	19EIO431	Embedded Systems and its Applications	PC	3	0	2	0	4	IoT
2	19EAI433	Big Data Analytics	PC	3	0	2	0	4	Common to AI&ML/DS
	19ECF433	Mobile Application Security	PC	3	1	0	0	4	CS
	19EIO433	Cloud Based IoT	PC	3	0	2	0	4	IoT
3	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective III	PE	2	0	2	0	3	Program Specific
4	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective IV	PE	2	0	2	0	3	Program Specific
5	19EHS403	HS-II(Organizational Behavior)	HS	3	0	0	0	3	
6	19ECS491	Project Phase I	PW	0	0	2	0	1	Common with CSE
7	19ECS493	Industrial Training/Internship/ Research Projects in National Laboratories/ Academic Institutions	PW	0	0	0	0	1	Common with CSE
8	19ECS495	Comprehensive Skill Development VI	PW	0	0	0	6	1	Department Specific
						Total	20		

Semester VIII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EID4XX	Interdisciplinary Elective II	ID	x	x	x	x	3	
2.	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective V	PE	2	0	2	0	3	Program Specific
3.	19ECS492	Project Phase II	PW	0	0	12	0	6	Common with CSE
4.	GSS115	Gandhi for the 21st Century	HS	0	0	0	0	1	Online Course
							Total	**13**	

Total Number of Credits distribution

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	**19.5/ 20.5**	**23/22**	**20.5**	**21**	**21**	**24**	**20**	**13**	**162**

Category wise and Credits distribution

Category	Code	Courses	Credits GITAM	Credits suggested by AICTE
Humanities & Social Sciences	HS	Communicative English	**12**	**12**
		HS1 and HS2 (elective)		
		Gandhi for the 21st Century		
		Comprehensive Skill Development I		
		Comprehensive Skill Development II		
Basic Sciences	BS	Engineering Physics	**24**	**25**
		Engineering Chemistry		
		Mathematics (4 Courses)		
		Life Sciences for Engineers		
Engineering Sciences	ES	Problem Solving and Programming	**24**	**24**
		Basic Electrical and Electronics Engineering		
		AI Tools		
		Engineering Graphics		
		Workshop		
		Design Thinking		
		Internet of Things		
Open Electives	OE	OE1, OE2	**6**	**18**
Interdisciplinary Electives	ID	ID1, ID2	**6**	
Program Electives	PE	PE1 – PE5	**15**	**18**
Program Core	PC	PC1 – PC17	**61**	**48**
Project	PW	Venture Discovery		
		Internship	**14**	**15**
		Project Phase I		
		Project Phase II		
		Comprehensive Skill Development III		
		Comprehensive Skill Development IV		
		Comprehensive Skill Development V		
		Comprehensive Skill Development VI		
Mandatory	MC	Environmental Science, Constitution of India, Engineering Ethics	**-**	**-**
Total			**162**	**160**

Engineering Mathematics II

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA102	Engineering Mathematics II (ODE, PDE and Multivariable Calculus)	BS	3	0	0	3	Offered for ECE, EEE,MEand CE
2.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	3	Common with CSE
3.	19EMA106	Mathematics for Biotechnology II	BS	3	0	0	3	Offered for BT

Engineering Mathematics III

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA201	Engineering Mathematics III (Applications of PDE, Complex Variables and Transform Techniques)	BS	3	0	0	3	Offered for ME and CE
2.	19EMA203	Engineering Mathematics III (Complex Variables and Transform Techniques)	BS	3	0	0	3	Offered for ECE and EEE
3.	19EMA205	Engineering Mathematics III (Discrete Mathematical Structures)	BS	3	0	0	3	Common with CSE
4.	19EMA207	Mathematics for Biotechnology III	BS	3	0	0	3	Offered for BT

Engineering Mathematics IV

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA202/ 19EMA104	Engineering Mathematics IV (Numerical Methods/ Probability and Statistics)	BS	3	0	0	3	Offered for CE/ME/ EEE
2.	19EMA204	Engineering Mathematics IV (Probability Theory and Random Process)	BS	3	0	0	3	Offered for ECE
3.	19EMA206/ 19EMA210/ 19EMA212	Engineering Mathematics IV (Number Theory and Applications/ Numerical Methods/ Differential Equations)	BS	3	0	0	3	Offered for CS/ CSE / AI&ML
4.	19EMA208	Mathematics for Biotechnology IV	BS	3	0	0	3	Offered for BT
5.	19EMA214/ 19EMA216	Engineering Mathematics IV (Descriptive Statistics/Applied Statistics)	BS	3	0	0	3	Offered for DS/IoT

Engineering Physics

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EPH131	Engineering Physics	BS	3	0	3	4.5	Offered for ECE/CSE/ AI&ML/ CS/ DS/ IoT/ EEE
2.	19EPH133	Applied Physics	BS	3	0	3	4.5	Offered for AE, CE and ME
3.	19EPH135	Physics for Biotechnology	BS	3	0	3	4.5	Offered for BT

Engineering Chemistry

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19ECY131	Engineering Chemistry	BS	3	0	3	4.5	Offered for ECE/ CSE/ AI&ML/ CS/ DS/ IoT/ EEE
2.	19ECY133	Chemistry of materials	BS	3	0	3	4.5	Offered for AE, CE and ME
3.	19ECY135	Chemistry for Biotechnology	BS	3	0	3	4.5	Offered for BT

OPEN ELECTIVES

Open Elective I

S.No.	Course Code	Course Title	Category	L	T	P	C
1	19EOE301	Japanese for Beginners	OE	3	0	0	3
2	19EOE303	French for Beginners	OE	3	0	0	3
3	19EOE305	Biotechnology and Society	OE	3	0	0	3
4	19EOE307	Contemporary Relevance of Indian Epics	OE	3	0	0	3
5	19EOE309	Indian National Movement	OE	3	0	0	3
6	19EOE313	Personality Development	OE	3	0	0	3
7	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
8	19MOE303	Introduction to International Business	OE	3	0	0	3
9	19EOE319	Introduction to Music	OE	3	0	0	3
10	19EOE321	Environment and Ecology	OE	3	0	0	3
11	19EOE323	Indian History	OE	3	0	0	3
12	19EOE327	Professional Communication	OE	3	0	0	3
13	GEL244	English for Higher Education	OE	3	0	0	3
14	19EOE224	Virtual Reality	OE	1	0	4	3
15	GEL345	Work Place Communication – Basic	OE	3	0	0	3

Open Elective II

S.No.	Course Code	Course Title	Category	L	T	P	C
1	19EOE302	German for Beginners	OE	3	0	0	3
2	19EOE304	Chinese for Beginners	OE	3	0	0	3
3	19EOE306	Analytical Essay Writing	OE	3	0	0	3
4	19EOE308	Indian Economy	OE	3	0	0	3
5	19EOE310	Public Administration	OE	3	0	0	3
6	19EOE312	Environmental Management	OE	3	0	0	3
7	19EOE327	Professional Communication	OE	3	0	0	3
8	19MOE301	Basics of Finance	OE	3	0	0	3
9	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
10	19EOE313	Personality Development	OE	3	0	0	3
11	19MOE305	Basics of Marketing	OE	3	0	0	3
12	GEL347	Work Place Communication - Advanced	OE	3	0	0	3

PROGRAM ELECTIVES

Program Elective- I

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19ECS343/ 19EDS345	Advanced Data Structures for Machine Learning/ Soft Computing	PE	2	0	2	3
2	Cyber Security	19ECF341/ 19ECS345	Operating System Security/ Advanced Computer Networks	PE	2	1	0	3
3	Data Science	19EDS343/ 19EDS345	E-Commerce / Soft Computing	PE	2 2	1 0	0 2	3 3
4	IoT	19ECS362/ 19EIO341	Cloud Computing/ Software Defined Networks	PE	2	1	0	3

Note: The faculty has to design the activity for each Program Elective.

Program Elective- II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19ECS342	Data Warehousing and Data Mining	PE	2	0	2	3
2	Cyber Security	19ECF342/ 19ECF344/ 19ECF346	Web Application Security/ Malware Analysis and Reverse Engineering/ Security for Cyber Physical Systems	PE	2	1	0	3
3	Data Science	19EDS342	Data Analytics with Tableau	PE	2	0	2	3
4	IoT	19EIO342/ 19EIO344	IoT Architectures and protocols/ Energy Management for IoT devices	PE	2	0	2	3

Note: The faculty has to design the activity for each Program Elective.

Program Elective- III

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19EAI441	Web Mining	PE	2	0	2	3
2	Cyber Security	19ECF441/ 19ECF443/ 19ECF445	Cloud Security/ IoT Security/ Android Security Internals	PE	2	1	0	3
3	Data Science	19ECS362/ 19EDS441/ 19ECS459	Cloud Computing/ Health Analytics/ Block Chain Technology	PE	2 2 2	1 1 1	0 0 0	3 3 3
4	IoT	19EIO441/ 19EIO443	IoT for Industries/ IoT Technologies and Applications	PE	2	0	2	3

Note: The faculty has to design the activity for each Program Elective.

Program Elective- IV

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19ECS443/ 19ECS352	Natural Language Processing/ Image Processing	PE	2	0	2	3
2	Cyber Security	19ECF447/ 19ECF449/ 19ECS459	Intrusion Detection and Prevention Systems/ Threat Intelligence/ Block Chain Technology	PE	2	1	0	3
3	Data Science	19ECS441/ 19ECS443	Information Retrieval Systems/ Natural Language Processing	PE	2	0	2	3
4	IoT	19ECS344/ 19EIO442	Machine Learning/ Edge Computing/	PE	2 2	0 1	2 0	3 3

Note: The faculty has to design the activity for each Program Elective.

Program Elective- V

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19EAI442	Computer Vision	PE	2	1	0	3
2	Cyber Security	19ECS344/ 19ECF446/ 19ECF448	Machine Learning/ Cyber Law and IT Protection/ Fundamentals of IOS Security	PE	2 2 2	0 1 1	2 0 0	3 3 3
3	Data Science	19EDS442/ 19ECF444	Social Media Analytics/ Financial Analytics	PE	2	0	2	3
4	IoT	19ECF443/ 19EIO444	IoT Security/ Communication and Network Technologies in IoT	PE	2	1	0	3

Note: The faculty has to design the activity for each Program Elective.

INTERDISCIPLINARY ELECTIVES

Interdisciplinary Elective I

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EEC371	Fundamentals of Communication Systems	ID	2	1	0	3
2		19EEI371	Sensors and Signal Conditioning	ID	2	1	0	3
3	Basic Science Courses	19ECY371	Applications of Chemistry in Electronics	ID	2	1	0	3
4	Management Courses	19EHS405	Operations Research	ID	2	1	0	3
5		19EME371	Quantitative Techniques for Management	ID	2	1	0	3
6		19ECE371	Disaster Management	ID	2	1	0	3

Interdisciplinary Elective II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EEC475	Microcontrollers and Interfacing	ID	2	1	0	3
2		19EEI471	Robotics & Automation	ID	2	1	0	3
3		19EEC473	Fundamentals of Digital Signal Processing	ID	2	1	0	3
4		19EBT473	Introduction To Bioinformatics	ID	2	1	0	3
5	Basic Science Courses	19EPH471	Quantum Computing	ID	2	1	0	3
6	Managem ent Courses	19EME456	Optimization Techniques	ID	2	1	0	3

19EMA101: ENGINEERING MATHEMATICS I

(CALCULUS AND ALGEBRA)

(Common to all branches of Engineering except Biotechnology)

L	T	P	C
3	0	0	3

This course is designed for the students of all B.Tech programmes except for Biotechnology as a prerequisite for the core programme. The course imparts concepts of calculus and matrix algebra that are essential in applications in solving engineering problems.

Course Objectives:

- Tofamiliarizethestudentswiththetheoryofmatricesandquadraticforms.
- To explain the series expansions using mean value theorems.
- To teach basic concepts of partial derivatives.
- To explain the evaluation of double integrals and its applications.
- To demonstrate the evaluation and applications of triple integrals.

UNIT I:Matrices 10 L

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous linear equations, eigen values, eigenvectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Learning Outcomes:

After completion of this unit, the student will be able to

- solve system of homogeneous and non-homogeneous linear equations (L3)
- find the eigenvalues and eigenvectors of a matrix(L3)
- identify special properties of a matrix(L3)

UNIT II: MeanValueTheorems 6 L

Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof).

Learning Outcomes:

After completion of this unit, the student will be able to

- demonstrate the given function as series of Taylor's and Maclaurin's with remainders (L2)
- illustrate series expansions of functions using mean value theorems (L2)

UNIT III: Multivariable Calculus 8 L

Partial derivatives, total derivatives, chain rule, change of variables, Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

After completion of this unit, the student will be able to

- interpret partial derivatives as a function of several variables(L2)
- apply Jacobian concept to deal with the problems in change of variables (L3)
- evaluate maxima and minima of functions(L3)

UNIT IV: Multiple Integrals-I **8 L**

Double integrals, change of order of integration, double integration in polar coordinates, area enclosed by plane curves.

Learning Outcomes:

After completion of this unit, the student will be able to

- apply double integrals in cartesian and polar coordinates(L3)
- calculate the areas bounded by a region using double integration techniques (L3)

UNIT V: Multiple Integrals-II **8 L**

Evaluation of triple integrals, change of variables (cartesian, cylindrical and spherical polar co-ordinates), volume as triple integral.

Learning Outcomes:

After completion of this unit, the student will be able to

- apply multiple integrals in cartesian, cylindrical and spherical geometries (L3)
- evaluate volumes using triple integrals(L3)

Text Book(s):

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons,2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

References:

1. R.K.Jainand S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd.,2002.
2. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas, Calculus, 13/e, Pearson Publishers,2014.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson Publishers,2011.

Course Outcomes:

After completion of this unit, the student will be able to

- Utilize the techniques of matrix algebra for practical applications(L3)
- apply mean value theorems to engineering problems(L3)
- utilize functions of several variables in optimization(L3)
- employ the tools of calculus for calculating the areas(L3)
- calculate volumes using multiple integrals(L3)

GEL131: COMMUNICATIVE ENGLISH
(Common to all)

L	T	P	C
2	0	2	3

The course is a unified approach to enhance language skills of learners with an aim to hone their social skills and to increase their employability. The course is designed to acquaint the learners with the necessary LSRW (Listening/ Speaking / Reading/ Writing) skills needed either for recruitment or further studies abroad for which they attempt international exams like TOEFL, IELTS and GRE. It enables the learners improve their communication skills which are crucial in an academic environment as well as professional and personal lives.

Course Objectives:

- To enable learners to develop listening skills for better comprehension of academic presentations, lectures and speeches.
- To hone the speaking skills of learners by engaging them in various activities such as just a minute (JAM), group discussions, oral presentations, and role plays.
- To expose learners to key Reading techniques such as Skimming and Scanning for comprehension of different texts.
- To acquaint the learners with effective strategies of paragraph and essay writing, and formal correspondence such as email, letters and resume.
- To provide learners with the critical impetus necessary to forge a path in an academic environment, in the professional life and in an increasingly complex, interdependent world.

UNIT I **8L**

Listening: Listening for gist and specific information, speaking: Introducing self and others; Developing fluency through JAM, Reading: Skimming for gist and Scanning for specific information, Writing: Paragraph writing-writing coherent and cohesive paragraph (narrative and descriptive); use of appropriate Punctuation. Grammar & Vocabulary: Articles & Prepositions; Word Families (Verbs, Nouns, Adjectives, Adverbs; Prefixes and Suffixes)

Learning Outcomes:

After completion of this unit, the student will be able to

- apply the requisite listening skills and comprehend at local and global level. (L5)
- introduce themselves with accurate structure in diverse social and professional contexts. (L2)
- apply relevant reading strategies for comprehension of any given text(L3)
- write a paragraph using cohesive devices maintaining coherence (L3)
- understand the use of Articles and Prepositions, and apply appropriately for meaningful communication (L3)
- understand the relevance of various categories in word family and apply them meaningfully in context (L3)

UNIT II **10L**

Listening: Listening for Note taking and Summarizing, Speaking: Role plays and Oral Presentations, Reading: Intensive Reading-Reading for implicit meaning, Writing: Note making and summarizing, Grammar & Vocabulary: Verb Forms-Tenses; synonyms to avoid repetition in speech and writing.

Learning Outcomes:

After completion of this unit, the student will be able to

- employ note taking and summarizing strategies to comprehend the listening text (L2)
- use strategies for successful and relevant oral presentation (L4)
- demonstrate effective communication skills by applying turn-taking and role distribution techniques for meaningful and contextual Speaking (L4)
- apply various reading strategies imbibing inferential and extrapolative comprehension of any given text. (L3)
- apply various note-making techniques while comprehending the reading text to present a complete and concise set of structured notes (L5)
- apply the notes to draft a summary (L3)
- use correct tense forms and appropriate structures in speech and written communication (L3)
- context specific use of Prefixes and Suffixes for meaningful communication (L3)

UNIT III **8L**

Listening: Listening for presentation strategies: introducing the topic, organization of ideas, conclusion. Speaking: Aided presentations, Reading: Inferring using textual clues, Writing: Formal Letter and Email writing, Grammar & Vocabulary: Active and Passive Voice; linkers and discourse markers.

Learning Outcomes:

After completion of this unit, the student will be able to

- notice and understand effective listening strategies to identify discourse markers in presentations. (L2)
- make formal oral presentations using effective strategies such as audio – visual aids (L3)
- infer meaning and inter – relatedness of ideas (L4)
- understand relevant structures and draft formal letters in suitable format (L4)
- construct relevant sentences in active and passive voice for meaningful communication (L3)
- comprehend and apply available vocabulary items relevant to the context (L3)

UNIT IV **10L**

Listening: Listening for labelling-maps, graphs, tables, illustrations, Speaking: Aided group presentation using charts, graphs etc. Reading: Reading for identification of facts and opinions, Writing: Information transfer (writing a brief report based on information from graph/chart/table), Grammar & Vocabulary: Subject-verb agreement; language for comparison and contrast; Antonyms.

Learning Outcomes:

After completion of this unit, the student will be able to

- match visual and auditory inputs and use the information comprehensively and adequately demonstrate important relationships or patterns between data points (L2)
- choose and coordinate resources appropriate to context and speak intelligibly (L4)
- develop advanced reading skills for analytical and extrapolative comprehension (L5)
- make decisions on arrangement of ideas and transfer them from visual to verbal form using context appropriate structure. (L4)
- demonstrate ability to use task specific grammatically correct structures (L3)
- Comprehend and use expressions for negation/contradiction (L3)

UNIT V **8L**

Listening: Listening to discussions for opinions, Speaking: Group Discussion, Reading: Reading for inferences, Writing: Guided essay writing (argumentative), Grammar & Vocabulary: Editing short texts: correcting common errors in grammar and usage; Action verbs for fluency and effective writing.

Learning Outcomes:

After completion of this unit, the student will be able to

- apply analytical and problem-solving strategies to identify and interpret facts and opinions from a dialogue. (L3)
- able to administer group dynamics to contribute valid ideas to a discussion with clarity and precision (L3)
- demonstrate techniques to analyze contextual clues(L4)
- compare and correlate ideas and facts to produce an organized essay with adequate supporting evidences (L5)
- organize the available structural/grammatical knowledge and apply them in a real time context (L3)
- comprehend meaning for new words/phrases used and apply them in a new context. (L3)

Reference Book(s):

1. Arosteguy, K.O. and Bright, A. and Rinard, B.J. and Poe, M", A Student's Guide to Academic and Professional Writing in Education", UK, Teachers College Press,2019.

2. Raymond Murphy, "English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English, Cambridge University Press,2019.

3. Peter Watkins," Teaching and Developing Reading Skills", UK, CUP, 2018.

4. Deeptha Achar et al., "Basic of Academic Writing" (1and 2) parts New Delhi: Orient BlackSwan, (2012& 2013).

5. Kumar S and Lata P, "Communication Skills", New Delhi Oxford University Press, 2015.

Course Outcomes

By the end of the course, the Student will be able to

- think critically, analytically, creatively and communicate confidently in English in social and professional contexts with improved skills of fluency and accuracy. (L3)
- write grammatically correct sentences employing appropriate vocabulary suitable to different contexts. (L3)
- comprehend and analyze different academic texts. (L4)
- make notes effectively and handle academic writing tasks such as Paragraph writing and Essay writing. (L3)
- effectively handle formal correspondence like e-mail drafting and letter writing. (L3)

19EPH131: ENGINEERING PHYSICS
(Common with ECE & EEE)

L	T	P	C
3	0	3	4.5

This course is designed with fundamentals of electromagnetism and properties of materials for advanced courses in the irrespective engineering branches. It introduces electromagnetic theory with relevant mathematical tools, optical fibers and their propagation characteristics, properties of dielectric and magnetic materials. It also introduces principles of semiconductors and some widely used semiconductor devices for various applications.

Course Objectives

- To introduce mathematical principles to estimate forces, fields and waves.
- To familiarize students with electromagnetics in modern communication systems.
- To impart knowledge concerning the electrical behaviour of dielectric materials.
- To demonstrate the properties of magnets.
- To introduce semiconductor physics and devices.

UNIT I: Basics of Electromagnetics **9 L**

Electrostatic field: Coulomb's law and Gauss' law, derivation of Coulombs law from Gauss' law, applications of Gauss' law(linecharge, thin sheet of charge and solid charged sphere),Gauss' law of electrostatics in dielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson's and Laplace equations.

Magnetostatic field: Biot–Savarts' law, divergence and curl of magnetic fields, Faraday's and Ampere's laws in integral and differential form, displacement current, continuity equation, Maxwell's equations.

Learning outcomes:
After completion of this unit, the student will be able to

- Apply Coulomb's and Gauss' laws to electric field configurations from charge distributions (L3)
- Apply the Biot-Savarts' law to derive magnetostatic field distributions (L3)
- use vector calculus to describe electromagnetic phenomena(L2)
- relate the law of conservation of charge to continuity equation(L3)
- illustrate the Maxwell's equations, Maxwell's displacement current and correction of Ampere's law(L2)

UNIT II: Fiber Optics **7 L**

Introduction, advantages of optical fibers, principle and structure, accept an ceangle, numerical aperture, modes of propagation, classification of fibers, fiber optic communication, importance of V-number, fiber optic sensors (Temperature, displacement and force), applications.

Learning outcomes:
After completion of this unit, the student will be able to

- apply the principle of propagation of light in optical fibers(L3)

- explain the working and classification of optical fibers(L2)
- analyze propagation of light through optical fibers based on the concept of modes (L4)

- explain the working and classification of optical fibers(L2)
- analyze propagation of light through optical fibers based on the concept of modes (L4)

- summarize applications of optical fibers in medical, communication and other fields(L2)

UNIT III: Dielectric and Magnetic Materials **10 L**

Dielectric materials: Introduction, electric polarization, dielectric polarizability, susceptibility and dielectric constant, types of polarizations (qualitative treatment only), frequency dependence of polarization, Lorentz (internal) field (quantitative), Clausius- Mossotti equation.

Magnetic materials: Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theory of ferromagnetism(qualitative), domain theory, hysteresis, soft and hard magnetic materials.

Learning Outcomes:

After completing this unit, the students will be able to

- explain the concept of dielectric constant and polarization in dielectric materials (L2)
- interpret dielectric loss, Lorentz field and Claussius-Mosotti relation (L2)
- classify the magnetic materials(L2)
- explain the phenomenon of hysteresis for a ferromagnetic material and summarize the properties of hard and soft magnetic materials (L2)

UNIT IV: Semiconductor physics **8 L**

Introduction, origin of energy band, intrinsic and extrinsic semiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors, carrier concentration in n-type and p-type semiconductors.

Learning outcomes:

After completion of this unit, the student will be able to

- outline the properties of semiconductors(L2)
- interpret expressions for carrier concentration in intrinsic and extrinsic semiconductors(L2)
- assess the variation of carrier concentration in semiconductors with temperature (L5)

UNITV: Semiconductor devices **8 L**

Drift and diffusion currents in semiconductors, Hall effect and its applications, magnetoresistance, p-n junction layer formation and V-I characteristics, direct and indirect band gap semiconductors, construction and working of photodiode, LED, solar cell.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the drift and diffusion currents and formation of junction layer (L2)

- state Einstein's relations(L1)
- explain Hall effect and its applications(L3)
- illustrateandinterprettheV-Icharacteristicsofap-njunctiondiode(L2)
- describe applications of p-n junction diodes in photodiodes, LEDs and solar cells (L3).

Text Book(s)

1. David J.Griffiths,"IntroductiontoElectrodynamics",4/e, Pearson Education, 2014.
2. Charles Kittel, "Introduction to Solid State Physics", Wiley Publications,2011.

Reference book(s)

1. M.N. Avadhanulu, P.G. Kshirsagar, "A Text book of Engineering Physics", 11/e, S. Chand Publications,2019.
2. Gerd Keiser, "Optical Fiber Communications", 4/e, Tata Mc Graw Hill, 2008.
3. S.O.Pillai,"SolidStatePhysics",8/e,NewAgeInternational,2018.
4. S.M. Sze, "Semiconductor Devices-Physics and Technology", Wiley, 2008.

Engineering Physics Laboratory

List of Experiments

1. To determine the magnetic field a long the axis of a circular coil carrying current.
2. To determine the numerical aperture of a given optical fiber and hence to find its accept an ceangle
3. To determine magnetic susceptibility by Gouy's method
4. To determine the Hall coefficient using Hall effect experiment
5. To determine the resistivity of semiconductor by Four probe method
6. To determine the energy gap of a semiconductor.
7. To study the characteristics of PN Junction diode.
8. To study magnetic hysteresis loop (B-H curve).
9. To determine the dielectric constant of a substance by resonance method.
10. To determine hysteresis loss by CRO.
11. To study the characteristics of Photodiode

    To study the characteristics of Solar Cell

References

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers,2017

Course Outcomes

After completion of this unit the student will be able to

- utilize four probe set up and measure resistance(L3)
- determine the susceptibility of a paramagnetic substance(L5)
- understand the characteristics of photodiode, p-n junction diode and solar cell (L2).
- demonstrate the importance of dielectric material in storage of electric field energy in the capacitors(L2)
- assess the intensity of the magnetic field of circular coil carrying current with varying distance(L5)
- evaluate the acceptance angle of an optical fiber and numerical aperture and loss (L5).
- determine hysteresis losses by B-H curve and measure magnetic parameters using hysteresis loop (L5).
- identify the type of semiconductor i.e., n-type or p-type using Hall effect(L3)
- determine the band gap of a given semiconductor(L5)

19ECY131: ENGINEERING CHEMISTRY
(Common with ECE & EEE)

L	T	P	C
3	0	3	4.5

This course enables the students to gain knowledge on various aspects of renewable energy resources, electrochemical energy systems, construction of batteries, technological importance machining and etching, polymers, nano-materials, molecular machines and switches. The knowledge gained in this course can be applied to the latest problems in the above areas.

Course Objectives

- To acquaint with electrochemical energy systems and their applications.
- To impart knowledge on the basic concepts of battery technology.
- To familiarize the students with various sources of renewable energy and their harnessing.
- To demonstrate the construction of photo voltaic cells.
- To introduce different types of nano-materials.
- To expose the students to latest instrumental techniques such as scanning electronic microscope (SEM) & transmission electron microscope (TEM).

Module I **9L**

Electrochemical Energy Systems

Introduction Origin of electrode potential, Electrode Potentials, Measurement of Electrode Potentials, Nernst Equation for a single electrode, EMF of a cell, Types of Electrodes or Half Cells Hydrogen and Calomel electrode, Electrochemical Cell, Galvanic Cell vs. Electrolytic Cell, Electrochemical conventions, Types of Ion Selective Electrodes- glass membrane electrode, polymer membrane electrodes, solid state electrodes, gas sensing electrodes (classification only), Concentration Cells.

Learning outcomes:

After the completion of the Unit I, the student will be able to

- list the different types of electrodes.(L1)
- illustrate the construction of concentration cells.(L2)
- explain the significance of electrodepotentials. (L2)
- compare different types of cells and batteries.(L2)
- classify the ion selective electrodes.(L2)

Module II **8L**

Battery Technology

Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zincair, lithium cells-$LiMnO_2$ cell-challenges of battery technology.FuelcellsIntroduction-classificationoffuelcells–hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell.

Learning outcomes:

After the completion of the Unit II, the student will be able to

- classify batteries into different types.(L2)
- explain the concept involved in the construction of lithium cells.(L2)
- compare the merits of different fuel cells.(L2)
- identify the significance of batteries.(L3)
- apply the redox principles for construction of batteries and fuel cell. (L3

Module III **8L**

Renewable Sources of Energy Introduction- sources of renewable energy

Solar energy–Introduction-Physical and Chemical properties of Silicon- Production of Solar Grade Silicon from Quartz-Doping of Silicon-p and n type semiconductors- PV cell / solar cell-Manufacturing of Photovoltaic Cells using Chemical Vapor Deposition Technique-applications of solar energy.

Learning outcomes:

After the completion of the Unit III, the student will be able to

- list different renewable sources of energy.(L1)
- explain how photovoltaic cells convert light into energy.(L1)
- compare p and n type semiconductors.(L2)
- illustrate the construction of PV cell.(L2)

Module IV **9L**

Metal Finishing

Technological importance of metal finishing, methods of metal finishing, manufacturing of electronic components, electrochemical techniques of forming, machining and etching, electrolytic cell, principle of electroplating, nature of electrodeposits, electroplating process, Electro plating of chromium, gold, etc. Electroless plating of copper, nickel.

Learning outcomes:

After the completion of the Unit IV, the students will be able to

- explain the electrochemical techniques of forming.(L2)
- extend it to electroless plating of some metals.(L2)
- identify different methods of metal finishing.(L3)
- apply the methods of metal finishing in the manufacture of electronic components. (L3)

Module V **8L**

Polymers, Nanomaterials and Molecular Machines & Switches:

Polymers: Introduction, differences between thermoplastic and thermo setting resins, Preparation, properties and uses of polystyrene and Poly phosphazines.

Nanomaterials: Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and nanowires. Chemical synthesis of nanomaterials: sol-gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM).

Molecular machines & Molecular switches: Rotaxanes and Catenanes as artificial molecular machines; Molecular switches–cyclodextrin-based switches

Learning outcomes:

After the completion of the Unit V, the students will be able to

- explain the concept so far tificial molecular machines and molecular switches. (L2)
- identify different types of polymers.(L3)
- distinguish between thermoplastic and thermo setting resins.(L4)
- compare nanoclusters and nanowires.(L4)

Text Book(s):

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi,2014.
2. B.K.Sharma, Engineering Chemistry, Krishna Prakashan, Meerut.
3. G Palanna, Engineering Chemistry, Tata McGraw Hill2009.

References:

1. Sashichawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons,2003.
2. B.S Murthy and P. Shankar, A Text Book of Nano Science and Nano Technology, University Press, 2013.
3. S.S. Dara, A Textbook of Engineering Chemistry, S. Chand& Co, 2010.
4. N. Krishna Murthy and Anuradha , A text book of Engineering Chemistry, Murthy Publications,2014.
5. K. Sesha Maheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services,2016.

Course Outcomes

After the completion of the course, the student will be able to

- list various sources of renewable energy. (L1)
- compare different types of cells.(L2)
- explain the merits of fuel cells.(L2)
- identify suitable methods for metal finishing.(L3)
- distinguish between nanoclusters and nanowires, polymers, molecular machines & switches(L4)

Engineering Chemistry Laboratory

The course enables the students to gain knowledge on various, instrumental methods of analysis, measurements of physical parameters, volumetric analysis, preparation of polymers, analysis of water, and chromatographic separation techniques.

Course Objectives

- To familiarize the students with the basic concepts of Engineering Chemistry lab.
- To train the students on how to handle the instruments.
- To demonstrate the digital and instrumental methods of analysis.
- To expose the students in practical aspects of the theoretical concepts.

List of Experiments

1. Determination of Mohr's salt by potentiometric method
2. Determination of strength of an acid by pH metric method
3. Determination of conductance by conductometric method
4. Determination of viscosity of a liquid
5. Determination of surface tension of a liquid
6. Determination of sulphuric acid in lead-acid storage cell
7. Determination of chromium (VI) in potassium di chromate
8. Determination of copper in a copper ore
9. Determination of Zinc by EDTA method.
10. Estimation of active chlorine content in Bleaching powder
11. Preparation of Phenol-Formal de hyderesin
12. Preparation of Urea-Formal d dehyderes in
13. Thin layer chromatography
14. Preparation of TiO_2/ZnO nanoparticles
15. SEM analysis of nanomaterials

Text Book(s)

1. Mendham J, Denney RC, Barnes JD, Thomas M and Sivasankar B , Vogel's Quantitative Chemical Analysis, 6/e, Pearson publishers, 2000.
2. N.K Bhasin and SudhaRani Laboratory Manual on Engineering,
3. Chemistry, 3/e, Dhanpat Rai Publishing Company, 2007.

Course Outcomes:

After the completion of the laboratory course, the student will be able to

- Explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods. (L2)
- identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods). (L3)
- experiment with the physical parameter of organic compounds. (L3)
- compare the viscosities of oils.(L4)
- list the preparation of polymers and nano materials.(L4)

19EID131:PROBLEM SOLVING AND PROGRAMMING

(Common to all)

L	T	P	C
3	1	3	5.5

This course focuses on problem solving using visual programming and flowchart tools. Python being simple and easy to learn syntax, it is used as an introductory coding platform to translate flow charts into programs. The course introduces fundamental programming concepts. Python language is used to present concepts including control structures, functions, data structures followed by important Python packages that will be useful in data analysis.

Course Objectives:

- To introduce programming through Visual programming tool - Scratch
- To teach problem solving through Flow charting tool - Raptor
- To elucidate problem solving through python programming language
- To introduce function-oriented programming paradigm through python
- To train in development of solutions using modular concepts
- To teach practical Pythonic solution patterns

UNIT I: Computational Thinking and Visual Programming Concepts 10 L+6P

Introduction to computational thinking. Visual programming concepts. Scratch environment: sprites -- appearance and motion, angles and directions, repetition and variation, changing costumes, adding background. Input/Output, variables and operators.

Learning Outcomes

After completion of this unit the student will be able to

- develop a program, controlled by a loop. (L3)
- experiment with "costumes" to change the appearance of sprites. (L3)
- perform Input, Output Operations using scratch. (L3)
- perform computation using common mathematical formulas. (L3)
- develop programs by passing messages between sprites. (L3)

UNIT II: Algorithms and Flowchart design through Raptor 10L+6P

Introduction to the idea of an algorithm. Pseudo code and Flow charts. Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, procedure and sub charts.

Example problems – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers

Example problems -- Fibonacci number generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

Learning outcomes:

After completion of this unit the student will be able to

- select flowchart symbols for solving problems. (L1)

- develop basic flowcharts for performing Input, Output and Computations (L3)
- solve numerical problems using Raptor (L3)
- analyze problems by modular approach using Raptor (L4)

UNIT III: Introduction to Python **10L+6P**

Python – Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/output statements, Conditional If, while and for loops, User defined Functions, parameters to functions, recursive functions, Turtle Graphics.

Learning outcomes:

After completion of this unit the student will be able to

- interpret numbers, strings, variables, operators, expressions and math functions using Python Interactive Mode. (L2)
- solve simple problems using control structures, input and output statements. (L3)
- develop user defined functions (recursive and non-recursive). (L3)
- build Python programs for section 1 raptor flowcharts. (L3)
- develop Python programs for creating various graphical shapes using turtle graphics. (L3)

UNIT IV: Data Structures and Idiomatic Programming in Python **10L+6P**

Lists, Tuples, Dictionaries, Strings, Files and their libraries. Beautiful Idiomatic approach to solve programming problems.

Learning outcomes:

After completion of this unit the student will be able to

- summarize the features of lists, tuples, dictionaries, strings and files. (L2)
- demonstrate best practices of "Beautiful Idiomatic Python". (L2)
- build Python programs for section 2 raptor flowcharts. (L3).

UNITV: Packages **10L+6P**

Numpy - Create, reshape, slicing, operations such as min, max, sum, search, sort, math functions etc.

Pandas -Read/write from csv, excel, json files, add/ drop columns/rows, aggregations, applying functions

Matplotlib - Visualizing data with different plots, use of subplots.

User defined packages, define test cases and perform unit testing

Learning outcomes:

After completion of this unit the student will be able to

- read data from files of different formats and perform operations like slicing, insert, delete, update (L3)
- visualize the data (L4)
- ability to define packages (L2)
- define test cases (L1)

Problem Solving and Programming Laboratory

Laboratory Experiments

1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, Pentagon.
2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.
3. Design a Memory Game in Scratch which allows the user to identify positions of similar objects in a 3 x 3 matrix.
4. Construct flowcharts to
    a. calculate the maximum, minimum and average of N numbers
    b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
5. Construct flowcharts with separate procedures to
    a. calculate simple and compound interest for various parameters specified by the user
    b. calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
6. Construct flowcharts with procedures to
    a. generate first N numbers in the Fibonacci series
    b. generate N Prime numbers
7. Design a flowchart to perform Linear search on list of N unsorted numbers (Iterative and recursive)
8. Design a flowchart to perform Binary search on list of N sorted numbers (Iterative and recursive)
9. Design a flowchart to determine the number of characters and lines in a text file specified by the user
10. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
11. Design a Python script to determine if a given string is a Palindrome using recursion
12. Design a Python script to sort numbers specified in a text file using lists.
13. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format (0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
14. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
15. Design a Python Script to determine the time difference between two given times in HH:MM: SS format. (0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
16. Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e)* of a given number using infinite series of the function.
17. Design a Python Script to convert a given number to words.
18. Design a Python Script to convert a given number to roman number.
19. Design a Python Script to generate the frequency count of words in a text file.
20. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
21. Design a Python Script to implement Gaussian Elimination method.
22. Design a Python script to generate statistical reports (Minimum, Maximum, Count, Average, Sum etc) on public datasets.
23. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.

Text Book(s):

1. Weingart, Dr. Troy, Brown, Dr. Wayne, An introduction to programming and algorithmic reasoning using raptor.

2. T R Padmanabhan, Programming with python, Springer.

3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press.

4. Wes McKinney , Python for Data Analysis, O.Reilly.

Course outcomes:

After the completion of the course, the student will be able to

- create interactive visual programs using Scratch. (L6)
- develop flowcharts using raptor to solve the given problems. (L3)
- build Python programs for numerical and text based problems (L3)
- develop graphics and event based programming using Python (L3)
- build Python programs using beautiful Pythonic idiomatic practices (L3)

19EME121: WORKSHOP
(Common to all)

L	T	P	C
0	0	3	1.5

The objective of this course is to expose students, common tools in engineering. This course enables the students to gain hands on experience and skills necessary to perform basic operations such as carpentry, sheet metal working and fitting. It also familiarizes the students with basic electrical house wiring concepts.

Course Objectives

- Explain different tools used in carpentry.
- Impart the skills to do some carpentry operations.
- Demonstrate different types of tools used in fitting, soldering and brazing.
- Train fitting, soldering and brazing jobs.
- Familiarize different types of basic electric circuit connections.

Wood Working:

Familiarity with different types of woods and tools used in woodworking and make following joints

a) Half – Lap joint.

b) Mortise and Tenon joint.

c) Corner Dovetail joint or Bridle joint.

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working,
Developments of following sheet metal job from GI sheets
a)Taperedtray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:

Familiaritywithdifferenttypesoftoolsusedinfittinganddothefollowing fitting exercises

a)V-fit b)Dovetail fit c) Semi-circular fit
d) Bicycle tire puncture and change of two wheeler tire

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections
a) Parallel and series b) Two-way switch

c)Godown lighting d) Tube light
e) Three phase motor f) Soldering of wires

Course Outcomes:

After completion of this lab the student will be able to

- Summarize various carpentry operation required to create a product in real time applications. (L2)
- Develop different parts with metal sheet in real time applications. (L3)
- demonstrate fitting operations in various applications.(L3)
- preform soldering and brazing operations.(L3)
- select different types of electric circuits in practical applications (L3)

19EME131: ENGINEERING GRAPHICS
(Common to all)

L	T	P	C
1	0	3	2.5

This course enables the students to convey the ideas and information graphically that come across in engineering. This course includes projections of lines, planes, solids sectional views, and utility of drafting and modeling packages in orthographic and isometric drawings.

Course Objectives

- Create awareness of the engineering drawing as the language of engineers.
- Familiarize how industry communicates, practices for accuracy in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Demonstrate utility of drafting and modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling software's.
- Impart graphical representation of simple components.

Manual Drawing: **7 L**

Introduction to Engineering graphics: Principles of Engineering Graphics and their Significance-Conventions in drawing-lettering - BIS conventions.

a) Conic sections - general method only,

b) Cycloid, epicycloids and hypocycloid

c) Involutes **2L**

Projection of points, lines and planes: Projection of points in different quadrants, lines inclined to one and both the planes, finding true lengths and angles made by line. Projections of regular plane surfaces. **2L**

Projections of solids: Projections of regular solids inclined to one and both the reference planes. **1L**

Sections of solids: Sectional planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections. **1L**

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts. **1L**

Computer Aided Drafting: **6L**

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional presentations. **1L**

Orthographic Projections: Systems of projections, conventions and application to orthographic projections. **3L**

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple and compound solids. **2L**

Text Book(s):

1. K.L. Narayana &P. Kannaiah, Engineering Drawing, 3/e, SciTech Publishers, 2012.
2. N.D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

References:

1. DhanajayAJolhe, EngineeringDrawing, TataMcGraw-Hill, 2009.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009.
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000.
4. K.C. John, Engineering Graphics, 2/e, PHI, 2013.
5. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill,2008.

Course Outcomes:

After completion of this unit the student will be able to

- utilize Engineering Graphics as Language of Engineers.(L3)
- prepare drawings as per standards(BIS). (L3)
- identify various engineering curves. (L3)
- solve geometrical problems in plane geometry involving lines and plane figures(L3)
- represent solids and sections graphically.(L3)
- develop the surfaces of solids.(L3)
- draw isometric and orthographic drawings using CAD packages. (L3)

19EMC181A : NATIONAL SERVICE SCHEME (NSS)

L T P C
0 0 2 0

National Service scheme is a public service program encouraged by Ministry of Youth Affairs and Sports of the Government of India. NSS is a voluntary association of young people in Colleges, Universities and at +2 level working for a campus-community linkage. The objective of this course is to expose the students to the activities of National Service Scheme, concept of social Service and principles of health, hygiene and sanitation.

UNIT I **2Hours**

Introduction and Basic concepts of NSS: History. Philosophy, aims and Objectives of NSS, Emblem, Flag, Motto, Song, Badge etc.: Organizational structure, role and responsibilities of various NSS Functionaries.

UNIT II **2Hours**

Regular activities: College campus activities, NS.S, activities in Urban and Rural areas, NSS Annual Activities Calendar, Suggestive List of Activities, Role of Non-Government Organization (NGO) in social Reforms i) Red Cross ii) Rotary

UNIT III **2Hours**

Special Camp activities: Nature and its objectives: Selection of camp site -Identification of community problems- physical arrangement- Organization of N.S.S.camp through various committees and discipline in the camp- adaption of village-planning for pre -camp during and post campaigning. **Activities-** Activities to be undertaken during the N.S.S. camp- Use of the mass media in the N.S.S activities.

UNIT IV **4hours**

Health, Hygiene and Sanitation: Definition, needs and scope of health education, food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan. **Disaster Management:** Introduction to Disaster Management, Classification of Disasters. Role of Youth in Disasters Management, Home nursing, First Aid. **Civil Self Defense:** Civil Defense services, aims and objectives of civil defense, Need for self defen.ce training

UNIT V **10hours**

Social Project: Problems Identification - Data Collection- Preparation of a Questionnaire-Observation- Schedule Interview-Qualitative Research-Quantities Research-Major Findings-Suggestions-Conclusion-Report Writing.

Text Book(s):

1) National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi
2) NSS Diaries
3) Sanjay Bhattacharya, Social Work Interventions and Management-Deep and Deep Publications, New Delhi.

19EMC181B: NATIONAL CADET CORPS

L T P C
0 0 2 0

UNIT I **5 hours**

Aims and objectives of NCC: Organization and training, NCC song, incentives for cadets. National integration and awareness: religion, culture, traditions and customs of India, national integration – importance and necessity, freedom struggle and nationalist movement in India, national interests, objectives, threats and opportunities, problems/ challenges of national integration, national integration and awareness, unity and diversity, national integration council, images/ slogans for national integration, contribution of youth in nation building

UNIT II **5 hours**

Drill Attention, stand at ease and stand easy, turning and inclining at the at the halt, ceremonial drill-guard mounting, guard of honour, platoon / company drill, instructional practice, weapon training stripping, assembling, care and cleaning and sight setting of .22 rifle, the lying position, holding and aiming, trigger control and firing a shot, short range firing, aiming – alteration of sight

UNIT III **5 hours**

Personality development: Introduction to personality development, factors influencing / shaping personality – physical , social, psychological and philosophical self-awareness – know yourself / insight, change your mindset, interpersonal relationship and communication communication skills – group discussion / lecturettes, leadership traits, types of leadership, attitude – assertiveness and negotiation, time management, personality development, effects of leadership with historical examples, stress management skills, interview skills, conflict motives – resolution, importance of group – team work, influencing skills, body language, sociability: social skills, values / code of ethics **Disaster Management:** Civil defence organization and its duties – ndma, types of emergencies / natural disasters, fire service and fire fighting, traffic control during disaster under police supervision, essential services and their maintenance, assistance during natural / other calamities / floods / cyclone / earth quake / accident, setting up of relief camp during disaster management, collection and distribution of aid material

UNIT IV **5 hours**

Social awareness and community development : Basics of social service, weaker sections of our society and their needs, social/ rural development projects – menrega , sgsy , nsap etc, ngos : role and contribution, contribution of youth towards social welfare, family planning, drug abuse and trafficking, civil responsibilities, causes and prevention of hiv/ aids role of youth, counter terrorism, corruption, social evils – dowry / female foeticide / child abuse and trafficking, rti and rte, traffic control organization and anti drunken driving, provision of protection of children from sexual harassment act 2012.

UNIT V **5 hours**

Health and Hygiene: Structure and functioning of the human body, hygiene and sanitation (personal and food hygiene), physical and mental health, infectious and contagious diseases and its prevention, basic of home nursing and first aid in common medical emergencies, wounds and fractures, introduction to yoga and exercises. **Adventure training:** Para sailing, slithering, rock climbing, cycling / trekking, environment awareness and conservation natural resources conservation and management, water conservation and rain water harvesting, waste management, pollution control, water, air, noise and soil, energyconservation, wildlife conservation – projects in India. obstacle training, obstacle course, practical training

Text Book(s)

1. Cadet Hand Book (Common Subjects), published by DG NCC.
2. Cadet Hand Book (Specialized Subjects), published by DG NCC.

Reference Books

1. Grooming Tomorrow’s Leaders, published by DG, NCC.
2. Youth in Action, published by DG, NCC.
3. The Cadet, Annual Journal of the NCC.

19EMC181C: NATIONAL SPORTS ORGANIZATION(Common to all)

L	T	P	C
0	0	2	0

National Sports Organization is intended by the Government of India to promote the development of athletics and sporting activities of the nation's youth. This activity enables physical fitness, teamwork and mental health within the students. This course teaches the rules and skills of below sports and games to the students. Each student shall be made proficient in one of the chosen sport from the below list:

1. Cricket
2. Volley Ball
3. Table Tennis
4. Foot Ball
5. Throw Ball (Only for Women)
6. Basket Ball
7. Athletics -100 Meters Run, Long Jump, Shot Put
8. Chess
9. Lawn Tennis
10. Kabaddi
11. Aerobics
12. Badminton

Text Book(s):

1. Myles Schrag, The Sport Rules Book, 4/e, Human Kinetics, 2018
2. Dhama Prakash Jyoti, Rules. Of. Games. And. Sports, Laxmi Book Publication, 2018

19EMC181D: YOGA (Common to all)

L T P C

0 0 2 0

The course is designed to enable the student to know about yoga an ancient Indian tradition. It embodies unity of mind and body; thought and action; harmony between human and nature and a holistic approach to health and well-being. It is not only exercise but to discover the sense of oneness with ourselves, the world and nature. The student will be able to learn about Yoga and practice different Yoga asana which influences his lifestyle and creating consciousness, it can help a student to deal with health issues and climate change.

Course Objectives:

- Familiarize the student with YOGA and ancient Indian tradition.
- Enable the student to know the different asana their advantages and disadvantages.
- Explain with the features of different Yoga asana.
- Demonstrate and perform Yoga asana.
- Enable the student to perform pranayama and meditation.

- **Introduction to Yoga:** Evolution of Yoga and Schools of Yoga, Origin of Yoga, History and Development of Yoga; Etymology and Definitions, Misconceptions, Nature and Principles of Yoga.
- **Guidelines to yoga practice:** Prayer, warmup exercises/ loosening exercises
- **Yoga Theory:** Therapeutic Benefits of Yoga – primitive, preventive and curative aspects of Yoga
- **Application of Yoga to students,** Surya namaskaras, Tad asan, Nataraj asan, Vriksh asan, Padahasthasan, Ardhachakrasan, Trikonasan, Bramari pranayama.
- **Yoga for allround fitness,** Bhadrasan, Vajrasan, ArdhaUstrasan, Nadishuddhi pranayama, Navasan, Janusirasan, Paschimotthanasan, Shashankasan, Vakrasan, Bhujangasan, Kapalabhati..
- **Meditative Postures**: Sukhasan, ArdhaPadmasan, Padmasan and Siddhasan,Meditation
- **Yoga Practice**: Makarasan, Sethubandhasan, Pavanmuktasan, Sarvangasan, Matsyasan, Halasan.

Text Book(s):

1. Swami Muktibodhanda Saraswathi Shay G.S., Hatha yoga Pradipika, Bihar School of yoga publications, Munger, 2000.
2. Hatha Yoga Pradeepika of Svatmarama, MDNY Publication, 2013
3. Svatmarama, Swami, The Hatha yoga Pradipika/ the original Sanskrit [by] Svatmarama; an English translation [by] Brian Dana Akers. Woodstock, NY:YogaVidya.com, 2002.

References:

1. Bharati, Swami Veda Reddy Venkata: Philosophy of Hatha Yoga (Englis), Himalayan, Pensylvania, Hatha Ratnavali.
2. Swami Satyananda Saraswathi - Asana, Pranayama, Mudra & Bandha. Bihar School of Yoga, Munger
3. B.KS.Iyenger - The Illustrated Light on Yoga. Harper Collins, New Delhi.

Course Outcomes:

After completion of this course the student will be able to

- understand history and evolution of Yoga (L2).
- list different schools of yoga (L2).
- interpret the aim and objectives of yoga to students (L2).
- perform yoga asana, pranayama, and meditation (L3).

VDC111: VENTURE DISCOVERY

L	T	P	C
0	0	4	2

India as part of its Make in India initiative has been focusing on creating incubation centers within educational institutions, with an aim to generate successful start-ups. These start-ups will become employment creators than employment seekers, which is the need of the hour for our country.

This common course for all the disciplines is a foundation on venture development. It is an experiential course that lets students venture and find out what is a business, financial and operating models of a business are. How to design and prototype a solution that meets their customers' needs and generate revenue for the business.

COURSEOBJECTIVES

- Discover who you are – Values, Skills, and Contribution to Society.
- Gain experience in actually going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.
- Understand innovation outcomes: issues around business models, financing for start-ups, intellectual property, technology licensing, corporate ventures, and product line or service extensions.

UNIT I (6 sessions)

Personal Values: Defining your personal values, Excite & Excel, build a Team, Define purpose for a venture. Four stages: Personal Discovery, Solution Discovery, Business Model Discovery, Discovery Integration.

UNIT II 6 sessions)

Solution Discovery: Craft and mission statement, Experience design, Gaining user insight, Concept design and positioning, Product line strategy, Ideation & Impact.

UNIT III (6 sessions)

Business Model Discovery: Prototyping solutions, Reality Checks, understand your industry, Types of business models, Define Revenue Models, Define Operating Models

UNIT IV (6 sessions)

Discovery Integration: Illustrate business models, validate business models, Define company impact

UNIT V (6 sessions)

Tell a Story: Can you make money, Tell your venture story.

Assessment methods

Task	Task type	Task mode	Weightage (%)
A1. Assignments	Individual	Report/Presentation	20
A2. Case / Project/Assignment	Groups* or Individual	Presentations/Report/Assignment	40
A3. Project	Individual/Group	Report/Pitch	40

Transferrable and Employability Skills

	Outcomes	Assessment
1	Know how to use online learning resources: G-Learn, online journals, etc.	A1 & A2
2	Communicate effectively using a range of media	A1 & A2
3	Apply teamwork and leadership skills	A2
4	Find, evaluate, synthesize & use information	A1 & A2
5	Analyze real world situation critically	A3
6	Reflect on their own professional development	A3
7	Demonstrate professionalism & ethical awareness	A2
8	Apply multidisciplinary approach to the context	A2

Learning and teaching activities

Mixed pedagogy approach is adopted throughout the course. Classroom based face to face teaching, directed study, independent study via G-Learn, case studies, projects and practical activities (individual & group)

Teaching and learning resources

Soft copies of teaching notes/cases etc. will be uploaded onto the G-learn. Wherever necessary, printouts, handouts etc. will be distributed in the class. Prescribed text book will be provided to all. However you should not limit yourself to this book and should explore other sources on your own. You need to read different books and journal papers to master certain relevant concepts to analyze cases and evaluate projects. Some of these reference books given below will be available in our library.

***Prescribed Modules*:**

Access to NU-IDEA online modules will be provided.

***Referential text books and journal papers*:**

Personal Discovery Through Entrepreneurship, Marc H. Meyer and Chaewon Lee, The Institute of Enterprise Growth, LLC Boston, MA.

Suggested journals:

Vikalpa, Indian Institute of Management, Ahmedabad
Journal of General Management, Mercury House Business Publications, Limited
Harvard Business Review, Harvard Business School Publishing Co. USA

On successful completion of this course, students will be able to:

	COURSE Outcome	**Assessment**
1	Understand conceptual framework of the foundation of a venture	A1, A2
2	Understand the concept of purpose, mission and value-add service offered by a venture	A3
3	Analyze design and positioning of the product	A3
4	Demonstrate prototyping	A3
5	Analyze business, revenue and operating models	A3

Semester II

S. No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	0	3	Common with CSE
2.	19EID134/ 19EID234	AI Tools/ Life Sciences for Engineers	ES/BS	2	0	2	0	3	Common to all
3.	19ECY131/ 19EPH131	Engineering Chemistry / Engineering Physics	BS	3	0	3	0	4.5	Common to CSE/ECE/EEE
4.	19EEE131	Basic Electrical and Electronics Engineering	ES	3	1	3	0	5.5	Common to all
5.	19EME131/ 19EME121	Engineering Graphics / Workshop	ES	1/0	0	3	0	2.5/ 1.5	Common to all
6.	19ECS134	Data Structures with Python	PC	2	0	3	0	3.5	Common with CSE
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/National Cadet Corps/National Sports Organization/YOGA	MC	0	0	2	0	0	Common to all
8.	19EHS122	Comprehensive Skill Development- I	HS	0	0	0	6	1	Common to all
						Total	**23/22**		

19EMA104: ENGINEERING MATHEMATICS II
(PROBABILITY AND STATISTICS)

L	T	P	C
3	0	0	3

This course is designed to impart knowledge on the concepts of Data Science, fundamental properties of probability, distributions, correlation, regression, testing of hypothesis for small and large samples in engineering applications.

Course Objectives:

- To familiarize the students with the foundations of Data Science, probability and statistical methods.
- To explain the concepts in random variables and several distributions in engineering applications.
- To teach the concepts of correlation, regression and estimations and their properties.
- To explain the concept of testing of hypothesis for large samples.
- To impart knowledge on small sample tests.

UNIT I: Data Science and Probability 10 L

Data Science: Introduction to statistics, population vs sample, collection of data, primary and secondary data, types of variables: dependent, independent, categorical and continuous variables, data visualization, measures of central tendency, measures of dispersion (variance).

Probability: Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem (without proof).

Learning Outcomes:

After completion of this unit the student will be able to

- summarize the basic concepts of data science and its importance in engineering (L2)
- analyze the data quantitatively or categorically, measure of averages, variability (L4)
- define the terms trial, events, sample space, probability and laws of probability (L2)
- make use of probabilities of events in finite sample spaces from experiments (L3)
- apply Baye's theorem to practical problems(L3)

UNIT II: Random Variable and Probability Distributions 8 L

Random variables (discrete and continuous), probability mass and density functions, probability distribution Binomial, Poisson, normal distribution- and their properties (mathematical expectation and variance).

Learning Outcomes:

After completion of this unit the student will be able to

- explain the notion of random variable, distribution functions and expected value (L2)
- apply Binomial and Poisson distributions to compute probabilities, theoretical frequencies (L3)
- explain the properties of normal distribution and its applications (L3)

UNIT III: Correlation, Regression and Estimation 8 L

Correlation, correlation coefficient, rank correlation, regression, lines of regression, regression coefficients, principle of least squares and curve fitting (straight line, parabola and exponential curves).

Estimation: Parameter, statistic, sampling distribution, point estimation, properties of estimators, interval estimation.

Learning Outcomes:

After completion of this unit the student will be able to

- identify different trends in scatterplots, strengths of association between two numerical variables (L3)
- make use of the line of best fit as a tool for summarizing a linear relationship and predicting future observed values (L3)
- estimate the value of a population parameter, computation of point and interval estimation (L3)

UNIT IV: Testing of Hypothesis and Large Sample Tests 8 L

Formulation of null hypothesis, alternative hypothesis, critical region, two types of errors, level of significance and power of the test. **Large Sample Tests**: Test for single proportion, difference of proportions, test for single mean and difference of means confidence interval for parameters in one
sample and two sample problems.

Learning Outcomes:

After completion of this unit the student will be able to

- identify the difference between one-tailed and two-tailed hypothesis tests (L3)
- analyze the testing of hypothesis for large samples(L4)

UNIT V: Small Sample Tests 6 L

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes:

After completion of this unit the student will be able to

- analyze the testing of hypothesis for small samples(L4)
- testfortheχ2squaregoodnessoffitandindependenceofattributes (L4)

Text Book(s):

1. Richard A. Johnson, Iswin Miller and John Freund, Miller &Freund's probability & statistics for engineers, 7/3, Pearson, 2008.
2. Miller and Freunds, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Educational Publications, 2012.

References:

1. S. Ross, A First Course in Probability, Pearson, 2002.
2. W. Feller, An Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

Course Outcomes:

After completion of the course, the student will be able to

- classify the concepts of Data Science and its importance(L2)
- apply discrete and continuous probability distributions(L3)
- explain the association of characteristics through correlation and regression tools (L3)
- identify the components of a classical hypothesis test(L3)
- use the statistical inferential methods based on small and large sampling tests (L4)

19EID134: AI TOOLS

(Common to all)

L	T	P	C
2	0	2	3

The surge in the production of data has led to the development of various technologies. The term "Artificial Intelligence (AI)" has become ubiquitous in everyday applications from virtual assistants to self-driving cars. Several applications such as Healthcare, Finance, Bioinformatics etc. are benefitting from the advances in the domain. The global market for artificial intelligence is going to face a phenomenal growth over the coming years with organizations across the world capitalizing on the disruptive technologies that AI is offering. This course introduces the recent applications of AI namely, Virtual Assistants, Computer Vision, along with trending topics such as Deep Learning and Reinforcement Learning. The idea of the course is to introduce the basic concepts of AI as well as latest trends in the domain. This course is envisaged to provide a basic understanding on latest developments of AI to all disciplines engineering undergraduates.

Course objectives:

- Provide introduction to basic concepts of artificial intelligence.
- Explore applications of AI
- Explore the scope, advantages of intelligent systems
- Experiment with different machine learning concept
- Exposure to AI-intensive computing and information system framework

Module I: 9 L

Introduction to Artificial intelligence: Basics of AL Agents and Environment, The Nature of Environment, Applications of AI: Game Playing, [Deep Blue in Chess, IBM Watson in Jeopardy, Google's Deep Mind in AlphaGo]

Learning Outcomes:
After completion of this unit, the student will be able to:

- Recognize various domains in which Al can be applied

Module II: 9 L

Conceptual introduction to Machine Learning: Supervised, Unsupervised, and Semi-Supervised Learning, Reinforcement Learning, Introduction to Neural Networks, Deep Learning.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Define machine learning and forms of learning
- Identify types of machine learning

Module III: 9 L

Image Processing & Computer Vision: Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Edge Detection. Segmentation. Feature Detection & Recognition. Classification of images. Face recognition, Deep Learning algorithms for Object detection & Recognition.

Learning Outcomes:
After completion of this unit, the student will be able to:
- Identify the concepts of image processing:
- Implement the methods in processing an image:

Module IV: 9 L
Conceptual introduction to Natural Language Processing: Speech Recognition & Synthesis: Speech Fundamentals, Speech Analysis, Speech Modelling, Speech Recognition, Speech Synthesis, Text-to-Speech, Sentiment Analysis, Segmentation and recognition

Learning Outcomes:
After completion of this unit, the student will be able to:
- illustrate how to construct a Chabot:
- Describe natural language processing and concepts for converting speech to different forms

Module V: 9 L
BOT Technologies: Chatbots: Introduction to o Chatbot, Architecture of a Chatbot. NLP in the cloud, NL Interface, How to Build a Chatbot, Transformative user experience of chatbots, Designing Elements of a chatbot, Best practices for chatbot development. NLP components. NLP wrapper to chatbots. Audio bots and Music bots. Smart Applications: Smart Manufacturing, Smart Agriculture, Smart Healthcare, Smart Education, Smart Grids, Smart Transportation and
Autonomous Vehicles, Smart Homes, Smart Cities

Learning Outcomes:
After completion of this unit, the student will be able to:
- Understand the application of intelligence in various domains
- Correlate Artificial Intelligence to advanced applications

Text Books(s)
1. Tom Markiewicz& Josh Zheng, Getting started with Artificial intelligence, Published by O'Reilly Media,20l7
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach.

Reference Book(s)
1. Aur6lienGiron. Hands on Machine Learning with Scikit-Learn and TensorFlow concepts, Tools, and Techniques to Build lntelligent Systems , Published by O'Reilly Mcdia,20l 7
2. Build an AI Assistant with wolfram alpha and Wikipedia in python. https://medium .com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe.
3. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv Computer Vision Projects with Python-Publishing (201 6).
4. Curated datasets on kaggle https://www.kaggle.com/datasets.

Course Outcomes:
- Able to grasp the concepts of artificial intelligence, machine learning, natural language processing, image processing
- Recognize various domains in which Al can be applied
- Implement the methods in processing an image:
- Implement simple of chatbots
- identify smart applications:

For Laboratory courses: List of Experiments

1. Supervise - Perform Data Labelling for various images using object recognition
2. Teachable Machine Brain.JS In Browser Object Recognition through
3. Lobe.ai - Build custom models using the visual tool for Object recognition and sentiment analysis that can convert facial expressions into emoticons
4. Haar Cascade Object detection for Eye and Face in Python using Open CV
5. Text to Speech recognition and Synthesis through APIs
6. Sentiment Analysis and Polarity detection
7. Building a Chatbot using IBM Watson visual studio
8. Building a Chatbot using Pandora bots
9. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python

19EID234: LIFE SCIENCES FOR ENGINEERS

(Common to all)

L	T	P	C
2	0	2	3

Life sciences have been introduced in to curriculum of all engineering branches. Students in engineering programs should be aware of fundamentals of biology so as to relate to their field. This course is a critical application area for engineering analysis and design, emphasizing concepts, technology, and the utilization of living things. Further it is important to know how living things work and act.

Course Objectives

- Introduce the molecular basis of life.
- Provide the basis for classification of living organisms.
- Describe the transfer of genetic information**.**
- Introduce the techniques used for modification of living organisms**.**
- Describe the applications of biomaterials

UNIT I **10 L**

Introduction to Biology: Comparison of eye and camera, flying bird and aircraft, Biological observations and major discoveries- genera, species and strains, and Classification of living organisms: Cellularity, Ultrastructure, carbon and energy sources, excretion, habitat and molecular taxonomy.

Learning Outcomes:
After completing this unit, the student will be able to

- summarize the basis of life (L2).
- distinguish prokaryotes from eukaryotes (L4).
- compare biological organisms and manmade systems (L2).
- classify organisms (L2).

UNIT II **12 L**

Water, Biomolecules: sugars, starch and cellulose, Amino acids and proteins, lipids, Nucleotides and DNA/RNA, structure and functions of proteins and nucleic acids, hemoglobin, antibodies and enzymes, Industrial applications of enzymes, Fermentation and its industrial applications.

Learning Outcomes:

After completing this unit, the student will be able to

- outline the importance of water (L2).

- explain the relationship between monomeric units and polymeric units (L2).
- explain the relationship between the structure and function of proteins (L2).
- interpret the relationship between the structure and function of nucleic acids (L2).
- summarize the applications of enzymes in industry (L2).
- explain the applications of fermentation in industry (L2).

UNIT III **12 L**

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis, Human physiology, neurons, synaptic and neuromuscular junctions.

Learning Outcomes:

After completing this unit, the student will be able to

- apply thermodynamic principles to biological systems (L3).
- explain the mechanism of respiration and photosynthesis (L2).
- summarize the principles of information transfer and processing in humans (L2).

UNIT IV **12 L**

Mendel's laws, gene mapping, Mitosis and Meiosis, Epistasis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

Learning Outcomes:

After completing this unit, the student will be able to

- define Mendel's laws (L1).
- demonstrate the mapping of genes (L2).
- explain interactions among genes and their significance (L2).
- differentiate the mitosis and meiosis (L4).
- explain the medical importance of gene disorders (L2).
- Identify DNA as a genetic material in the molecular basis of information transfer (L3).

UNIT V **10 L**

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

Learning Outcomes:

After completing this unit, the student will be able to

- outline the principles of recombinant DNA technology (L2).

- appreciate the potential of recombinant DNA technology (L2).
- summarize the use of biological materials for diagnostic devises (L2).

Lab Experiments (Virtual or Field Experiments)

1. Microscopy, Mendel's laws, mapping, interactions, - 4 lab experiments
2. Nitrogen cycle, Species interactions, Sterilization, Bacterial population growth, - 4 lab experiments

Text Book(s):

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.

Reference Books:

1. Alberts et.Al., The molecular biology of the cell, 6/e, Garland Science, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.

Course Outcomes

After studying the course, the student will be able to:

- explain catalytic properties of enzymes (L2).
- summarize application of enzymes and fermentation in industry (L2).
- identify DNA as a genetic material in the molecular basis of information transfer (L3).
- apply thermodynamic principles to biological systems. (L3)
- analyze biological processes at the reductionistic level (L4).
- appreciate the potential of recombinant DNA technology (L2).

19EEE131: BASIC ELECTRICALAND ELECTRONICS ENGINEERING
(Common to all)

L	T	P	C
3	1	3	5.5

This course introduces the student, to the fundamental principles and building blocks of electrical and electronics engineering. The first three units cover the electric circuit laws, theorems and principles of electrical machines. The last two units cover semiconductor devices and their applications.

Course Objectives

- To familiarize the basic DC and AC networks used in electrical and electronic circuits.
- To explain the concepts of electrical machines and their characteristics.
- To introduce the importance of transformers in transmission and distribution of electric power.
- To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors(MOSFETs).
- To expose basic concepts and applications of Operational Amplifier and configurations.

UNITI **10L**

Basic laws and Theorems: Ohms law, Kirchoff's Laws, series and parallel circuits, source transformations, delta-wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples.

Learning Outcomes:

After completion of this unit, the student will be able to

- state Ohms law and Kirchhoff's Laws(L1)
- identify and analyze series and parallel connections in a circuit (L4)
- predict the behavior of an electrical circuit(L2)
- determine the current, voltage and power in the given electrical circuit(L3)
- apply various techniques to analyze an electric circuit(L3)

UNITII **10L**

DC Machines: Constructional features, induced EMF and torque expressions, different types of excitation, performance characteristics of different types of dc machines, Starters: 2-point, 3-point starters, losses and efficiency, efficiency by direct loading.

Learning Outcomes:
After completion of this unit, the student will be able to

- describe the constructional features of DC machines(L1)
- analyze EMF and torque expressions of DC machine(L4)
- demonstrate the performance characteristics of different types of DC machines (L3)
- explain types of starters used for starting of DC motors(L2)
- estimate losses and efficiency of electrical machine(L2)

UNITIII **12L**

Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination of efficiency. **Three Phase Induction Motors**: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.

Learning Outcomes:
After completion of this unit, the student will be able to

- describe the constructional details of transformers(L1)
- demonstrate voltage regulation of transformer(L2)
- discuss about open and short- circuit tests of transformer(L2)
- explain the working principle of three phase induction motor(L5)
- describe torque and torque slip characteristics(L1)
- estimate losses and efficiency of three Phase Induction Motors(L2)

UNIT IV **12L**

Semiconductor Devices: p-n Junction diode **-** Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.

Learning Outcomes:

After completion of this unit, the student will be able to

- describe the device structure and physical operation of a diode(L1)
- discuss V-I characteristics of diodes(L2)
- explain the use of diode as switch and in electronic circuits(L2)
- describe the construction and operation of n-channel and p-channel MOSFETs(L1)

- explain the use of MOSFET as an amplifier and bidirectional switch(L2)

UNIT V **10L**

Operational Amplifiers: The Ideal Op Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non Inverting Configuration, Effect of finite open loop gain, the voltage follower, Difference amplifiers, A Single Op-amp difference amplifier.

Learning Outcomes:

After completion of this unit, the student will be able to

- list the characteristics of an ideal Op Amp(L1)
- explain the Inverting and Noninverting configurations ofOp-Amp(L2)
- construct a single Op-amp difference amplifier(L3)

Basic Electrical and Electronics Engineering Laboratory

1. Verification of Kirchhoff's Laws KVL and KCL.
2. Verification of DC Superposition Theorem.
3. Verification of Thevenin's Theorem and Norton's Theorem.
4. OCC and External characteristics of separately excited DC generators.
5. Swinburne's test on a DC shunt motor.
6. OC and SC Tests on single phase transformer.
7. Brake Test on DC shunt motor.
8. Current Voltage Characteristics of a p-n Junction Diode/LED.
9. Diode Rectifier Circuits.
10. Voltage Regulation with Zener Diodes.
11. Design of a MOSTFET amplifier and MOSFET inverter/NOR gate
12. Inverting and Non-inverting Amplifier Design with Op-amps.
13. Simulation experiments using PSPICE
    a. Diode and Transistor Circuit Analysis.
    b. MOSFET Amplifier design.
    c. Inverting and Noninverting Amplifier Design withOp-amps.

Text Book(s):

1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1/e, McGraw Hill Education (India) Private Limited, 2017.

2. B. L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1/e, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C.Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2014.

References:

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

Course Outcomes

Upon successful completion of the course, the student will be able to:

- predict and analyze the behavior of an electrical circuit(L3)
- analyze the performance quantities such as losses, efficiency and identify applications of DC machines(L4)
- explain the use of transformers in transmission and distribution of electric power and other applications (L2)
- demonstrate the operation and applications of various electronic devices (L2)
- construct Inverting and Noninverting configurations of Op-Amp (L3)

19ECS134: DATA STRUCTURES WITH PYTHON

L	T	P	C
2	0	3	3.5

The study of data structures, a fundamental component of a computer science education, serves as the foundation upon which many other computer science applications are built. Knowledge of data structures is a must for students who wish to work in design, implementation, testing or maintenance of any software system. Organization of data in an efficient way for application, is the major focus of the course.

Course Objectives

- Introduce object-oriented concepts.
- Introduction to sort and search methods.
- Familiarize with linear data structures and operations on them.
- Demonstrate the organization of data as trees and various operations on trees.
- Teach various graph representations.
- Enable to perform graph traversal and find shortest path and minimal spanning tree for a graph.
- Expose common sorting techniques and their complexities.

UNITI **10**L

Object-oriented concepts in Python: Creating a class, objects, methods, constructor, encapsulation, inheritance, polymorphism, operator overloading.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the advantages of object-oriented approach (L2)
- explain the concept of abstraction and encapsulation(L2)
- summarize the benefits of inheritance and polymorphism(L2)

UNITII **10**L

Searching: Sequential Search, binary search.

Sorting: Insertion sort, selection sort, bubble sort.

Linked lists: Single linked list, double linked list, circular linked list.

Learning Outcomes:

After completion of this unit, the student will be able to

- summarize various ways of representing data(L2)
- explain the working of searching and sorting algorithms(L2)
- compare different types of linked lists (L5)

UNITIII **10**L

Stacks: Definition, operations: array implementation, linked list implementation.

Queues: Definition, operations: array implementation, linked list implementation and applications, Priority Queue, Double-Ended Queues.

Learning Outcomes:

After completion of this unit, the student will be able to

- discuss how stacks and queues are implemented using arrays and linked lists(L2)
- explain the implementation of priority queues(L2)
- list the applications of stacks, queues and priority queues(L1)
- compare different types of linked lists(L5)

UNITIV **10**L

Trees: Definition, Tree properties, Binary trees: properties, implementation, tree traversals, Heap tree, Heap sort, binary search tree and operations

Learning Outcomes:

After completion of this unit, the student will be able to

- discuss the properties of trees, binary trees , binary search trees(L2)
- explain different tree traversals and applications(L2)
- analyze the complexity of operations on binary search trees(L4)

UNIT V **10L**

Graphs: ADT, data structure for graphs, properties of graphs, types of graphs, graph representations, graph traversals, directed acyclic graph, shortest path algorithms, spanning trees and min spanning tree.

Learning Outcomes:

After completion of this unit, the student will be able to

- demonstrate different graph representations and operations(L2)
- illustrate the working of shortest path algorithms and min spanning tree(L2)

Text Book(s):

1. Michel T.Goodrich, RobertoTamassia, MichelH. Goldwasser, **Data Structures & Algorithms in Python,** Willey March, 2013. ISBN:978-1-118-29027-9.
2. RanceD.Necaise, Data**Structures & Algorithms using** Python, John Willey & Sons, India. 2011, ISBN 9788126562169

References:

1. Wesly J.Chun, Core Python Programming, 2/e, Prenctice Hall, 2006

DATA STRUCTURES WITH PYTHON LABORATORY

This Lab provides hands-on experience in designing, implementing, and using the most – commonly used concepts like Object-oriented concepts, searching, sorting algorithms, and linked list. Followed by data structure concepts like arrays, stacks, queues, linked lists, trees and graphs.

List of Practical Experiments:

1. Write a program to create
    - Student class with data members student rollno, name, address, course. Include a constructor to initialize data members. Add a method to print the student details.
    - Book class with data members book_id, name, cost and publisher. Include constructor and a method to display the book details. Create 3 objects and display their details.
    - Account class with data members acc_no, name, balance. Include a constructor and methods to perform deposit and withdraw operations on account. Create account object perform some operations and display the account details.
    - Product class with data members product_id, product_name, price, expiry_date. Include constructor to initialize data members and a method to print products details.
    - Complex_Number with data members real_part and imaginary_part. Include constructor to initialize complex number. Add a method which adds two complex numbers.

- Employee class with data members eno, ename, sal, designation. Include constructor to initialize employee details and count the number of employee objects created.

2. Create a class called Distance. A person has to travel a certain distance and he used two cars. Now create two objects “cardist1” and “cardist2” for the class Distance. Add the two objects distances and put the total distance in the third object of class Distance “totaldist”. Take one data member, which will accept the distance input in km. Take two functions, for accepting the distance and the other for displaying. Display the total distance in meters.

3. Develop a program to Perform Python Multi-Level and multiple inheritances.

4. Design a program to overload “+” operator for

   - Concatenating two strings
   - Adding two complex numbers

5. Develop a program to overload “area” method to calculate area of different polygon shapes.

Write a program to

6. implement Method Overriding
7. Perform Linear Search on an array.
8. Perform Binary Search on a list stored in an array.
9. Develop a program to implement various sorting techniques

   - Insertion sort
   - Selection Sort
   - Bubble Sort

10. Design a program to create a singly linked list for the following operations

    - Insert a Node at Beginning, at Ending and at a given Position
    - Delete a Node at Beginning, at Ending and at a given Position
    - Search, Count the Number of Nodes and Display

11. Design a program to create a doubly linked list for the following operations

- Insert a Node at Beginning, at Ending and at a given Position
- Delete a Node at Beginning, at Ending and at a given Position
- Search, Count the Number of Nodes and Display

12. Create a Circular singly linked list for adding and deleting a Node.

13. Create a stack and perform various operations on it.

14. Convert the infix expression into postfix form.

15. Perform String reversal using stack

16. Create a queue and perform various operations on it.

17. Construct a binary tree and perform various traversals.

18. Construct a binary search tree and perform search operation.

19. Implement Depth First Search, Breadth First Search traversals on a graph.

20. Implement Dijkstra's Shortest Path Algorithm.

Course Outcomes:

After Completion of this course, the student will be able to:

- explain various ways of representing data in a computer (L2)
- demonstrate operations on linear data structures (L2)
- illustrate the mechanisms for creating, altering and traversing various types of trees (L2)
- explain the representations, traversals and applications of graphs (L2)
- analyze common sorting algorithms (L4)
- choose a data structure that gives the best performance for a given application(L6)

19EHS122: COMPREHENSIVE SKILL DEVELOPMENT I

L	T	P	A	C
0	0	0	6	1

Course Objectives:

- To encourage the all-round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Stream	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
Comprehensive Skill Development	19EHS122	Soft Skills And Quant itative Aptitude	HS	1	2		1
		Coding	HS			3	
Total number of hrs per week						6	

<u>Part-1</u>

A. Verbal and Soft Skills

Self Awareness and Motivation, Goal Setting and Time Management, Interpersonal Skills, Team Work.

B. Quantitative Aptitude and Reasoning

Puzzles, Non-Verbal Reasoning, Data Sufficiency, Analytical Reasoning,

<u>Part-2</u>

Coding: **GitHub** – Accepting assignments pull and push the code or resource, GitHub configuration,

Visual Studio code – Configuring, integrating Git for assignment submission

Online competitive coding platforms – Introduction to online coding platforms to get prepared for competitive coding.

Problem Solving with Python: Collections, Techniques for manipulating Strings, Recursion, Searching, Sorting, Stacks and Queues.

Problem Solving with C: Memory, C Syntax, Conditions and Loops, Functions and Recursion, Arrays, Techniques for manipulating Strings, Searching, Sorting, Stacks and Queues, Structures.

Course Outcomes:

On completion of the course, student will be able to

- effectively communicate through verbal/oral communication and improve the listening skills. (L3)
- write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self-motivation and practicing creative thinking. (L6)
- understand the problems and develop his competitive coding skills. (L2)
- apply the skills in various domains and will be able to solve complex problems faced by the industry(L3).
- function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality. (L4)

19EMA205: ENGINEERING MATHEMATICS III
(DISCRETE MATHEMATICAL STRUCTURES)

L	T	P	C
3	0	0	3

This course is exclusively designed for the students of Computer Science and Information Technology branches to understand the logic gates, the analytic approach of Fibonacci recurrence relations, algebraic structures for Cryptography and Network Security & Graphs, Trees for data structures in their core subjects.

Course objectives:

- To explain the logical operations and validity of statements
- To familiarize with the solution of linear recurrence relations by various methods.
- To introduce basics of group theory and its applications.
- To demonstrate the basic concepts of graphs and its applications
- To train the students on the topics: trees, spanning trees, shortest spanning trees and justification of Kruskal's algorithm.

Module I: **Mathematical Logic:** 10 L

Connectives, negation, conjunction, disjunction, conditional and bi-conditional, well formed formulae, tautologies, equivalence of formulae, duality, tautological implications, functionally complete set of connectives, principal disjunctive and conjunctive normal forms, inference calculus, rules of inference, indirect method of proof, conditional proof.

Learning Outcomes:
After completion of this unit, the student will be able to:

- find equivalence formulae, implement the logic with mathematical proofs (L2)
- apply inference theory to verify the consistency of data (L3)

Module II: Recurrence Relations 8 L

Recurrence relations, solving linear recurrence relations by characteristic roots method, system of recurrence relations, non-linear recurrence relations.

Learning Outcomes:
After completion of this unit, the student will be able to:

- construct recurrence relations of the sequences (L3)
- solve homogeneous linear recurrence relations (L3)
- solve complementary function and particular integral for non-homogeneous linear recurrence relations(L3)

Module III: Group Theory 8 L

Groups, subgroups, Lagrange's theorem on finite groups, normal subgroups, permutation groups, cyclic groups (definition and examples), Group codes (single error detection and correction)

Learning Outcomes:
After completion of this unit, the student will be able to:

- test whether the given algebraic structure is a group or not(L4)
- identify different types of groups (L3)
- examine single error detection and correction (L4)

Module IV: Graph Theory 8 L

Definitions, finite and infinite graphs, incidence and degree, isolated pendant vertices, isomorphism, sub graphs, walk, path and circuit, connected and disconnected graphs, components, Euler graphs, Euler graph theorem, operations on graphs, decomposition of Euler graphs into circuits, arbitrarily traceable Euler graphs, Hamiltonian paths and circuits, travelling salesman problem.

Learning Outcomes:
After completion of this unit, the student will be able to:

- identify different graphs and their properties (L3)
- construct Euler and Hamiltonian graphs (L3) Text 3

Module V: Trees 6 L

Some properties of trees, pendant vertices, distance and centers, rooted and binary trees, spanning trees, shortest spanning trees, Kruskal's algorithm.

Learning Outcomes:
After completion of this unit, the student will be able to:

- construct the spanning tree and binary tree from graphs (L3)
- build minimal spanning tree using different algorithms (L3)

Text Books(s)

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997. Dkfjd
2. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2012.

Reference Book(s)

1. Keneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill, 2009.
2. Richard Johnsonburg, Discrete mathematics, 7/e, Pearson Education, 2008.
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2006.

Course Outcomes:

- identify through enhanced logical capabilities (L3)
- find a general solution of recurrence (L3)
- build algebraic structures and relations (L3)
- analyze the concepts in graph theory (L4)
- apply graph theory concepts in core subjects such as data structures and network theory effectively (L3)

19EID132: DESIGN THINKING

L	T	P	C
2	0	2	3

Design is a realization of a concept or idea into a configuration, drawing or a product. Design Thinking is cognitive and practical processes by which design concepts are developed by designers. Innovation is a new idea or a new concept. Product development is the creation of a new or different product that offers new benefits to the end user. This course introduces the design thinking in product innovation.

Course objectives:

- To familiarize product design process
- To introduce the basics of design thinking
- To bring awareness on idea generation
- To familiarize the role of design thinking in services design

Module I: 8 L

Introduction to design, characteristics of successful product development, product development process, identification of opportunities, product planning, Innovation in product development.

Learning Outcomes:

After completion of this unit, the student will be able to:

- identify characteristics of successful product development(L3)
- identify opportunities for new product development(L3)
- plan for new product development(L3)

Module II: 8 L

Design Thinking: Introduction, Principles, the process, Innovation in Design Thinking, benefits of Design thinking, design thinking and innovation, case studies.

Learning Outcomes:

After completion of this unit, the student will be able to:

- explain the principles of Design Thinking(L2)
- identify the benefits of Design Thinking(L3)
- use innovations in Design Thinking(L3)

Module III: 10 L

Idea generation: Introduction, techniques, Conventional methods, Intuitive methods, Brainstorming, Gallery method, Delphi method, Synectics etc. Select ideas from ideation methods, case studies.

Learning Outcomes:

After completion of this unit, the student will be able to:

- explain the techniques in idea generation(L2)
- select ideas from ideation methods(L3)
- identify the methods used in idea generation in some case studies(L3)

Module IV: 10 L

Design Thinking in Information Technology, Design Thinking in Business process model, Design Thinking for agile software development, virtual collaboration, multiuser and multi account interaction, need for communication, TILES toolkit, Cloud implementation.

Learning Outcomes:
After completion of this unit, the student will be able to:

- use Design Thinking in business process model(L3)
- apply Design Thinking for Agile software development(L3)
- use TILES toolkit(L3)

Module V: 8 L

Design thinking for service design: How to design a service, Principles of service design, Benefits of service design, Service blueprint, Design strategy, organization, principles for information design, principles of technology for service design.

Learning Outcomes:
After completion of this unit, the student will be able to:

- use principles of service design(L3)
- explain the benefits of service design(L5)
- apply principles of technology for service design(L3)

Text Books(s)

1. Pahl, Beitz, Feldhusen, Grote – Engineering Design: a systematic approach, Springer, 2007
2. Christoph Meinel and Larry Leifer, Design Thinking, Springer, 2011
3. Aders Riise Maehlum - Extending the TILES Toolkit – from Ideation to Prototyping
4. Marc stickdorn and Jacob Schneider, This is Service Design Thinking, Wiely, 2011

Course Outcomes:

At the end of this course, the student will be able to

- innovate new methods in product development(L6)
- apply Design Thinking in developing the new designs(L3)
- select ideas from ideation methods in new product development(L5)
- use Design Thinking in developing software products(L3)
- apply principles of Design Thinking in service design(L3)

19ECS201: FUNDAMENTALS OF DIGITAL LOGIC CIRCUITS

L	T	P	C
3	0	0	3

Digital logic circuits are the basic building blocks of modern computers. To understand the working of computers, one needs to know how numbers are represented and processed using digital logic circuits. This course first teaches number representation in computers and Boolean algebra. After covering minimization of expressions and basic logic gates, the design of combinational and sequential circuits that perform a specific function are discussed. The aim of the course is to provide the student with an understanding of how data is represented and processed at the hardware level. This course acts as a foundation for a course on Computer Architecture and Organization.

Course Objectives:

- Facilitate the student to represent numbers in different number systems and convert numbers from one number system to another.
- Introduce logic gates, theorems and properties of Boolean algebra.
- Familiarize the student with techniques for minimizing expressions.
- Demonstrate the design of combinational and sequential logic circuits.

Module I: Binary Systems: 8 L

Positional representation of numbers, Decimal, Octal, Hexadecimal number systems, General radix 'r' system, Conversions, Complements, Binary codes, Arithmetic with signed and unsigned numbers (addition, subtraction), Introduction to error detection and error correction.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Explain different number systems(L2)
- Solve the number system conversion problems (L3)
- Apply arithmetic operations on signed and unsigned binary numbers (L3)
- Explain basic error detection and correction methods(L2)

Module II: Boolean Algebra and Logic Circuits: 8 L

Axiomatic definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean Functions, Minterms and Maxterms, Canonical and Standard Forms, Digital logic gates, Synthesis using AND, OR and NOT gates, NAND and NOR logic networks.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Solve expressions in the canonical and standard forms (L3)
- Construct logic circuits with logic gates (L3)
- Construct any Boolean function using Universal gates (L3)
- Summarize the properties of Boolean algebra (L2)

Module III: Gate-Level Minimization: 8 L

The K-Map method, two variable K-Map, three variable K-Map, four variable K- Map, five variable K-Map, six variable K-Map, K-Maps with don’t care conditions (incompletely specified functions), Tabular method for minimization (Quine McCluskey Method), Sum of products (SOP) and Product of sums (POS) simplification.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Illustrate the representation of Boolean expression as a K-map (L2)
- Translate the Boolean expression into its minimal form using K-maps (L2)
- Translate the given expression into its minimal form using QMC method (L2)

Module IV: Combinational Logic 9 L

Design procedures, Adders, Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Priority encoder, Code converters, Seven segment display, Magnitude comparator, Decimal adder (BCD adder), Binary Multiplier.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Explain the working of basic combinational circuits (L5)
- Distinguish between the functions of different combinational circuits (L4)
- Build combinational circuits to perform a required function (L6)

Module V: Sequential Circuits 9 L

Flip Flops, Basic latch, R-S flip flop, D flip flop, T flip flop, JK flip flop, Conversion of flip flops, Registers, Shift registers, Synchronous and Asynchronous (ripple) counters, BCD counter (synchronous andasynchronous), Ring counter, Johnson counter.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Distinguish between combinational circuits and sequential circuits (L2)
- Explain the working of different flip-flops (L5)
- Design registers and counters to perform a given function (L6)

Text Book(s) :

1. M Morris Mano, Michael D. Ciletti Digital Design, 5/e, Pearson Education, 2011.

Reference Book(s):

1. Z.V. Kohavi, Switching Theory and Finite Automata, 2/e, McGraw Hill, 1978.
2. Stephen Brown & Zvonko Vranesic, Fundamental of digital logic with Verilog Design, 2/e, Tata McGrawHill,2007.

19ECS231: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

L	T	P	C
2	0	3	3.5

This course enables the students to gain knowledge on various object oriented aspects of Java. The course tours the students through classes, inheritance, interfaces, packages and exceptions. The knowledge gained in this course can be applied to develop standalone applications for Android, Real Time Programming etc.

Course objectives:

- To familiarize object-oriented programming concepts and techniques.
- To illustrate classes and class libraries, developing classes for simple applications.
- To demonstrate various types of Inheritance mechanisms
- To introduce diverse software packages applicability and usage of Exceptions and Generics.
- To train designing graphical effects through Applets.

Module I: 7 L

Java Programming Fundamentals: Java Language, Key Attributes of Object-Oriented Programming, Java Development Kit, Simple Program, Create Blocks of Code, Keywords, Identifiers, The Java Class Libraries.
Data Types and Operators: Java's Primitive Types, Literals, Variables, Scope and Lifetime of Variables, Operators- Arithmetic, Relational, Logical, Bitwise, Assignment. Type conversion in Assignments, Using a Cast, Operator Precedence.
Program Control Structures: if, switch, for, enhanced for, while, do-while, break, continue.

Learning Outcomes:
After completion of this unit, the student will be able to:

- explain attributes of object oriented programming(L2).
- write a basic program(L2).
- apply various data types and operators specific to Java(L3).
- Implement control structures and extended structures specific to Java (L3).

Module II: 10 L

Introduction to Classes, Objects And Methods: Class Fundamentals, Objects creation, Reference Variables and Assignment, Methods, Returning a Value, Using Parameters, Constructors, Parameterized Constructors, new Operator, this Keyword, finalize()method.
Arrays: 1D Arrays, Multidimensional Arrays, Irregular Arrays, Array References, Using the Length Member.
Strings: String Fundamentals, Literals, String Arrays, Concatenation, toString() ,length(), obtaining characters within a string ,String comparison, picking indexes, modifying string, Command-Line Arguments, Scanner Class, Vector class, Wrapper Classes, Parsing, Auto boxing and Un boxing.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Identify the advantages of using classes(L3).
- demonstrate the knowledge on Arrays and irregular arrays(L3).
- Implement classes that support user input(L3).

Module III: 7 L

A Closer Look into Methods and Classes: Controlling Access to Class Members, Passing objects to methods, Passing arguments, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Variable-Length Arguments. Inheritance: Basics, Member Access and Inheritance, Constructors and Inheritance, Using Super, Multilevel Hierarchy, Constructor execution hierarchy, Super class References and Subclass Objects, Method Overriding, Abstract Classes, Using final, Object Class

Learning Outcomes:
After completion of this unit, the student will be able to:

- interpret knowledge on method usage variants in classes(L2).
- use various types of inheritances(L3).

Module IV: 8 L

Interfaces: Fundamentals, Creating and Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Extending Interfaces, Nested Interface. Packages: Package Fundamentals, Member Access, Importing Packages, Static import.
Exception Handling: Exception Hierarchy, Fundamentals, Consequences of an Uncaught Exception, Handling errors, Multiple Catch, Throwing and Re throwing an Exception, Throw able, using finally, using throws, Creating Exception Subclasses.

Learning Outcomes:
After completion of this unit, the student will be able to:

- implement Multiple inheritance through interfaces(L3).
- develop packages(L3).
- employ exceptions originated in various scenarios(L3).

Module V: 8 L

Multi-Threading: Introduction to threads, creating a thread, extending the Thread class, implementing Run able interface, life cycle of a thread, priority of a thread, synchronization and deadlock.
Applet Programming: Introduction, how applets differ from applications, building applet code, applet life cycle, about HTML, designing a web page, passing parameters to applets, getting input from the user.

Learning Outcomes:
After completion of this unit, the student will be able to:

- illustrate streams and their contribution towards I/O mechanism(L2). Text 2
- explain the concept of generic programming(L2). Text 4
- develop graphics with the support of Applets(L3).

Text Books(s)

1. Herbert Schildt, Dale Skrien, Java Fundamentals A Comprehensive Introduction, 1/e, Tata McGraw Hill, 2017.

Reference Book(s)

1. Herbert Schildt, The Java complete References, 9/e, Tata McGraw Hill,2014.
2. Y. Daniel Liang, An Introduction to JAVA Programming, 10/e, Tata
3. McGraw Hill.
4. Kathy Sierra, Head First Java, 2/e, Shroff Publishers,2012
5. Balagurusamy, Programming with JAVA, 2/e, Tata McGraw Hill, 2014.

Course Outcomes:

- describe the data types, operators and control structures (L2). Outcome 2
- understand the concepts of Object Oriented Programming(L2).
- apply attributes of OOP to reap its benefits(L3).
- demonstrate the ease of handling various scenarios of program execution without abrupt interruption(L2).
- explain the flavour of generics(L2).
- construct standalone applications for various platforms(L3).

For Laboratory courses :List of Experiments

1. Develop a program that will take a string from a command line argument and check whether it is a palindrome or not.
2. Given two single dimensional arrays A and B which are sorted in ascending order. Write a program to merge them into a single sorted array C that contains every item from arrays A and B in ascending order.
3. Develop a program to implement the following string methods. a) equals() b) compareTo() c) substring() d) indexOf() e) toLowerCase()
4. Develop a program to demonstrate constructor overloading
5. Design a vehicle class hierarchy in Java, and develop a program to demonstrate Polymorphism.
6. Develop a program to demonstrate multiple inheritance through interface.
7. Write a program to find the roots of a quadratic quotation using interface and packages.
    - Declare an interface in packageQuad1
    - Declare another package Quad2 and implement the interface
8. Develop a program to demonstrate exception handling by using FINALLY &MULTIPLE CATCH statements.
9. Write a program to throw a user defined exception for employee details
10. If an employee age is greater than 50, an age exception must be thrown
11. Develop an applet that receives three numeric values as input from the user and then display the largest of the three.

19ECS203: Data Communications

L	T	P	C
2	0	0	2

A large majority of computer applications require communication of data from one device to another. As such, this course deals with data communications, including conversion of data into a signal, propagation of the signal through a medium and conversion of the signal back into data. Proper communication also requires the two communicating devices to follow a common protocol. This course covers the concepts of layered network architecture, properties of different transmission media and data communication principles. Various signal encoding techniques and their merits and demerits are taught, together with basic error and flow control techniques and multiplexing. The course acts as a foundation for later courses.

Course objectives:

- Introduce the basic concepts of data communication and layered models
- Familiarize the concepts of Data Transmission and various characteristics of transmission media
- Study the analog and digital signal encoding techniques
- Expose the basic error control and flow control techniques.
- To get acquainted with static channel allocation using multiplexing techniques

Module I: Data communication, Data networking and the Internet 9 L

A communication model, data communications, networks, the Internet. Protocol Architecture: Need for protocol architecture, TCP/IP protocol architecture, OSI model, TCP/IP Vs OSI model.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Explain the basic concepts of data communications (L2).
- Discuss the nature and evolution of internet technology(L2)
- Infer the necessity of layered protocol architecture (L2)
- Analyse the functionalities of the OSI and TCP/IP models (L4).
- Summarize the characteristics of OSI and TCP/IP models(L2)

Module II: Data transmission 9 L

Concepts and terminology, analog and digital data transmission, transmission impairments, channel capacity. Transmission Media: Guided and unguided.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Discuss about the concepts and terminology of Data Transmission (L2).
- Describe Analog transmission, Digital transmission (L2)
- Summarize various Transmission impairments(L2)
- Explain the concept of Channel capacity under given considerations(L2)
- Compare guided and unguided media(L2)

Module III: Signal encoding techniques 9 L

Digital data to digital signals, digital data to analog signals, analog data to digital signals, analog data to analog signal.

Learning Outcomes:
After completion of this unit, the student will be able to:

- How to represent digital data by using digital signals (L3)
- Able to learn how to convert analog signal to digital data (L3)
- Ability to know converting digital data to a bandpass analog signal (L2)
- Ability to know Converting a low pass analog signal to a bandpass analog signal (L3)
- Compare different digital modulation techniques (L3)

Module IV: Digital Data Communication Techniques 9 L
Asynchronous and synchronous transmission, types of errors, error detection techniques, error correction techniques (single bit) Data link control protocols: Flow control, error control, high level datalink control (HDLC) protocol.

Learning Outcomes:
After completion of this unit, the student will be able to:

- learn the Asynchronous and Synchronous transmission (L3)
- detect error position and error correction (L4)
- learn the main functions of the data link layer (L2)
- Analyse the data link control and media access control (L2)
- learn different protocols (L4)

Module V: Multiplexing 9 L
Frequency division multiplexing, characteristics, synchronous time division multiplexing, characteristics. statistical time division multiplexing, characteristics.

Learning Outcomes:
After completion of this unit, the student will be able to:

- describe the need for multiplexing(L2)
- illustrate the working of FDM and TDM techniques(L2)
- summarize the characteristics of Frequency Division Multiplexing(L2)
- explain the difference between Synchronous TDM and Statistical TDM techniques(L2)
- compare the performance of multiplexing techniques under different conditions(L3)

Text Books(s)

1. William Stallings, Data and Computer Communications, 8/e, Pearson Education., 2013.

Reference Book(s)

2. Fred Harshall, Data Communications, Computer Networks and Open systems,4/e, Pearson Education, 2005.
3. Behrouz A Forouzan, Data Communications and Networking, 4/e, McGraw Hill, 2012.

Course Outcomes:
At the end of the course, students will be able to

- Explain and summarize the purpose of OSI and TCP/IP network architectures (L2)
- Compare the properties of Data transmission and various transmission Media(L2)
- Describe the analog and digital signal encoding techniques
- Analyse error and flow control techniques
- Explain different multiplexing techniques and their characteristics

19ECS221: COMPUTER ENGINEERING WORKSHOP

L	T	P	C
0	0	4	2

The Computer Engineering Workshop course enables the students to gain practical knowledge of PC Hardware and Software, Software installation, troubleshooting aspects, working with the Internet, Excel, and PowerPoint tools. This is spread over 14 weeks of duration.

Course objectives:

- Demonstrate assembly and disassembly of a Personal Computer.
- Installation of an Operating System.
- Train to troubleshoot either Hardware or Software.
- Enable to work with Internet and Search Engines.
- Familiarize with MS Office Tools (Excel and PowerPoint).

Module I: PC Hardware and Software **6 P**

Task 1: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a viva. Students need to go through the video, which shows the process of assembling a PC. A video would be given as part of the course content.

Task 2: Every student should individually install MS Windows on their personal computer. The lab instructor should assist and verify the installation, and the teachers follow it up with a viva.

Task 3: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should assist and verify the installation, and the teachers follow it up with a viva.

Task 4: This task covers basic commands and system administration in Linux, including basic Linux commands in bash, Create hard and symbolic links, Text processing, and usage of wildcards.

Learning Outcomes:

After completion of this unit, the student will be able to:

- assemble and disassemble various components of PC [L2]

- identify the names, distinguishing features, and units for measuring different kinds of Components and storage devices [L1]
- identify the names and distinguishing features of different kinds of input and output devices [L1]
- install system software's like windows and Linux [L3]
- perform various basic commands and operations on files in Linux [L3]

Module II: Hardware and Software Troubleshooting 9 P

Task 5: Hardware Troubleshooting: Students must be given a PC that does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Task 6: Software Troubleshooting: Students must be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a viva.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Indicate the names and functions of hardware ports and the parts of the motherboard [L1]
- understand the process of reviewing, diagnosing and identifying operational or technical problems within the system [L2]
- resolve physical and/or logical problems and issues within computing hardware [L3]
- Perform the process of scanning, identifying, diagnosing and resolving problems, errors and bugs in software [L3]
- resolve the issues due to incorrect installation or restoring software after corruption or file deletion caused by a virus [L3]

Module III: Internet and World Wide Web 9 P

Task 7: Orientation and Connectivity Boot Camp: Students should connect to their Local Area Network and access the Internet. In the process, they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity, preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 8: Web Browsers and Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars, and pop-up blockers. Plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 9: Search Engines and Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors.

Task 10: Cyber Hygiene: Students would be exposed to the various threats on the Internet and would be asked to configure their computers to be safe on the Internet. They need to install anti-virus software first and configure their firewall and windows update on their computer. Then they need to customize their browsers to block pop-ups, block ActiveX downloads to avoid viruses or worms.

Learning Outcomes:

After completion of this unit, the student will be able to:

- demonstrate the setting up of new dial-up connections [L2]
- illustrate the process of creation and accessing the emails [L2]
- explain the different types of web browsers [L2]
- select the appropriate search engine for a specific application [L1]
- install freeware antivirus software to the system [L3]

Module IV: Excel **9 P**

Task 11: Excel Orientation: The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) Excel as a Spreadsheet tool.

Task 12: Using Excel: Accessing, an overview of toolbars, saving excel files, using help and resources, creating a Scheduler: Features to be covered: Gridlines, Formatting Cells, Summation, Autofill, Formatting Text.

Task 13: Calculating GPA: Features to be covered: Cell Referencing, Formulae in excel: Count, Average, Standard deviation, etc., Charts, Renaming and Inserting worksheets, Hyperlinking, LOOKUP/VLOOKUP, Sorting, Conditional formatting.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Identify the names and functions of the Excel interface components. [L1]
- Enter and edit data, Format data and cells. [L1]
- Use formulas, including the use of built-in functions, and relative and absolute references. [L3]
- Create and modify charts. [L3]
- Preview and print worksheets. [L2]

Module V: Power Point **9 P**

Task-14: PPT Orientation: Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines, and Arrows.

Task-15: Making interactive presentations: Hyperlinks, Inserting Images, Clip Art, Audio, Video, Objects, Tables, and Charts.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Identify the names and functions of the PowerPoint interface. [L1]
- Create and manipulate simple slide shows with outlines and notes. [L3]
- Create slide presentations that include text, graphics, animation, and transitions. [L3]
- Use design layouts and templates for presentations. [L3]
- Create a PowerPoint presentations. [L3]

Text Books(s)

1. Vikas Gupta, Comdex Information Technology Course Tool Kit, Wiley Dreamtech, 2009.
2. Cheryl A Schmidt, The Complete Computer upgrade and repair book, Wiley,3/e, Dreamtech, 2002.
3. ITL Education Solutions Limited, Introduction to Information Technology, Pearson Education, 2006.
4. Kate J. Chase, PC Hardware and A+ Handbook, PHI (Microsoft), 2000.

Reference Book(s)

1. Dinesh Maidasani, Computer Fundamentals, MS Office and Internet & Web Technology, Firewall Media, 2005.
2. Hardware and Software of Personal Computers by Sanjay K. Bose.

Course Outcomes:

At the end of the course, students will be able to

- Identify various hardware components of a Personal Computer(L3)
- Install Operating System(L3)
- Troubleshoot hardware and software(L3)
- Work with Internet and Search engines(L4)
- Make use of Excel and PowerPoint(L3)

19EMC281: CONSTITUTION OF INDIA

L	T	P	C
3	0	0	0

Module I: Introduction to Indian Constitution 10 L

Constitutional history, constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.

Module II: Rights and Duties 8 L

Citizenship, fundamental rights and directive principles, fundamental duties.

Module III Union Government 8 L

President and vice president, election, removal and powers, prime minister and council of ministers, parliament, supreme court, union, state relations, emergency provisions.

Module IV: State and Local Governments 8 L

Governor, state legislature, assembly and council, chief minister and council of ministers, high court, rural and urban local governments with special reference to 73rd and 74th constitutional amendment acts.

Module V: Other Constitutional and Statutory Bodie 8 L

Comptroller and auditor general, election commission, finance commission, attorney general and advocate general, union public service commission (UPSC), state public service commissions (SPSCs), tribunals, national human rights commission (NHRC).

Text Books(s)

1. J. C. Johari, Indian Government and Politics, Vishal Publications, Delhi, 2009
2. M. V. Pylee, Introduction to the Constitution of India, 5/e, Vikas Publishing House, Mumbai, 2007

Reference Book(s)

1. D.D. Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis, Gurgaon, India, 2011
2. Subhas C. Kashyap, Our Constitution, 2/e, National Book Trust India, New Delhi, 2013.

19EMC282: ENVIRONMENTAL SCIENCES

L	T	P	C
3	0	0	0

The course enables the students to adapt eco-centric thinking and actions rather than human-centric thinking on natural resources, their utilization and conservation. The course also focuses on the importance of ecosystems, biodiversity and their degradation leads to pollution, finding solutions through application of control measures to combat pollution and legal measures to achieve sustainable development.

Course objectives:

- To familiarize the students about the importance of the environmental studies.
- To acquaint with different natural resources and their associated problems.
- To introduce various ecosystems, values of biodiversity and their conservation.
- To expose to today's pollution levels and their impacts.
- To create awareness on different social issues such as conservation of water, green building concept
- To impart knowledge on present population scenario, its impacts and role of informational technology on environment and human health.

Module I: **Introduction to environment and natural resources** 10 L

Introduction to environment: Definition, scope and importance, multidisciplinary nature of environment, need for public awareness. Natural Resources: Renewable and non-renewable resources, natural resources and associated problems. Forest resources: Uses, Reasons for over-exploitation, deforestation effects, timber extraction, case studies. Water resources: Use and over – utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral resources: Uses, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, Impacts of overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, use of renewable and non-renewable energy sources, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Learning Outcomes:
After completion of this unit, the student will be able to:

- list different renewable and non-renewable resources (L1)
- learn how the over-exploitation of natural resources impact human life (L1)
- demonstrate the role of an individual in the conservation of natural resources (L2)
- explain the equitable use of natural resources for sustainable lifestyles (L2)

Module II: **Ecosystems and biodiversity: Structure components of ecosystem** 9 L

Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem (10% law), Ecological succession. Biogeochemical cycle: (Nitrogen, carbon, Phosphorus cycle). Introduction, types, structure and function of the following ecosystem: - Forest ecosystem. Grassland ecosystem. Desert ecosystem. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity: Definition, Levels of 100 biodiversity: genetic, species and ecosystem diversity. Biogeographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega – diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, manwildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ conservation of biodiversity.

Learning Outcomes:

After completion of this unit, the student will be able to:

- learn how ecosystem functions (L1)
- explain the structure and function of terrestrial and aquatic ecosystems (L2)
- illustrate the values and threats to biodiversity (L2)
- explain the importance of conservation of biodiversity (L2)

Module III: **Environmental pollution and control** 8 L

Environmental Pollution: Definition, causes, effects and control measures: Air Pollution, Water pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards, Solid waste Management, e-waste, Hazardous waste management. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: floods, earthquake, cyclone and landslides.

Learning Outcomes:

After completion of this unit, the student will be able to:

- list causes, effects and control measures of pollution (air, water & soil) (L1)
- classify different types of pollutants (L2)
- explain disaster management of floods, earthquake, cyclone and landslides (L2)
- identify the pollution related case studies (L3)
- demonstrate the role of an individual in prevention of pollution (L2)

Module IV: **Social issues and global environment problems and efforts** 9 L

From unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management, Remote sensing and GIS methods. Resettlement and rehabilitation of people: its problems and concerns. Case Studies, Environmental ethics: Issues and possible solutions. Green building concept, Environmental Impact Assessment (Checklists, matrix methods), Environmental Management Plan, Climate change: global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust

Learning Outcomes:

After completion of this unit, the student will be able to:

- explain different water conservation methods (L2)
- compare remote sensing and GIS methods (L2)
- apply green building concept (L3)
- demonstrate the consequences of global warming, acid rains and ozone layer depletion (L2)
- analyze environmental impact assessment and management plan (L4)

Module V: **Human population and environment legislation** 6 L

Population growth, variation among nations. Family Welfare programme. Environment and human health. HIV/AIDS, Human rights. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Environmental Protection Act, Pollution prevention act. Issues involved in enforcement of environmental legislation. Public awareness. Project Work.

Learning Outcomes:
After completion of this unit, the student will be able to:

- compare population growth and variation among nations (L2)
- apply value education (L3)
- classify women and child welfare (L2)
- distinguish different environmental legislation acts and issues involved in enforcement of legislation (L4)
- analyze the role of information technology in environment and human health (L4)

Text Books(s)

1. Anubha Kaushik and C.P. Kaushik, Text book of environmental studies New Age International Publisher ,2014.
2. Erach Barucha, Text book of environmental studies for undergraduates courses, published by – University Grants Commission, University Press ,2005
3. Anindita Basak, Environmental Studies. Pearson ,2009

Reference Book(s)

1. D.K. Asthana and Meera Asthana, A Text book of Environmental Studies, S. Chand ,2010.
2. P.M Cherry Solid and Hazardous Waste Management, CBS Publisher ,2016
3. Charles H. Ecclestion, Environmental Impact Assessment, CRC Press ,2011.
4. K.K. Singh, Natural Resources Conservation and Management, MD Publications,2008.
5. J. Jeffrey Peirce, Ruth F. Weiner and P. Aarne Vesilind, Environmental Pollution and Control, Butterworth-Heinemann ,1998.
6. James Maclaurin and Kim Sterelny, What is Biodiversity, The University of Chicago Press 2008.
7. R.B. Mandal, Introductory Methods in Population Analysis, Concept Publishing Co, 2007.

Course Outcomes:

- explain about environment and natural resources (L2)
- illustrate the values and threats to biodiversity (L2)
- identify the pollution related case studies (L3)
- demonstrate the consequences of global warming, acid rains and ozone layer depletion (L2)
- analyze the role of information technology in environment and human health (L4)

19EHS221: COMPREHENSIVE SKILL DEVELOPMENT II

L T P A C
0 0 0 6 1

Course Objectives:

- To encourage the all round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes:

- On completion of the course, student will be able to– Effectively communicate through verbal/oral communication and improve the listening skills
- Write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
- Student will be able to understand the problems and develop his competitive coding skills.
- Apply the skills in various domains and will be able to solve complex problems faced by the industry.
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality

Part-1 **3 Hours per week**

A. Verbal and Soft Skills:

Communication Skills, Presentation Skills, Decision Making and Problem-Solving, Group Discussion.

Unit	**Module/ Topics**	**Hrs**
1.	Communication Skills	4
2.	Presentation Skills	4
3.	Decision Making and Problem-Solving	3
4.	Group Discussion	4
	Total	**15**

B. Quantitative Aptitude and Reasoning

Puzzles, Numbers, Arithmetic, Data Interpretation.

Unit	**Module/ Topics**	**Hrs**
1.	Non-Verbal Reasoning	5
2.	Data Sufficiency	2
3.	Analytical Reasoning	3
4.	Puzzles	5
	Total	15

Unit	Module/ Topics	Hrs
1.	Numbers [Number System, Divisibility rules, Remainders, LCM & HCF]	3
2.	Numerical Computation and Estimation-1 [i. Chain Rule ii. Ratio Proportions iii. Partnerships & Averages iv. Percentages v. Profit-Loss, and discounts vi. Mixtures]	6
3.	Data Interpretation [Pie diagrams, Line Graph, Bar Graph, Tabular forms, and Case lets]	3
4.	Progressions and Series	3
	Total	15

Part-2 **3 Hours per week**

Coding: Complex problem solving using Data Structures in terms of improving efficiency:
Time Complexity and Space Complexity, Linked List, Stacks and Queues using Linked List, Binary Trees, Binary Search Trees, Representation of graphs, Breadth First Search, Depth First Search, Dynamic Programming.

Scheme of Evaluation

Internal Assessments by Assignments, Quizzes (multiple Choice questions). All the Students are expected to do at least 5 problems in each topic and they should submit the content written by them in each topic for final evaluation.

Type of Assessment	No.of Marks
At least 5 problems in each topic	15
Assignments	15
Content writing	10
Quizzes	10
Total	**50**

Late Work

Each homework is due in the beginning of the class meeting (that is, at 6:00pm) on the due date. If homework is submitted within seven days after this deadline, the grade will be reduced by 50%. Submission more than seven days after the deadline will not be accepted. If you have a serious reason for requesting an extension, such as illness or family emergency, you should discuss it with one of the instructors as soon as the problem arises, and definitely before the submission deadline.

References:-

The course does *not* have a required textbook. You may optionally use the following textbook and URLs to look up standard algorithms:

1. Data Structures and Algorithms made easy by Narasimha Karumanchi
2. **Data Structure and Algorithmic Thinking with Python by Narasimha Karumanchi**
3. **Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide and Conquer and Dynamic Programming by Narasimha Karumanchi**
4. Coding Interview Questions by Narasimha Karumanchi
5. Competitive Programming in Python- 128 Algorithms to develop your Coding Skills by Cristhop Durr & Jill-Jen Vie.
6. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests (Undergraduate Topics in Computer Science) *by* Antti Laaksonen
7. https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/
8. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
9. https://codeforces.com/
10. https://leetcode.com/

19EMA212: ENGINEERING MATHEMATICS-IV
Differential Equations

L	T	P	C
3	0	0	3

This course is designed for engineering students to impact the knowledge on differential equations, both ordinary and partial, which are widely used in the modelling and analysis of a wide range of physical phenomena and has got applications across all branches of engineering. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course objectives:

- To familiarize the students with the basic concepts of linear differential equations and their applications.
- To explain the evaluations of linear homogeneous and non-homogeneous differential equations.
- To teach the applications of higher order differential equations..
- To explain the concepts of first order partial differential equations.
- To teach the applications of higher order partial differential equations.

Module I: 10 L

Differential Equations of First Order and Its Applications : Exact differential equations, Integrating factors, rules to find an integrating factor, Definition of linear differential equation of any order, Solving first order linear differential equation, Bernoulli's equation, Applications: Newton's law of cooling, Rate of decay of radio-active materials.

Learning Outcomes:

After completion of this unit, the student will be able to:

- distinguish between linear and non linear differential equations (L4).
- solve exact differential equations (L3).
- apply the concept of first order ordinary differential equations to solve real world problems (L3).

Module II: 8 L

Linear Differential Equations of Higher Order :Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

Learning Outcomes:

After completion of this unit, the student will be able to:

- classify the solutions of linear differential equations (L3)
- identify the essential characteristics of linear differential equations with constant coefficients (L3)
- solve the linear differential equations with constant coefficients by appropriate methods (L3)

Module III: 8 L

Equations Reducible to Linear Differential Equations and Applications

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

Learning Outcomes:
After completion of this unit, the student will be able to:

- examine the special type of nonlinear differential equations (L4)
- analyze physical situations using higher order differential equations (L4)

Module IV: 8 L

Partial Differential Equations: First order partial differential equations, solutions of first order linear PDEs, Charpit's method, solutions to homogenous and non-homogenous linear partial differential equations

Learning Outcomes:
After completion of this unit, the student will be able to:

apply a range of techniques to find solutions of PDEs (L3)
identify the basic properties of PDEs (L3)

Module V: 10 L

Partial Differential Equations– Higher order: Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.

Learning Outcomes:
After completion of this unit, the student will be able to:

- apply a range of techniques to find solutions of higher order PDEs (L3)
- analyze physical situations using higher partial ordinary differential equations (L4)

Text Books(s)

1. Erwin Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Book(s)

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
3. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

Course Outcomes:

- apply the concept of first order ordinary differential equations to solve real world problems (L3).
- evaluate linear homogeneous and non homogeneous differential equations (L3)
- apply the concept of higher order ordinary differential equations to solve real world problems (L3).
- apply the concept of first order partial differential equations to solve real world problems (L3).
- apply the concept of higher order partial differential equations to solve real world problems (L3).

19EMA206: ENGINEERING MATHEMATICS-IV
NUMBER THEORY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

This course is designed to give an introduction to the deep theory of the integers, with focus on the properties of prime numbers, and integer or rational solutions to equations.

Course objectives:

- The course provides an introduction to basic number theory, where the focus is on computational aspects with applications in cryptography.
- To gain knowledge about the mathematics of the cryptographic algorithms.
- To get an insight into the working of different existing cryptographic algorithms.
- To learn how to use cryptographic algorithms in security.

Module I: 8 L

Basic Concepts in Number Theory: Divisibility, Greatest Common Divisors, Euclidean Algorithm, Factorization of integers, Congruence, Modular arithmetic, Quadratic residues, Fermat's theorem, Cauchy 's theorem, Chinese Remainder theorem, Primality testing algorithm, Euclid's algorithm for integers, Quadratic residues, Legendre symbol, Jacobi symbol

Learning Outcomes:

After completion of this unit, the student will be able to:

- develop the basics of number theory (L3)
- perceive the congruence modulo, modular arithmetic and quadratic residues (L5)

Module II: 6 L

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Learning Outcomes:

After completion of this unit, the student will be able to:

- discover the concepts of different modes of symmetric ciphers (L4)

Module III: 10 L

Block Ciphers: Traditional Block Cipher Structures, Fiestal Cipher, Data Encryption Standard, Advanced Encryption Standard, Block Cipher Operation, Stream Ciphers, RC4

Pseudo Random Number Generators: Principles of Pseudo random number generation.

Pseudo Random Number Generators, Randomness and Pseudo randomness.

Learning Outcomes:

After completion of this unit, the student will be able to:

- determine the classical encryption techniques (L5)
- determine AES, DES (L5)

Module IV: 10 L

Public Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm. Diffie-Hellman Key Exchange Algorithm, Elliptic Curve Cryptosystem, Probabilistic encryption.

Learning Outcomes:

After completion of this unit, the student will be able to:

estimate the importance of Public Key Cryptography (L5)

apply RSA algorithm and Elliptic Curve Cryptography (L3)

Module V: 10 L

Cryptographic Hash Function Applications of Cryptographic hash Functions. , Hash Functions, Message Authentication Codes, Message Digest, Digital Signatures, Introduction to DSA

Learning Outcomes:

After completion of this unit, the student will be able to:

- apply cryptographic hash function for Message Authentication Code (L3)
- choose cryptographic hash functions for Digital Signatures (L5)

Text Books(s)

1. Neal Koblitz, A Course in Number Theory and Cryptography: Springer- Verlag, New York Inc. May 2001.
2. William Stallings, Cryptography and Network security: Principles and Practice, Pearson Education, 2002.
3. Stinson D, Cryptography: Theory and Practice, 3/e, Chapman & Hall/CRC, 2012

Reference Book(s)

1. W. Trappe and L. C. Washington, Introduction to Cryptography with Coding Theory, 2/e, Pearson Education 2007.
2. Douglas R. Stinson, Cryptography: Theory and Practice, CRC Press.
3. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995.
4. Ivan Niven, Herbert S. Zukerman, Hugh L. Montgomery John Wiley, An Introduction to the Theory of Numbers, 5/e, 2015.

Course Outcomes:

- develop fundamental mathematical concepts of number theory (L3)
- determine the classical encryption techniques (L5)
- construct public key encryption, key establishment protocols and digital signatures (L3)

19EMA214: ENGINEERING MATHEMATICS-IV
(DESCRIPTIVE STATISTICS)

L	T	P	C
3	0	0	3

This course is an introductory to descriptive statistics for undergraduate students in engineering sciences. Statistical methods are important tools which provide the engineer with both descriptive and analytical methods for dealing with the variability in observed data. It introduces students to cognitive learning in statistics; and develops skills on analyzing the data by using different tests and designing the experiments with several factors.

Course objectives:

- To summarize the data and to obtain its salient features from the vast mass of original data.
- To describe the basic measures of statistics including measures of location, dispersion and linear regression.
- To analyze data pertaining to attributes and to interpret the results.
- To Interprets summery features of data.
- To understand the concepts of Large Samples and Small Samples

Module I: 8 L

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives.
Learning Outcomes:
After completion of this unit, the student will be able to:

- organize, manage and present the given data. (L3)
- analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- understand the difference between the levels of measurement: nominal, ordinal, interval, and ratio.
- identify the general elements that characterize a study.
- understand the fundamentals of experimental design.

Module II: 8 L

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.
Learning Outcomes:
After completion of this unit, the student will be able to:

- analyze statistical data using measures of central tendency, dispersion and location.
- understand the differences between each measure of center.
- identify the symbols and know the formulas for sample and population means.
- determine the values in a data set that are outliers.
- identify the values to be removed from a data set for an n − percent trimmed mean.
- calculate the range and inter-quartile range
- calculate the standard deviation for a population and a sample, and understand its meaning.

Module III: 8 L

Bivariate Data Analysis: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression

Learning Outcomes:
After completion of this unit, the student will be able to:

- understand the concept of bivariate data, correlation and the use of scatter plots to display bivariate data
- understand when the terms "positive," "negative" "strong," and "perfect" apply to correlation between two variables in a scatter plot graph
- calculate and interpret the correlation between two variables then fitting of regression line.
- calculate the simple linear regression equation for a set of data
- calculate residuals and understand the least-squares property and its relation to the regression equation

Module IV: 8 L

Curve Fitting & Attributes: Principle of least squares and fitting of polynomials and exponential curves. Theory of attributes: Independence and association of attributes, consistency of data, measures of association and contingency, Yule's coefficient of colligation.

Learning Outcomes:
After completion of this unit, the student will be able to:

- to find the probabilities of events, to fit various mathematical curves (linear and non- linear).
- to observed data by using principle of least squares and forecasting values of unknown values of the variable.
- know the association between the attributes
- know the 'Conditions for the consistency' and criteria for the independence of data based on attributes
- knowledge of other types of data reflecting quality characteristics including concepts of independence and association.

Module V: 10 L

Testing of Hypothesis : Formulation and procedure testing of hypothesis
Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems. Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes:
After completion of this unit, the student will be able to:

- apply parametric tests in different real life data.
- know the difference between sample proportions and sample means based on large sample.
- understand the differences between the F-and the Student's t-distributions.
- understand the features of experiments that allow Goodness-of-Fit tests to be used.
- run a Test of Independence to determine whether two variables are independent or not.

Text Books(s)

1. Feller, W, An Introduction to Probability theory and application, Wiley,2014.
2. Goon A.M., Gupta M.K. and Dasgupta B, Fundamentals of Statistics, Vol.I & II, 8th Edition. The World Press, Kolkata,2002.

3. Gupta, S.C. and Kapoor, V.K, Fundamental of Mathematical Statistics, 11th Edition,Sultan Chand &Sons,2007

Reference Book(s)

1. Statistics with Applications, (7th Edition.), Pearson Education, Asia. 1. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical
2. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edition., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New D.
4. S. Ross, A First Course in Probability, Pearson Education India, 2002.

Course Outcomes:

- analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- analyze statistical data using measures of central tendency, dispersion and location.
- calculate and interpret the correlation between two variables then fitting of regression line.
- know the 'Conditions for the consistency' and criteria for the independence of data based on attributes.
- understand the differences between the F-and the Student's t-distributions.

19EMA216: ENGINEERING MATHEMATICS-IV
(APPLIED STATISTICS)

L	T	P	C
3	0	0	3

This course is an introductory to applied statistics for undergraduate students in engineering sciences. Statistical methods are important tools which provide the engineer with both descriptive and analytical methods for dealing with the variability in observed data.

Course objectives:

- To acquaint the students with some important but useful concepts on topics in sampling theory, ANOVA and time series analysis
- To train and develop in depth understanding of the key technologies in data science and analytics: applied statistics, data mining, data visualization techniques, and forecasting methods
- To provide opportunities of higher studies in the area of Applied statistics and data science.
- To impart knowledge on various theoretical and practical aspects of statistics and data science.
- To practice problem analysis and decision-making.
- This course will give exposure to four applied fields of statistics viz. Sampling Theory, Design of experiments, Time Series, Index Numbers, and Demographic methods

Module I: 8 L

Sampling Theory: Principle steps in a sample survey, Censes versus sample survey, sampling and Non-sampling errors. Types of sampling - subjective, probability and mixed sampling methods. Simple Random Sampling, Stratified random sampling, Systematic sampling, Advantages and Disadvantages of above methods of sampling.

Learning Outcomes:
After completion of this unit, the student will be able to:

- know the basic knowledge of complete enumeration and sample, sampling frame, sampling distribution,
- know the basic knowledge of sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling etc.,
- introduced to various statistical sampling schemes such as simple, stratified and systematic sampling
- an idea of conducting the sample surveys and selecting appropriate sampling techniques,
- knowledge about comparing various sampling techniques.

Module II: 10 L

Analysis of Variance: One way &Two way classifications.
Design of Experiments: Principles of experimentation in Designs, analysis of completely randomised design (CRD), Randomised block design (RBD) and Latin square design (LSD) including one missing observation.

Learning Outcomes:
After completion of this unit, the student will be able to:

- understand what between-group and within-group variability consist of and represent
- understand the purpose of conducting analytical comparisons

- understand the process of designing an experiments
- make use of the basics of the Design of Experiments such as randomization and blocking.
- identify common and important types of experimental designs with respective advantages and disadvantage

Module III: 10 L

Time series: -Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares, moving average methods. Growth curves and their fitting with reference to modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

Learning Outcomes:
After completion of this unit, the student will be able to:

- time series data, its applications to various fields and components of time series,
- fitting and plotting of various growth curves such as modified exponential, Gompertz and logistic curve,
- fitting of trend by Moving Average method
- measure the Seasonal Indices by Ratio-to-Trend ,
- measure the Ratio-to-Moving Average and Link Relative methods

Module IV: 10 L

Index Numbers: Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.

Learning Outcomes:
After completion of this unit, the student will be able to:

- formulate and application of index numbers.
- solve the problems and the construction of index numbers.
- appreciate, formulate solutions, analyze use of index numbers and time series to real world problems.
- Know the concepts of time reversal test, factor reversal test and circular test.
- verify the various tests for good index numbers, chain base and consumer price index number

Module V: 8 L

Vital statistics: Introduction, definition and uses of vital statistics. Sources of vital statistics ,registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate ,total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and abridged life tables.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Learn the distinction between Vital Statistics and Demography.
- Learn the measurement of Population
- Learn the Distinction between Rate and Ratio.
- Learn the Basic measures of Mortality.
- Learn the Concept of Life Tables, their construction and uses.
- Learn the Basic measures of Fertility & Population Growth.

Text Books(s)

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol.I& II, 8th Edition. The World Press, Kolkata.
2. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
3. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency.
4. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey Designs .Wiley Eastern

Reference Book(s)

1. B.L.Agarwal: Basic Statistics. New Age publications.
2. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.

Course Outcomes:

- know the basic knowledge of sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling etc.,
- make use of the basics of the Design of Experiments such as randomization and blocking
- measure the Ratio-to-Moving Average and Link Relative methods
- know the concepts of time reversal test, factor reversal test and circular test.
- know the Concept of Life Tables, their construction and uses.

19EID232: INTERNET OF THINGS

L	T	P	C
2	0	2	3

The Internet of Things (IoT) is a network of a wide variety of devices like vehicles, humans, soil etc. These devices gather data using sensors, which can be used for monitoring or control. This course is an introduction to the embedded devices, communication protocols and APIs used in IoT.

Course Objectives

- Introduce the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT Platforms
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with application program interfaces for IoT.
- Enable students to create simple IoT applications.

UNIT I **5 L**

Overview of IoT: The Internet of Things: An Overview, The Flavor of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? Design Principles for Connected Devices, Calm and Ambient Technology, Privacy, Keeping Secrets, Whose Data Is It Anyway?,Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet, Graceful Degradation, Affordances.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain IoT architecture(L2)
- interpret the design principles that govern connected devices(L2)
- summarize the roles of various organizations for IoT(L2)

UNIT II **6 L**

Embedded Devices - I: Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the basics of microcontrollers(L2)
- outline the architecture of Arduino(L2)
- develop simple applications using Arduino(L3)

UNIT III **6 L**

Embedded Devices - II: Raspberry Pi , Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness, Other notable platforms, Mobile phones and tablets, Plug Computing: Always-on Internet of Things.

Learning Outcomes:

After completion of this unit, the student will be able to

- outline the architecture of Raspberry Pi(L2)
- develop simple applications using Raspberry Pi(L3)
- select a platform for a particular embedded computing application(L3)

UNIT IV **6 L**

Communication in the IoT: Internet Principles, Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols- HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.

Learning Outcomes:

After completion of this unit, the student will be able to

- interpret different protocols and compare them(L2)
- select which protocol can be used for a specific application(L3)
- utilize the Internet communication protocols for IoT applications(L3)

UNIT V **5 L**

Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, ReaLTime Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.

Learning Outcomes:

After completion of this unit, the student will be able to

- select IoT APIs for an application(L3)
- design and develop a solution for a given application using APIs(L6)
- test for errors in the application(L4)
- judge the security issues in Real time applications. (L5)

Text Book(s):

1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley Publications, 2012.

References

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2014.
2. Pethuru Raj, Anupama C. Raman, The Internet of Things, Enabling technologies and use cases – CRC Press, 2017.

Web Sources

https://www.arduino.cc/

https://www.raspberrypi.org/

Course Outcomes:

After completion of this course, the student will be able to

- choose the sensors and actuators for an IoT application(L1)
- select protocols for a specific IoT application(L2)
- utilize the cloud platform and APIs for IoT application(L3)
- experiment with embedded boards for creating IoT prototypes(L3)
- design a solution for a given IoT application(L6)

INTERNET OF THINGS LABORATORY

List of Practical Experiments:

1. Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.
2. Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.
3. Control any two actuators connected to the development board using Bluetooth.
4. Read data from sensor and send it to a requesting client. (using socket communication)
   Note: The client and server should be connected to same local area network.
5. Create any cloud platform account, explore IoT services and register a thing on the platform.
6. Push sensor data to cloud.
7. Control an actuator through cloud.
8. Access the data pushed from sensor to cloud and apply any data analytics or visualization services.
9. Create a mobile app to control an actuator.
10. Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it (Mini Project).

19ECS202: COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

Computer Architecture and Organization provides a comprehensive knowledge on the structure and behaviour of computer hardware architecture and application of the design concepts. The basic concepts of this course can have a view as to how a computer system works. This course enables the students to learn the basics of hardware components from basic gates to memory and I/O devices and instruction set architectures.

Course objectives:

- Attain the knowledge of fundamental circuit components and techniques for designing the circuits
- Describe and understand the processor memory hierarchy
- Understand the concepts of interrupts and I/O devices
- Attain the general knowledge of advances in microprogramming an their implementation in computer design
- Experience the design process in the context of a reasonable size hardware system.

Module I: Register Transfer and Micro operations: 8 L

Register transfer language, register transfer, bus and memory transfers, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic shift unit.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Demonstrate the register transfer language(L2)
- Learn different types of micro operations(L2)

Module II: Basic Computer Organization and Design: 10 L

Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory-references instructions, input-output and interrupt, complete computer description. Design of the basic computer, design of accumulator logic.

Micro programmed Control: Control memory, address sequencing, micro program example, design of control unit.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Learn different types of memory-reference instructions(L2)
- Construct the micro programmed control unit(L3)

Module III: Central Processing Unit 10 L

Introduction, general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control.

Pipeline and Parallel Processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline.

Computer Arithmetic: Introduction, addition and subtraction, decimal arithmetic unit, Booth's multiplication algorithm.

Learning Outcomes:
After completion of this unit, the student will be able:
- Illustrate different types of addressing modes(L2)
- Understand the concepts of pipelining and parallel processing(L2)
- Solve and practice computer arithmetic algorithms(L3)

Module IV: Input-Output Organization 8 L
Peripheral devices, I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, I/O Processor, Serial Communication.

Learning Outcomes:
After completion of this unit, the student will be able to:
- Understand the peripheral devices(L2)
- Explain the modes of data transfer(L2)
- Understand I/O interface(L2)

Module V: Memory Organization 8 L
Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memories, Cache Memory, Virtual Memories, Memory Management Hardware.

Learning Outcomes:
After completion of this unit, the student will be able to:
- Understand the memory hierarchy(L2)
- Analyze the organization of different types of memories(L4)
- Learn the memory management hardware(L2)

Text Books(s)

1. M. Morris Mano, Computer System Architecture, 3/e, Pearson education, 2008.

Reference Book(s)

1. Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization,5/e, McGraw Hill,2001.
2. John P. Hayes, Computer Architecture and Organization, 3/e, McGraw Hill, 1998.
3. William Stallings, Computer Organization and Architecture, 6/e, Pearson PHI, 2012**.**

Course Outcomes:

- Classify the machine's instruction set architecture (ISA) including basic instruction fetch and execute cycles, instruction formats, control flow, and operand addressing modes(L2)
- Build the design and functioning of a machines central processing unit (CPU) including the data path components (ALU, register file) and the control unit(L3)
- Understand the basic input/output functioning including program controlled I/O and interrupt I/O(L1)
- Analyze the organization of different types of memories (L4)
- Analyze the performance of processors and cache(L4)

19ECS204: OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Operating system is an essential part of any computer system. This course is designed to explain the basics and the applications of operating system, the working of operating system. This course also focuses on other concepts of operating system: scheduling Algorithms, process management and process synchronization. It also gives us a detailed idea about memory management and I/O systems.

Course objectives:

- To introduce students with basic concepts of operating system, its functions, and services.
- To provide the basic concepts of process management and synchronization.
- To familiarize the dead lock issues.
- To understand the various memory management schemes.
- To give exposure over I/O systems and mass storage structures and Linux system.

Module I: Introduction and Operating System Structures **8 L**

Introduction: What Operating Systems Do, Computer System Organization, Computer-System Architecture, Operating System Structure, Operating system operations, Process Management, Memory Management, Storage management, Protection and security, Kernel data structures

Operating system Structures: operating system services, User and operating system Interface, system calls, Types of System calls, system programs, operating system structure, system boot.

Learning Outcomes:

After completion of this unit, the student will be able to:

- explain the main responsibilities of an operating system (OS) and the history leading to their current form(L2)
- list the most fundamental subsystems and services of OS (L1)
- analyse and list out different system calls (L4)

Module II: Process Management and CPU Scheduling **8 L**

Process Management: Process concepts, process scheduling, Operations on processes, inter -process communication

CPU Scheduling: Scheduling-criteria, scheduling algorithms, Thread scheduling, Multiple processor scheduling, algorithm evaluation, Multithreaded programming, Multi-core Programming, Multi-threading Models, Thread Libraries.

Learning Outcomes:

After completion of this unit, the student will be able to:

- demonstrate the concepts of Process, thread and CPU scheduling(L2)
- list out different scheduling algorithms(L1)
- analyse scheduling algorithms with different examples (L4)

Module III: Process Synchronization and Deadlock **8 L**

Process Synchronization: Critical section problem, Peterson's solution, synchronization hardware, Mutex locks, semaphores, classic problems of synchronization, monitors.

Deadlock: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock.

Learning Outcomes:
After completion of this unit, the student will be able to:

- classify and compare hardware and software solutions to the critical section problem, demonstrate several classical process synchronization problems(L2)
- analyse deadlock prevention and avoidance policies(L4)
- apply different methods to recover from deadlock(L3)

Module IV: Memory Management , Virtual memory and File Concepts 8 L
Memory Management: Swapping, contiguous memory allocation, paging, segmentation, structure of page the table.
Virtual memory: Demand paging, Copy-on-Write, page-replacement, allocation of frames, thrashing.
File Concepts: File concept, access Methods, directory and disk structure, protection.
Learning Outcomes:
After completion of this unit, the student will be able to:

- list out detailed description of various ways of organizing memory hardware(L1)
- analyse various techniques of allocating memory to processes, analyse different file concepts and access methods. (L4)
- compare different page replacement algorithms(L2)

Module V: I/O systems, Mass-storage structure , Protection and Linux System 10 L
I/O systems: Application interface, kernel I/O subsystem, transforming I/O to hardware operation.
Mass-storage structure: Disk management, disk scheduling, Swap space management System
Protection: Goals of protection, principles of protection, Domain of protection, Access matrix.
Linux System: Design principle, kernel modules, process management, scheduling, memory management, file systems, input and output, network structure, security.

Learning Outcomes:
After completion of this unit, the student will be able to:

- demonstrate the principles and complexities of I/O and hardware. (L2)
- analyse system protection techniques(L4)
- evaluate disk scheduling algorithms(L5)

Text Books(s)

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Concepts with Java, 9/e, John Wiley, 2016.

Reference Book(s)

1. Andrew S Tanenbaum, Modern Operating Systems, 2/e, Pearson/PHI, 2014.
2. Crowley, Operating System- A Design Approach, McGraw-Hill, 2012
3. Stallings, Operating Systems - Internal and Design Principles, 5/e, 2013.
4. Pal Chaudhary, Operating system principles & Design, 1/e, PHI Learning, 2013.
5. Deitel and Deitel, Operating System, Pearson Education, 2003.
6. D.M. Dhamdhere, Operating systems- A Concept based Approach,2/e, McGraw Hill, 2010.

Course Outcomes:

- illustrate the basic and overall view of operating system (L2)
- analyse the concept of a process, process life cycle, process states and state transitions (L4)
- implement and practice CPU scheduling strategies, process synchronization techniques and memory-management schemes (L3)
- simplify and resolve Deadlock handling situation (L4)
- evaluate Disk storage management, protection and security mechanisms (L5)

19ECS232: COMPUTER NETWORKS

L	T	P	C
3	0	2	4

The course is designed to impart a basic understanding of the working of computer networks,with the Internet as the case in point. Starting with the application layer with which the userinteracts directly, it covers the important principles and protocols in the application, transport,network and link layers. Brief introductions to socket programming and wireless networks areintroduced.

Course objectives:

- Familiarize the student with the components of the Internet and the concept of layeredprotocol architecture.
- Expose the student to the important principles behind the working of various layers of anetwork.
- Enable the student to write simple network applications using socket programming.
- Demonstrate the working of the most important protocols used in the Internet.
- Acquaint the student with the basics of wireless networking.

Module I: Computer networks and the Internet 9 L

Internet, The Network Edge, The Network Core: Delay, Loss and Throughput in Packet-Switched Networks, Protocol Layers and Their Service Models, History of Computer Networking and the Internet.

Learning Outcomes:

After completion of this unit, the student will be able to:

- identify the roles of the various components of the Internet(L3)
- explain network parameters such as delay, loss and throughput(L2)
- model the network using a layered architecture(L3)

Module II: Application Layer 9 L

Principles of Network Applications, The Web and HTTP, Electronic Mail inthe Internet, DNS- The Internet’s Directory Service, Socket Programming: Creating NetworkApplications

Learning Outcomes:

After completion of this unit, the student will be able to:

- summarize the principles governing the working of network applications(L2)
- outline the working of popular applications in the Internet(L2)
- develop simple network applications using socket programming(L6)

Module III: Transport Layer 9 L

Introduction and Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-oriented Transport: TCP, Principles of Congestion Control: TCP Congestion Control

Learning Outcomes:

After completion of this unit, the student will be able to:

- explain the need for multiplexing and de-multiplexing at the transport layer(L2)
- compare connectionless service with connection-oriented service(L4)
- outline the working of TCP and UDP(L2)
- analyze the principles of congestion control(L4)

Module IV: The Network Layer 9 L

Introduction, Virtual Circuit and Datagram Networks, Inside Router, The Internet Protocol (IP), Routing Algorithms–The Link State (LS) Routing Algorithm, The Distance Vector (DV) Routing Algorithm, Hierarchical Routing

Learning Outcomes:

After completion of this unit, the student will be able to:

- distinguish between virtual circuit and datagram networks(L4)
- outline the working of the Internet Protocol(L2)
- explain and analyze the working of routing algorithms(L2)

Module V: 9 L

The Link Layer: Introduction to the Link Layer, Multiple Access Links and Protocols, Switched Local Area Networks

Wireless and Mobile Networks: Introduction, Wireless Links and Network Characteristics, Wi-Fi: 802.11 Wireless LANs (Architecture and MAC Protocol), Mobile IP

Learning Outcomes:

After completion of this unit, the student will be able to:

- summarize the protocols used for multiple access links(L2)
- compare the characteristics of wireless networks with those of wired networks(L4)
- outline the working of IEEE 802.11 standard and Mobile IP(L2)

Text Books(s)

1. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, 6/e, Pearson, 2012.

Reference Book(s)

1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, 5/e, Prentice Hall, 2011.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, 3/e, Morgan Kaufmann, 2011.
3. Richard Stevens, UNIX Network Programming – Volume 1, 3/e, Prentice Hall of India, 1997.

Course Outcomes:

- interpret the concept of modular network design using layered protocol architecture(L5)
- list the various components in the Internet and their functions(L1)
- analyze various types of services provided by each layer in the network architecture(L4)
- discuss the working of the important protocols used in the Internet(L6)
- develop simple network applications and test them(L6)

For Laboratory courses: List of Experiments:

1. Write a report that includes a diagram showing the topology, type of connection devices,and speed of the wired and wireless LAN in your organization. Also find out the MAC and IP addresses and the subnet mask of your computer.
2. Find the default subnet address based on given mask and IP address (Class A, Class B)
3. Install and run a network diagnosis tool such as Tcp dump or Wireshark. Start capturing packets on an active interface, open a browser and type the address of your favouritesearch engine. Wait till the page loads and stop capture. List out the type and number ofeach type of packets captured.
4. Write a program to create a server that listens to port 5003 using stream sockets. Write a simple client program to connect to the server. Send a simple text message “Hello” fromthe client to the server and the server to the client and close the connection.
5. Write a program to create a chat server that listens to port 5004 using stream sockets.Write a simple client program to connect to the server. Send multiple text messages fromthe client to

the server and vice versa. When either party types “Bye”, close the connection.

6. Write a program to create a server that listens to port 5005 using stream sockets. Write asimple client program to connect to the server. The client should request for a text file and the server should return the file before terminating the connection.
7. Write a program to create a server that listens to port 5006 using stream sockets. Write asimple client program to connect to the server. Run multiple clients that request the server for binary files. The server should service each client one after the other before terminating the connection.
8. Write a program to create a server that listens to port 5007 using stream sockets. Write asimple client program to connect to the server. Run multiple clients that request the server for text files. The server should service all clients concurrently.
9. Write a program to create a server that listens to port 5009 using datagram sockets. Write a simple client program that requests the server for a binary file. The server should service multiple clients concurrently and send the requested files in response.

19EAI232: Introduction to Artificial Intelligence and its Applications

L	T	P	C
3	0	2	4

This course enables the students to think critically about what makes humans intelligent, and how computer scientists are designing computers to act more like us Artificial Intelligence (AI) is the study of how to make computers make things which at the moment people do better. AI plays an important role in the design and development of systems with intelligent behaviour. The primary objective of this course is to provide an introduction to the basic principles and applications of Artificial Intelligence. Upon successful completion of the course, students will have an understanding of the basic areas of Artificial Intelligence - problem solving, search mechanisms, constraint satisfaction, and knowledge representation using logic, reasoning and their applications.

Course objectives:

- The fundamentals of Artificial Intelligence, the concept of Intelligent Agents and problem solving process through uninformed and informed searches.
- How to gain an insight into competitive environments which give rise to adversarial search problems, often known as games.
- Viewing many problems in AI as problems of constraint satisfaction.
- Getting complete idea of knowledge representation and understand the two knowledge representation techniques Propositional and First-order logics.
- How to trace the inference mechanism in First-order logics.

Module I: 9 L

Introduction: What is AI?, Foundations and History of AI, the state of Art of AI, Risks, Benefits and Applications of AI.
Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.
Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

Learning Outcomes:
After completion of this module, the student will be able to:

- define Artificial Intelligence (L1)
- how agents work in environments (L1)
- recall uninformed search techniques (L1)
- illustrate the working of informed search techniques (L2)
- apply heuristics in real time problem (L3)

Module II: 9 L
Search in Complex Environments: Local Search and Optimization Problems, Local Search in Continuous Spaces, Search in Partially Observable Environments.
Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the Art Game Programs, Alternative Approaches.

Learning Outcomes:

After completion of this module, the student will be able to:

- explain how games improve intellectual abilities of humans (L1)
- choose optimal decisions in games (L1)
- illustrate alpha-beta pruning (L2)
- compare stochastic and partially observable games (L2)
- distinguish imperfect and perfect real time decisions (L4)

Module III: 9 L

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Local Agents: Knowledge-based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving.

Learning Outcomes:

After completion of this module, the student will be able to:

- define constraint satisfaction problems (L1)
- illustrate inference in constraint satisfaction problems (L2)
- contrast backtracking search and local search for constraint satisfaction problems (L2)
- explain knowledge - based agent (L2)
- apply propositional logic for real time problems (L3)

Module IV: 9 L

First-Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic.

Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Learning Outcomes:

After completion of this module, the student will be able to:

- define knowledge-based agents (L1)
- how to represent real world facts in propositional and first-order logic (L1)
- explain the wumpus world problem-solving process (L2)
- infer proofs in propositional and first-order logic (L2)
- contrast forward chaining and backward chaining (L2)

Module V: 9 L

Applications: Introduction, Categories of Applications of AI (Text Book 2)

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The Theory of Learning, Linear Regression and Classification, Unsupervised Learning and Transfer Learning.

Expert Systems: Introduction, Need and Justification of Expert System, Knowledge Representation, Knowledge Acquisition and Variation, Utilization and Functionality (Text Book 2)

Learning Outcomes:

After completion of this module, the student will be able to:

- define expert systems (L1)
- outline machine learning (L2)
- experiment with classifications techniques (L3)
- make use of Knowledge representation (L3)
- justify the need of expert system (L5)

Text Books(s)

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Publications, 2020
2. Dr.Nilakshi Jain, Artificial Intelligence : Making a System Intelligent, Wiley Publications,1st Edition,2019

Reference Book(s)

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, TMH Education Pvt. Ltd., 2008.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson.

Course Outcomes:

- illustrate artificial intelligence, the role of intelligent agents, uninformed and informed search techniques (L2)
- examine competitive environments like game problems (L4)
- interpret many real-world problems as constraint satisfaction problems (L2)
- illustrate what knowledge representation is and distinguish propositional and first-order logics (L2)
- infer proofs using resolution in first-order logic (L2)
- illustrate various real world applications of expert systems (L2)

For Laboratory courses: List of Experiments:

1. Revisit/Refresh the Study of Python and/or PROLOG
2. Write a program to control the VACUUM Cleaner moves (Intelligent systems design process)
3. Write a program to solve Monkey & Banana Problem. ii) Write a program to solve Water-Jug problem (Implementing the Production for real world problems.)
4. Write a program to solve 8-puzzle problem ii) Write a program to solve Short path problem/Travelling Sales man Problem (Understanding various search algorithms BFS, DFS, A* and AO* algorithms)
5. Write a program to implement TIC – TAC - TOE game (Understanding Alpha – Beta pruning)
6. Write a program to implement Cross- Word puzzle (Understanding Constraint specific problem)
7. Write a program to solve Robot traversal problem (Understanding Means End Analysis)
8. Write a program to implement Hangman game
9. Write a program to understand Prepositional logic using KANREN, SYMPY, pyDatalog packages in Python
10. Write a program to understand Inferential logic using KANREN, SYMPY, pyDatalog packages in python
11. Write a program to design an expert system using PyPi package (Understanding Expert

system design process)

12. Write a program to implement a binary classification using Decision Tree (Understanding Decision Tree)
13. Write a program to implement a linear regression problem
14. Write a program to implement kNN neighbour problem
15. Write a program to implement Chatbot application
16. Write a program to implement logistic regression

19EIO232: Sensor Technology and Instrumentation

L	T	P	C
3	0	2	4

Environmental parameters are necessary in several domains, such as home automation, industrial automation, medical aids, mobile healthcare, elderly assistance, intelligent energy management and smart grids, automotive, traffic management, and many others. At present, it is a clear trend to integrate new components and expand the features of the older ones to make the whole assembly smarter. Smart sensors are sensors with integrated electronics that can perform one or more of the logic functions, two-way communication, make decisions. Physically, it consists of transduction element, signal conditioning electronics and controller/processor that support some intelligence in a single package. Applications of Sensors and Internet of Things include smart agriculture, transportation, environment monitoring, healthcare, and smart wearable. This course covers fundamental principles of sensor technology and instrumentation applicable for the current trends of Artificial Intelligence and Internet of Things.

Course objectives:

- To Introduce the Principles and Performance characteristics of Sensors.
- To Discuss principles and working of Resistive, Capacitive and Inductive sensors.
- To Identify different types of Magnetic and optical sensors.
- To create awareness about application areas of Advanced Sensors
- To Compare Traditional and Virtual Instruments to use in IoT Applications.

Module I: Sensor Fundamentals 9 L

Types of sensors, Characteristics of sensors- static characteristics, dynamic characteristics, sensor selection. Applications of sensors in IoT

Learning Outcomes:
After completion of this unit, the student will be able to:

- Explain the principle behind the sensor.
- Classify The Sensor types.
- Select the sensor for an Application in IoT.
- Describe Static Characteristics of Sensors.
- Describe Dynamic Characteristics of Sensors.
-

Module II: Resistive, Inductive and Capacitive sensors 9 L

Resistive sensors-Potentiometers, Strain gauge, RTD, Thermistor, Inductive sensors - LVDT, Synchro, Capacitive sensors – Variable area, Variable permittivity, distance between the plates, capacitive microphone.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Explain the principles behind Resistive sensors.
- Describe Inductive sensors and their applications.
- Describe the Principle and applications of Synchro.
- Classify Capacitive sensors.
- Explain the principle behind Microphone

Module III: Magnetic and Optical Sensors 9 L

Magnetostrictive sensor, Hall effect sensor, Piezo-electric sensor, photo detectors, photo diode, phototransistor, photomultiplier, photo emissive cell.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Explain the principles behind Magnetostrictive sensors.
- Describe Hall effect sensors and their applications
- Summarize Principles and applications of Pezo -electric sensors.
- Explain the principles of Photoelectric sensors
- Identify different types of Photoelectric sensor used in IoT.

Module IV: Advancements in Sensor Technology 9 L

Smart sensors, micro electro mechanical system (MEMS), Nanosensors, Thinfilm sensors, Biosensors.

Learning Outcomes:
After completion of this unit, the student will be able to:

- Summarize different advanced sensors in IoT applications.
- Explain the principles of MEMS systems
- Describe Smart sensors and their applications.
- Identify sensors used in Biomedical applications.
- Explain the principles and types of Nanosensors.

Module V: Introduction to Virtual Instrumentation 9 L

Virtual Instrumentation – Block diagram and Architecture of Virtual Instruments, Virtual Instruments versus Traditional Instruments, VI programming techniques-sub VI, loops, structures, charts, arrays, clusters, graphs, file I/O, DAQ in VI

Learning Outcomes:
After completion of this unit, the student will be able to:

- Describe the Architecture of Virtual Instrumentation.
- Compare Virtual Instruments and Traditional Instruments.
- Summarize Programming techniques used in VI.
- Explain the principles of DAQ in VI.
- Use of VI techniques in IoT.

Text Books(s)

1. D. Patranabis, Sensors and Transducers, PHI Learning Pvt Ltd, Second edition, 2013
2. LabVIEW based advanced Instrumentation System, PSumathi, Springer Science Elsievier 2007.

Reference Book(s)

1. A K Sawhney, “ A course on Electrical and Electronic Measurements and Instrumentation”, Danpat Rai & Co. , 2015
2. Lab view for everyone, Lisa K.Wells and Jeffrey Travis, Prentice Hall, NewJersey, 1997.

Course Outcomes:

- Explain the principles, performance characteristics and Application of Sensors.
- Describe the principles and types of Resistive, Capacitive, and Inductive sensors.
- Summarize Principles and applications of Magnetic and Optical sensors.
- Explain advancements in Sensors Technology and their application areas.
- Apply Virtual instrumentation in IoT technologies.

For Laboratory courses: List of Experiments:

1. Characteristics of First Order System
2. Characteristics of Second Order System
3. Static characteristics of Thermocouple
4. Dynamic characteristics of Thermocouple
5. Characteristics of LVDT
6. Level measurement using capacitive sensor
7. Characteristics of RTD
8. Characteristics of Strain gauge
9. Design the signal conditioning circuit for RTD
10. To study the performance of Biosensor (Pulse sensor)
11. Arithmetic and Logic operations using LabVIEW
12. Sub-VI using LabVIEW
13. Performing array and cluster operations using LabVIEW
14. DAQ using LabVIEW
15. Digital signal processing using LabVIEW
16. Controller design using LabVIEW

19ECS292: COMPREHENSIVE SKILL DEVELOPMENT III

L	T	P	A	C
0	0	0	6	1

Course Objectives:

- To encourage the all-round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes:

- On completion of the course, student will be able to– Effectively communicate through verbal/oral communication and improve the listening skills
- Write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
- Student will be able to understand the problems and develop his competitive coding skills.
- Apply the skills in various domains and will be able to solve complex problems faced by the industry.
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality

Part-1 **3 Hours per week**

A. Verbal and Soft Skills:

Vocabulary Builder, Reading Comprehension, Fill-in-the-Blanks, General Usage

Unit	**Module/ Topics**	**Hrs**
1.	Vocabulary Builder	4
2.	Reading Comprehension	4
3.	Fill-in-the-Blanks	3
4.	General Usage	4
	Total	**15**

B. Quantitative Aptitude and Reasoning

Puzzles, Arithmetic, Geometry, Mensuration

Unit	Module/ Topics	Hrs
1.	Puzzles	5
2.	Arithmetic	2
3.	Geometry	3
4.	Mensuration	5
	Total	15

Part-2 **3 Hours per week**

Coding : Medium Level problem solving techniques:

Permutations and Combination, Probability, Hash Tables, Heap, Greedy Method, Backtracking

Scheme of Evaluation

Internal Assessments by Assignments, Quizzes (multiple Choice questions). All the Students are expected to do at least 5 problems in each topic and they should submit the content written by them in each topic for final evaluation.

Type of Assessment	Marks
At least 5 problems in each topic	15
Assignments	15
Content writing	10
Quizzes	10
Total	**50**

Late Work

Each homework is due in the beginning of the class meeting (that is, at 6:00pm) on the due date. If homework is submitted within seven days after this deadline, the grade will be reduced by 50%. Submission more than seven days after the deadline will not be accepted. If you have a serious reason for requesting an extension, such as illness or family emergency, you should discuss it with one of the instructors as soon as the problem arises, and definitely before the submission deadline.

References:-

The course does *not* have a required textbook. You may optionally use the following textbook and URLs to look up standard algorithms:

1. Data Structures and Algorithms made easy by Narasimha Karumanchi
2. Data Structure and Algorithmic Thinking with Python by Narasimha Karumanchi
3. Algorithm Design Techniques: Recursion, Backtracking, Greedy, Divide and Conquer and Dynamic Programming by Narasimha Karumanchi
4. Coding Interview Questions by Narasimha Karumanchi
5. Competitive Programming in Python- 128 Algorithms to develop your Coding Skills by Cristhop Durr & Jill-Jen Vie.
6. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests (Undergraduate Topics in Computer Science) *by* Antti Laaksonen
7. https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/
8. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
9. https://codeforces.com/
10. https://leetcode.com/

19ECS333: DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	2	4

This course provides fundamental and practical knowledge on database management system concepts through Data Modeling, Normalization, Structured Query Language. Concurrency control, Transaction management and crash recovery are introduced. This course is structured to enable students to gain experience in creation of data models, design of database and Database Application Development.

Course Objectives

- Focus the role of a database management system in an organization
- Demonstrate basic database concepts, including the structure and operation of the relational data model
- Introduce simple and moderately advanced database queries using Structured Query Language (SQL)
- Explain and successfully apply logical database design principles, including E-R diagrams and database normalization
- Demonstrate the concept of a database transaction and related database facilities, including concurrency control, and data object locking and protocols

UNIT I: Introduction to DBMS and ER-Model 8 L

Introduction to DBMS: Overview, File system vs DBMS, advantages of DBMS, storage data, queries, transaction management, DBMS structure, people who work with Databases.

Data base Design: data models, the importance of data models.

E-R model: Entities, attributes and entity sets, relationship and relationship sets, mapping cardinalities, keys, features of ER model, conceptual database design with ER model.
Learning Outcomes:
After completion of this unit, the student will be able to:

- interpret the basic terminology of DBMS like data, database, database management systems(L2)
- compare DBMS over File Systems(L2)
- define levels of abstraction with three tier architecture(L1)
- define the role of DBA and other users of DBMS(L1)
- model a given application using ER diagram(L3)

UNIT II: Relational Model 8 L

Relational model: Integrity constraints over relations and enforcement, querying relation data, logical database design, views, destroying/altering tables and views.
Relational Algebra and Relational Calculus
Learning Outcomes:
After completion of this unit, the student will be able to:

- translate an ER Model to Relational Model and vice versa(L2)
- match the integrity constraints from ER model to relational model(L1)
- compare the difference between views and physical tables and working with views(L2)
- construct the given Query in Relational Algebra and Relational Calculus(L3)

UNIT III: Structured Query Language (SQL) and Database Application Development 8 L

Structured Query Language (SQL): Introduction to SQL, Basic SQL Queries: DML, DDL, DCL, TCL commands, The set oriented commands like Union, Intersection, Except and Nested Queries, Aggregate Operators, Null values, Relational set operators, SQL join operators

Database Application Development: SQL functions, procedural SQL, embedded SQL, cursors, ODBC and JDBC, triggers and active database, designing active databases.

Learning Outcomes:

After completion of this unit, the student will be able to:

- create and modify database using SQL query(L5)
- illustrate different types of query forms (simple queries, nested queries, and aggregated queries) in SQL(L2)
- build Embedded SQL, cursors, triggers and active database using PL/SQL programs(L3)
- develop knowledge about ODBC and JDBC connectivity to connect database(L3)

UNIT IV: Schema Refinement and Normal Forms 8 L

Schema Refinement and Normal Forms: Schema Refinement, Functional Dependencies,Reasoning about Functional Dependencies.Normal Forms, Properties of Decomposition, Normalization, Different types of normal forms, different types of dependencies.

Learning Outcomes:

After completion of this unit, the student will be able to:

- make use of about schema refinement process(L3)
- extend the concept of functional dependencies (FDs) and knows about anomalies(L2)
- illustrate knowledge about different types of normal forms and the importance of normalization(L2)

UNIT V: Transaction Management and Concurrency Control 10 L

Transaction Management and Concurrency Control: Introduction to Transaction Management, ACID properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency control without locking,

Crash Recovery: Aries, Recovering from a System Crash, Media recovery.

Learning Outcomes:

After completion of this unit, the student will be able to

- interpret the overview of transaction management in DBMS(L2)
- explain the importance of concurrency and concurrency control mechanisms(L2)
- develop knowledge about concurrency control with and without locks(L3)
- identify different types of crashes in DBMS(L3)
- apply crash recovery techniques to recover from DBMS crashes (L3)

Text Books(s)

Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill, 3e, 2014.

Reference Book(s)

1. H.F.Korth and A.silberschatz, Database System Concepts, McGraw-Hill, 6e, 2011.
2. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education,7e, 2016.

Course Outcomes:

- understand and evaluate the role of database management system in an organization(L2)
- explain and apply logical database design principles, including E-R diagrams and database normalization(L3)
- understand and use of database queries using Structured Query Language (SQL)n(L2)

- demonstrate the concept of a database transaction and related database facilities, including concurrency control, and data object locking and protocols(L2)
- design and develop a small database project using database software (L6)

For Laboratory courses: List of Experiments:
Software used: MySql / Oracle 19c

1. (a) Develop a sample ER model for the specified database.
   (b) Implementation of DDL, DML, TCL and DRL commands
   (a) Create (b) alter (c)drop (d) rename (e) truncate (f) Insert
   (g) Select (h) Update (i)Delete (j) commit (k) rollback
   (l)save point (m) Like'%' (n)grant (o) revoke (p)relational operators.

2. Create an Employee database to set various constraints. (The Employee relation is having EID, Ename, DoB, Dept., Joining date, Salary)
   (a) Primary key (e) Null, (i) Disable Constraints
   (b)Foreign Key (f) Not null (j) Drop Constraints
   (c) Check (g) Default
   (d) Unique (h) Enable Constraints

3. Write PL/SQL statements for the following queries on EMPLOYEE table with following schema.*(Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id, Designation , Salary)*

a) List the E_no, E_name, Salary of all employees working for MANAGER.
b) Display all the details of the employee whose salary is more than the Sal of any IT PROFF.
c) List the employees in the ascending order of Designations of those joined after 1981.
d) List the employees along with their Experience and Daily Salary.
e) List the employees who are either 'CLERK' or 'ANALYST'.
f) List the employees who joined on 1-MAY-81, 3-DEC-81, 17-DEC-81,19-JAN-80.
g) List the employees who are working for the Dept no 10 or 20.
h) List the Enames those are starting with 'S'.
i) Display the name as well as the first five characters of name(s) starting with 'H'
j) List all the employees except 'PRESIDENT' & 'MGR" in as order of Salaries.

4. Creating Views, grouping functions and performing joins.

5. Lab Practice Assignment:
   a. Create user and implement the following commands on relation (Emp and Dept).
   b. Develop a query to grant all privileges of employees table into departments table.
   c. Develop a query to grant some privileges of employees table into departments table.
   d. Develop a query to revoke all privileges of employees table from departments table.
   e. Develop a query to revoke some privileges of employees table from departments table.4. Use of different of operators for nested sub-queries.

6. Trigger:
   a. To write a Trigger to pop-up the DML operations.
   b. To write a Trigger to check the age valid or not Using Message Alert.
   c. Create a Trigger for Raise appropriate error code and error message.
   d. Create a Trigger for a table it will update another table while inserting values.

7. Checking normalization for database tables and use of cursors.

8. **Mini Projects**.
The students are given the following use cases as mini project for a group of 3-4 as a batch, to model the data and create UI with Databse connectivity.

a) Inventory Control System.
b) Material Requirement Processing System.
c) Hospital Management System.
d) Railway Reservation System.
e) Personal Information System.
f) Web Based User Identification System.
g) Timetable Management System.
h) Hotel Management System.

19EAI331: Artificial Neural Networks

L	T	P	C
2	0	2	3

Artificial Neural Networks to be more precise, represent a technology that is rooted in many disciplines: neurosciences, mathematics, statistics, physics, computer science and engineering. ANN find applications in such diverse fields as modelling, time series analysis, pattern recognition, signal processing and control by virtue of an important property: the ability to learn from input data with or without a teacher.

Course objectives:

- To understand the architecture, learning algorithm and issues of various neural networks.
- Analyze ANN learning, Error correction learning, Memory-based learning, Competitive learning and Boltzmann learning
- To adopt gradient - descent techniques in real time applications
- Provide knowledge on Generalization and function approximation and various architectures of building an ANN
- Implement and learn the applications of Self-organization Map

Module I:	**An Introduction to Neural Networks**	Number of hours (LTP)	6	0	6

Introduction, The Basic Architecture of Neural Networks, Training a Neural Network with Backpropagation, Practical Issues in Neural Network Training, Common Neural Architectures

Learning Outcomes:

After completion of this unit, the student will be able to:

1. acquire a basic understanding of the neural networks (L2)
2. have the understanding of backpropagation. (L2)
3. explain back propagation in naturally existed organism (L2)
4. analyse the neural network problems (L4)
5. illustrate machine perception (L2)

Module II:	**Shallow Neural Networks**	Number of hours (LTP)	6	0	6

Neural Architectures for Binary Classification Models, Neural Architectures for Multiclass Models, Autoencoder: Basic Principles, Neural embedding with continuous bag of words, Simple neural architectures for graph embeddings.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. experiment with binary classification models. (L3)
2. make use of the multiclass models. (L3)
3. outline the knowledge of neural embeddings (L2)
4. understand graph embeddings (L2)
5. make use of autoencoder (L3)

Module III:	**Deep Neural Networks**	Number of hours (LTP)	6	0	6

Introduction, Backpropagation, Setup and Initialization Issues, Gradient-Descent strategies, the bias-variance trade-off, Generalization Issues in Model Tuning and Evaluation, Ensemble Methods

Learning Outcomes:

After completion of this unit, the student will be able to:

1. understand deep neural networks(L2)
2. visualize backpropagation (L3)
3. experiment on model tuning and evaluation (L3)
4. apply bias-variance trade-offs (L3)
5. define ensemble methods (L1)

Module IV:	**Attractor Neural Networks**	Number of hours(LTP)	6	0	6

Associative Learning, Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. apply linear associative memory (L3)
2. understand simulated annealing. (L2)
3. illustrate Boltzmann machine (L2)
4. distinguish various associative memories (L2)
5. explain about how to use Hopfield network (L2)

Module V:	**Self-organization Feature Map**	Number of hours (LTP)	6	0	6

Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. have a basic understanding of extracting principal components. (L2)
2. have the understanding eigen-vector filtering. (L2)
3. infer vector quantization (L2)
4. understanding self – organization feature maps (L2)
5. make use of learning laws (L3)

Text Books(s)

1. Neural Networks and Deep Learning - Charu C. Aggarwal, Springer International Publishing AG, part of Springer Nature 2018 (Chapters 1, 2, 3)
2. Neural Networks A Classroom Approach– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition. (Chapters 4, 5)

Reference Book(s)

1. Neural Networks: A Comprehensive Foundation - Simon Haykin PHI, 2nd Edition 2005.
2. Introduction to Artificial Neural Systems-J.M. Zurada, Jaico Publications 1994.
3. Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.

Course Outcomes:

At the end of the course, students will be able to

1. Understand the origin, ideological basics, Learning process and various Neural Architectures of ANN.
2. Understand the concepts and techniques of Shallow neural networks through the study of important neural network models.
3. Training Deep Neural Networks and Teaching Deep Learners to Generalize.
4. Apply Attractor neural networks to particular application.
5. Design a self-organizing system that are capable of extracting useful information from the environment within which they operate.

19ECS305: CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

The aim of this course is to introduce information security concepts to the students. This course develops a basic understanding of goals, threats, attacks and mechanisms, algorithms and their design choices. The course also familiarizes students with a few mathematical concepts used in cryptology. The course emphasizes to give a basic understanding of attacks in cryptosystems and how to shield information from attacks. It also deals with message authentication, Digital signatures and Network security.

Course objectives:

- Understand basics of security concepts and comprehend Classical Encryption Techniques (L3)
- Impart various symmetric cryptographic techniques (L2)
- Learn number theory related to RSA and Diffie-Hellman algorithms (L3)
- Study different hash functions and message authentication techniques (L3)
- Impart knowledge on application and transport layers security concepts (L2)

Module I: 9 L

Introduction: Computer Security Concepts, The OSI Security Architecture, Cryptography, cryptanalysis, attacks, services, security mechanisms.

Classical Encryption Techniques: Substitution Techniques**,** Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher Polyalphabetic Ciphers. Transposition Techniques.

Learning Outcomes:

After completion of this unit, the student will be able to:

- illustrate different security attacks (L2)
- apply classical substitution methods (L3)
- explain Transposition techniques (L2)

Module II: 9 L

Symmetric Key Cryptography: Block Ciphers and the Data Encryption Standard (DES) algorithm. Differential and linear cryptanalysis, triple DES. Block cipher design principles, Block cipher modes of operation, Advanced Encryption Standard (AES), Stream Ciphers: RC4.

Learning Outcomes:

After completion of this unit, the student will be able to:

- distinguish block and stream ciphers (L2)
- explain working of block cipher DES and AES algorithm (L2)
- discuss working of stream cipher RC4 (L2)

Module III: 9 L

Number theory: Divisibility and The Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem. Public Key **Cryptography:** Principles of public key cryptosystem, RSA algorithm, security of RSA. Diffie Hellman key exchange.

Learning Outcomes:

After completion of this unit, the student will be able to:

- illustrate the concepts of divisibility, modularity and primality (L2)
- program RSA algorithm using suitable programming language (L4)
- explain Diffie Hellman key exchange method (L2)

Module IV: 9 L

Cryptographic Hash Functions: Applications of hash Functions, Secure Hash Algorithm (SHA) SHA-512, SHA 3. MAC and Digital Signatures: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, HMAC, DAA and CMAC. Digital signatures, Digital Signature Standard (DSS). Authenticated Encryption: CCM, GCM.

Learning Outcomes:

After completion of this unit, the student will be able to:

- explain and implement simple hash functions (L2)
- discuss message authentication techniques (L2)
- explain Digital Signature Standard (DSS) (L2)

Module V: 9 L

Key management and distribution: Distribution of Public Keys, X.509 Certificates

Internet Security: Introduction to SSL and TLS. Email Security: Pretty Good Privacy (PGP), S/MIME. IP Security: IP security overview, IP security Policy, Encapsulating Security Payload**.**

Learning Outcomes:

After completion of this unit, the student will be able to:

- explain transport-level security techniques (L2)
- discuss application-level security techniques (L2)
- list network-level security techniques (L2)

Text Books(s)

1. William Stallings, Cryptography and Network Security – Principles and Practice, 7/e. Pearson Education, 2017.

Reference Book(s)

1. Behrouz A Fourozen and Debdeep Mukhopadhyaya, Cryptography and Network Security, 3/e, McGraw Hill, 2015.
2. Atul Kahate, Cryptography and Network Security, 4/e, McGraw Hill, 2019.
3. Buchmann, Introduction to Cryptography, Springer, 2004
4. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C (cloth), 2/e, Publisher: John Wiley & Sons, Inc., 1996.
5. Chwan-Hwa(John) Wu, Introduction to Computer Networks and Cybersecurity, CRC Press, 2013

Course Outcomes:

- illustrate working of classical encryption techniques (L3)
- describe the working of symmetric encryption techniques (L2)
- experiment the working of public key cryptography algorithms such as RSA, Diffie-Hellman (L3)
- apply Hash functions and message authentication techniques (L3)
- summarize Application and transport layers security mechanisms. (L2)

19EIO331: ***Interfacing through Microprocessors and Microcontrollers***

L	T	P	C
2	0	2	3

Interfacing through Microprocessors and Microcontrollers course provides an insight to hardware details of standard typical Microprocessor along with programming the Microprocessor using Assembly language instructions .This is a basic course to introduce the architecture, programming of microprocessors and interfacing select range of hardware circuits to microprocessors. The topics covered are architecture, addressing modes, instruction set of 8086, minimum and maximum mode operation of 8086, 8086 INSTRUCTION SET, Assembly language programming fundamentals, interfacing of keyboard, display, stepper motor, A/D and D/A converter.

Course objectives:

1. To develop an in-depth understanding of the operation of microprocessors.
2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
3. To create an exposure to basic peripherals, its programming and interfacing techniques
4. To understand the concept of Interrupts and interfacing microprocessors.
5. To impart the basic concepts of serial communication in 8086.

Module I: The x86 microprocessor: Number of hours(LTP) 6 0 6

Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. **Assembly language programming:** Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the 8086 architecture
2. Demonstrate the use appropriate assembly directives for writing Assembly programs.
3. Chose appropriate addressing modes while developing assembly program
4. Assemble and run assembly programs

Module II: Assembly Programming (Contd..) Number of hours(LTP) 6 0 6

Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code. Instructions sets description**, Arithmetic and logic instructions and programs:** Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Demonstrate the use of different data types supported by 8086 microprocessor.
2. Write and execute assembly programs to demonstrate Arithmetic operations
3. Write and execute assembly programs to demonstrate Logic instructions.

Module III: Interrupts Number of hours(LTP) 6 0 6

INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment. **Signed Numbers and Strings:** Signed number Arithmetic Operations, String operations.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Demonstrate the use of selected INT instructions
2. Write and execute assembly programs involving string operations.

Module IV Introduction to microcontrollers Number of hours(LTP) 6 0 6

Overview of 8051 micro-controller, Architecture, I/O ports, Memory organization, addressing modes and instruction set of 8051, Simple programs.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the difference between Microprocessor and Microcontroller
2. Explain the architecture of 8051 microcontroller.
3. Explain the Addressing modes and instruction set of 8051
4. Write simple assembly programs using instruction set of 8051

Module V: Memory Interfacing Number of hours(LTP) 6 0 6

Memory and Memory interfacing: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. **8255 I/O programming:** I/O addresses MAP of x86 PC's, programming and interfacing the 8255.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Demonstrate the interfacing of Memory unit.
2. Demonstrate the interfacing of 8255.

Text Books(s)

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.

Reference Book(s)

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Uma shankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning

Course Outcomes: Upon completion of the course, student will be able to:

1. Explain the architecture of microprocessors
2. Write and demonstrate simple assembly program for8086 microprocessors.
3. Write simple Assembly programs to demonstrate the Interrupts and string operations
4. Explain the architecture of microcontrollers
5. Interface different external peripheral devices with microprocessors and micro controllers.

19ECS234: DESIGN AND ANALYSIS OF ALGORITHMS

L T P C
3 0 2 4

This course enables the students to gain knowledge in various techniques of designing algorithms, estimating the efficiency of the developed algorithms in terms of time and space. The knowledge gained in this course can be applied to the latest developments in technology.

Course Objectives

- Explain the asymptotic performance of algorithms.
- Demonstrate the complexity of an algorithm in terms of time and space.
- Help to design and implement programs in various programming paradigms.
- Familiarize with efficient algorithms in software design and development.

UNIT I **9 L**

Introduction to Algorithms: Algorithm specification, Performance Analysis. Divide and Conquer: The general method: Binary search, finding maximum and minimum, Merge sort, Quick sort, Selection, Strassen's Matrix multiplication.

Learning Outcomes:

After completion of this unit, the student will be able to

- define and specify the characteristics of an algorithm(L1)
- analyzethe performance of an algorithm(L4)
- list different methods in analyzing time complexity(L1)
- interpret divide and conquer technology for designing algorithms(L2)
- illustrate the efficiency of algorithms designed(L2)

UNIT II **8 L**

The Greedy Method: The general method, Knapsack problem, Job sequencing with deadlines, optimal storage on tapes, minimum cost spanning trees, single source shortest paths.

Learning Outcomes:

After completion of this unit, the student will be able to

- define control abstraction of Greedy method(L1)
- illustrate the significance of greedy method(L2)
- compare divide and conquer strategy with greedy method(L2)
- apply the method to implement various applications(L3)

UNIT III **8 L**

Dynamic Programming: The general method, multistage graphs, all pairs shortest paths, optimal binary search trees, reliability design, the travelling sales person problem.

Learning Outcomes:

After completion of this unit, the student will be able to

- compare dynamic method with previous methods(L2)
- apply dynamic method for developing algorithms(L3)
- illustrate the merits of dynamic method(L2)
- analyze the performance of algorithms(L4)

UNIT IV **9 L**

Basic search and traversing techniques: Techniques for Binary trees, Techniques for Graphs, connected components and spanning trees, Bi-connected components and depth first search. Back Tracking: The General Method, Eight Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycle.

Learning Outcomes:

After completion of this unit, the student will be able to

- illustrate techniques of searching(L2)
- make use of different methods of searching and traversing(L3)
- recall the concept of spanning trees(L1)
- apply principles of backtracking in solving problems related to graphs(L3)

UNIT V **8 L**

Branch and Bound: The method, traveling sales person problem, efficiency considerations.

Algebraic Problems: The general method, Evaluation and Interpolation.

Learning Outcomes:

After completion of this unit, the student will be able to

- outline general method of branch and bound(L2)
- develop solution for travelling salesperson problem(L3)
- distinguish between performance of various methods(L4)
- compare different interpolation methods(L4)
- evaluate algebraic expressions(L5)

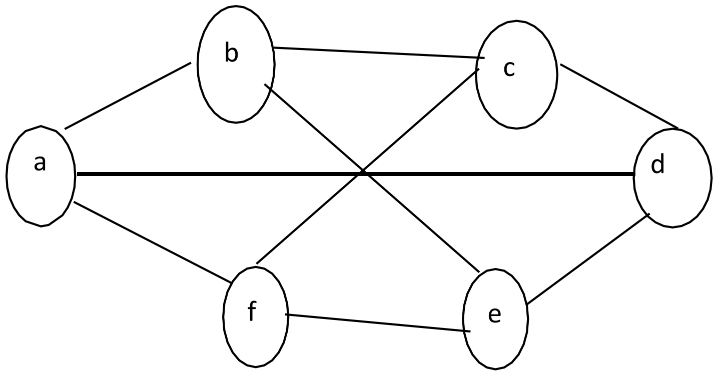
DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

List of Practical Experiments:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Use divide and conquer method to recursively implement and to find the maximum and minimum in a given list of n elements.
4. Find Minimum Cost Spanning Tree of a given undirected graph using
   (i) Kruskal's algorithm.
   (ii) Prim's algorithm.
5. Consider the following five jobs and their associated weights and deadlines, implement job sequencing algorithm to obtain optimal solution.

Index	1	2	3	4	5
Job	J1	J2	J3	J4	J5
Deadline	2	1	3	2	1
profit	60	100	20	40	20

6. (i) Print all the nodes reachable from a given starting node in a digraph using BFS method.
   (ii) Check whether a given graph is connected or not using DFS method.
7. Find a subset of a given set S = {s1,s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6} and {1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.
8. Implement All Pairs Shortest Paths Problem using Floyd's algorithm.
9. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
10. Implement backtracking method to color all the vertices of a graph such that no two adjacent vertices have the same color (Graph Coloring Problem).



Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the errorin the approximation.

11. Develop an algorithm to evaluate an algebraic expression.

Text Book(s):

1. Ellis Horowitz, S. Sahni, Fundamentals of Computer Algorithms, 2/e, University Press, 1984.

2. Thomas H. Cormen, Charles E. Leiserson, Introduction to Algorithms, et.al., 3/e, MIT Press,2012.

References

1. Aho, Hopecraft, Ullman, The Design and Analysis of Computer Algorithms, 1/e, 2002.
2. Michel T. Goodrich & Roberto Tamassia, Algorithm Design: Foundations, Analysis, andInternet Examples, 1/e, John Weily and Sons, 2001.
3. Sara Baase, Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis,3/e, Pearson Education, 1999.
4. Mark Allen Weiss, Data Structures and Algorithm Analysis in JAVA, 3/e, Pearson Education,2011.
5. Jon Kleinberg, Eva Tardos, Algorithm Design, 1/e, Pearson, 2013.

Course Outcomes:

At the end of the course, the student will be able to

- define algorithm(L1)
- compare various methods of designing algorithms(L2)
- illustrate the merits and demerits of different designing techniques(L2)
- identify best method to develop an algorithm(L3)
- evaluate the algorithms in terms of efficiency(L5)

19EAI332: Automata Theory and Compiler Design

L	T	P	C
3	1	0	4

Finite Automata comprises theoretical computer science to study abstract machines for solving computation problems. Compilers play a significant role in fulfilling users' computing requirements, specified in programs in a high-level language, which translate into machine-understandable form. The process involved in such a transformation of a program is quite complex. This course intends to help the students learn the fundamentals of the theory of computation that can recognize formal languages typically illustrated by the Chomsky hierarchy and how this knowledge enables one to design a compiler. Automata Theory provides the basis for developing a compiler.

Course objectives:

1. Impart the mathematical concepts of theoretical computer science from the perspective offormal languages in solving computational machines.
2. Familiarize various formal languages, grammar, and their relationships.
3. Demonstrate various finite state machines and recognize formal languages.
4. Explore the basic techniques that underlie the principles, algorithms, and data structures in Compiler Construction.
5. Gain experience in using automated tools that helps in transforming various phases of the compiler.

Module I: Finite Automata and Regular Languages Number of hours(LTP) 9 3 0

Central concepts of strings, languages and automata theory, Regular expressions and languages, Deterministic Finite Automata (DFA) and equivalence with Regular expression, Non- Deterministic Finite Automata, and equivalence with DFA, Minimization of Finite Automata by partitioning, Chomsky hierarchy of grammars

Learning Outcomes:

After completion of this unit, the student will be able to:

1. illustrate the central concepts of automata theory **(**L2**)**
2. construct Deterministic Finite Automata equivalent to Non-Deterministic Finite Automata (L3)
3. construct a Non-Deterministic Finite Automaton equivalent to a regular expression (L3**)**
4. build the equivalent minimized Deterministic Finite Automata **(**L3)

Module II: Grammars Number of hours(LTP) 9 3 0

Regular grammars equivalent with Finite Automata, Context-free grammars, and languages; Parse trees; Applications; Ambiguity in grammars and Languages, Simplification of Context-Free Grammars, Closure Properties of Context-Free Languages, Membership Algorithm (CYK).Push down automata,equivalence of push down automata and context free grammar

Learning Outcomes:

After completion of this unit, the student will be able to:

1. classify the Chomsky hierarchy of grammars for formal languages **(**L2**)**
2. construct an unambiguous grammar from ambiguous grammar(L3)
3. decide whether a string belongs to a given context free language or not using membership algorithm(L5)

Module III: Introduction to Compiler Design Number of hours(LTP) 9 3 0

The Structure of Compiler, The Science of Building a Compiler in Bootstrapping and Cross compiler, The role of the Lexical analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical Analyzer Generator (LEX/FLEX).

Learning Outcomes:

After completion of this unit, the student will be able to:

1. summarizing various phases involved in the design of compiler construction(L2)
2. comparing methods involved in constructing the compiler(L2)
3. highlighting how regular expressions help to design the Lexical Analysis phase(L1)
4. exploring how LEX Tool simplifies the design of the Lexical Analysis phase(L2)

Module IV: Parsing Techniques Number of hours(LTP) 9 3 0

Top-Down parsing: Recursive Descent Parsing, Non-recursive Predictive Parsing, Bottom-Up parsing - Shift Reduce Parsing, Simple LR Parser, More Powerful LR Parsers, Parser Generator (YACC).

Learning Outcomes:

After completion of this unit, the student will be able to:

1. design the possible ways of constructing parsers (L3)
2. identifying the issues involved in creating an efficient Top-Down (LL) parser(L1)
3. implementing LR Parsers (L3)
4. illustrating the design of parser through YACC tool (L4)

Module V: Other Phases of Compiler Design Number of hours(LTP) 9 3 0

Intermediate Code Generation: Three Address codes**, Code Optimization**: The Principal Sources of Optimization, Basic blocks, and Flow Graphs, Optimization of Basic Blocks, **Code Generation:** Issues in designing a code Generator, The Target Language, A Simple Code Generator, Peephole Optimization.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. illustrating various techniques to store three address statements(L3)
2. identifying issues involved in the machine-independent code optimization(L1)
3. illustrating with a suitable example on local and loop optimization(L4)
4. estimating the processes involved in obtaining the final code (L2)

Text Books(s)

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory,Languages and Computation, 3/e, Pearson, 2008.
2. Alfred.V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey. D. Ullman, Compilers Principles, Techniques and Tools, 2/e, Pearson Education, 2008.

Reference Book(s)

1. Alfred.V. Aho, J.D.Ullman, Principles of compiler design, Narosa Publications, 2002
2. Peter Linz, An Introduction to Formal Language and Automata, NarosaPub. House, Reprint 2000.
3. Michael Sipser, Introduction to Theory of Computation, 3/e, Wadsworth Publishing Co Inc, 2012.

Course Outcomes:

1. illustrate the concepts in the design of Finite State Machines to recognize Regular Languages(L2)
2. analyze the relation between grammar and language, and design Context-Free Grammars for formal languages (L4)
3. define and analyze various phases involved in developing a compiler(L1)
4. compare between bottom-up and top-down parsing techniques(L2)
5. identify different machine-independent optimization generating target code techniques(L4)

19EAI334:OOSE Based application Development

L	T	P	C
2	0	2	3

Object Oriented Software Engineering builds on the skills of Software Engineering Methodologies and emphasizes the iterative and incremental nature of the software development process best illustrated by currently practiced Agile Modelling and Unified Process techniques. This course provides you with the necessary preparation for a software development project. You will continue to develop the problem solving skills required of a systems analyst through the analysis and design of business, health and gaming systems.. All diagrams are UML-based, and a Visual Modelling Case Tool is used to prepare diagrams. You will also use a project management tool in managing the deliverables.

Course objectives:

1. Understand software engineering concepts along with their applicability contexts.
2. Given a problem, identify domain objects, their properties and relationships among them.
3. Identify and model/represent domain constraints on the objects and (or) on their relationships
4. Develop design solutions for problems on various O-O concepts
5. Learn various modelling techniques to model different perspectives of object-oriented software design (UML)

Module I: **Introduction to Software Engineering** Number of hours(LTP) 6 0 6

Introduction: Software engineering Failures, What Is Software Engineering? : Modelling ,Problem Solving, Knowledge Acquisition, Rationale ,Software Engineering Development Activities: Requirements Elicitation, Analysis , System Design , Object Design, Implementation, Testing , ARENA Case study

An Overview of UML :Use Case Diagrams, Class Diagrams, Interaction Diagrams ,State Machine Diagrams ,Activity Diagrams

Modelling Concepts : Systems, Models, and Views-Data Types, Abstract Data Types, and Instances -Classes, Abstract Classes, and Objects -Event Classes, Events, and Messages - Object-Oriented Modelling- Falsification and Prototyping

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understands the basics of software engineering(L1)
2. Familiarize with usage of UML(L2)
3. Illustrate modelling concepts(L2)

Module II: **More UML & Analysis** Number of hours(LTP) 6 0 6

A Deeper View into UML : Use Case Diagrams ,Class Diagrams , Interaction Diagrams ,State Machine Diagrams ,Activity Diagrams , Diagram Organization ,Diagram Extensions

Analysis Concepts :Analysis Object Models and Dynamic Models - Entity, Boundary, and Control Objects - Generalization and Specialization

Analysis Activities: From Use Cases to Objects

Identifying Entity Objects, Identifying Boundary Objects, Identifying Control Objects, Mapping Use Cases to Objects with Sequence Diagrams, Modelling Interactions among Objects with CRC Cards ,Identifying Associations ,Identifying Aggregates ,Identifying Attributes , Modelling State-Dependent Behaviour of Individual Objects, Modelling Inheritance Relationships between Objects, Reviewing the Analysis Model Analysis Summary ,ARENA Case study

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Categorize various uml diagrams(L4)
2. Illustrate Analysis concepts(L2)
3. Familiarize with Analysis activities(L2)
4. Apply the Analysis activities(L4)

Module III: **System Design** Number of hours(LTP) 6 0 6

System Design: Decomposing the System

System Design Concepts**: Subsystems** and Classes, Services and Subsystem Interfaces, Coupling and Cohesion, Layers and Partitions, Architectural Styles *System Design Activities***:** From Objects to Subsystems**,** Analysis Model for a Route Planning System, Identifying Design Goals ,Identifying Subsystems

System Design: **Addressing Design Goals**

An Overview of System Design Activities, Concepts: UML Deployment Diagrams,
System Design Activities: Addressing Design Goals: Mapping Subsystems to Processors and Components, Identifying and Storing Persistent Data, Providing Access Control, Designing the Global Control Flow, Identifying Services, Identifying Boundary Conditions, Reviewing System Design, ARENA Case study

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understands the basics of System design(L1)
2. Familiarize with Design goals(L2)
3. Apply the system design(L4)

Module IV: **Object Design** Number of hours(LTP) 6 0 6

Object Design: Reusing Pattern Solutions

Reuse Concepts, Reuse Activities: Selecting Design Patterns and Components Encapsulating Data Stores with the Bridge Pattern , Encapsulating Legacy Components with the Adapter Pattern ,Encapsulating Context with the Strategy Pattern ,Encapsulating Platforms with the Abstract Factory Pattern ,Encapsulating Control Flow with the Command Pattern , Encapsulating Hierarchies with the Composite Design Pattern , Heuristics for Selecting Design Patterns , Identifying and Adjusting Application Frameworks

Object Design: Specifying Interfaces,

Interface Specification Concepts**:** Class Implementor, Class Extender, and Class User, Types, Signatures, and Visibility, Contracts: Invariants, Preconditions, and Postconditions, Object Constraint Language, OCL Collections: Sets, Bags, and Sequences, OCL Quantifiers: for All and exists, ARENA Case study

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understands the basics of Object design(L1)
2. Familiarize with Object design with patterns(L2)
3. Apply the Object design(L4)

Module V: **Coding & Testing** Number of hours(LTP) 6 0 6

Mapping Models to Code

Mapping Concepts Model Transformation, Refactoring, Forward Engineering, Reverse Engineering, Transformation Principles, Mapping Activities: Optimizing the Object Design Model, Mapping Associations to Collections, Mapping Contracts to Exceptions, Mapping Object Models to a Persistent Storage Schema, ARENA Case study

Testing:

An Overview of Testing, Testing Concepts: Faults, Erroneous States, and Failures, Test Cases, Test Stubs and Drivers, Corrections Testing Activities: Component Inspection, Usability Testing, Unit Testing, Integration Testing, System Testing Managing Testing: Planning Testing, Documenting Testing ,Assigning Responsibilities ,Regression Testing, Automating Testing

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understands mapping models to code (L1)
2. Apply Forward and Reverse engineering(L4)
3. Adapt various testing strategies(L6)
4. Familiarize with Automated Testing(L2)

Text Books(s)

1. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering Using UML, Patterns, and Java, Prentice-Hall.
2. Michael R. Blaha and James R Rumbaugh, Object-Oriented Modeling and Design with UML, Prentice Hall

Reference Book(s)

1. Craig Larman*, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and the Unified Process,* Prentice-Hall.
2. Stephen R. Schach, *Object-Oriented Software Engineering*, McGraw-Hill
3. Stephen R. Schach, *Introduction to Object-Oriented Analysis and Design*, McGraw-Hill

Course Outcomes:

1. Describe the OOAD paradigm (Unified Processes)
2. Employ the UML diagramming standards.
3. Demonstrate use of a software tool to support the planning, analysis and design phases
4. Use a case tool for all UML diagrams.
5. Develop prototypes of the system design, code, and Testing

Lab Activities Suggested:

Draw standard UML diagrams using a UML modelling tool and map design to code and implement. Test the developed code and validate whether the SRS is satisfied to a semester-long software engineering project by following the sequence of steps given below

1. Identifying Requirements from Problem Statements
2. Modelling UML Use Case Diagrams and Capturing Use Case Scenarios
3. Identifying Domain Classes from the Problem Statements
4. State chart and Activity Modelling
5. Modelling UML Class Diagrams and Sequence Diagrams
6. Mapping diagram to code (Forward Engineering)
7. Designing Test Suites

***Project* can be carried out in teams**

Reference Books & web links

1. Bernd Bruegge & Allen H. Dutoit, "Object-Oriented Software Engineering",2009.
2. Ivar Jacobson, "Object-Oriented Software Engineering", Pearson Education,2009.
3 Stephen R. Schach, "Object-Oriented Classical Software Engineering", McGraw Hill, 2010.
4 Yogesh Singh, "Object-Oriented Software Engineering", 2012
https://pl.cs.jhu.edu/oose/resources/tools.shtml
http://www.cse.lehigh.edu/~glennb/oose/oose.htm
https://www.upgrad.com/blog/software-development-project-ideas-topics-for-beginners/
http://www.cs.gordon.edu/courses/cs211/ATMExample/index.html

19EAI336: Machine Learning and Applications

L	T	P	C
3	0	2	4

Machine Learning is a flourishing subject in Computer Science which devises models that can automatically learn from data and detect patterns from data. The applications of machine learning are diverse ranging from self-driven cars to disaster management systems. With easy availability of data from different devices and measurements, machine learning techniques become imperative in analysing trends hidden in the data. This course focuses on the major tasks of machine learning that can robustly address data that is non-linear, noisy as well as high-dimensional in nature.

Course objectives:
1. To understand various key paradigms for machine learning approaches
2. Familiarize with mathematical relationships across various machine learning algorithms
3. To understand various key approaches in supervised learning.
4. To understand the concept of the neural network

Module I:	Number of hours (LTP)	9	0	6

Machine Learning Fundamentals: Use of Machine Learning, Types of machine learning systems, machine learning challenges, testing and validating, working with real data, obtaining the data, visualizing the data, data preparation, training and fine tuning the model.

Learning Outcomes:

After completion of this unit, the student will be able to:
1. Identify different machine learning approaches and applications(L1)
2. Demonstrate basic machine learning approach using real world data(L3)
3. Use machine learning approach to train and fine tune a learner(L3)

Module II:	Number of hours (LTP)	9	0	6

Linear Algebra: Scalars, Vectors, Matrices and Tensors Multiplying Matrices and Vectors, Identity and Inverse Matrices, Linear Dependence and Span, Norms, The Trace Operator, The Determinant.

Learning Outcomes:

After completion of this unit, the student will be able to:
1. Understanding the linear algebra for machine learning (L1)
2. Applying the various matrices operations (L3)
3. Understanding and applying the representation of real-world data for machine learning algorithms (L2/L3)

Module III:	Number of hours(LTP)	9	0	6

Prediction using Linear Regression, Gradient Descent, Linear Regression with one Variable, Linear Regression with Multiple Variables, Polynomial Regression, Feature Scaling/Selection.
learning curves, regularized linear models.

Learning Outcomes:

After completion of this unit, the student will be able to:
1. Demonstrate various prediction approaches (L2)
2. Describe prediction techniques for real – time data(L2)
3. Apply linear regression to make good predictions(L3)

Module IV:	Number of hours (LTP)	9	0	6

Classification, training a binary classifier, performance measures, multiclass classification, error analysis, multi label classification, multi output classification.
Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one Variable and with Multiple Variables.

Learning Outcomes:

After completion of this unit, the student will be able to:
1. Demonstrate various classification approaches (L2)
2. Describe classification techniques for real time data (L2)
3. Apply classification using the logistic regression(L3)

Module V:	Number of hours(LTP)	9	0	6

Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Back Propagation Algorithm.

Learning Outcomes:

After completion of this unit, the student will be able to:
1. Show the working of neural networks (L3)
2. Demonstrating different layered networks (L2)
3. Apply classification using backpropagation (L3)

Text Books(s)
1. AurelionGeron, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools and Techniques to build Intelligent Systems, 2/e, O'Reilly Media, 2019.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville,Deep learning, MIT press, 2016
3. Tom M. Mitchell, "Machine Learning" First Edition by Tata McGraw- Hill Education.

Reference Book(s)
1. Ethem Alpaydin,"Introduction to Machine Learning " 2nd Edition, The MIT Press, 2009
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning" By Springer, 2007.
3. Mevi P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012

Course Outcomes:
1. To formulate the different machine learning problems (L1)
2. To formulate the basics of linear algebra concepts required for machine algorithms (L2)
3. Apply various learning approaches on real time problems(L3)
4. Construct the neural networks for classification problems(L4)

List of Experiments:

Introduction to Python libraries- Numpy, Pandas, Matplotlib, Scikit-learn.
1. Using matplotlib perform data visualization on the given dataset
2. Implement a program on eigen decomposition and SVD
3. Implement the matrices operations using both Numpy and pandas
4. Implement Linear Regression using ordinary least square(OLS) and Gradient Descent methods
5. Implement classification Logistic Regression
6. Evaluate performance measures on regression models (Linear and Logistic).
7. Implement the single layer perceptron and Multilayer Perceptron for classification
8. Implement the back propagation
9. Implement the above learning algorithms using Scikit-Learn packages
10. Tackle the curse of dimensionality by implementing PCA algorithm on a high dimensional dataset.

19ECF332: Ethical Hacking

L	T	P	C
3	0	2	4

Introduces the ethical hacking methodologies. Covers applying cyber security concepts to discover and report vulnerabilities in a network. Explores legal and ethical issues associated with ethical hacking. Government agencies and business organizations today are in constant need of ethical hackers to combat the growing threat to IT security. A lot of government agencies, professionals and corporations now understand that if you want to protect a system, you cannot do it by just locking your doors.

Course objectives:

1. Learn aspects of security, importance of data gathering, foot printing and system hacking.
2. Learn tools and techniques to carry out a penetration testing.
3. How intruders escalate privileges?
4. Explain Intrusion Detection, Policy Creation, Social Engineering, DDoS Attacks, Buffer Overflows and Virus Creation.
5. Compare different types of hacking tools.

Module I: Number of hours(LTP) 9 0 6

Casing the Establishment: What is foot printing, Internet Foot printing, Enumeration, Scanning, basic banner grabbing, Enumerating Common Network services. Case study: Network Monitoring using Wireshark

Learning Outcomes:

After completion of this unit :

1. Student will learn about collecting information about the target
2. Student will learn about scanning process

Module II: Number of hours(LTP) 9 0 6

Securing permission: Securing file and folder permission, Using the encrypting file system, Securing registry permissions. Securing service: Managing service permission, Default services in windows 2000 and windows XP. Unix: Basic Unix commands, The Quest for Root, Remote Access vs Local access, Remote access, Local access., After hacking root.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand about basic Linux commands
2. Learn about securing files and folders

Module III: Number of hours (LTP) 9 0 6

Dial-up, PBX, Voicemail and VPN hacking, preparing to dial up, War-Dialling, Brute-Force Scripting PBX hacking, Voice mail hacking, VPN hacking, Network Devices: Discovery Autonomous System Lookup, Service Detection, Network Vulnerability.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand about network services and attacks
2. Illustrate about Network Vulnerability

Module IV: Number of hours (LTP) 9 0 6

Wireless Hacking: Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks, Firewalls: Firewalls landscape, Firewall Identification-Scanning Through firewalls, packet Filtering, Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of DoS Attackers, Types of DoS attacks, Generic DoS Attacks, Wireless Encryption, wireless hacking methodology, wireless hacking tools, and wi-fi security tools.

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Learn about Firewall and gain knowledge of wireless hacking
2. Know about various Hacking methods.

Module V: Number of hours (LTP) 9 0 6

Remote Control Insecurities, Discovering Remote Control Software, Connection, Weakness. VNC, Advanced Techniques Session Hijacking, Back Doors, Trojans, Cryptography, Subverting the systems Environment, Social Engineering, Web Hacking, poisoning attack, Web server hacking web application hacking, Hacking the internet Use, Malicious Mobile code, SSL fraud, E-mail Hacking,

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Gain the knowledge of cryptographic approaches
2. Understand about web hijacking, web servers’ attacks

Text Books(s)

1. 1. Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Tata Mc Graw Hill Publishers, 2010.
2. 2. Bensmith, and Brian Komer, Microsoft Windows Security Resource Kit, Prentice Hall of India, 2010

Reference Book(s)

1. Stuart McClure, Joel Scambray and Goerge Kurtz, “Hacking Exposed Network Security Secrets &
   Solutions”, 5th Edition, Tata Mc Graw Hill Publishers, 2010.
2. 2. Rafay Baloch, “A Beginners Guide to Ethical Hacking”.
3. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, “Gray Hat Hacking the Ethical Hackers Handbook”, 3rd Edition, McGraw-Hill Osborne Media paperback (January 27, 2011)

Course Outcomes:

1. Students will learn the underlying principles and techniques associated with the cybersecurity practice known as penetration testing or ethical hacking.
2. Student will become familiar with the entire penetration testing process including planning, reconnaissance, scanning, exploitation, post-exploitation and result reporting.
3. For every offensive penetration technique, the students will learn the corresponding remedial technique.
4. the students will develop a practical understanding of the current cybersecurity issues and the ways
5. how the errors made by users, administrators, or programmers can lead to exploitable insecurities.

19EDS332:DATA VISUALIZATION AND EXPLORATION WITH R

L	T	P	C
3	0	2	4

The course is designed to enable the student to write programs for problem solving. After an introduction to R, R Studio, Exploratory Data Analysis, Using R for Data Visualization and Graphics for Communication are designed to work together to make data science fast, fluent. This course lays for developing program logic and for writing programs in R according to the developed logic.

Course objectives:

1. To make the fundamentals of statistical analysis in R environment.
2. To be familiar with standard techniques for visualizing data.
3. To be able to transform raw data into formats suitable for analysis.
4. To be able to perform basic exploratory analysis.
5. To be able Check for missing data and other mistakes using exploratory analysis.

Module I: Number of hours(LTP) 9 0 6

Introduction: Importance of R and R Studio (IDE).

R Language Constructs: Variables, Data types, Arithmetic and Boolean operators.

R data structures : Introduction to Data Structure in R, Vectors Lists, Data Frames, Matrices, Arrays, Strings, Factors.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the basics in R programming in terms of constructs(L2).
2. Learn the main R data structures(L2).

Module II: Number of hours(LTP) 9 0 6

Data Visualization: Data Preparation-Importing data, Cleaning Data, Introduction to Base graphics, lattice graphics,,Univariate Graphs: bar graphs, pie charts, histograms, line charts, stacked bar graphs, box plots,,Bivariate Graphs, Multivariate Graphs, Maps-Dot density maps,choropleth maps, Time-dependent graphs, Survival plots, Mosaic plots,3-D Scatter plot,Biplots,Heat maps, Customizing Graphs, Saving Graphs.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Create and edit visualizations with R(L6).
2. Make it easier to identify patterns, trends and outliers in large data sets(L3).
3. Create charts to describe and compare the composition of data sets(L6).
4. Illustrate the distribution of data through visualizations(L4).

Module III: Number of hours(LTP) 9 0 6

Data Visualization with ggplot2 : Introduction, Aesthetic Mappings, Facets, Geometric Objects, Statistical Transformations, Position Adjustments, Coordinate Systems, The Layered Grammar of Graphics.

Graphics for Communication: Introduction, label, Annotations, scales, zooming, themes.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Gain an understanding of the grammar of graphics, the theory behind ggplot2(L2).
2. Learn why ggplot2 is the current best option for Data Visualization(L2).
3. Learn how to use the different ggplot geometries (L2) .

Module IV: Number of hours(LTP) 9 0 6

Exploratory Data Analysis: Overview of EDA, Types of EDA, Procedure for conducting EDA,Exploring a new data set, summarizing numerical data, anomalies in numerical data, Visualizing relationship between variables, variation, missing values, co variation, patterns and models, Describing data-measures of central tendency, Measures of dispersion and skewness,A survey of probability concepts, The normal probability distribution.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Choose and apply the most suitable techniques for exploratory data analysis(L1).
2. Map out the hidden underlying structure of the data(L1).
3. Detect anomalies and missing data(L3).

Module V: Number of hours(LTP) 9 0 6

Statistical Modeling : Data, Statistics, Analysis of covariance: variance (ANOVA),,Correlation Plots, Simple Linear Regression, , Multiple Linear Regressions, Logistic Regression, Clustering model.

R Markdown: Introduction, Code Chunks, Markdown Basics, R Notebooks, Output Formats.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand how to implement various modeling procedures using R(L2).
2. Explore linear and logistic regression, generalized linear models, general estimating equations(L2).
3. Understand the benefits of using r markdown(L2).
4. Aware of the main features of a markdown file(L1).
5. Create reproducible markdown reports in r(L6).

Text Books(s)

1. Jared P. Lander, R for Everyone, 2/e, Pearson Publications, 2017.
2. Ronald K, Exploratory Data Analysis Using R,1/e, CRC Press, 2018.
3. David S. Brown, Statistics and Data Visualization Using R, 1/e,SAGE Publications.2018.
4. Garrett Grolemund and Hadley Wickham, R for Data Science, O'Reilly Media, 1/e, 2017.

Reference Book(s)

1. Seema Acharya, Data Analytics Using R ,1/e,Mc Grawhill.
2. Dr.Tania Moulik, Applied Data Visualization with R and ggplot2,1/e,Packt.

Course Outcomes:

1. Understand critical programming language concepts and Perform simple arithmetic and statistical operations in R(L2).
2. Have an understanding of the basic principles of exploratory analysis and lay the foundation for future learning in the area(L2).
3. Know the basic principles behind working with all types of data for building all types of models(L1).
4. Understand the foundations and characteristics of data, which forms the beginning of the visualization pipeline (L2).
5. Create basic bar charts, histograms, pie charts, scatter plots, line plots, box plots, and maps using R and related packages (L6).

19EIO332: Wireless Sensor Networks

L	T	P	C
3	0	2	4

This course starts with a brief introduction of Wireless Sensor Networks (WSNs). It then introduces the concepts of localization and time synchronization and methods to perform them in WSNs. After examining the issues in medium access control, routing, transport and application layers in WSNs, the most important protocols for WSNs in each of these layers are discussed. Finally, WSN middleware and operating systems are introduced with examples.

Course objectives:

1. To introduce to the students the concepts of localization and time synchronization in WSNs and ways to perform them.
2. To enable the student to study the design issues in MAC for WSNs and popular MAC protocols for WSNs.
3. To acquaint the student with the challenges in routing in WSNs and popular routing protocols for WSNs.
4. To let the student examine the feasibility of TCP and UDP for WSNs and study WSN transport and application layer protocols.
5. To familiarize the student with the design issues for middleware and operating systems for WSNs and example middleware and operating systems for WSNs.

Module I:	Introduction to Sensor Networks, Localization and Time Synchronization	Number of hours(LTP)	9	0	6

Introduction and Overview of Wireless Sensor Networks, Applications of WSNs, **Localization**: Overview, Key issues, Localization approaches, Coarse-grained node localization using minimal information, Fine-grained node localization using detailed information, Network-wide localization, **Time Synchronization:** Overview, Key issues, Traditional approaches, Fine-grained clock synchronization, Coarse-grained data synchronization

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Define localization and time synchronization. (L1)
2. Analyze the key design issues in localization and time synchronization for WSNs. (L4)
3. Explain the key traditional approaches to localization and time synchronization. (L4)
4. Differentiate between fine and coarse-grained localization and time synchronization. (L2)
5. Outline the various ways of achieving localization and time-synchronization in WSNs. (L1)

Module II:	Number of hours(LTP)	9	0	6

Medium Access Control Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Outline the fundamentals of MAC protocols. (L1)
2. Summarize the working of MAC protocols for WSNs. (L2)
3. Interpret the working of Sensor-MAC. (L2)
4. Summarize the working of IEEE 802.15.4. (L2)
5. Analyze the working of Sensor-MAC and IEEE 802.15.4. (L4)

Module III:		Number of hours(LTP)	9	0	6

Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks - LEACH, Directed Diffusion and geographical routing. RPL and 6LoWPAN.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Summarize the background of routing in networks. (L2)
2. Interpret the role of data dissemination and gathering in WSNs. (L2)
3. Explain the challenges and design issues in routing for WSNs. (L4)
4. Summarize the important routing strategies in WSNs. (L2)
5. Compare the routing strategies for WSNs. (L2)

Module IV:	Transport Control and Application Protocols for Wireless Sensor Networks	Number of hours(LTP)	9	0	6

A brief review of Traditional Transport Control Protocols, Feasibility of Using TCP or UDP for WSNs, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols - CODA, RMST.

Application Protocols for WSNs : CoAP and MQTT

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Summarize the working of traditional transport layer protocols. (L2)
2. Question the feasibility of using existing transport layer protocols in WSNs. (L4)
3. Deduce the design issues in developing transport protocols for WSNs. (L4)
4. Infer the working of WSN transport protocols. (L2)
5. Distinguish between various WSN transport protocols. (L4)

Module V:		Number of hours(LTP)	9	0	6

Middleware and Operating Systems for Wireless Sensor Networks: Middleware: Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware: DDS, SensorWare.
Operating Systems: Introduction, Operating System Design Issues, Examples of Operating Systems, TinyOS, SenOS.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Outline WSN middleware principles. (L1)
2. Summarize the working of example middleware architecture for WSNs. (L2)
3. Explain operating system design issues for WSNs. (L4)
4. Examine the working of example WSN operating systems. (L3)
5. Distinguish between the working of example WSN operating systems and middleware. (L4)

Text Books(s)

1. Wireless Sensor networks- Technology, Protocols and Applications by Kazem Sohraby, Daniel manoli , Wiley InterScience Publications 2007
2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
3. Networking Wireless Sensors, Bhaskar Krishnamachari, Cambridge university press, 2005

Reference Book(s)

1. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.
2. Wireless Sensor Networks, C.S Raghavendra, Krishna M.Sivalingam, Taieb znati, Springer Science 2004

Course Outcomes:

After completing this course, the student will be able to:

1. Define localization and time synchronization. (L1)
2. Compare various localization and time synchronization techniques for WSNs. (L2)
3. Analyze the difference between protocol design at the MAC, network, transport and application layers for WSNs and that for the Internet. (L4)
4. Explain the working of popular WSN protocols at the MAC, network, transport and application layers. (L4)
5. Summarize the working of popular WSN operating systems. (L2)

List of experiments:

The following simulation experiments are to be carried out using ns-3 or TOSSIM.

1) Create a simple WSN with ten nodes in a linear topology. Plot the average energy spent and packet delivery ratio (PDR, end-to-end) when the simulation is run for 500 seconds for two different transmission radii. Use standard protocols at the different layers.
2) Create a small network with a tree topology (the sink at the root) and static nodes. Run the simulation for 500 seconds and examine the node energy spent and packet delivery ratio spent for transmitting data:
    a) To the sink from the leaves.
    b) To the leaves from the sink.
3) Create a small network with mobile sensor nodes. Any standard mobility pattern can be used. Trigger transmissions with random sources and destinations and plot the average energy spent and PDR. Use standard MAC and routing protocols.
4) Repeat the experiment in (2) using Sensor-MAC at the MAC level.
5) Repeat the experiment in (2) using IEEE 802.15.4 at the MAC level.
6) Repeat the experiment in (2) with a clustered network using LEACH for routing.
7) Repeat the experiment in (2) using IEEE 802.15.4 at the MAC level and 6LowPAN and RPL for routing.
8) Create a small WSN and use CoAP and MQTT at the application layer.

19EHS302: ENGINEERING ECONOMICS AND MANAGEMENT

L	T	P	C
3	0	0	3

Course objectives

Define the basic terms of economics and analyze law of demand and elasticity of demand

- Explain cost concepts and interpret Financial statements
- Apply break even analysis concept in business organization
- Discuss the advantages of different forms of organization
- Elaborate the principles of Management

Unit I **8 hours**

Economics: Utility, value, wealth, consumption, wants necessaries, comforts and luxuries.
Demand: Law of demand, elasticity of demand, price elasticity of demand, factors affecting elasticity ofdemand, simple problems.

Learning outcomes:

Student will be able to

- Define utility and value of goods.
- Distinguish between necessities, comforts and luxuries.
- Classify demand
- Analyze the elasiticity of demand for various economic goods.

Unit II **8 hours**

Costing: Cost concepts, elements of cost, methods of distribution of overhead costs, unit costing, job costing and process costing; Simple problems. Accounts: Preparation of profit and loss account and balance sheet (outlines only).

Learning outcomes:

Student will be able to

- List types of costs
- Apply cost analysis in finding profit
- Classify accounts
- Compose & Interpret balance sheet for a given enterprise

Unit III **6 hours**

Break-Even Analysis: Assumptions, break-even charts, simple problems.Depreciation: Depreciation methods - Simple problems.

Learning outcomes:

Student will be able to

- Apply break even analysis in business organization
- Examine the impact of fixed and variable costs on profits
- List depreciation methods
- Compute the depreciation of assets.

Unit IV **10 hours**

Forms of Business Organization: Single trader, partnership and public limited company.
Principles of Organization: Types of organization; Span of management; Authority, delegation and decentralization, source of formal authority, difference between authority and power, line and staff authority, simple case studies.

Learning outcomes:

Student will be able to

- Categorize forms of business organization
- Distinguish types of organization
- Illustrate advantages and disadvantages of each form of organization
- Evaluate the effect of span of management on decision making

Unit V **10 hours**

Principles of Management: Importance of management, definition of management, management process, roles of a manager; Management, a science or art - Management, a profession; Functions of management. Leadership: Difference between a leader and a manager, characteristics of leadership, functions of a leader, simple case studies.

Learning outcomes:

Student will be able to

- Summarize the function of management
- Assess the role of manager
- Compare and contrast between Leader and Manager
- List the characteristics of Leader

Course Outcomes

- Interpret and summarize the country's economy and market economics, as an entrepreneur.
- Develop the background behind making cost implications and related concepts.
- Analyze various accounting concepts and financial management techniques for preparingeffective profit and loss statements
- Discover the optimal production strategies.
- Examine and analyze break even evaluation concepts for identification of minimum productionvolume for survival and to gain profits.
- Adapt and build good manager skills by employing the concepts of various skills like goodleadership qualities, utilizing motivation capabilities and incorporating communications skills.

19EMC382: ENGINEERING ETHICS

L	T	P	C
3	0	0	0

Unit I **8 hours**

Basic Concepts: Terminology, morals, ethics, values, integrity and spirituality, edicts-religious, social, and constitutional edicts, the question of universality, personal and professional ethics, emotional intelligence, dimensions of ethics.

Unit II **8 hours**

Rights and Responsibilities: As citizens, as professionals, concepts of justice and fairness, preservation, production, exchange for mutual fulfilment vs. storage for future use, social responsibility, and individual rights.

UNIT III **9 hours**

Global Issues in Ethics: Technology and globalization, business ethics, corporate social responsibility, environmental ethics, media ethics, pro-testing the common good while respecting the values and beliefs of nations/ ethnic groups, issues of compliance and governance, equal opportunities.

Unit IV **8 hours**

Ethical Integrity and Attitudes: Integrity as wholeness and consistency of character, beliefs, actions, methods and principles, core group of values, accountability, prioritization, subjectivity and objectivity, attitude, com-ponents (cognitive, behavioral, and affective), attitude formation and attitude change.

Unit V **9 hours**

Ethical Living: Needs of life, materialistic and non-materialistic, qualitative, and quantitative, harmony in living, self (physical and mental wellbeing), family, building trust, sharing of responsibilities, cultivating sense of security, society, peace, non-violence, diversity, multiculturalism and oneness, nature,environmental sustainability, reorganizing living conditions, reappraising economic sectors and work practices, developing green technologies, ethical consumerism.

References

1. G. Subba Rao, Roy Chowdhury, P.N. Ethics, Integrity and Aptitude: For Civil Services Main Examination Paper V, Access Publishing, 2013.
2. Singer, Peter. Practical Ethics, Cambridge University Press, 1999.
3. Swami Tathagatananda, Healthy Values of Living, Advaita Ashrama, Kolkata, 2010.
4. M. Frost (Ed), Values and Ethics in the 21st Century, BBVA, Available at https://www.bbvaopenmind.com/wp-content/uploads/2013/10/Val-ues-and-Ethics-for-the-21st-Century_BBVA.pdf

19ECS392 – COMPREHENSIVE SKILL DEVELOPMENT - V

L	T	P	A	C
0	0	0	6	1

MOBILE APPLICATION DEVELOPMENT

Course introduction:

For the students in Penultimate semester, an application oriented session with whatever they have learntso far may be suggested. As smart phones are widely used, an application for a mobile can be given which tests their application specific skills.

Course objectives:

- Build an application for a mobile (preferably Android due to its popularity).
- Construct specific cases which can be utilized for academic purposes.

Week- I & 2: Android Studio
Installation and familiarity with Android Studio.
Build, launch and emulate a simple application
on an Android Phone.Week- 3 & 4:Android
App Components -1
Android app components, such as intents, activities,
and broadcast receivers.Week- 5 & 6: Android
App Components -2
Program core Android components together with Android concurrency frameworks and basic Javafile I/O classes (such as File and InputStream) and Android storage mechanisms (such as Shared Preferences)
Week- 7 & 8: Interactive Application
Build a graphical user interface with an activity controlling it, resulting in a first interactiveapplication.
Week- 9 & 10 : Analysis of smart phones components and the mobile network.
Analyze the components of smartphones and check the mobile network. Focus on the characteristicsand operations of the smartphone Operating Systems.
Week- 11 & 12: Analysis of smartphones components and the mobile network.

Analyze the components of smartphones and check the mobile network. Focus on the characteristicsand operations of the smartphone Operating Systems.

References:

1. Build Your First Android App (Project-Centered Course) offered by Centrale Supelee in Coursera(sponsored by GITAM)
2. Smart Device & Mobile Emerging Technologies offered by Yonsei University in Coursera(sponsored by GITAM)
3. Android App Components - Intents, Activities, and Broadcast Receivers offered by VanderbiltUniversity

HSMCH102: UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY

L	T	P	C
2	1	0	3

Human Values Courses: During the Induction Program, students would get initial exposure to human values through Universal Human Values -1. This exposure is to be augmented by this compulsory entire semester foundation course. It is an introductory foundational input and desirable to follow it up by Faculty-student or mentor-mentee programs throughout their time with the institution.

Course objectives:

- Development of a holistic perspective based on self-explanation about themselves (human being), family, society, and nature/existence
- Understanding (or developing clarity) of the harmony in the human being, family, community, and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

UNIT I: Course Introduction – Need, basic guidelines, content, and process for value education 6L 3T

1. Purpose and motivation for the course, recapitulation from universal human values-1
2. Self-exploration-what is it? – It's content and process; 'Natural Acceptance' and Experimental Validation – as the process for self-exploration
3. Continuous happiness and prosperity – A look at basic human aspirations
4. Right understanding, relationship, and physical facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding happiness and prosperity correctly – A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Include practice sessions to discuss natural acceptance in human beings as the innate acceptance for living with responsibility (living in relationship, harmony, and co-existence) rather than arbitrariness in choice based on linking-dislinking.

UNIT II: Understanding harmony in the human being – harmony in myself? 6L 3T

1. The understanding human being as a co-existence of the sentient 'I' and the material 'Body.'
2. Understanding the needs of self ('I') and 'Body' – happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer, and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I.'
5. Understanding the harmony of I with the Body; Sanyam and health; correct appraisal of physical needs, the meaning of prosperity in detail
6. Programs to ensure Sanyam and Health

Include practice sessions to discuss the role others have played in making material goods available to me. They are identifying from one's own life.
Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with the disease.

UNIT III: Understanding harmony in the family and society-harmony in human-human relationship 6L 3T

1. Understanding values in a human-human relationship; the meaning of justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; trust and respect as the foundational values of relationship
2. Understanding the meaning of trust; the difference between intention and competence
3. Understanding the meaning of respect, the difference between respect and differentiation; the other salient values in a relationship

4. Understanding the harmony in the society (society being an extension of the family); resolution, prosperity, fearlessness (trust), and co-existence as comprehensive human goals
5. Visualizing a universal harmonious order in society – undivided society, universal order – from family to world family

Include practice sessions to reflect on relationships in the family, hostel, and institute as extended family, real-life examples, teacher-student relationship, the goal of education, etc. Gratitude is a universal value in relationships—discuss with scenarios. Elicit examples from students' lives.

UNIT IV: Understanding harmony in the nature and existence – whole existence as co-existence 6L 3T

1. Understanding the harmony in the nature
2. Inter-connectedness and mutual fulfillment among the four orders of nature – recyclability, and self-regulation in nature.
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
4. Holistic perception of harmony at all levels of existence.
5. Include practice sessions to discuss human beings as the cause of imbalance in nature, pollution, depletion of resources and role of technology, etc.

UNIT V: Implications of the above Holistic Understanding of Harmony on Professional Ethics 6L 3T

1. Natural acceptance of human values
2. The definitiveness of Ethical Human Conduct
3. The basis for Humanistic Education, Humanistic Constitution, and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems.
5. Case studies of typical holistic technologies, management models, and production systems
6. Strategy for the transition from the present state to Universal Human Order:
7. At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers
8. At the level of society: as mutually enriching institutions and organizations
9. Sum up.

Include practice exercises and case studies to discuss the conduct of an engineer or scientist.

Text Books(s)

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Book(s)

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakash an, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditS underlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - M aulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Course Outcomes:

By the end of the course, students will expect:

- to become more aware of themselves and their surroundings (family, society, nature);
- to become more responsible in life and handle problems with sustainable solutions while keeping human relationships and human nature in mind.
- to be sensitive to their commitment to what they have understood (human values, human relationships, and society).
- to apply what they have learned to themselves in different day-to-day settings.

19ECS343: ADVANCED DATA STRUCTURES FOR MACHINE LEARNING

L	T	P	C
2	0	2	3

After the students have gone through a course on data structures using python, where they learn the formal and abstract representations of data and its manipulation. Studying course on advanced data structures should teach the students concrete implementations and manipulation of such basic data structures and their use in design and analysis of non-trivial algorithms for a given computational task. On completion of such a course, students should be able to analyse the asymptotic performance of algorithms demonstrate their familiarity with major data structures, rule to manipulate those, and their canonical applications such as graphs and pattern recognition.

Course objectives:

- CO1: Analyze algorithms and data structures applying methods for amortized analysis
- CO2: Evaluate methods for performance improvement of dictionaries and hashing techniques.
- CO3: Analyze and assess various time and space efficient searching tree data structures
- CO4: Analyze and assess the applicability of fundamental graph algorithms to applications and external sorting schemes.
- CO5: Define and apply data structures for Pattern Matching and tries

UNIT I: Review of basic data structures 6 0 6

Recursion: illustrative examples; Array based sequences: low level arrays, Dynamic Arrays, amortized analysis; Stacks, Queues, Double Ended Queues; **Priority Queues**: Priority Queue as ADT, Implementing Heap using Priority Queue, Sorting with Priority Queue;

Learning Outcomes:
After completion of this unit, the student will be able to:

- analyse the fundamental concepts of linear data structures (L3)
- apply priority queue for implementation of heaps (L3)
- demonstrate sorting using priority queues (L2)

UNIT II: Maps and Hash Tables 6 0 6

Maps, and Hash Tables: Maps and Dictionaries; Hash Tables;
Hashtablerepresentation:hashfunctions,collisionresolution-separatechaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skiplists.

Learning Outcomes:
After completion of this unit, the student will be able to:

- describe the fundamental concepts of maps and hashing techniques(L2)
- apply hashing techniques for indexing(L4)

UNIT III: Trees 6 0 6

General Trees, Binary Trees, Implementing Trees, Binary search trees; Balanced search trees, AVL trees, Splay Trees, Red –Black Trees, Multiway search Trees, B-Trees, B-Tree of order m, height of a B-Tree, insertion, deletion and searching, Comparison of Search Trees.

Learning Outcomes:
After completion of this unit, the student will be able to:
illustrate the representation and use of non linear data structures (L2)

• illustrate different variants of search trees (L5)
• construct B-Trees of higher order (L3)

UNIT IV: Graphs **6 0 6**
The graph ADT, Representation in memory; Directed Acyclic Graph; Shortest path using Prim-Jarnik Algorithm and Kruskal's Algorithm; Disjoint Partitions and Union Find Structures.
External Sorting: Model for external sorting, Multi-way merge, Polyphase merge.

Learning Outcomes:
After completion of this unit, the student will be able to:
demonstrate the applications of graph for finding shortest paths (L2)
• analyze sets through disjoint partition and union (L2)
• apply model for external sorting techniques for datasets (L2)
• apply merging schemes to datasets (L2)

UNIT V: Pattern Matching and Tries 6 0 6
Pattern Matching: Pattern matching algorithms -Brute force, the Boyer –Moore algorithm, theKnuth-Morris- Pratt algorithm;
Tries: Standard Tries, Compressed Tries, Suffix Tries, Search Engine Indexing.

Learning Outcomes:
After completion of this unit, the student will be able to:

- compare different pattern matching algorithms(L4)
- demonstrate the fundamental concepts of *trie* data structure(L2)
- create applications for search engine indexing(L2)

Text Books(s)

1. Michael T. Goodrich, Tamassia and Michael H.Goldwasser, Data structures and Algorithms in Python, Wileystudentedition,JohnWileyandSons,2013.

2. S.Sahni,Datastructures,AlgorithmsandApplicationsinjava,UniversitiesPre ssOrient Longman Pvt. Ltd,2011.

3. Bradley N Miller, David Ranum, Problem Solving with Algorithms and Data Structuresusing Python, Franklin, Beedle& Associates publishing, 2013.

Reference Book(s)

1. Mark Allen Weiss, Data structures and Algorithm Analysis inJava,3/e Pearson Education. Ltd.,2011.

2. Data structures using java, Langsam, Augenstein and Tanenbaum, PHI, 2003.

19ECF341: OPERATING SYSTEMS SECURITY

L	T	P	C
2	1	0	3

This course deals with security concepts and procedures applied in operating systems. Students will examine security concepts that are uniquely implemented into operating systems. Also, this course will enable practical hands-on approach when testing operating system security techniques and apply these concepts in real time. It makes us understand the significance of Security Kernels, Secure Communications, and examine secure capability systems .

Course objectives:

1. Design trusted computing base that defines a trust model, define a threat model for the trusted computing base, and ensure protection of the trusted computing base under that model.
2. Examine the UNIX and Windows operating systems and show why they are fundamentally not secure operating systems
3. Analyze the concept for expressing secrecy and integrity goals, information flows, and then describe models for expressing these goals in mandatory access control policies
4. Identify the security features to an existing operating system, with its existing customer base and applications to building secure systems.
5. Construct the secure operating systems from capability systems

Module I: **Introduction** Number of hours(LTP) 6 3 0

Introduction - Security goals, Trust model, Threat model

Access Control Fundamentals – Protection system – Lampson's Access Matrix, Mandatory protection systems, Reference monitor, Secure Operating System Definition, Assessment Criteria.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Describe the Operating system security fundamental points
2. Define security goals, trust model, threat model
3. Examine OS protection system
4. Discuss OS reference monitor
5. Define secure operating system

Module II: **Multics** Number of hours(LTP) 6 3 0

Multics- Multics History, The Multics System, Multics Fundamentals, Multics Security Fundamentals, Multics Protection System Models, Multics Protection System, Multics Reference Monitor, Multics Security, Multics Vulnerability Analysis.

Security in Ordinary OS: System Histories-UNIX History, Windows History.

UNIX Security - UNIX Protection System, UNIX Authorization, UNIX Security Analysis, UNIX Vulnerabilities.

WINDOWS Security - WINDOWS Protection System, WINDOWS Authorization, WINDOWS Security Analysis, WINDOWS Vulnerabilities.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Discuss Multics security fundamentals
2. Describe multics protection system models
3. Understand multics reference monitor and ecurity
4. Demonstrate security in windows operating system
5. Demonstrate security in Unix operating system

Module III: **Security Goals** Number of hours(LTP) 6 3 0

Verifiable Security Goals-Information Flow-Information Flow Secrecy Models, Information Flow Integrity Models, Covert Channels.

Security Kernels, Secure Communications processor- Scomp Architecture, Scomp Hardware, Scomp Trusted Operating Program, Scomp Kernel Interface Package, Scomp Applications, Scomp Evaluation

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Discuss about information flow secrecy models2
2. Explain information flow integrity models
3. Understand Scomp hardware
4. Describe Scomp architecture

Module IV: **Linux** Number of hours(LTP) 6 3 0

Building a Secure Operating System for Linux -Linux Security Modules, LSM History, LSM Implementation, Security-Enhanced Linux SE Linux Reference Monitor, SE Linux Protection State, SELinux Labeling State, SELinux Transition State, SE Linux Administration, SE Linux Trusted Programs, SE Linux Security Evaluation.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Demonstrate LSM implementation
2. Explain SE Linux reference monitor and protection state
3. Appraise SE linux security evaluation

Module V: **Solaris Trusted Extensions** Number of hours(LTP) 6 3 0

Solaris Trusted Extensions - Trusted Extensions Access Control, Solaris Compatibility, Trusted Extensions Mediation ,Process Rights Management (Privileges), Privilege Bracketing and Relinquishing ,Controlling Privilege Escalation, Assigned Privileges and Safeguards, Role-based Access Control (RBAC),RBAC Authorizations ,Rights Profiles ,Users and Roles ,Converting the Super user to a Role, Trusted Extensions Networking , Trusted Extensions Multilevel Services, Trusted Extensions Administration

Secure Capability Systems-Capability System Fundamentals, Capability Security, Challenges in Secure Capability Systems,

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Discuss about Role Based Access Control (RBAC) in Solaris OS
2. Describe Solaris trusted extensions
3. Explain challenges in secure capability systems

Text Books(s)

1. Trent Jaeger," Operating System Security", Morgan and Claypool, 2008

Reference Book(s)

1. Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition, Prentice Hall, 2009.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts with Java", Ninth Edition, Wiley, 2012.
3. Enrico Perla, Massimiliano Oldani, "A Guide to Kernel Exploitation – Attacking the Core", VElsevier, Syngress, 2011
4. Wolfgang Mauerer, "Professional Linux Kernel Architecture", Wiley, 2008.
5. Daniel P. Bovet and Marco Cesati, "Understanding the Linux Kernel", Third Edition, O'Reilly, 2006.

6. W. Richard Stevens, Stephen A. Rago, “Advanced Programming in the Unix Environment”, Third Edition, 2013.
7. Matt Bishop “Computer Security: Art and Science” Addison-Wesley, 2002
8. Michael Palmer “Guide to Operating Systems Security”,

Course Outcomes:

1. Understand the challenges of building a secure operating system
2. Compare and illustrate security in Unix and Windows operating systems.
3. Illustrate Verifiable Security Goals
4. Understand the significance of Security Kernels and Secure Communications processor
5. examine the challenges in secure capability systems

19ECS345: ADVANCED COMPUTER NETWORKS

L T P C
2 1 0 3

This course aims to provide understanding of advanced computer network concepts, building on the basic functions of various layers, protocols and standards used in practice to have a comprehensive and deep knowledge in computer networks.

Course objectives:

- Introduce the concepts of network architecture and application programming interface concepts
- Enable the students to understand various Internetworking protocols
- Familiarize the students with advanced internetworking concepts such as Interdomain routing and multicast communication
- Introduce the concepts of end-to-end protocols, congestion control, and resource allocation techniques
- Expose the student to the latest trends in traditional, multimedia applications and content distribution networks

Module I Introduction LTP 6 3 0

Introduction: Applications, Requirements – Perspectives, Scalable Connectivity, Cost-Effective Resource Sharing, Support for Common Services. Network Architecture- Layering and Protocols, OSI Architecture, Internet Architecture. Implementing Network Software- Application Programming Interface (Sockets). Performance- Bandwidth and Latency, Delay×Bandwidth Product, Application Performance Needs.

Learning Outcomes:

After completion of this unit, the student shall be able to:

- Differentiate connectivity and scalable connectivity (L2)
- Describe network architectures (L2)
- Explain cost effective resource sharing (L2)
- Program simple network software using socket programming (L3)
- Summarize the performance of a network in terms of bandwidth, latency and their product (L2)

Module II Internetworking LTP 6 3 0

Internetworking (Part - I): Switching and Bridging-Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN switches. **Basic Internetworking (IP)-**What is an internetwork, service model, global addresses, Datagram Forwarding in IP, Subnetting and classless addressing, address translation (ARP), DHCP, ICMP, Virtual Networks and Tunnels.

Learning Outcomes:

After completion of this unit, the student shall be able to:

- Compare datagram networks with virtual circuit networks (L2)
- Describe various data link layer switching techniques (L2)
- Sketch datagram forwarding approach in Internet Protocol (L2)
- Present the process of subnetting and classless addressing (L2)
- Explain the concept of tunnelling (L2)

Module III Internetworking and Advanced Internetworking LTP 6 3 0

Inter-networking (Part - II): Routing - Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics**. Implementation and Performance**- Switch Basics, Ports, Fabrics, Router Implementation. **Advanced Internetworking**: The Global Internet – Routing Areas, Interdomain Routing (BGP), IP Version 6 (IPv6). **Multicast**: Multicast addresses, Multicast routing (DVMRP, PIM)

Learning Outcomes:
After completion of this unit, the student shall be able to:
● Illustrate with an example working of distance vector and link state routing protocols (L3)
● Describe performance of network devices such as a switch, router and a bridge (L2)
● Explain the concepts of autonomous system and Interdomain routing (L2)
● Sketch the header of Internet Protocol version 6 (L2)
● List different multicast communication techniques (L2)

Module IV Advanced Internetworking and End-to-End Protocols LTP 6 3 0
Multiprotocol Label Switching (MPLS): Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels, **Routing among Mobile Devices**: Challenges for Mobile Networking, Routing to Mobile Hosts (Mobile IP), **End-to-End Protocols**: Simple Demultiplexer (UDP), Reliable Byte Stream (TCP) - End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Performance, Alternative Design Choices. **Congestion Control and Resource Allocation:** Issues in Resource Allocation - Network Model, Taxonomy, Evaluation Criteria. Queuing Disciplines - FIFO, Fair Queuing
Learning Outcomes:
After completion of this unit, the student shall be able to:
● Describe the concept of virtual private networks and tunnels (L2)
● Summarize routing process in mobile hosts (L2)
● Sketch TCP's connection establishment and termination (L3)
● Explain the process congestion control in TCP (L2)
● List and describe different queuing mechanisms (L2)

Module V Applications LTP 6 3 0
Traditional Applications - Email, world wide web, HTTP, web services. Multimedia Applications, Session Control and Call Control (SDP, SIP, H.323), Resource Allocation for Multimedia Applications. Infrastructure services - DNS, SNMP. Overlay Networks - Routing Overlays, Peer-to-Peer Networks, Content Distribution Networks.
Learning Outcomes:
After completion of this unit, the student shall be able to:
● Illustrate working of electronic mail and world wide web (L3)
● Enumerate various protocols used for multimedia communication (L2)
● Describe various resource allocation techniques for multimedia applications (L2)
● Explain the working of DNS and SNMP (L2)
● Summarize working of different overlay networks (L2)

Textbook(s)
1. Larry L. Peterson, Bruce S. Davie. Computer Networks, A Systems Approach, Morgan Kaufmann Publishers, Fifth Edition, 2012

Reference Book(s)
1. W. R. Stevens. Unix Network Programming, Vol.1, Pearson Education, 1990
2. Andrew S Tanenbaum and David J Wetherall, Computer Networks, 5/e, Pearson Education, 2010
3. Darren Spohn, Data Network Design, 3/e TMH, 2002
4. D.Bertsekas, R.Gallager, Data Networks, 2/e, PHI, 1992

Course Outcomes: After successful completion of the course, the student shall be able to:
● Describe network architecture and application programming interface concepts (L2)

● Explain working of internetworking protocols (L2)
● Illustrate different routing protocols and end-to-end transmission (L3)
● Distinguish the various protocols used at the transport layer (L2)
● Summarize working of traditional, multimedia applications and overlay networks (L2)

For Tutorial Classes: List of Experiments:

1. Configuration and logging to a router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Write client server programs using socket programming to exchange messages between the client and the server.
4. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address
5. Configure, implement and debug the following: Use open source tools for debugging and diagnostics.
    a) ARP/RARP protocols
    b) RIP routing protocols
    c) BGP routing
    d) OSPF routing protocols
    e) Static routes (check using netstat)
6. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down
7. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
8. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive emails.
9. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a linux PC

19EDS343:E-COMMERCE

L	T	P	C
2	1	0	3

The course imparts knowledge on E-commerce concepts, building e-commerce web and mobile apps. It also provides knowledge on security issues in e-commerce related platforms.

Course objectives:

1. To identify the major categories, technologies and trends in e-commerce
2. To identify the essential processes of an e-commerce system.
3. To identify several factors and web store requirements needed to succeed in e-commerce.
4. To define various electronic payment types and associated security risks and the ways to protect against them.
5. To discuss the various marketing strategies for an online business and build e-commerce models

Module I:	INTRODUCTION TO E-COMMERCE	Number of hours (LTP)	8	0	0

Introduction to E-COMMERCE, Types of E-COMMERCE, Understanding E-COMMERCE: Organizing Themes

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the basic concepts in e-commerce
2. Identify the building blocks of e-commerce
3. Understand different types of e-commerce

Module II:	E-COMMERCE BUSINESS STRATEGIES	Number of hours (LTP)	10	0	0

E-COMMERCE BUSINESS MODELS: Key Elements of a Business Model, Major BUSINESS-TO-CONSUMER (B2C) Business Models, Major BUSINESS-TO-BUSINESS (B2B) Business Models, How E-Commerce Changes Business: Strategy, Structure, and Process.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understanding e-commerce business models, business concepts, and business strategies
2. Identify the familiar type of e-commerce
3. How e-commerce has changed the business environment

Module III:	TECHNOLOGY INFRASTRUCTURE FOR E-COMMERCE	Number of hours(LTP)	9	0	0

The WEB, The Internet and the Web: Features And Services, Mobile APPS.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand how the Web works.
2. Describe how Internet and web features and services support e-commerce.
3. Understand the impact of mobile applications.

Module IV:	BUILDING AN E-COMMERCE PRESENCE	Number of hours(LTP)	9	0	0

Building An E-COMMERCE Presence: A Systematic Approach, Choosing Software, Choosing Hardware.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Identify the steps in developing an e-commerce presence.
2. Identify and understand the major considerations involved in choosing web server and e-commerce merchant server software.
3. Understand the issues involved in choosing the most appropriate hardware for an e-commerce site.

Module V:	E-COMMERCE SECURITY AND PAYMENT SYSTEMS	Number of hours(LTP)	9	0	0

The E-COMMERCE Security Environment, Security Threats in The E-COMMERCE Environment, E-COMMERCE Payment Systems.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the scope of e-commerce crime and security problems
2. Identify the key security threats in the e-commerce environment.
3. Understand the major e-commerce payment systems in use today.

Text Books(s)

1. Kenneth C.Laudon, Carol Guercio Traver —E-commerce 2021–2022 business, technology, society, Pearson, 17th Edition

Reference Book(s)

1. Ravi Kalakota and Andrew B. Whinston, Frontiers of electronic commerce, Pearson, 1996.
2. Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, ECommerce fundamentals and applications, John Wiley, 2008.
3. S. Jaiswal, E-Commerce, Galgotia Publications, 2003.
4. International B2B (Business to Business) Marketing, Yonsei University. https://www.coursera.org/learn/b2b-marketing
5. The Future of Payment Technologies, University of Michigan. https://www.coursera.org/learn/paytech

Course Outcomes:

1. To understand the underlying concepts of e-commerce and different e-business models.
2. To implement different e-commerce models for different online business applications
3. To Implement web and app-based applications
4. To understand the process and be able to create, manage, and maintain e-commerce systems
5. To understand different electronic payment systems in e-commerce

19EDS345: Soft Computing

L	T	P	C
2	0	2	3

Soft computing is an emerging approach to computing which parallel the remarkable ability of the human mind to reason and learn in an environment of uncertainty and imprecision. Soft computing is based on some biological inspired methodologies such as genetics, evolution, ant's behaviors, particles swarming, human nervous systems, etc. Now, soft computing is the only solution when we don't have any mathematical modelling of problem solving (i.e., algorithm), need a solution to a complex problem in real time, easy to adapt with changed scenario and can be implemented with parallel computing. It has enormous applications in many application areas such as medical diagnosis, computer vision, hand written character recondition, pattern recognition, machine intelligence, weather forecasting, network optimization, VLSI design, etc.

Course objectives:

1. To provide an introduction to the basic principles, techniques, and applications of soft computing.
2. To understand the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms.
3. To provide the mathematical background for carrying out the optimization associated with neural network learning.
4. To develop some familiarity with real time problems.

Module I: Number of hours (LTP) 6 0 6

Introduction to Intelligent Soft Computing: About Soft Computing, Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. illustrate the concept of Soft Computing(L2).
2. classify the types of soft computing and difference between them(L4).
3. identify the need of soft computing and its applications(L3).

Module II: **Fuzzy logic** Number of hours (LTP) 6 0 6

Fuzzy logic: Introduction, human learning ability, un-decidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems

Learning Outcomes:

After completion of this unit, the student will be able to:

1. analyse the basics of fuzzy logic(L4).
2. summarize fuzzy set operations and relations(L2).
3. represent fuzzy compositions and interpretations(L2).

Module III: **Neural Networks** Number of hours (LTP) 6 0 6

About Neural Network, Learning rules and various activation functions, Single layer Perceptron, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back Propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications

Learning Outcomes:

After completion of this unit, the student will be able to:

1. explain Neural Networks and its learning rules(L5).
2. categorize types of Neural Networks(L4).
3. identify applications of Neural Networks(L4).

Module IV: Number of hours (LTP) 6 0 6

Genetic Algorithms: Introduction to GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. demonstrate the procedures and working of Genetic Algorithms(L3).
2. illustrate Evolutionary programming and its working(L3).
3. identify Genetic Algorithm applications(L4).

Module V: Number of hours (LTP) 6 0 6

Swarm Intelligent systems: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence(PSO).

Fuzzy Methods: Fuzzy control (including model based control), Fuzzy clustering, Fuzzy decision trees, Neuro-fuzzy systems, Fuzzy genetic algorithms.

Case study: Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. apply the Swarm Intelligent systems(L3).
2. explain the working of ACO(L2).
3. describe fuzzy methods like clustering, decision trees, genetic algorithms(L2).

Text Books(s)

1. Soft computing: N. P Padhy and S P Simon , Oxford University Press 2015.

Reference Book(s)

1. Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, ISBN 13: 2011

Course Outcomes:

After completion of the course, the student will be able to

1. outline the major areas of Soft Computing and its applications(L4).
2. apply Fuzzy Logic to solve related problems(L3).
3. design solutions by using Neural Network functions(L5).
4. employ Genetic Algorithms in real world problems(L3).
5. analyse Swarm Intelligent systems and fuzzy methods(L4).

19ECS362: CLOUD COMPUTING

LTPC
2 1 0 3

This course will help the students to get familiar with Cloud Computing Fundamental concepts, technologies, architecture and state-of-the-art in Cloud Computing fundamental issues, technologies,applications and implementations

Course objectives:

- To understand basic concepts related to cloud computing technologies and the concept ofcloud delivery models IaaS, PaaS and SaaS.
- To evaluate the underlying principles of Data Center, cloud virtualization, cloud multitenantand service technologies.
- To implement different infrastructure and specialized mechanisms related to cloud storageand usage monitor.
- Fundamentals of cloud computing architectures based on current standards, protocols, andbest practices.

Module I: Understanding Cloud Computing LTP 6 3 0

Cloud origins and influences, basic concepts and terminology, goals and benefits, risks and challenges.

Fundamental Concepts and Models: Roles and boundaries, cloud characteristics, cloud delivery models, cloud deployment models

Learning Outcomes:

After completion of this unit, the student will be able to:

- define the cloud and the IT resource(L1)
- name the cloud consumers and cloud providers(L1)
- infer the goals and benefits(L2)
- classify the characteristics of cloud(L2)
- illustrate the delivery and deployment models(L2)

Module II: Cloud Enabling Technology LTP 6 3 0

Data center technology, virtualization technology, web technology, multitenant technology, service technology

Learning Outcomes:

After completion of this unit, the student will be able to:

- list the various Internet Service Providers(L1)
- illustrate the various technologies and components(L2)
- compare the computing hardware technologies(L2)
- select the web-based services(L3)

Module III: Cloud Infrastructure Mechanisms LTP 6 3 0

Logical network perimeter, virtual server, cloud storage device, cloud usage monitor, resource replication

Learning Outcomes:

After completion of this unit, the student will be able to:

- compare the various cloud infrastructure mechanisms(L2)
- build the hypervisor mechanism(L3)
- compare the physical server and virtual servers(L4)
- test for cloud storage device(L4)

Module IV: Specialized Cloud Mechanisms LTP 6 3 0

Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-Per-Use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi-Device Broker, State Management Database. Case Studies.

Learning Outcomes:
After completion of this unit, the student will be able to:
- compare the various specialized cloud mechanisms(L2)
- apply the cloud service instances(L3)
- apply the load balancer(L3)
- examine the case studies(L4)

Module V: Fundamental Cloud Architecture LTP 6 3 0
Workload distribution architecture, resource pooling architecture, dynamic scalability architecture, elastic resource capacity architecture, service load balancing architecture, cloud bursting architecture,elastic disk provisioning architecture, redundant storage architecture.
Cloud Delivery Model Considerations: The cloud provider perspective: Building IaaS environments, equipping PaaS environments, optimizing SaaS environments, the cloud consumer perspective: Working with IaaS environments, working with PaaS environments, working with SaaS services.
Learning Outcomes:
After completion of this unit, the student will be able to:
- compare the various architectures(L2)
- categorize the context of IaaS, PaaS and SaaS environments(L4)
- distinguish between the environments(L4)
- evaluate the working of cloud delivery models(L5)

Text Books(s)
1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Cloud Computing: Concepts, Technology &Architecture, Prentice Hall, 2013.

Reference Book(s)
1. John W. Rittinghouse, James F. Ransome, Cloud Computing: Implementation, Management andSecurity, CRC Press, 2012.
2. Anthony T.Velte, Toby J Velte Robert Elsenpeter, Cloud Computing a practical approach, McGraw Hill,2010.
3. Michael Miller, Cloud Computing: Web based Applications That Change the Way You Work andCollaborate Online, Que Publishing, 2008.

Course Outcomes:
- define the basic concepts, terminology and the fundamental models(L1)
- demonstrate the set of primary technology components and characteristics associated withcloud computing(L2)
- identify the building blocks of cloud environments(L3)
- evaluate the specific runtime function in support of one or more cloud Characteristics(L4) elaborate the cloud delivery model issues pertaining to cloud providers and consumers(L4)

For Tutorial Classes courses:
List of Exercises:
1. Installing and using identity management feature of OpenStack.
2. Installing and using JOSSO.
3. Installation and Configuration of virtualization using KVM.
4. Study and implementation of Infrastructure as a Service.
5. Study of Cloud Computing & Architecture.
6. Study and implementation of Infrastructure as a Service.
7. Study and implementation of Storage as a Service.
8. Case study on AWS/Microsoft Azure/Google Cloud Platform.
9. Basic programs using DBMS on cloud.

19EIO341: SOFTWARE DEFINED NETWORKS

L	T	P	C
2	1	0	3

In this course, student will learn about Software Defined Networking for IoT applications. The student is able to explore some core issues relevant to traditional networking, and discover how SDN can address issues such as network management, resource utilisation, and security and privacy.

Course objectives:

1. To learn the fundamentals of software defined networks.
2. To understand the separation of the data plane and the control plane
3. To study about the SDN Programming.
4. To study about the various applications of SDN
5. To Explore the concepts of SDN framework and its features

Module I: Module Name (if any) Number of hours(LTP) 6 3 0

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized, Distributed Control and Date Planes

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Knowing about the basics of SDN
2. To analyse about how SDN works and its evolution
3. Understand about the Centralized, Distributed Control and Date Planes

Module II: Module Name(if any) Number of hours(LTP) 6 3 0

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor- Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand about the SDN specification, its drawbacks
2. Knowing about Comparing about the SDN and opening up device
3. Able to understand about SDN controllers

Module III: Module Name(if any) Number of hours(LTP) 6 3 0

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand about the Multitenant and Virtualized data center
2. Able to know about SDN solutions for VLANs – EVPN – VxLAN – NVGRE environments.

Module IV: Module Name(if any) Number of hours(LTP) 6 3 0

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Able to know about the programming concepts of SDN
2. Able to create SDN API with its language
3. Understand about the components of SDN, its NFV
4. Able to create an application with program SDN concepts

Module V: Module Name(if any) Number of hours(LTP) 6 3 0

Details of module

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Able to know about the Juniper SDN Framework
2. Able to create IETF SDN Framework
3. Understand about the components Open Daylight Controller, Floodlight Controller and Bandwidth Calendaring.

Text Books(s)

1. Paul Goransson and Chuck Black, —Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, —SDN: Software Defined Networks, O'Reilly Media, 2013.

Reference Book(s)

1. Siamak Azodolmolky, —Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, —SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, —Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

Course Outcomes:

After completion of this unit, the student will be able to:

1. Analyze the evolution of software defined networks
2. Express the various components of SDN and their uses
3. Explain the use of SDN in the current networking scenario
4. Design and develop various applications of SDN

19EOE301: JAPANESE FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Introduction to Japanese language, simple explanation of writing and pronunciation systems, characteristics of Japanese, grammar, meeting people, introductions, exchanging business cards, identifying people and things, useful daily expressions.

Unit II **8 hours**
Asking about business hours, shopping, time and numbers, large numbers, counters. Grammar: Pronouns and noun modifiers. Useful daily expressions.

Unit III **8 hours**
Getting around, confirming schedules (including going/coming), visiting another company (including month/week/day). Grammar: Motion verbs. Useful daily expressions.

Unit IV **8 hours**
Existence of people and things, asking/telling location, dining out, making plans for a weekend. Grammar: State of being/existence, basic verbs. Useful daily expressions.

Unit V **9 hours**
Giving and receiving, expressing gratitude, talking about plans (usage of Te-Form), Grammar: Adjectives, present form of i-adjective, present form of na-adjective, past forms of i-adjective and na- adjective, the Te-Form. Useful daily expressions.

References

1. Ajalt, Japanese for Busy People: Romanized Version Volume 1, 2006.

*Study through Romanized Textbook - No reading/writing in Japanese letters 188

19EOE303: FRENCH FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Asking for and giving personal information, asking for and giving directions, gender and number. Grammar: Verbs "avoir" and "etre", present tense, questions, vocabulary: countries and nationalities, professions, family, food

Unit II **8 hours**

Asking and giving the time, asking when something is open or someone is available, asking for prices and describing what one wants. Grammar: Alphabet and numbers, possessive adjectives, negative sentences. Vocabulary: Days of the week, months, money.

Unit III **8 hours**

Asking for information related to travel and accommodation, expressing one's wants/needs. Grammar: Present tense for verbs in -er, -ir and -re, present tense of irregular verbs. Verbs: to be able to, to want, to know. Vocabulary: Food, shops, packaging and measures.

Unit IV **8 hours**

Talking about daily routine and the working day, describing things, expressing oneself when buying things. Grammar: Possessive pronouns, reflexive verbs. Vocabulary: Clothes, colours and shapes, weather.

Unit V **9 hours**

Describing places; visiting the doctor, reading short advertisements, describing places, feelings and symptoms. Grammar: Using avoir aller, etre faire, vouloir pouvoir. Vocabulary: Parts of the body, rooms and features of interior spaces.

Textbook (s)

1. LE NOUVEAU SANS FRONTIÈRES - Workbook CD and selected passages/ exercises 189

References

1. LE NOUVEAU SANS FRONTIÈRES -

19EOE305: BIOTECHNOLOGY AND SOCIETY

L	T	P	C
3	0	0	3

Unit-I **9 hours**

History of Biotechnology, Genes (basic concepts) Genetic Engineering Inventions, Genetic engineering, Tools for manipulation of genes (introduction to recombinant DNA technology) Vectors and expression systems (introduction) Genomic engineering (concepts and potential applications)

Unit-II **9 hours**

Intellectual property rights (concepts related to drugs, genes and genomes) Recombinant DNA Debates, Biotechnology and Business, Patenting Life, Genetically Modified Foods: Risk, Regulation, and Our Food

Unit-III **8 hours**

Freezing, Banking, Crossing, Eugenics, The Human Genome Project, Genetic Testing, Disability, and Discrimination, Bioethics and Medicine, From the Pill to IVF, Cloning, Stem Cells.

Unit-IV **8 hours**

Drugs and Designer Bodies, Personal Genomics, Biotechnology and Race, Bioprospecting and Bio colonialism

Unit-V **8 hours**

Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Use of bio-fertilisers and bio-pesticides for organic forming

Text books:

1. Biotechnology and Society: An introduction. Hallam Stevens. University of Chicago Press. 2016. ISBN 022604615X, 9780226046150

References:

1. W. Godbey, An Introduction to Biotechnology, The Science, Technology and Medical Applications, 1/e, Woodhead Publishing, 2014.
2. J.M. Walker and R. Rapley, Molecular Biology and Biotechnology, 5/e, Royal
3. society of chemistry, 2009.
4. B.R.Glick, J.J.Pasternak, C.L.Patten. Molecular Biotechnology.ASM Press. 2009. ISBN-10: 1555814980, ISBN-13: 978-1555814984s

19EOE307: CONTEMPORARY RELEVANCE OF INDIAN EPICS

L	T	P	C
3	0	0	3

Unit I **8 hours**
Reading the Texts: Reading for gist, chapter summaries, plot, pair work and discussions in small groups.

Unit II **8 hours**
Understanding the Texts: Basic themes, characterization-major characters, watching short videos followed by discussion, analysis and writing short reviews.

Unit III **8 hours**
Story Retelling and Responsive Writing: Narrating short episodes, enacting select scenes, role play, writing short paragraphs and short essays based on basic themes, plot and major characters.

Unit IV **9 hours**
Exploring the Texts from Socio-cultural and Political Perspectives: Identifying examples of mutual co-existence, duties and responsibilities of individuals in the context of family and society, righteous action, conflict between good and evil, possibilities of redefining cultural and political systems, identifying spaces for reconciliation in conflict situations.

Unit V **9 hours**
Contemporary Relevance of the Epics: Human relations, team play, leadership lessons, resource management, core competencies and competitiveness.

References

1. C. Rajagopalachari, Ramayana, 44/e, Bharatiya Vidya Bhavan, Mumbai, India, 1951.
2. C. Rajagopalachari, Mahabharata, 57/e, Bharatiya Vidya Bhavan, Mumbai, India, 2012.
3. R. K. Narayan, The Mahabharata: A Shortened Modern Prose Version of the Indian Epic, Penguin Group, 2009.
4. R. K. Narayan, The Ramayana: A Shortened Modern Prose Version of the Indian Epic, Penguin Classic, 2006. 190

19EOE309: INDIAN NATIONAL MOVEMENT

L	T	P	C
3	0	0	3

Unit1
9 hours

Background: Early British colonialism in India, early rebellions-Pazhassi Raja (the cotiote war - Kerala, 18th century), Veerapandiyan Kattabomman (Tamilnadu/Madras Presidency - 18th century), Paik rebellion (Kalinga/ Odisha, early 19th century), Vellore mutiny (early 19th century); The Sepoy Mutiny of 1857 and its consequences.

Unit II **8 hours**
Contributory Factors: Socio-political consciousness, growth of Western education and its impact on socio-religious movement, British economic policies and their impact.

Unit III **8 hours**
Rise of Organized Movements: Emergence of Indian national congress, its policies and programmes, partition of Bengal, rise of radical nationalists, Bal-Lal-Pal, formation of the Muslim league; Minto- Morley reforms, the national movement during the first world war.

Unit IV **9 hours**
Gathering Momentum: Non-cooperation and civil disobedience, emergence of Gandhi, some prominent revolutionaries - Khudiram Bose, Prafulla Chaki, Bhupendra Nath Dutt, V.D. Savarkar, Sardar Ajit Singh, Lala Hardayal, Sardar Bhagat Singh, Raj Guru, Sukh Deo, Chandra Shekhar Azad, development ofsocialist ideas, communal divide.

Unit V **8 hours**
Towards Independence: Constitutional developments, provincial elections, quit India movement and after, participation of women, national movement during the second world war, Indian national army, naval mutiny of 1946, freedom and partition, impact on the world.

References

1. K. Majumdar, Advent of Independence, Bhartiya Vidya Bhavan, Mumbai, 1969.
2. R. Desai, Social Background of Indian Nationalism, 5/e, Popular Prakashan, Mumbai, 1976.
3. Bandyopadhyay, Sekhar, Nationalist Movement in India: A Reader, Oxford University Press,2008.
4. Chandra, Bipin, Nationalism and Colonialism in Modern India, Orient Longman Limited,New Delhi, 1979. 191

19EOE313: PERSONALITY DEVELOPMENT

L	T	P	C
3	0	0	3

Unit I **8 hours**

Self Awareness: Know yourself, have a snapshot of yourself, assess your personal traits, discovernatural potential. Activities and Tasks: Class discussion, questionnaires, Johari Window, SWOC analysis (strengths, weaknesses, opportunities and challenges).

Unit II **8 hours**

Self Discipline: Importance of self discipline, characteristics of a self disciplined achiever, self discipline in personal life and career. Activities and Tasks: Viewing short videos followed by discussion and analysis, brainstorming in small groups, creating an action plan to realize academic and career goals.

Unit III **8 hours**

Motivating Oneself: Self motivation, confidence building, goal setting, decision making. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

Unit IV **9 hours**

Managing Oneself: Handling emotions, time management, stress management, change management. Activities and Tasks: Discussion and analysis of case studies, completing self- assessment questionnaires.

Unit V **9 hours**

Interpersonal Behaviour: Attitude towards persons and situations, team work, leadership skills, problem solving skills, interpersonal adaptability, cultural adaptability. Activities and Tasks: Team-building games and activities.

References

1. Hurlock Elizabeth B., Personality Development, McGraw Hill Education, India, 1979.
2. Covey, Stephen R., The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change, Free Press, 2004.
3. Carnegie, Dale, Levine, Stuart. R., The Leader In You: How to Win Friends, Influence Peopleand Succeed in a Changing World, Pocket Books, 1995.
4. Swami Vivekananda, Personality Development, Advaita Ashrama, 1993.

19LOE301: FUNDAMENTALS OF CYBER LAW

L	T	P	C
3	0	0	3

Objectives: *The objective of this course is to make students familiar with the developments that are taking place in different areas of study with the help of Computer and Information Technology. The students will acquire knowledge in national and international legal order on the Fundamentals of Cyber Laws. The abuse of computers has also given birth to a gamut of new age crimes that are addressed by the Information Technology Act, 2008 (as amended). The chief aim of this course is to encourage inter- disciplinary studies.*

UNIT-I **8 hours**
Conceptual and theoretical perspectives of Cyber Law - Computer and Web Technology –Evolution of Cyber Law – National &International Perspectives of Cyber Law - Legal Issues &Challenges in India, USA and EU - Data Protection - Cyber Security, etc.

UNIT-II **8 hours**
International Perspectives - Budapest Convention on Cybercrimes - ICANN's core principles and the domain names disputes - Net neutrality - EU electronic communications regulatory framework - Web Content Accessibility Guidelines (WCAG).

UNIT-III **9 hours**
Information Technology Act, 2008 as amended - Overview of the Act - Jurisdiction -Electronic Governance - Electronic Evidence (Relevant portions of Indian Evidence Act) - Digital Signature Certificates (DSCs) - Duties of Subscribers of DSCs - Role of DSC Certifying Authorities - The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability – Powers of Police - Impact of the Act on other Laws - Social Networking Sites vis-à-vis Human Rights.

UNIT-IV **9 hours**
Cyber Laws vis-à-vis IPRs - Copyright in Information Technology - Software - Copyrights Vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Patents - European Position on Computer related Patents - Legal position of U.S and India on Computer related Patents - Trademarks in Internet - Domain name registration - Domain Name Disputes & World Intellectual Property Organization (WIPO) - Databases in Information Technology - Protection of database in USA, EU &India.

UNIT-V **8 hours**
Mobile Technology- SIM (Subscriber Identity Module) cloning–Mobile frauds - Usage of mobile software - Special reference to the relevant provisions of IT ACT 2008, India Penal Code and Evidence Act.

Textbooks:

1. Yatindra Singh : Cyber Laws
2. Vakul Sharma, Handbook of Cyber Laws

References:

1. Linda Brennan and Victoria Johnson: Social, ethical and policy implication of Information Technology.
2. Kamath Nandan : Law relating to Computer, Internet and E-Commerce.
3. Mike Godwin: Cyber Rights Defencing free speech in the Digital Age.

19EOE319: INTRODUCTION TO MUSIC

L	T	P	C
3	0	0	3

Unit I **8 hours**

Introduction to Indian Classical Music: Heritage-Contribution of vari-ous races and tribes to the evolution of music in India, technical aspects of Indian classical music, influences Persian music especially on hindustani music, significance of music in bringing about social change.

Unit II **9 hours**

History of Indian Music: Origin-Vedas, scriptures and bharata's natyasastra, traditions- hindustani and carnatic, basic elements, shruthi, swara, raaga and taala, similarities and variations in hindustani, carnatic and western classical music, octave, semitones, introduction to shruthi, swara, raaga and taala, fundamental ragas, importance of taala in indian music, introduction to pallavi, anupallavi and charana.

Unit III **8 hours**

Hindustani Music: Brief history of hindustani music, concepts of raagaand taala, introduction to various gharanas, classification of music (folk, semi-classical, bhajans, light), appreciation of music.

Unit IV **8 hours**

Carnatic Music: History of carnatic music, traditions, the musical trinity,Syama Sastri, Thyagaraja, Muthuswami Dikshitar, introduction to tech-nical terms in carnatic music, compositional forms/strategies.

Unit V **9 hours**

Connections-Music, Art and Culture: Musical oral tradition as a trans-mitter of culture, music as an expression of societal change, music as a means of communication across cultures.

References

1. Rangaramanuja Iyengar R., History of South Indian Carnatic Music: From Vedic Times To The Present, Wilco Publishing House, 1972.
2. Beni Madhab Barua, Swami Prajnanananda, The Historical Development of Indian Music: A Critical Study, Buddh Gaya, India, 1973.
3. G.H. Ranade, Hindustani Music, Popular Prakashan, 1971.

19EOE321: ENVIRONMENT AND ECOLOGY

L	T	P	C
3	0	0	3

Unit I **8 hours**

Basic Concepts: Environment types, features of environment, structure of atmosphere, earth's four spheres, ecology, ecological principles, photosynthesis, components of ecosystem, carbon and oxygen cycles, nitrogen, hydrological, sedimentary, phosphorous and energy cycles.

Unit II **8 hours**

Biomes: Terrestrial biomes, Aphine Tundra biomes, extinction of species.Bio-diversity: Biodiversity in American contents, Europe, central Asia and Africa. Categorization of species, biogeographic zones of India, biodiversity conservation, strategies, biodiversity conservation in India.

Unit III **8 hours**

Environmental Degradation and Management: Greenhouse effect and global warming, acidification, world distribution of acid rain, impact of acid of precipitation, ozone depletion, Antarctic ozone hole, some basic facts about ozone depletion, salinisation, desertification or desertisation, soil erosion, types of soil erosion, soil conservation, deforestation, waste disposal, sustainable development.

Unit IV **8 hours**

Natural Hazards and Disaster Management: Disaster, natural hazards,earthquakes in India, seismic zones of India, earthquake prediction, tsu-nami, landslides, types of landslides, avalanches, cyclones, thunderstorms, tornadoes, surge, sea-surge or storm surge. Floods: floods in India, flood disaster management. Drought hazards: causes of droughts, consequences of droughts, biological hazards and disasters, famines, wildfire (forest fire), forest fires in India.

Unit V **8 hours**

Climate Change: Evidence of global warming, consequences of climaticchange, consequences of climate change in India. Biodiversity and Leg-islation: Earth summit, the five earth summit agreements, the Montréal protocol, Kyoto protocol on climatic change.

Text Book(s)

1. Majid Husain, Environment and Ecology, 2/e, Access Publishing, New Delhi, 2014.

References

1. S. V. S. Rana, Essentials of Ecology and Environmental Science, Prentice Hall India, New Delhi, 2011.

19EOE323: INDIAN HISTORY

L	T	P	C
3	0	0	3

Unit I **10 Hours**

Ancient Indian History and Culture (Earliest Times to 700 AD): Indus valley civilisation, origin, significance. art and architecture, aryans and vedic period, expansions of Aryans in India, significance of the vedic age, evolution of monarchy and varna system, political conditions and admin-istration under Mauryas, Guptas, social and economic conditions in an-cient India, philosophy and religions in ancient India.

Unit II **8 Hours**

Medieval Indian History and Culture: Delhi sultanate, great mughals,bahumanis, rise of south supremacy and conflicts, Pallava, Chalukya, Chola and Rasthrakutas.

Unit III **8 Hours**

Modern Indian History and Culture: European penetration into India,the Portuguese and the Dutch, the English and the French east India com-panies, their struggle for supremacy, the battle of Plassey and its signifi-cance, consolidation of British rule in India.

Unit IV **8 Hours**

Impact of British Colonial Rule: Economic: Commercialization of ag-riculture, dislocation of traditional trade and commerce, de-industrialisation, decline of traditional crafts, drain of wealth, famine and poverty in the rural interior. Social and Cultural Developments: The state of indigenous education and its dislocation, orientalist, anglicist controversy, introduc-tion of western education in India, the rise of print media, literature and public opinion, the rise of modern vernacular literature, progress of sci-ence, rail and road connectivity.

Unit V **8 Hours**

The Rise of Indian National Movement: Indian response to British rule,the great revolt of 1857, the peasant movements of the 1920s and 1930s, the foundation of the Indian national congress, the moderatesand extrem-ists, the partition of Bengal (1905), the swadeshi movement in Bengal, the economic and political aspects of swadeshi movement. Gandhian nationalism: Gandhi's popular appeal, Rowlett Act, satyagraha, the Khilafat movement, the non-cooperation movement, civil disobedience movement, Simon commission, the peasant and working class movements, Cripps mission, the quit India movement, declaration of independence.

Text Book(s)

1. Romila Thapar, A History of India, Vol. I, Penguin Books, 2013.
2. R.C. Majumdar, The History and Culture of the Indian People: Volume 1, The Vedic Age, Bharatiya Vidya Bhavan, 2010.
3. B. L. Grover, Modern Indian History: From 1707 to the Modern Times, S. Chand, 1998.
4. R.C. Majumdar, History of the Freedom Movement in India, South Asia Books, 1988.

References

1. D. N. Jha, Ancient India in Historical Outline, Manohar Publishers and Distributors, 2001.
2. G. S. Chabra, Advanced Study in the History of Modern India, Lotus Press, 2007.
3. M.K. Gandhi, Hind Swaraj: Indian Home Rule, Sarva Seva Sangh Prakashan, Varanasi, 2014.
4. W. W. Hunter, History of British India, Read Books Design, India, 2010.
5. A. R. Desai, Social Background of Indian Nationalism, 6/e, Popular Prakashan, 2005

19EOE327: PROFESSIONAL COMMUNICATION

L	T	P	C
3	0	0	3

Unit I **8 hours**

Internal Communication: Memo-structure, layout and style, e-mail-structure, style, content and etiquette, notice-structure, content and layout, conducting a meeting, purpose and preparation, drafting agenda and minutes, conducting effective meetings, meeting etiquette.

Unit II **9 hours**

Making a Business Presentation: Planning-define the purpose, analyze audience and occasion, preparation-developing central idea, main ideas, gathering supporting materials, audio-visual aids, organization-introduction, body and conclusion, delivery-addressing the audience, body language, eye contact, use of appropriate language, style and tone.

Unit III **8 hours**

Business Letters: Form and structure, style and tone, letters of enquiry, letters placing orders/ giving instructions/urging action, letters of complaint and adjustment.

Unit IV **9 hours**

Proposals and Reports: Proposals, types, structure, prefatory parts, body of the proposal, supplementary parts, reports, types, informative, analytical, formal/informal, oral/written, individual/group, format and structure.

Unit V **8 hours**

Resume, Cover Letter, Interview and Telephone Etiquette: Resume, design and structure, cover letter, cover letters, accompanying resumes, opening, body, closing; Interview, planning, purpose, pre-interview preparation, conversation, two-way interaction, projecting a positive image, telephone etiquette- guidelines for telephone conversations in a professional context.

References

1. Seely, John, Oxford Guide to Effective Writing and Speaking, Oxford University Press, India, 2013.
2. Olsen Leslie, Huckin Thomas, Technical Writing and Professional Communication for Non-Native Speakers, McGraw Hill, 1991.
3. Rizvi, M. Ashraf, Effective Technical Communication, Tata McGraw Hill, 2005. 193

GEL244: ENGLISH FOR HIGHER EDUCATION

L	T	P	C
3	0	0	3

Introduction

The course aims to provide students with the knowledge and practical skills required to take globally-recognized tests of English language proficiency. This preparatory course will enable students to achieve the required band score by providing opportunities to practise the strategies for effective use of the four language skills, in addition to application of the standard language rules. The integrated skills approach, exercises in various question/task types, and mock tests give the students ample exposure to the test conditions.

Course Objectives

- To provide comprehensive training to students for various English language proficiency tests that are prerequisite for admission into higher education programs
- To facilitate the required practice in each of the four skills, as well as language elements such as pronunciation, vocabulary and grammar
- To enable students to take the test/s with confidence by discussing, practicing, and analyzing each section/task type of the test
- To determine students to communicate opinions and information on everyday topics and common experiences effectively in English.
- To hone students writing skills through consistent guidance and practice of every subskill of writing.
- To offer a wide variety of reading topics/texts over the course, maintaining students' interest and giving a sense of meaningful progress in their reading comprehension ability.
- To enable the students to practice vocabulary and grammar in context integrating with four skills.

Unit 1: Listening **8 hours**

Listening for main ideas, gist and opinions; listening for specific information; understanding different accents

Task types: Form completion, table completion, pick from a list, matching, flow chart completion, note completion, multiple choice, labelling a diagram, labelling a plan, sentence completion and short answer questions.

Learning Outcomes

At the end of the unit, the learners will be able to

- comprehend the main ideas, specific information, and opinions presented in listening inputs that include short talks, conversations, transactional dialogues, and short discussions in general and academic contexts
- demonstrate ability to handle various listening comprehension tasks
- understand various native and non-native accents and respond correctly and appropriately to various questions

Unit 2: Speaking **8 hours**

Using appropriate vocabulary and correct grammar; demonstrate awareness of chunking while speaking; speaking about oneself; speculating and talking about the future; addressing abstract topics; paraphrasing; generalising and distancing; speculating and hypothesising; giving reasons and examples; discussing advantages and disadvantages; structuring a talk; speaking fluently for short duration on specific topics; making useful notes to respond effectively to questions asked; understanding questions and giving

appropriate answers
Task Types: Responding to questions on a range of personal topics in general and academic contexts; speaking based on specific verbal prompts: giving a structured coherent talk with adequate fluency, a clear introduction and effective conclusion; participating in a discussion of abstract concepts or general topics which are thematically linked
Learning Outcomes
At the end of the unit, the learners will be able to

- respond to general questions on personal, academic and professional information using appropriate and correct language
- demonstrate adequate fluency and speak coherently on a specific topic using the given prompts
- express and justify opinions, analyse, and speculate about issues in discussions
- present abstract concepts thematically using appropriate examples and reasons

Unit 3: Reading **9 hours**
Skimming for main ideas/themes/topics; scanning for details and locating specific information; understanding a process or the flow of information presented; distinguishing examples from main ideas; understanding factual, inferential, analytical and extrapolative texts; understanding gist and paraphrase; identifying authors' opinions/attitude
Task types: True/false/not given, sentence completion, note completion, summary completion, table completion, flow chart completion, pick from a list, multiple choice, short answer questions, matching headings, matching information, matching features, matching sentence endings
Learning Outcomes
At the end of the unit, the learners will be able to

- understand the gist, specific information, and opinions presented in a text, and distinguish examples from main ideas
- demonstrate understanding of the author's opinions as presented in a text
- use suitable strategies to answer various question types that test comprehension

Unit 4: Writing **9 hours**
Paragraph writing: interpretation of graphical data such as charts and tables; essay writing: argumentative and persuasive; organising ideas in writing to achieve coherence; grouping information/ideas in paragraphs and linking paragraphs; writing suitable introduction and conclusion to the given tasks; signalling, comparing and contrasting, presenting a balanced view; selecting and summarising main features; analysing the task requirements and planning an answer; summarising information/key features/trends in a diagram/chart/table; categorising data; brainstorming for ideas; introducing argumentsand maintaining a clear position using reasons and examples for support
Task types: Describing, summarising, and explaining data presented in a chart/table, describing the stages of a process or how something works; describing an object or an event; writing essays in response to a point of view, an argument, an issue, or a problem
Learning Outcomes
At the end of the unit, the learners will be able to

- demonstrate that they have had adequate practice in preparing drafts, revising, editing and rewriting in order to ensure task accomplishment
- produce descriptive/ narrative paragraphs based on their understanding of the data/information presented in various forms such as diagrams, charts, and tables
- write structured and coherent argumentative/ persuasive essays using use a range of vocabulary and correct grammar

Unit 5: Grammar and vocabulary in context **8 hours**

Tenses; phrasal verbs; idiomatic expressions; verb+noun collocations; collocations and phrases with *make*, *take, do* and *have;* negative affixes; adjectives+noun collocations; verbs and dependent prepositions; nouns and articles; discourse markers; punctuation; linking and pausing; intonation, word stress, speech rate and chunking; vocabulary to express amount extent or category, comparisons and contrasts, agreement and disagreement

Learning Outcomes

At the end of the unit, the learners will be able to

- apply knowledge of language for better comprehension of reading texts and listening inputs
- demonstrate knowledge of correct use of tense forms, prepositions, articles, adjective-noun collocations, and appropriate structures in speech and writing
- use idiomatic expressions, and phrasal verbs in suitable contexts, and draw upon a wide range of vocabulary for effective oral and written communication
- organising ideas in written and oral communication using appropriate discourse markers, and punctuation/pauses

References

1. Seely, John.*Oxford Guide to Effective Writing and Speaking.*Oxford University Press, (India), 2013
2. Rizvi, M Ashraf. *Effective Technical Communication*.Tata McGraw Hill. 2005.
3. Olsen, Leslie & Huckin, Thomas.*Technical Writing and Professional Communication for Non-native Speakers.*McGraw-Hill.1991

19EOE224: VIRTUAL REALITY

L	T	P	C
1	0	4	3

Summary

Virtual Reality extends the boundaries of the physical environment by providing a never ending real estate on which an infinite number of worlds can be built to learn, explore and visualise. In order to empower interested students by providing them with an opportunity to learn a cutting-edge technology like VR and getting skilled for industry while in university, Facebook School of Innovation powered by SV.CO, has provided a VR skill pathway offering VR 201 (Beginner), VR 301 (Intermediate) and VR 401 (Advanced) level course.

Course Objectives

The objective of this course is to introduce the students to learn about Virtual Reality and the skills required to become a Unity VR developer.

Course Outcomes

By the end of the course, the student should be:

- well versed with the concepts of VR,
- able enough to understand, articulate and criticize VR experiences/applications in sufficient detail
- able to execute the concepts into demonstrable examples,
- able to understand the requirements and the skillset to be a VR developer in the current economy.

Skills required

None (But a basic understanding of VR, Unity, and C# will be helpful)

Skills acquired

- Basic VR Developer (Oculus Platform)
- Basic Unity Developer (Wireframing/Storyboarding, Level Designing, C# Programming)

Project

Build a basic Virtual Reality application that allows the student to exercise all the fundamental knowledge gained in the course

Course Syllabus

Level 1 : Introduction to VR and Unity3D

M1: Keep it Virtual (Introduction to VR)
M2: Platforms and Paradigms
M3: Unity, Diversity (Introduction to Unity 3D)
M4: Ready Player One (Getting Started in Unity)
M5: Oh Hello World (Deploying your First App to Oculus Quest or Go)

Level 2 : Components of Unity

M1: Materials and Meshes
M2: Lights, Camera, VR

M3: I like to Move it (Animation in Unity)

Level 3 : Scripting in Unity #1

M1: Basics of C# in Unity #1
M2: Basics of C# in Unity #2

Level 4 : Scripting in Unity #2

M1: Let's Code #1
M2: Let's Code #2

Level 5 : Oculus Quest (Go) and its basics

M1: Oculus Inputs and UI Fundamentals
M2: Events and Buttons

M3: Buttons and the Joystick

Level 6 : Fundamentals of Unity Physics and Visual Effects

M1: Action, but Reaction? (Physics, Colliders, Raycast)
M2: More Controller Interactions

M3: Visual Effects

Level 7 : Design and Debug

M1: Debug.Log("This is where it breaks")
M2: VR Design
M3: Documentation and Unity Collab

Level 8 : Performance in Unity and Easter Eggs (Optional Level)

M1: Device Performance
M2: Easter egg #1
M3: Easter egg #2

Capstone Project Targets

P1: Level Design and UI
P2: Mechanics, Navigation and Deploy

Continuous Evaluation Plan (100 marks)

Milestones Based Evaluation (50 marks):

- Each level has a graded target where the students demonstrate their understanding of the content and get feedback.
- Each target is evaluated for 5 marks.
- These targets from Level 1 to 8 will contribute to the internal marks. Level 8 is optional.
- Marks received out of 35 / 40 (if Level 8 is attempted) are scaled up to 50.

Project Evaluation (50 marks):

This will have two components:

1. Capstone Project linked Targets:
    a. Students will complete extra targets from which will contribute to a mini project /capstone work.

2. Viva Q&A
    a. Students are given a small task on the spot to complete based on the course, and/or asked a few questions to check their understanding of the course by an industry expert.

Annexure (Optional)

Checklist for students in VR201 to be eligible for the startup-aligned project

1. Interest was shown to build a startup in the pre-course interest form. (Likely teamed up)
2. The 4 highest scorers of the students (team of 2) that also show continuing interest in building a startup at the end of the 6 weeks in the program get to choose the problem statements (discussed and worked with coaches/TAs to structure into outcomes) that they get to work on.
3. In case the students choose not to go with their self-described problem statement then the next in the list in terms of scores top-down gets a chance. And if nobody later during the program wishes to go with their self-described problem statement, they'll go with the problem statement given out in the program .

19ECS342: DATA WAREHOUSING AND MINING

L	T	P	C
2	0	2	3

Due to advent of technology, internet, and advanced applications like social media, huge amount of digital data has been accumulated in data centers/Cloud Databases, which has led to a situation "we are drowning in data but starving for knowledge". Various data mining techniques like Association Analysis, Classification, Clustering, Outlier Analysis and Web mining are applied on the data to extract golden nuggets useful for decision making process.

Data warehousing (DW) is an integral part of knowledge discovery process, where DW plays a vital role. DW is an integration of multiple heterogeneous data repositories under a unified schema at a single site. The students will acquire knowledge in Data modeling, design, architecture, Data warehouse implementation and further development of data cube technology.

Course objectives:

- Understand the importance of Data Mining and its applications
- Introduce various types of data and pre-processing techniques
- Learn various multi-dimensional data models and OLAP Processing
- Study concepts of Association Analysis
- Learn various Classification methods
- Learn basics of cluster analysis

UNIT I: Introduction 6L6P

Motivation for Data Mining, Importance of Data Mining, Definition, kinds of data, Data mining functionalities, kinds of patterns to be mined, pattern interestingness, Classification of data mining systems, data mining task primitives, integration of a data mining system with a database or data warehouse system.

Learning Outcomes:

After completion of this unit, the student will be able to:

- understand the basic concepts of data mining(L2)
- learn the KDD process(L2)
- learn different data mining tasks(L2)

UNIT II: Data preprocessing 6L6P

Types of data sets and attribute values, Basic statistical descriptions of data, Data visualization, Measuring data similarity, data quality, Major tasks in data preprocessing, data cleaning and data integration, data reduction, data transformation and discretization.

Data Warehousing and On-Line Analytical Processing: Data Warehouse- Basic concepts, data warehouse modeling: Data cube and OLAP, data generalization by attribute-oriented induction.

Learning Outcomes:

After completion of this unit, the student will be able to:

- understand various types of data sets and attributes(L2)
- apply different statistical techniques on different types of attributes to find the similarities and dissimilarities(L3)
- learn different data preprocessing techniques and apply them on data sets(L2)
- learn the basics of data warehousing and different OLAP operations(L2)

UNIT III: Mining frequent patterns, associations and correlations 6L6P

Basic concepts, applications of frequent pattern and associations, frequent pattern and association mining: A road map, Apriori algorithm, FP growth algorithm, mining various kinds of association rules, Pattern evaluation methods.

Learning Outcomes:

After completion of this unit, the student will be able to:

- understand the use of frequent patterns in business analysis(L2)
- implement Apriori algorithm and FP-growth algorithm(L3)
- learn different types of association rules(L2)

UNIT IV: Classification Analysis **6**L6P

Classification - Basic concepts, Decision tree induction, Bayes classification methods, Rule-based classification, Classification by neural networks, Model evaluation and selection, Techniques to improve classification accuracy: Ensemble methods.

Learning Outcomes:

After completion of this unit, the student will be able to:

- understand the basic concepts of classification(L2)
- implement the classification algorithms(L3)
- compare the performance of various classification algorithms(L2)

UNIT V: Cluster analysis **6**L6P

Basic concepts and methods, Clustering structures, Major clustering approaches, Partitioning methods,Hierarchical methods, Density-based methods, Grid based methods, Evaluation of clustering.

Learning Outcomes:

After completion of this unit, the student will be able to:

- understand the basic concepts of clustering(L2)
- implement the clustering algorithms(L3)
- compare the performance of various clustering algorithms(L2)

Text Books(s)

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, MorganKaufmann publishers, 3/e, 2011. (Modules 2 – 5)
2. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmannpublishers, 2/e, 2006. (Module 1)

Reference Book(s)

1. Michael Steinbach, Vipin Kumar, Pang-Ning Tan, Introduction to Data Mining, Addison-Wesley, 1/e, 2006
2. Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Pearsonpublishers, 1/e, 2006

Course Outcomes:

- understand the functionality of various data warehousing and data mining components(L2)
- understand various OLAP operations(L2)
- understand the strengths and limitations of various data mining models(L2)
- implement the data mining algorithms with different datasets(L3)
- compare various approaches of data mining implementations(L2)
- identify and apply appropriate data mining technique to solve a problem(L3)

19ECF342 Web Application security

	L	T	P	C
	2	1	0	3

The course is designed to provide an opportunity for students to obtain knowledge on foundations to design a web application in a secure manner. This course covers the basics of web technologies and the vulnerabilities in web application design, handling the errors, auditing logs, alert and reacting to the attacks. It also deals with authentication technologies and their flaws, the tools to capture the passwords and access control mechanisms, learn the basics related SQL injection attacks and how to prevent these kinds of attacks.

Course objectives:

1. Expertise in web application security core mechanisms.
2. Learn various web technologies and their security.
3. To provide awareness on web application mapping.
4. To provide practical and hands on experience on attacking authentication and data stores.

Module I: Web Application (In)security Number of hours(LTP) 6 3 0

The Evolution of Web Applications, Common Web Application Functions, Benefits of Web Applications, Web Application Security. Core Defense Mechanisms: Handling User Access Authentication, Session Management, Access Control, Handling User Input, Varieties of Input Approaches to Input Handling, Boundary Validation. Multistep Validation and Canonicalization: Handling Attackers, Handling Errors, Maintaining Audit Logs, Alerting Administrators, Reacting to Attacks.

Learning Outcomes:

After completion of this module, the student will be able to:

1. Understand the basics of web applications security.
2. Explore varieties of user inputs and approaches in handling input.
3. Identify various attacks, errors and core defense mechanism.

Module II: Web Application Technologies Number of hours(LTP) 6 3 0

HTTP Protocol, HTTP Requests, HTTP Responses, HTTP Methods, URLs, REST, HTTP Headers, Cookies, Status Codes, HTTPS, HTTP Proxies, HTTP Authentication, Web Functionality, Server-Side Functionality, Client-Side Functionality, State and Sessions, Encoding Schemes, URL Encoding, Unicode Encoding, HTML Encoding, Base64 Encoding, Hex Encoding, Remoting and Serialization Frameworks.

Learning Outcomes:

After completion of this module, the student will be able to:

1. Explain about HTTP protocol and the authentication.
2. Understand the development of a client-side and server-side browser-based web application including its capabilities and limitations.
3. Explain different encoding schemes

Module III: Mapping the Application Number of hours(LTP) 6 3 0

Enumerating Content and Functionality, Web Spidering, User Directed Spidering, Discovering Hidden Content, Application Pages Versus Functional Paths, Discovering Hidden Parameters, analyzing the Application, Identifying Entry Points for User Input, Identifying Server-Side Technologies, Identifying Server-Side Functionality, Mapping the Attack Surface.

Learning Outcomes:

After completion of this module, the student will be able to:

1. Comprehend web and user directed spidering
2. Identify user input entry points, server-side technologies and functionalities.
3. Discover hidden content and parameters.

Module IV: Attacking Authentication Number of hours(LTP) 6 3 0

Authentication Technologies, Design Flaws in Authentication Mechanisms, Bad Passwords, Brute-Forcible Login, Verbose Failure Messages, Vulnerable Transmission of Credentials, Password Change, Functionality, Forgotten Password Functionality, "Remember Me" Functionality, User Impersonation, Functionality Incomplete, Validation of Credentials, Nonunique Usernames, Predictable Usernames, Predictable Initial Passwords, Insecure Distribution of Credentials. Attacking Access Controls: Common Vulnerabilities, Completely Unprotected, Functionality Identifier-Based Functions, Multistage Functions, Static Files, Platform Misconfiguration, Insecure Access Control Methods.

Learning Outcomes:

After completion of this module, the student will be able to:

1. Explain different authentication technologies.
2. Identify the weaknesses of authentication of web applications.
3. Outline the attacking access controls.

Module V: Attacking Data Stores Number of hours(LTP) 6 3 0

Injecting into Interpreted Contexts, Bypassing a Login, Injecting into SQL, Exploiting a Basic Vulnerability Injecting into Different Statement Types, Finding SQL Injection Bugs, Fingerprinting the Database, The UNION Operator, Extracting Useful Data, Extracting Data with UNION, Bypassing Filters, Second-Order SQL Injection, Advanced Exploitation Beyond SQL Injection: Escalating the Database Attack, Using SQL Exploitation Tools, SQL Syntax and Error Reference, Preventing SQL Injection.

Learning Outcomes:

After completion of this module, the student will be able to:

1. Develop skills in analyzing the vulnerabilities injections in web application.
2. Understand in detail about SQL injection.
3. Explore SQL exploitation tools.

Text Books(s)

1. The Web Application Hacker's Handbook: Finding and Exploiting Security Defydd Stuttard, Marcus Pinto Wiley Publishing, Second Edition.

Reference Book(s)

1. Professional Pen Testing for Web application, Andres Andreu, Wrox Press.
2. Carlos Serrao, Vicente Aguilera, Fabio Cerullo, "Web Application Security" Springer; 1st Edition.
3. Joel Scambray, Vincent Liu, Caleb Sima ,"Hacking exposed", McGraw-Hill; 3rd Edition, (October,2010).
4. OReilly Web Security Privacy and Commerce 2nd Edition 2011.
5. Software Security Theory Programming and Practice, Richard sinn, Cengage Learning.
6. 6. Database Security and Auditing, Hassan, Cengage Learning.

Course Outcomes:

1. Explore security in web applications
2. Explore various web application technologies
3. Discuss how to map web applications and analysing them
4. Explore various techniques for attacking authentication.
5. Simulate various data stores attacking techniques.

List of activities for Tutorial classes

1. An input validation mechanism designed to block cross-site scripting attacks performs the following sequence of steps on an item of input:
   1. Strip any <script> expressions that appear
   2. Truncate the input to 50 characters.
   3. Remove any quotation marks within the input.
   4. URL-decode the input.
   5. If any items were deleted, return to step 1.

   Can you bypass this validation mechanism to smuggle the following data past it?
   “><script>alert(“foo”)</script>

2. Find the following terms to analyse the web application in browser.
   i. Status codes ii. URL encoding schemes iii, HTTP vs HTTPS iv. Trace the web page v. Session vs cookies
3. Map a Web application with URL given. https://wahh-app.com/CookieAuth.dll?GetLogon?curl= Z2Fdefault.aspx What information can you deduce about the technologies employed on the server, and how it is likely to behave?
4. An application developer wishes to stop an attacker from performing brute-force attacks against the login function. Because the attacker may target multiple usernames, the developer decides to store the number of failed attempts in an encrypted cookie, blocking any request if the number of failed attempts exceeds five. How can this defense be bypassed?
5. While testing a web application you log in using your credentials of joe and pass. During the login process, you see a request for the following URL appear in your intercepting proxy: http://www.wahh-app.com/app?action=login&uname = joe & password=pass What three vulnerabilities can you diagnose without probing any further?
6. An application incorporates an anti-phishing mechanism into its login functionality. During registration, each user selects a specific image from a large bank of memorable images presented to them by the application. The login function involves the following steps:
   (a) The user enters their username and date of birth.
   (b) If these details are correct, the application displays to the user their chosen image; otherwise, a random image is displayed.
   (c) The user verifies that the correct image is displayed, and if so, enters their password. The idea behind the anti-phishing mechanism is that it enables the user to confirm that they are dealing with the authentic application, and not a clone, because only the real application knows the correct image to display to the user.

   What vulnerability does the anti-phishing mechanism introduce into the login function? Is the mechanism effective in preventing phishing?

19ECF344:MALWARE ANALYSIS AND REVERSE ENGINEERING

L	T	P	C
2	1	0	3

The course will provide an overview of malware research, intelligence gathering related to malware, and provide basic skills required to analyse and dis-assemble malicious programs. Students will explore the tools required to analyze and do reverse engineering of malicious code, learn malware Forensics techniques, how malware functions, and will perform live analysis and reverse engineering exercises.

Course objectives:

1. Learn fundamentals and Classification of Malware
2. Introduce Tools and Techniques of malware analysis
3. Enable to Identify malware through behavioural and Code analysis
4. Describe Malware Forensics

Module I: Module Name (if any) Number of hours(LTP) 6 3 0

Introduction: CISC/RISC and Programming Basics, Assembly languages, Becoming familiar with x86 (IA-32 and x64), Exploring ARM assembly, Basics of MIPS, Covering the SuperH assembly, Working with SPARC

Diving Deep into Windows Malware: Basic Static and Dynamic Analysis for x86/x64, Static and dynamic linking, Using PE header information for static analysis, PE loading and process creation, Dynamic analysis with OllyDbg/immunity debugger, Debugging malicious services

Learning Outcomes:

After completion of this unit, the student will be able to:

1. understand goals of malware analysis(L1)
2. compare dynamic analysis and static analysis(L2)
3. learn malware analysis. (L1)

Module II: Module Name(if any) Number of hours(LTP) 6 3 0

Unpacking, Decryption, and De-obfuscation: Exploring packers, Identifying a packed sample, Automatically unpacking packed samples, Manual unpacking using OllyDbg, Dumping the unpacked sample and fixing the import table, Identifying different encryption algorithms and functions, String search detection techniques for simple algorithms, Identifying the RC4 encryption algorithm, Standard symmetric and asymmetric encryption algorithms

Learning Outcomes:

After completion of this unit, the student will be able to:

1. review unpacking, decrypting and de-obfuscation (L2)
2. compare symmetric and asymmetric encryption algorithms. (L2)
3. understand how IDA is used for decryption and unpacking (L6)

Module III: Module Name(if any) Number of hours(LTP) 6 3 0

Inspecting Process Injection and API Hooking : Understanding process injection, DLL injection, Working with process injection, Dynamic analysis of code injection, Memory forensics techniques for process injection, Understanding API hooking, Working with API hooking, Exploring IAT hooking

Learning Outcomes:

After completion of this unit, the student will be able to:

1. develop code for process injection(L3)
2. Explore IAT Hooking (L2)

Module IV: Module Name(if any) Number of hours(LTP) 6 3 0

Examining Cross-Platform Malware: Handling Exploits and Shellcode, Cracking the shellcode, Exploring bypasses for exploit mitigation technologies, Analyzing Microsoft Office exploits, Studying malicious PDFs

Learning Outcomes:
After completion of this unit, the student will be able to:

1. record the experience of malware behaviour in Microsoft office(L1)
2. evaluate exploit mitigation technologies. (L5)

Module V: Module Name(if any) Number of hours(LTP) 6 3 0
Dissecting Linux and IoT Malware : Exploring common behavioral patterns, Static and dynamic analysis of x86 (32- and 64-bit) samples, Learning Mirai, its clones, and more, Static and dynamic analysis of RISC samples, Handling other architectures
Learning Outcomes:
After completion of this unit, the student will be able to:

1. identify common behavioural patterns (L1)
2. explain Static and dynamic analysis of x86. (L4)
3. understand how to handling other architectures (L2)

Text Books(s)

1. Alexey Kleymenov, Amr Thabet , Mastering Malware Analysis : The complete malware analyst's guide to combating malicious software, APT, cybercrime, and IoT attacks , Packt Publications,2019

Reference Book(s)

1. Michael Sikorski, Andrew Honig, Practical Malware Analysis: The Hands On Guide to Dissecting Malicious Software, William Pollock, 2012
2. Monnappa K A, Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware, Packt Publications,2018

Course Outcomes:

1. apply malware analysis methodology and technology (L3)
2. implement advanced static and dynamic malware analysis(L3)
3. make Process injection and API Hooking (L3)
4. analyse Office exploits and malicious PDFs (L1)
5. apply Linux and IoT Malware Dissection(L3)

19ECF346: Security for Cyber-Physical Systems

L	T	P	C
2	1	0	3

The course aspires to create organized systematic practices and approaches that are made from continuous assimilation of physical systems and cyber systems. The course will facilitate engineers through essential expertise in enterprise software-hardware design. The course similarly teaches awareness of various software's to design physical systems and tools for constructing cyber modules. The course will make experts who can model predictable and secure Cyber-Physical Systems (CPS).

Course objectives:

1. Ability to analyze overall specifications of CPS and translate it to the different sub-systems design requirements.
2. Adequate competency to model overall CPS using Hybrid system and other approaches and validate the model.
3. Capability to co-design hardware-software architecture in distributed environment and methods to embedded security in the overall design of CPS.
4. Ability to understand applications like smart grid, mobile networks, IoT, and different systems of a smart city.

Module I: Number of hours (LTP) 6 3 0

Overview of Security and Privacy in Cyber-Physical Systems

Introduction, Defining Security and Privacy, Defining Cyber-Physical Systems, Examples of Security and Privacy in Action, Approaches to Secure Cyber-Physical Systems, Ongoing Security and Privacy Challenges for CPSs

Network Security and Privacy for Cyber-Physical Systems

Security and Privacy Issues in CPSs, Local Network Security for CPSs, Internet-Wide Secure Communication, Security and Privacy for Cloud-Interconnected CPSs

Learning Outcomes:

After completion of this unit, the student will be able to:

1. interact with cyber-physical systems components and protocols
2. analyze current cyber-physical system challenges
3. interact with cloud interconnected CPSs

Module II: Number of hours (LTP) 6 3 0

Cyber-Physical Systems and National Security Concerns

National Security Concerns Arising from Cyber-Physical Systems, National Security Implications of Attacks on Cyber-Physical Systems

Legal Considerations of Cyber-Physical Systems and the Internet of Things

Privacy and Technology in Recent History, The Current State of Privacy Law, Meeting Future Challenges

Context Awareness for Adaptive Access Control Management in IoT Environments

Security Challenges in IoT Environments, Surveying Access Control Models and Solutions for IoT, Access Control Adaptation: Motivations and Design Guidelines, Our Adaptive Context-Aware Access Control Solution for Smart Objects, Open Technical Challenges

Learning Outcomes:

After completion of this unit, the student will be able to:

1. familiar with cyber-physical systems national security concerns
2. understand the legal considerations of CPSs and IoT
3. learn how to manage adaptive access control over IoT environments

Module III: Number of hours (LTP) 6 3 0

Key Management in CPSs

Key Management Security Goals and Threat Model, CPS Key Management Design Principles, CPS Key Management, CPS Key Management Challenges, and Open Research Issues

Data Privacy Issues in Distributed Security Monitoring Systems

Information Security in Distributed Data Collection Systems, Technical Approaches for Assuring Information Security, Approaches for Building Trust in Data Collection Systems

Privacy Protection for Cloud-Based Robotic Networks

Cloud Robot Network: Use Case, Challenges, and Security Requirements, Establishment of Cloud Robot Networks, Communication Security, Security Management of Cloud Robot Networks.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. learn CPS key management design principles and challenges
2. familiar with technical approaches towards CPS data privacy over the distributed environments
3. interact with cloud-based robotic network privacy and security requirements

Module IV: Number of hours (LTP) 6 3 0

Toward Network Coding for Cyber-Physical Systems: Security Challenges and Applications

Introduction, Background on Network Coding and Its Applications, Security Challenges, Secure Network Coding, Applications of Network Coding in Providing Security

Lightweight Crypto and Security

Lightweight Cryptography Implementations for Security and Privacy in CPSs, Opportunities, and Challenges

Cyber-Physical Vulnerabilities of Wireless Sensor Networks in Smart Cities

WSN Applications in Smart Cities, Cyber-Physical Vulnerabilities, Solution Approaches.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. demonstrate network coding for CPS
2. interact with lightweight cryptography implementations for CPS security
3. learn CPS vulnerabilities of WSN

Module V: Number of hours (LTP) 6 3 0

Detecting Data Integrity Attacks in Smart Grid

Data Security and Privacy in Cyber-Physical Systems for Healthcare

Medical Cyber-Physical Systems, Data Security and Privacy Issues and Challenges in Wireless Body Area Networks (WBANs), Existing Security and Privacy Solutions in (WBAN)

Cyber Security of Smart Buildings

What Is a Smart Building? Communication Protocols for Smart Buildings, Attacks, Solutions to Protect Smart Buildings, Recent Trends in Smart Building Security Research.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. study how to detect data integrity attacks in smart grid
2. interact security issues and challenges in healthcare CPS
3. learn smart building communication protocols

Textbooks(s)

1. Houbing Song, Glenn A. Fink, Sabina Jeschke, “Security and Privacy in Cyber-Physical Systems”, Wiley-IEEE Press, 1st edition, 2017.

2. Sajal Das, Krishna Kant, and Nan Zhang, “Handbook on Securing Cyber-Physical Critical Infrastructure – Foundations & Challenges”, Morgan Kaufmann, 2012.

Reference Book(s)

1. Eric D. Knapp and Raj Samani, “Applied Cyber Security and the Smart Grid: Implementing Security Controls into the Modern Power Infrastructure, Syngress,1st Edition, 2013
2. Ali Ismail Awad, Steven Furnell, Marcin Paprzycki, Sudhir Kumar Sharma, Security in Cyber-Physical Systems Foundations and Applications, Springer, 2021
3. F. Pasqualetti, F. Dörfler and F. Bullo, "Attack Detection and Identification in Cyber-Physical Systems," in IEEE Transactions on Automatic Control, vol. 58, no. 11, pp. 2715-2729, Nov.2013.
4. H. Fawzi, P. Tabuada and S. Diggavi, "Secure Estimation and Control for Cyber-Physical Systems Under Adversarial Attacks," in IEEE Transactions on Automatic Control, vol. 59, no.6, pp. 1454-1467, June 2014.
5. Yilin Mo, Rohan Chabukswar and Bruno Sinopoli “Detecting Integrity Attacks on SCADA Systems” in IEEE Transactions on Control System Technology, Vol. 22, No. 4, 2014
6. F. Pasqualetti, F. Dörfler and F. Bullo “Control Theoretic methods for Cyber Physical Security”, in IEEE Control System Magazine, pp. 110-127, Feb. 2015

Course Outcomes:

1. The general nature of distributed cyber-physical systems, how they can be modelled and the role of modelling to ensure system quality and timeliness in development processes
2. Analyse privacy and security of cyber physical systems
3. Adapt the latest data security and privacy preserving techniques in various domains
4. Validate and assess security and privacy of CPSs regulations and ethical constraints.

19EDS342: DATA ANALYTICS WITH TABLEAU

L	T	P	C
2	0	2	3

After the students have gone through a course on data analytics with tableau, where they learn the fundamentals of data visualization. Studying course on tableau should teach the students the basics of how to connect to data sources, How to use Tableau drag-and-drop interface, and create compelling visualizations. Digging Deeper, Building and Customizing Visualizations and Presenting Your Data. On completion of the course, students should be able to analyze the inner workings of the data analytics pipeline from joining, filtering, extracting data to developing dashboards, connect to different data sources, develop a solid understanding of how calculations on Tableau work, Create in-depth analyses with bar charts, line charts, donut charts and even geographical maps, understand joining data sources on Tableau.

Course objectives:

1. To introduce the fundamentals of using Tableau in the context of business and data analytics.
2. To explore the role and application of data visualization in the data analysis process using Tableau.
3. To Create and design static and dynamic tables and dashboards.
4. To connect multiple external data sources (e.g., Text Files, Excel, SQL databases) to Tableau and optimize large data to efficiently wrangle and analyze real-industry data.
5. To create insightful and impactful visualizations in an interactive and colourful way.

Module I: Number of hours(LTP) 6 0 6

Introduction-Overview of Data Analytics, Role of Tableau in Data Analytics, Overview of tableau-features, Tableau-Environment setup, create Tableau data analysis, Tableu Navigation, Designflow, file types, Data types, Show me, Data Terminology.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Identify the use of Tableau for Visualize the data (L3).
2. Understand the basic Concepts of Tableau (L2).
3. Interpret the Table Environment setup and various key features (L5).

Module II: Number of hours(LTP) 6 0 6

Data Analysis: How do you analyze data in Tableau, What kind of analysis is tableau, what should a data analyst know in tableau, what does tableau analyst do.

Data Visualization: Define Data Visualization in tableau; create visualization in tableau, advantages and benefits of good data visualization in tableau, Examples of data visualization.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Create the data that can be understood by professionals at any level in an organization (L6).
2. To prep, analyze, collaborate, and share your big data insights(L3).
3. Analyze and apply essential design principles to your Tableau visualizations (L3).
4. To make it easier to identify patterns, trends and outliers in large datasets (L3).

Module III: Number of hours(LTP) 6 0 6

Tables in Tableau: Create a custom table and contents in tableau, how to make a nice table in tableau, Create a custom header in tableau? How do you create a dynamic table? Create a dynamic header in tableau, Work Sheets, Sort and Filters, Types of Calculations

Dashboards: Dashboard creation, benefits of a dashboard tableau, Why are Tableau dashboards useful? What are data dashboards? How do dashboards work? What is dashboard and scorecard?

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Apply row-level and aggregate calculations(L3).
2. Understand how to use tableau to create tables, calculations and worksheets that can be used for effective analysis of institutional data(L2).
3. Make use of the basic techniques for creating visualizations and combining them in interactive dashboards (L3).

Module IV: Number of hours(LTP) 6 0 6

External Data Sources: How Tableau connect to external data sources such as File Systems (CSV, Excel, etc.), Relational Systems (Oracle, SQL Server, DB2, etc.), Cloud Systems (Windows Azure, Google Big Query etc.), Other Sources (Using ODBC).

Optimize large data in Tableau: Procedure for handle large data sets in Tableau, Procedure for Tableau deal with big data, how does tableau optimize performance? How large can a Tableau extract be? Benefits of using data extracts in Tableau.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Learn how to use tableau to connect to data and blend multiple data sources(L2)
2. Apply Tableau performance optimization to improve the speed of working with large data (L3).

Module V: Number of hours(LTP) 6 0 6

Data Visualization For More Effective And Engaging Design: Types of charts in tableau, Interactive visualization in tableau, beautiful visualization in tableau, Tips for More Effective and Engaging Design.

Advanced Tableau: Describe the options of Formatting, Forecasting and Trend Lines.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Learn to use tableau to create charts, and interactive visualizations that can be used for effective analysis of institutional data (L2).
2. Create advanced visualizations and Formatting visualization for appearance (L6).

Text Books(s)

1. Joshua N. Milligan, Learning Tableau 10 ,Second Edition, Publisher Packt, September 2016.
2. Lin, Lindy Ryan , Visual Data Storytelling with Tableau (4 Color), Data Analysis, First Edition Pearson Paperback ,30 July 2018.

Reference Book(s)

1. Marleen Meier, Mastering Tableau 2021 Implement advanced business intelligence techniques and analytics with Tableau, 3rd Edition Paperback, 31 May 2021

Course Outcomes:

1. Proficiently navigate Tableau using a full suite of commands (L1).
2. Analyse data and calculate with tables using Tableau commands (L3)
3. Generate the most meaningful visualizations (L4).
4. Develop interactive dashboards ((L6).
5. Deliver insightful stories visually in addressing a business problem (L2).

19EIO342: IoT Architectures and protocols

LTPC: 2023

This course aims to provide a basic understanding of the current architectures and protocols that make up the Internet of Things. It first starts with a discussion of two standardized IoT reference models - oneM2M and IoTWF, followed by the introduction of a simplified architectural model. The "things" in IoT are then defined, leading to the introduction of the various access technologies for IoT. Popular network and application layer protocols for IoT are discussed, followed by a brief introduction to IoT data analytics.

Course Objectives

1. To introduce to the student the popular IoT reference models.
2. To acquaint the student with the challenges in and solutions for IoT network access.
3. To let the student examine the feasibility of IP for IoT, leading to a study of optimization of IP for IoT.
4. To enable the student to study the application layer protocols for IoT with application development in view.
5. To familiarize the student with the basics of data analytics for IoT.

UNIT - I Introduction to IoT, IoT Network Architecture Architectures **LTP** **502**

What is IoT?: Genesis of IoT, IoT impact, IoT challenges.

IoT Network Architecture and Design: Drivers behind new network architectures, Comparing IoT architectures- The oneM2M IoT Standardized Architecture, The IoT World Forum Standardized Architecture. A simplified IoT architecture.

Learning Outcomes:

After completion of this unit, the student will be able to

- Analyze the key challenges in IoT. L4
- Infer the need for new network architectures for IoT. L2
- Compare the oneM2M and IoTWF architectures. L4

Pedagogy tools: Blended learning,video lectures, self-reading, case study

UNIT - II Smart Objects and Connecting Smart Objects **LTP** **704**

Smart Objects: The things in IoT: Sensors, actuators and smart objects, Sensor networks.

Connecting Smart Objects: Communications Criteria, **IEEE 802.15.4** - Standardization and Alliances, Physical Layer, MAC Layer, Topology, Security. IEEE 802.15.4g and 802.15.4e - Topology, IEEE 802.11ah - Topology. LoRAWAN - Topology. NB-IoT and other LTE variations.

Learning Outcomes:

After completion of this unit, the student will be able to

- Analyze the criteria for communications in IoT. L4
- Summarize the working of IEEE 802.15.4. L2
- Compare popular IoT access technologies and their uses. L3

Pedagogy tools: Blended learning, Flipped classroom, video lectures, self-reading

UNIT - III IP as the IoT Network Layer **LTP** **704**

The business case for IP: The key advantages of IP, Adoption or Adaptation of IP.

The need for optimization: Constrained nodes, Constrained Networks

Optimizing IP for IoT: From 6LoWPAN to 6Lo, Header compression, Fragmentation, Mesh addressing, Mesh-under vs Mesh-over routing.

6TiSCH

RPL: Objective Function, Rank, Metrics

Learning Outcomes:

After completion of this unit, the student will be able to

- Summarize the role of routing in networks. (L2) L2
- Justify the need for optimizing IP for IoT. (L4) L4
- Demonstrate the working of 6LoWPAN, 6TiSCH and RPL using an example network. L4

Pedagogy tools: Blended learning, video lectures, self-reading

UNIT - IV Application Protocols for IoT **LTP** **504**

The Transport Layer

IoT Application Transport Methods: Generic Web-based protocols. IoT Application Layer Protocols, CoAP, MQTT.

Learning Outcomes:

After completion of this unit, the student will be able to

- Question the feasibility of using existing application layer protocols for IoT. L4
- Deduce the design issues in developing application protocols for IoT. L4
- Apply CoAP and MQTT to IoT applications. L4

Pedagogy tools: Blended learning, video lectures, self-reading

UNIT - V Data and Analytics for IoT **LTP** **600**

An introduction to data analytics for IoT: Structured vs Unstructured Data, Data in motion vs data at rest, IoT data analytics overview, IoT data analytics challenges.

Edge streaming analytics: Comparing Big Data and Edge Analytics, Edge Analytics Core Functions, Distributed Analytics Systems

Learning Outcomes:

After completion of this unit, the student will be able to

- Summarize the challenges in analyzing IoT data. L2
- Distinguish between edge and Big data analytics. L4
- Choose the correct data analytics framework for a given IoT application. L3

Pedagogy tools: Blended learning, case study, video lectures, self-reading

Textbook(s):

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

Reference Book(s):

1. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011.

2. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

Journal(s):

1. X. Vilajosana, T. Watteyne, T. Chang, M. Vučinić, S. Duquennoy and P. Thubert, "IETF 6TiSCH: A Tutorial," in IEEE Communications Surveys & Tutorials, vol. 22, no. 1, pp. 595-615, First quarter 2020, doi: 10.1109/COMST.2019.2939407.
2. RPL: IPv6 routing protocol for low-power and lossy networks. (Accessed on 20/11/2019). [Online] Available: https://tools.ietf.org/html/rfc6550.

Website(s):

https://www.ietf.org/proceedings/94/slides/slides-94-rtgarea-2.pdf
https://www.thethingsnetwork.org/docs/lorawan/architecture/
https://datatracker.ietf.org/doc/html/rfc7252
https://mqtt.org/
https://www.onem2m.org/

Course Outcomes: After successful completion of the course the student will be able to:

1. Distinguish between different IoT network architectures. (L4)
2. Choose the appropriate access technology for a given IoT application. (L3)
3. Analyze the difference between protocol design at the network, transport and application layers for IoT and that for the Internet. (L4)
4. Explain the working of popular IoT protocols at the network and application layers. (L4)
5. Employ IoT data analytics techniques. (L4)

Suggested List of experiments:

The following simulation experiments are to be carried out using ns-3, TOSSIM, COOJA or MATLAB.

1) Create a simple network with ten nodes in a linear topology. Plot the average energy spent and packet delivery ratio (PDR, end-to-end) when the simulation is run for 500 seconds for two different transmission radii. Use standard protocols at the different layers.
2) Create a small network with a tree topology (the sink at the root) and static nodes. Run the simulation for 500 seconds and examine the node energy spent and packet delivery ratio spent for transmitting data:
    a) To the sink from the leaf nodes.
    b) To the leaf nodes from the sink.
3) Create a small network with mobile sensor nodes. Any standard mobility pattern can be used. Trigger transmissions with random sources and destinations and plot the average energy spent and PDR. Use standard MAC and routing protocols.
4) Repeat the experiment in (2) using IEEE 802.15.4 at the MAC level.
5) Repeat the experiment in (2) with using 6LoWPAN for routing.
6) Repeat the experiment in (2) using IEEE 802.11 at the MAC and physical level and 6LowPAN and RPL for routing.
7) Repeat the experiment in (2) using the IETF 6TiSCH protocol stack.
8) Create a small network with two end nodes that communicate data via an edge node to a server. The link from the end nodes to the edge node is a wireless link while the link from the edge node to the server is a wired link. Capture the packets at the edge node and the server and report the PDR at these two nodes.

19EOE302: GERMAN FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Introduction to the German language, grammar and pronunciation. Lan-guage: Greetings; Introducing oneself, asking the way, giving directions. Grammar: The nouns, gender distinctions, cases, definite and indefinite articles. Pronunciation: Vowels.

Unit II **8 hours**

Language: Asking for and giving information; Discussing home and the household. Grammar: Conjugation of verbs, verbs with separable and inseparable prefixes, modal verbs. Pronunciation: Vowels.

Unit III **8 hours**

Language: Describing people and their qualities, describing shape, size and colour of objects. Grammar: Personal pronouns, possessive pronouns, reflexive pronouns. Pronunciation: Consonants.

Unit IV **8 hours**

Language: The Working World: Returning faulty goods to a shop, asking someone to repeat something; Refusing or declining politely. Grammar: Cases: nominative, accusative, dative. Pronunciation: Diphthongs.

Unit V **9 hours**

Language: Making Comments and Suggestions: Asking for and giving opinions. Grammar: Structure of sentence and categories of sentences; subordinate clause - causative and conditional sentences. Pronunciation: Umlaut.

References

1. Deutsch als Fremdsprache IA Grundkurs
2. Ultimate German Beginner - Intermediate (Coursebook), Living Language, 2004.

19EOE304: CHINESE FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Introduction to the Chinese language and pronunciation system; Tones; Chinese numbers; Language: Saying hello, greetings. Pronunciation: Initials: b p m n l h; Finals: a o e I u ü / ao en ie in ing uo; First tone.

Unit II **8 hours**

Language: Asking what someone wants; Identifying people; Asking someone's name and nationality Grammar: Word order in Chinese sen-tence. Pronunciation: Initials: d t g k f; Finals: ei ou an ang eng iao iou(iu); Second tone.

Unit III **8 hours**

Language: Introducing oneself; Asking for permission. Grammar: Sentence with an adjectival predicate; "Yes-no" question. Pronunciation: Initials: zh ch sh r; Finals : -I / ai uai ong; Third tone.

Unit IV **8 hours**

Language: Introducing oneself; Asking for permission. Grammar: Ques-tions with an interrogative pronoun. Pronunciation: Initials: j q x; Finals: ia ian iang / uei(-ui) uen(-un) üe üan; Fourth tone.

Unit V **9 hours**

Language: Making comments and suggestions; Asking someone to repeat something; Refusing or declining politely. Grammar: Sentences with a verbal predicate. Pronunciation: Initials: z c s; Finals:-i er iong ua uan uang ün; Neutral tone; Retroflex ending.

*The course will focus on the pronunciation system, the introduction of common Chinese expressions and every-day phrases in the context of communicative activities.

References

1. Liu, Yuehua, Integrated Chinese: Simplified Characters Textbook, Level 1, Part 1. Cheng and Tsui Company, Inc. Boston, 2008.

19EOE306: ANALYTICAL ESSAY WRITING

L	T	P	C
3	0	0	3

Unit I **9 hours**

Mechanics of Essay Writing: Framework of an essay, introduction,hypothesis/statement of claim, body-claims and counter claims, refuting or disproving the opposing position with reasons and examples, providing evidence and examples that prove or support one's claim, conclusion-restatement of the claim and summary of the main ideas, paragraphing, discourse markers.

Unit II **9 hours**

Analyzing an Argument: Terms and definitions, statement, argument,claim, truth value, premise, identifying premises and claims/conclusions, strengths and weaknesses of an argument, discussion on the validity of a claim, scope for counter-argument if any, critiquing an argument.

Unit III **8 hours**

Analyzing an Issue: An issue statement or statements followed by specifictask instructions, discussing the extent to which one agrees or disagrees with the statement, rationale for the position one takes, developing and supporting one's position, discussion on the validity of the given statement/ claim, addressing the different views that are presented, remaining unbi-ased in assessing a claim, taking a stand and justifying it, writing a re-sponse.

Unit IV **9 hours**

Writing an Argumentative Essay on a Topic of Contemporary Inter-est: Planning, writing and revising, clear, concise and defined thesis state-ment that occurs in the introduction, clear and logical transitions. BodyParagraphs that include Evidential Support (factual, logical, statisticalor anecdotal), conclusion that does not simply restate the thesis, but re-addresses it in light of the evidence provided.

Unit V **7 hours**

Peer Review: Preparing a template for peer review that is derived fromthe response rubric given to the student and assessment rubric used for evaluation, formulating and communicating constructive feedback on a peer's work, responding to feedback on one's work, checklist for peer review-lead strategy use in the introduction, thesis statement, supporting details given in the body, the writer's acknowledgement of a counterargument and his/her response to it, closing strategy used in the conclusion.

References

1. Bailey S., Academic Writing: A Handbook for International Students, Routledge, London and NewYork, 2001.
2. Jordan R.R., Academic Writing Course, Nelson/Longman, London, 1999.
3. Hamp-Lyons L., Heasley B., Study Writing, Cambridge University Press, 2006.

19EOE308: INDIAN ECONOMY

L	T	P	C
3	0	0	3

Unit I **9 hours**

Structure of Indian Economy: Meaning of economic growth and development, features of Indian economy, changing structure of Indian economy, trends in national income, sources of growth, agriculture, industry and service sectors.

Unit II **8 hours**

Demography, Poverty and Unemployment in India: Demography: Population size and growth rates, age and gender distribution, trends of urbanization, occupational distribution of labour force. Poverty: Nature of poverty causes for poverty, measures to eradicate poverty. Unemployment: Nature and types of unemployment, causes for unemployment, remedial measures of unemployment.

Unit III **8 hours**

Public Finance: Sources of government revenue, Indian tax structure, direct and indirect taxes, composition of the government expenditure, role of monetary and fiscal policies, federal finance in India, 14th finance com-mission.

Unit IV **8 hours**

Foreign Trade: Importance, composition and direction of foreign trade, foreign direct investment, BoPs equilibrium, Foreign Exchange Management Act (FEMA).

Unit V **8 hours**

Economic Reforms in India: Industrial policy 1991, economic reforms, liberalization, privatization, and globalization.

Text Book(s)

1. V. K. Puri, S.K. Misra, Indian Economy, 31/e, Himalaya Publishing House, 2014.

References

1. R.C. Dutt, K.P.M. Sundaram, Indian Economy, S. Chand and Company, 2010.
2. A. N. Agarwal, Indian Economy, New Age International Limited, 2012.
3. I.C Dhingra, Indian Economy, Sultan Chand and Company, 2007.

19EOE310: PUBLIC ADMINISTRATION

L	T	P	C
3	0	0	3

Unit I **10 hours**

Introduction: Meaning, scope and significance of public administration, evolution of the discipline and its present status, challenges of liberalisation, privatization and globalization, good governance, electronic governance-concepts and applications, New Public Management (NPM).

Unit II **8 hours**

Administrative Thought: Scientific management theory, classical theory, bureaucratic theory, human relations theory, system theory.

Unit III **8 hours**

Accountability and Control: Legislative, executive and judicial control over administration, role of media, interest groups, NGOs, civil society, Right to Information Act (RTI), social audit, citizen chapters.

Unit IV **8 hours**

Union and State Governments Administration: President, prime min-ister, council of ministers, cabinet, central and state secretariats, boards and commissions, governor, chief minister and council of ministers, cen-tral- state relations, finance commission, Neeti ayog.

Unit V **8 hours**

Civil Services: Recruitment, training and other condition of services, district administration, role of collector, local self governing institutes-73rd and 74th constitutional amendments act.

Text Book(s)

1. Avasti, Maheswari, Public Administration, 31/e, Lakshmi Narain Agarwal Books, India, 2014.
2. B. L. Fadia, Kuldeep Fadia, Indian Administration, 8/e, Sahitya Bhawan, India, 2014.

References

1. Nicholas Henry, Public Administration and Public Affairs, 21/e, Prentice Hall of India, 2012.
2. D. Ravindra Prasad, V. Sivalinga Prasad, P. Satyanarayana, Administrative Thinkers, 2/e, Sterling Publishers, 1991.
3. D. D. Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis Butterworths, Wadhwa Nagpur, 2013.
4. Ramesh K. Arora, Rajni Goyal, Indian Public Administration, 3/e, New Age International Publishers, India, 1995.

19EOE 312: ENVIRONMENTAL MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize with basic with basic concepts of green buildings
- To acquire an insight on characteristics, collection transportation and disposal of different
- types ofbiomedical wastes
- To acquaint the basic principles of EIA.
- To impart about e-waste management.
- To understand the activities in environmental auditing.

Unit – I - Green Building Technology

Introduction to Green Technology-Use of technology towards sustainability. IGBC rating systems, Understanding of green building measures in the areas of Site Preservation, Energy Efficiency, Materials, Water Conservation, Solar Energy- Wind energy- Basic Concepts- Sources and uses .

Unit – II – Biomedical Waste Management

Definition-Sources-Classification of biomedical waste – Objectives of Biomedical waste management-segregation-containers for biomedical waste-Labeling Collection-Transport-Disposal methods.

Unit – III - Environmental Impact Assessment (EIA)

Introduction-Definition-Scope-Objectives of EIA-Basic EIA Principles, Classification of EIA-Life Cycle Assessment-Environmental Policy of India. BASELINE DATA ACQUISITION: Environmental Inventory- Rapid EIA.

Unit – IV - E-Waste management

E-waste : Sources- Types- components; Collection process- Segregation-Disposal methods; Effect on air, water and soil; Health hazards; Role of individual for E-waste management. Current E-waste Management Rules.

Unit – V- Environmental Audit

Introduction- Environmental audit Significance for Industry-Elements of Environmental audit. Process of environmental audit-Pre audit- Activity -Activities at site- Post audit.

Course outcome:

1. To explain the concepts of green buildings –L2.
2. To outline the disposal techniques in biomedical waste –L2.
3. To explain the preparation of EIA statements-L4
4. To Summarize e-waste management rules-L2
5. To identify various acytiviites involved in environmental audit –L3

Text Books

1. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007.
2. Rittmann, B.E., and McCarty, P.L., Environmental Biotechnology : Principles and Applications, McGraw Hill, 2001.

Reference Books

1. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000
2. Industrial Wastewater Management, Treatment and Disposal, WEF Manual of practice No. FD-3, 3rd Ed., WEF Press and McGrawHill, 2008

19EOE327: PROFESSIONAL COMMUNICATION

L	T	P	C
3	0	0	3

Unit I **8 hours**

Internal Communication: Memo-structure, layout and style, e-mail-structure, style, content and etiquette, notice-structure, content and layout, conducting a meeting, purpose and preparation, drafting agenda and minutes, conducting effective meetings, meeting etiquette.

Unit II **9 hours**

Making a Business Presentation: Planning-define the purpose, analyze audience and occasion, preparation-developing central idea, main ideas, gathering supporting materials, audio-visual aids, organization-introduction, body and conclusion, delivery-addressing the audience, body language, eye contact, use of appropriate language, style and tone.

Unit III **8 hours**

Business Letters: Form and structure, style and tone, letters of enquiry, letters placing orders/ giving instructions/urging action, letters of complaint and adjustment.

Unit IV **9 hours**

Proposals and Reports: Proposals, types, structure, prefatory parts, body of the proposal, supplementary parts, reports, types, informative, analytical, formal/informal, oral/written, individual/group, format and structure.

Unit V **8 hours**

Resume, Cover Letter, Interview and Telephone Etiquette: Resume, design and structure, cover letter, cover letters, accompanying resumes, opening, body, closing; Interview, planning, purpose, pre-interview preparation, conversation, two-way interaction, projecting a positive image, telephone etiquette- guidelines for telephone conversations in a professional context.

References

1. Seely, John, Oxford Guide to Effective Writing and Speaking, Oxford University Press, India, 2013.
2. Olsen Leslie, Huckin Thomas, Technical Writing and Professional Communication for Non-Native Speakers, McGraw Hill, 1991.
3. Rizvi, M. Ashraf, Effective Technical Communication, Tata McGraw Hill, 2005. 193

19MOE301: BASICS OF FINANCE

L	T	P	C
3	0	0	3

Unit I
Financial Management: An Introduction - Meaning and Definition of financial Management, objectives of Financial Management, Finance Functions, Organization of finance function, functions of finance Manager - Interface between Finance and other business functions.

Unit II
Sources of finance – classification of sources- security financing – kinds of ownership securities-debentures-bonds- types of bonds -internal financing– loan financing – innovative source of finance-venture capital-seed capital –private equity.

Unit III
Time value of money – introduction – concept – techniques of time value of money –compounding technique- doubling period-compound value of annuity-discounting or present value of technique – present value of annuity.

Unit IV
Financing Decisions: Cost of Capital - Cost of Debt, Cost of Preference Shares, Cost of Equity Shares, Cost of Retained Earnings, Weighted Average Cost of Capital.

Unit V
Working capital management- meaning – concept – components of working capital -factors determining working capital management – operating cycle- determinants of working capital -estimation of working capital management.

Textbook(s):
1. Shashi K. Gupta & R.K. Sharma, “Financial Management –theory and practices” 8^{th} revised edition, 2014, Kalyani Publishers.

References:

1. Pandey, I. M., “Financial Management”, Vikas Publications Print, New Delh, 2012
2. Khan, M. Y., & Jain, P. K., “Financial Management”, Tata McGraw Hill, New Delhi, 2012
3. Maheswari, S. N., “Financial Management”, Sultan Publications, New Delhi, 2013

Journals:
1. Chartered Financial Analyst - ICFAI - Hyderabad
2. Journal of Accounting and Finance - Research Development Association, Jaipur
3. GITAM Journal of Management, GITAM Institute of Management, GITAM University, Visakhapatnam

19LOE301: FUNDAMENTALS OF CYBER LAW

L	T	P	C
3	0	0	3

Course Objectives: The objective of this course is to make students familiar with the developments that are taking place in different areas of study with the help of Computer and Information Technology. The students will acquire knowledge in national and international legal order on the Fundamentals of Cyber Laws. The abuse of computers has also given birth to a gamut of new age crimes that are addressed by the Information Technology Act, 2008 (as amended). The chief aim of this course is to encourage inter-disciplinary studies.

UNIT-I

Conceptual and theoretical perspectives of Cyber Law - Computer and Web Technology –Evolution of Cyber Law – National &International Perspectivesof Cyber Law - Legal Issues &Challenges in India, USA and EU - Data Protection - Cyber Security, etc.

UNIT-II

International Perspectives - Budapest Convention on Cybercrimes - ICANN's core principles and the domain names disputes - Net neutrality - EU electronic communications regulatory framework - Web Content Accessibility Guidelines (WCAG).

UNIT-III

Information Technology Act, 2008 as amended - Overview of the Act - Jurisdiction -Electronic Governance - Electronic Evidence (Relevant portions of Indian Evidence Act) - Digital Signature Certificates (DSCs) - Duties of Subscribers of DSCs - Role of DSC Certifying Authorities - The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability – Powers of Police - Impact of the Act on other Laws - Social Networking Sites vis-à-vis Human Rights.

UNIT-IV

Cyber Laws vis-à-vis IPRs - Copyright in Information Technology - Software - Copyrights Vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Patents - European Position on Computer related Patents - Legal position of U.S and India on Computer related Patents - Trademarks in Internet - Domain name registration - Domain Name Disputes & World Intellectual Property Organization (WIPO) - Databases in Information Technology - Protection of database in USA, EU &India.

UNIT-V

Mobile Technology- SIM (Subscriber Identity Module) cloning–Mobile frauds - Usage of mobile software - Special reference to the relevant provisions of IT ACT 2008, India Penal Code and Evidence Act.

Textbooks:

a. Yatindra Singh : Cyber Laws
b. Vakul Sharma, Handbook of Cyber Laws

References:

1. Linda Brennan and Victoria Johnson: Social, ethical and policy implication of Information Technology.
2. Kamath Nandan : Law relating to Computer, Internet and E-Commerce.
3. Mike Godwin: Cyber Rights Defencing free speech in the Digital Age.

19EOE313: PERSONALITY DEVELOPMENT

L	T	P	C
3	0	0	3

Unit I **8 hours**

Self Awareness: Know yourself, have a snapshot of yourself, assess your personal traits, discover natural potential. Activities and Tasks: Class discussion, questionnaires, Johari Window, SWOC analysis (strengths, weaknesses, opportUNIT Ies and challenges).

Unit II **8 hours**

Self Discipline: Importance of self discipline, characteristics of a self disciplined achiever, self discipline in personal life and career. Activities and Tasks: Viewing short videos followed by discussion and analysis, brainstorming in small groups, creating an action plan to realize academic and career goals.

Unit III **8 hours**

Motivating Oneself: Self motivation, confidence building, goal setting, decision making. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

Unit IV **9 hours**

Managing Oneself: Handling emotions, time management, stress management, change management. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

Unit V **9 hours**

Interpersonal Behaviour: Attitude towards persons and situations, team work, leadership skills, problem solving skills, interpersonal adaptability, cultural adaptability. Activities and Tasks: Team-building games and activities.

References

1. Hurlock Elizabeth B., Personality Development, McGraw Hill Education, India, 1979.
2. Covey, Stephen R., The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change, Free Press, 2004.
3. Carnegie, Dale, Levine, Stuart. R., The Leader In You: How to Win Friends, Influence People and Succeed in a Changing World, Pocket Books, 1995.
4. Swami Vivekananda, Personality Development, Advaita Ashrama, 1993.

*This will be supplemented by materials and activities from internet-related sources.

19MOE305: BASICS OF MARKETING

L	T	P	C
3	0	0	3

Unit I: Introduction to Marketing – Nature, Scope and Importance of Marketing – Concepts and Approaches to Marketing – Product Vs. Service Marketing, Role of Marketing in the Economic Development – Latest Trends in Marketing.

Unit II: Analyzing Consumer Markets and Buyer Behaviour – Factors Influencing the Buyer Behaviour; Market Segmentation and Targeting.

Unit III: Marketing Mix Strategies & Extended Marketing Mix : Product, Service Product, Classification of Products – Product Life Cycle Stages, New Product Development

Unit IV: Pricing & Channels of Distribution: Pricing Objectives – Factors Influencing the Pricing Policy – Pricing Methods, Channels of Distribution – Channel Design Decisions – Channel Management.

Unit V: Promotion Mix – Importance of Promotion – Managing Advertising – Sales Promotion –, Personal Selling and Direct Marketing– Publicity and Public Relations.
Case study (Not exceeding 250 words).

Textbook(s)

1. Philip Kotler (2014), *A Framework for Marketing Management*, New Delhi: Pearson Education.

Reference books

1. W.J. Stanton (2011), *Fundamentals of Marketing* , New Delhi: McGraw Hill Publishing Co. Ltd.,
2. Gravens Hills & Wood Ruff (2012), *Marketing Management*, New Delhi: Cravens Hills, AITBS.
3. Rajan Saxena (2010), *Marketing Management,* New Delhi: Tata Mc-Graw Hill.
4. Sontakki C.N. (2012), *Marketing Management*, New Delhi: Kalyani Publications.

Journals

1. GITAM Journal of Management, Visakhapatnam.
2. Journal of Marketing, New Delhi.
3. Advertising & Marketing, New Delhi.
4. Indian Management, New Delhi.
5. Indian Journal of Commerce, New Delhi.

GEL345: WORKPLACE COMMUNICATION –BASIC

L	T	P	C
3	0	0	3

Introduction

The course is used to teach contemporary international business communication. An integrated skills approach is followed to enable students to communicate effectively in business contexts. It is a topic- based course with ample opportunity for practise to develop LSRW skills. It motivates and engages the students who wish to pursue various careers.

Course Objectives

- To enable students to hone their language skills with special focus on effective communication in business contexts
- To reinforce learning and enhance the ability to understand business communication
- To conduct business correspondence, write reports and suggestions, make presentations and participate in discussions
- To prepare students for BEC certification (B2 Level)

Unit 1: Listening

Understanding general idea; listening for specific information to complete notes, forms, and messages based on telephone conversations; recognising functions such as complaining, greeting, apologising; recognising topics and contexts; ability to follow extended speech during interviews, discussions, and presentations; ask relevant questions to indicate one's understanding of the main points of the speech

Learning Outcomes

At the end of the Unit the learners will be able to

- understand and follow a range of spoken business communication
- collect specific information from telephone conversations, interviews, discussions and presentations
- recognise different language functions such as greeting, apologising, and complaining
- make inferences and draw conclusions

Unit 2: Speaking

Interactive communication: sharing and participating in a conversation; giving a presentation or speaking at a business meeting: structuring a speech and connecting ideas; discussing on a given topic and expressing opinions, agreeing, disagreeing, comparing and contrasting ideas to reach a decision; speaking at length about the topic in a logical way

Learning Outcomes

At the end of the Unit the learners will be able to

- communicate with clarity and precision in business contexts
- understand and apply effective discourse management strategies
- make structured mini presentations/ elevator pitches
- participate in targeted discussions

Unit 3: Reading

Understanding the meaning, structure and cohesion of the text; reading in detail; scanning for specific details/information; identifying the writer's purpose and main idea of a paragraph; understanding opinions and ideas expressed in the text; understanding sentence structure; identifying and correcting errors in text.

Learning Outcomes

At the end of the Unit the learners will be able to

- comprehend business texts with focus on meaning, structure and cohesion
- get the gist, identify specific details and understand the writer's purpose
- make inferences and draw conclusions
- read short texts for error identification and correction

Unit 4: Writing

Writing for internal communication: a note/memo/email/message (formal); writing requests, instructions, explanations, ask for information, etc.; writing concisely and cohesively: linking your ideas; writing reports and proposals based on notes, charts, and tables.

Learning Outcomes

At the end of the Unit the learners will be able to

- identify formal internal communication contexts and write a note/ memo/ email/ message accordingly
- write instructions and explanations for process oriented activities
- produce different pieces of writing concisely and cohesively with appropriate discourse markers based on charts and tables.
- write effective letters, emails, reports, and proposals

Unit 5: Grammar and Vocabulary in Context

Countable and uncountable nouns; present perfect and past simple; phrasal verbs; collocations; linking words; infinitives and verb + -ing; formal requests; first and second conditionals; prepositions in time clauses; modal verbs: perfect forms; referencing; passives; the definite article; tense changes in reported speech; relative clauses

Learning Outcomes

At the end of the Unit the learners will be able to

- demonstrate appropriate use of a range of grammatical structures and vocabulary
- understand various forms of nouns, verb tense, voice, and reported speech
- use phrasal verbs, collocations and discourse markers as required
- be consistent in the correct use of grammar and effective word choice in written and oral communication

References:

1. Whitby, N. (2014). *BusinessBenchmark: Upper Intermediate.* Cambridge English: CUP.
2. Seely, John.*Oxford Guide to Effective Writing and Speaking.*Oxford University Press, (India), 2013
3. Rizvi, M Ashraf. *Effective Technical Communication*.Tata McGraw Hill. 2005.
4. Olsen, Leslie & Huckin, Thomas.*Technical Writing and Professional Communication for Non-native Speakers.*McGraw-Hill. 1991

GEL347: Workplace Communication –Advanced

L	T	P	C
3	0	0	3

Introduction

The aim of the course is to equip students with advanced language skills for successful communication in business contexts. This course will enhance students' employability and add value to their career prospects. This course will be taught through integration of the four language skills, using a blended approach.

Course Objectives

- To enhance critical thinking skills through challenging tasks and activities
- To train students for effectively using advanced language functions such as persuading, negotiating, interpreting data, hypothesizing and speculating
- To enable students to become independent and proficient users of English

Unit 1: Listening

Comprehending extended speech about complex topics in situations such as interviews, lectures, talks and meetings; identifying the purpose of speech and understanding advanced functions such as persuasion and negotiation; practising active listening strategies such as reflecting on what has been said during an extended conversation by paraphrasing, asking specific questions, and responding appropriately; dropping assumptions while listening; inferential listening: picking up on cues from what is said and not said

Learning Outcomes

At the end of the unit, the learners will be able to

- follow complex discussions, talks and presentations on business related topics
- understand the use of language in different situations for different purposes
- demonstrate an understanding of implicit language use

Unit 2: Speaking

Talking about one's work and experience; speaking at length on specific business related topics and demonstrating knowledge of relevant topics based on the conversation/discussion; developing, presenting, and defending an argument; use of persuasive language; use of appropriate register and tone

Learning Outcomes

At the end of the unit, the learners will be able to:

- express views/opinions and take part in discussions on business/work related topics using appropriate vocabulary and register
- contribute effectively to meetings and seminars
- engage in extended conversation on different topics in workplace contexts

Unit 3: Reading

Comprehending complex texts including articles on business related topics; reading with specific goals; using suitable strategies such as making connections, predicting, questioning, visualising, and summarising to become independent readers; using knowledge of text structure to enhance comprehension; interpreting opinions and ideas expressed in the texts; developing critical reading skills toidentify generalizations, spot errors in reasoning, and draw inferences/conclusions

Learning Outcomes

At the end of the unit, the learners will be able to:

- comprehend complex texts on business/workplace related topics
- understand implicit meaning and purpose of texts read
- develop critical reading skills to enhance comprehension at the inferential level

Unit 4: Writing

Writing brief reports: describing and interpreting graphical representation of data; writing proposals: describing, summarizing, recommending a course of action, and persuading the reader; writing letters for specific purposes; planning and organizing content in a coherent manner; using appropriate register for specific task types (correspondence, report or proposal)

Learning Outcomes

At the end of the unit, the learners will be able to

- produce different pieces of writing such as letters, reports, and proposals using language with clarity,precision, and accuracy
- consistently produce desired written message using a wide range of grammatical structures and vocabulary
- understand the use of appropriate register for different contexts

Unit 5: Grammar and vocabulary in context

Verb forms; modal verbs; defining and non-defining relative clauses; compound nouns; embedded questions; position of adverbs; cleft sentences; conditional sentences; future time clauses; complex sentences; infinitive and verbing; reference devices; articles; devices of concession; business vocabulary/ vocabulary related to workplace

Learning Outcomes

At the end of the unit, the learners will be able to:

- demonstrate understanding of a range of business vocabulary
- refine the ability to use English grammar as a tool for comprehension
- identify and correct select grammatical and word choice errors in texts
- speak fluently and write effectively

References

1. Whitby, N. (2014). *Business Benchmark: Advanced.* Cambridge English: CUP.
2. Seely, John. *Oxford Guide to Effective Writing and Speaking.* Oxford University Press, (India),2013
3. Rizvi, M Ashraf. *Effective Technical Communication*. Tata McGraw Hill. 2005.
4. Olsen, Leslie & Huckin, Thomas. *Technical Writing and Professional Communication for Non-native Speakers.* McGraw-Hill. 1991

19EEC371: FUNDAMENTALS OF COMMUNICATION SYSTEMS

L	T	P	C
2	1	0	3

This course covers fundamental concepts of communication systems, which are essential for the understanding of advanced communication systems. Beginning with the basic communication system, the need for modulation, various analog and digital modulation techniques are covered. Further, this course will also focus on the basic concepts of various antenna and Radar systems, their working principles and applications.

Course Objectives:

- To familiarize with the need of modulation, AM, DSBSC and its applications.
- To explain the concept of angle modulation techniques and its practical applications.
- To demonstrate various pulse coding and the generation of digital modulation techniques.
- To explain the basics of antenna and its applications in HF/UHF/MW frequencies.
- To describe the working principles and applications of various RADAR Systems.

UNIT I **LTP 6 3 0**

Introduction to Communication Systems: Introduction to communication, elements of communication system, need of modulation, electromagnetic spectrum and typical applications. amplitude modulation techniques: elements of analog communication, theory of amplitude modulation (AM) technique, double sideband suppressed carrier (DSBSC) technique, generation of amplitude modulated Signal: generation of AM Signal, generation of DSBSC Signal.

Learning Outcomes:

After completion of this unit, the student will be able to

- describe the elements of communication system (L1).
- explain the need of modulation, electromagnetic spectrum and applications (L2).
- analyze the generation of amplitude modulated signal and DSBSC signals (L5).

UNIT II **LTP 6 3 0**

Angle Modulation Techniques: Theory of angle modulation technique: frequency modulation, phase modulation, frequency spectrum of the FM wave, narrow band and wide band FM, stereophonic FM multiplex system, comparison of FM and AM.

Learning Outcomes:

After completion of this unit, the student will be able to

- describe the theory of angle modulation technique (L1).
- compare frequency modulation, amplitude modulation and phase modulation (L2).
- differentiate narrow band and wide band FM (L4).
- analyze the stereophonic FM multiplex system (L4).

UNIT III **LTP 6 3 0**

Digital Pulse Modulation Techniques: pulse code modulation, delta modulation, digital modulation techniques: introduction, basic digital modulation schemes: amplitude shift keying (ASK), frequency shift keying (FSK) and phase shift keying (PSK).

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the digital pulse modulation techniques like pulse code modulation and delta modulation (L2).
- classify the basic digital modulation schemes (L3).
- demonstrate the generation of ASK, PSK, FSK signals (L3).

UNIT IV **LTP 6 3 0**

Antennas: Basic considerations, wire radiator in space, terms and definitions, directional high-frequency antennas: dipole arrays, folded dipole and applications UHF and microwave antennas: parabolic reflector antenna, horn antenna.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the basic concepts of antenna fundamentals (L1).
- define the terms and definitions of antenna parameters (L1).
- illustrate the characteristics and applications of directional high-frequency antennas (L3).
- demonstrate the characteristics and applications of UHF and microwave antennas (L3).

UNIT V **LTP 6 3 0**

Radar Systems: Fundamentals, radar performance factors, basic pulsed radar systems, moving- target indication (MTI), CW doppler radar, frequency modulated CW radar.

Learning Outcomes:

After completion of this unit the student will be able to

- explain the fundamentals and performance factors of radar (L1).
- describe the principles of pulsed radar systems and moving- target indication (MTI) (L1).
- distinguish between CW Doppler radar and frequency modulated CW radar (L4).

Text Book:

1. George Kennedy, Bernard Davis and S R M Prasanna, Electronic Communication Systems, 5 EdMc Graw Hill Education (India) Private Limited, 2014.

References:

1. Taub H. and Schilling D., Principles of Communication Systems, Tata McGraw Hill, 2010.
2. Simon Haykins, Michel Mohar, Introduction to Analog and Digital Modulation, second edition, Wiley India, 2014.
3. P. Rama Krishna Rao, Analog Communications 1 Ed, Tata McGraw Hill, 2011.
4. Gottapu Sasibhushana Rao, Microwave and Radar Engineering, 1 Ed, Pearson Education, 2014.

Course Outcomes:

After successful completion of the course, the student will be able to

- summarize the need of modulation, AM, DSBSC and its applications (L2).
- describe the concept of angle modulation techniques and its practical applications(L1).
- Demonstrate various pulse coding and the generation digital modulation techniques(L3).
- explain the basics of antenna and its applications in HF/UHF/MW frequencies(L2).
- describe the working principles and applications of various RADAR Systems(L2).

19EEI371: SENSORS AND SIGNAL CONDITIONING

L	T	P	C
2	1	0	3

Measurements pervade our life. Industry, commerce, medicine, and science rely on measurements. Sensors enable measurements because they yield electric signals with embedded information about the measurand. Electronic circuits process those signals in order to extract that information. Hence, sensors are the basis of measurement systems. The emphasis of this course is on the design of a sensor and its signal conditioning circuits.

Course Objectives:

- To understand the basic fundamentals of sensors and their characteristics.
- To implement the principles of Resistive sensors and its signal conditioning circuit
- To apply the concepts of Reactance variation and Electromagnetic sensors
- To realize the Self-Generating sensors and its signal conditioning circuits
- To interpret the concepts of Intelligent Sensors & other sensing methods

UNIT I **LTP 6 3 0**

Introduction to sensor-based measurement systems: General concepts and terminology, sensor classification, static characteristics & dynamic characteristics of measurement systems **Primary Sensors:** Temperature, pressure, flow velocity and flow-rate, level, force and torque, acceleration and inclination, velocity sensors, microsensor technology.

Learning Outcomes: After completion of this unit, the student will be able to

- Understand the basic sensor classification (L1)
- Analyze the Sensor Performance Characteristics(L4)
- Limitations of sensor. (L3)
- Understand about the Different primary sensors. (L1)
- Analyze Purpose of microsensor technology(L4)

UNIT II **LTP 6 3 0**

Resistive Sensors: Potentiometers, strain gauges, resistive temperature detectors (rtds), thermistors, magnetoresistors, light-dependent resistors (LDRs), resistive hygrometers, resistive gas sensors, liquid conductivity sensors, **Signal conditioning for resistive sensors:** Measurement of resistance, voltage dividers, Wheatstone bridge: balance measurements, Wheatstone bridge: deflection measurements, differential and instrumentation amplifiers, interference.

Learning Outcomes: After completion of this unit, the student will be able to

- Understand the basics resistive sensors
- Describe the signal conditioning for the measurement of resistance
- Explain the basic circuits for Wheatstone Bridge.
- Analyze the Amplifiers circuits.
- Outline the concepts of interference circuits

UNIT III **LTP 6 3 0**

Reactance variation and electromagnetic sensors: capacitive sensors, inductive sensors, electromagnetic sensors, **Signal conditioning for reactance variation sensors:** problems and alternatives, ac bridges, carrier amplifiers and coherent detection, specific signal conditioners for capacitive sensors, resolver-to-digital and digital-to-resolver converters.

Learning Outcomes: After completion of this unit, the student will be able to

- Working principle of electromagnetic, capacitive, inductive sensors
- Analyze the problems related to AC Bridges.
- Understand the signal conditioning circuits reactance variation sensors

- Illustrate converters of sensors
- Amplify and detect signal conditioning

UNIT IV **LTP 6 3 0**

Self-generating sensors: thermoelectric sensors: thermocouples, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors, **Signal conditioning for self-generating sensors:** chopper and low-drift amplifiers, electrometer and transimpedance amplifiers, charge amplifiers, noise in amplifiers, noise and drift in resistors

Learning Outcomes: After completion of this unit, the student will be able to

- Understand the basic principles related to temperature sensors.
- Working principle of photodiodes and its types.
- Illustrate the self generating sensors
- Amplify the signal conditioning circuits
- Detect noise and drift in amplifiers & Resistors

UNIT V **LTP 6 3 0**

Digital and intelligent sensors: position encoders, resonant sensors, variable oscillators, conversionto frequency, period, or time duration, direct sensor-microcontroller interfacing, communication systems for sensors, intelligent sensors, **Other sensing methods:** Sensors based on semiconductor junctions, sensors based on MOSFET transistors, charge-coupled and CMOS image sensors, fiber- optic sensors, ultrasonic-based sensors, biosensors

Learning Outcomes: After completion of this unit, the student will be able to

- Understand the Interfacing circuits
- Working principle related to intelligent sensors
- Outline the concepts of sensors based on semiconductors
- Apply the principle related o Fiber optic sensors
- Illustrate the various Biosensors

TEXTBOOK:

1. Sensors and Signal Conditioning, 2nd Edition, Ramon Pallas-Areny, John G. Webster, John Wiley & Sons, 2000.

REFERENCES:

1. A. K. Sawhney, Puneet Sawhney, A Course in Mechanical Measurements and Instrumentation, 1/e, Dhanpat Rai and Company, 2001.
2. D. V. S. Murthy, Transducers and Instrumentation, 1/e, Prentice Hall of India, 1995.
3. D. Patranabis, Sensors and Transducers, 1/e, Prentice Hall of India, 2004.
4. D. Patranabis, Principles of Industrial Instrumentation, 1/e, Tata McGraw Hill Education, 2010.

Course Outcomes:

After successful completion of the course, the student will be able to

- Classify different types of sensors and their characteristics (L2)
- Build the signal conditioning circuits for different resistive sensors (L3)
- Develop the signal conditioning for reactance variation and electromagnetic sensors (L4)
- Implement the signal conditioning for self-generating sensors (L2)
- 5. Identify the differences between conventional sensors and Intelligent sensors (L1)

19ECY371: APPLICATION OF CHEMISTRY IN ELECTRONICS

L	T	P	C
2	1	0	3

This course enables the students to gain knowledge on various aspects of advanced electrochemical energy systems, solid state chemistry, superconductors and insulators, e-waste, Molecular machines and Molecular switches. The knowledge gained in this course can be applied to the latest developments in technology.

COURSE OBJECTIVES

- To impart knowledge on e-waste, its composition and hazardous material reduction.
- To familiarize the students on fundamentals of electrochemical energy systems and their applications.
- To create awareness on solids.
- To acquaint with the important characteristics of super conductors and insulators.
- To study the characteristics of molecular motors and machines, energy supply.

UNIT I

ADVANCED ELECTROCHEMICAL ENERGY SYSTEMS 6L3P

Electrodes – concepts, reference electrodes (Ag/AgCl electrode and glass electrode) electrochemical cell, cell potential calculations, numerical problems, Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.
Primary cells –alkali metal sulphide batteries, Fuel cells, methanol fuel cells, Propane oxygen fuel cell – working of the cells.
Secondary cells – nickel-metal hydride - working of the battery including cell reactions, button cells.

Learning outcomes:

After completion of Unit-I, the student will be able to

- explain the significance of electrode potentials (L2)
- compare Ag/AgCl electrode, glass electrode. (L2)
- explain electrochemical sensors. (L2)
- distinguish primary cells and secondary cells. (L4)

UNIT II

Solid State Chemistry 6L3P

Introduction, classification and properties of solids. Crystallographic systems, types of lattices, Brag's equation, Born-Haber cycle and cohesive energy. Ionic and liquid crystals - properties and applications.

Learning outcomes:

After completion of Unit-II, the student will be able to

- classify solids. (L2)
- compare the properties of solids. (L2)
- explain the Born Haber cycle and cohesive energy. (L2)
- distinguish the different types of liquid crystals. (L4)

UNIT III

SUPERCONDUCTORS & INSULATORS **6L3P**

Superconductors

Characteristics and applications- Green synthesis:- Principles – 3 or 4 methods of synthesis with examples – R4M4 principles

Insulators –

Definition and Classification with Examples; Characteristics of Insulating Materials; Thermal Insulators, Electrical Insulators - Their Characteristics and Engineering Applications.

Learning outcomes:

After completion of Unit-III, the student will be able to

- define characteristics of insulating materials. (L1)
- illustrate the characteristics and applications of green synthesis. (L2)
- explain R4M4 principles. (L2)
- apply the concepts of superconductors (L3)

UNIT IV

ANALYSIS OF e-WASTE **6L3P**

Definition of electronic waste, Composition of e-waste (Material composition and metal content of typical end –of life e-waste, Hazardous materials in e-waste), Hazardous materials reduction,Analysis of waste electrical and electronic equipment (WEEE) using laser induced breakdown spectroscopy (LIBS) .

Learning outcomes:

After completion of Unit-IV, the student will be able to

- define e-waste. (L1)
- explain material composition and metal content. (L2)
- explain WEEE and LIBS. (L2)
- demonstrate hazardous materials reduction. (L3)

UNIT V

MOLECULAR MACHINES AND MOLECULAR SWITCHES **6L3P**

Introduction to supramolecular chemistry, self assembly with suitable examples (self assembly on gold surface), characteristics of molecular motors and machines, energy supply, natural molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor.

Molecular switches – Introduction, cyclodextrin-based switches, in and out switching, back and forth switching, displacement switching,

Learning outcomes:

After completion of Unit-V, the student will be able to

- explain the concept of supramolecular chemistry. (L2)
- illustrate molecular motors and machines (L2)
- identify artificial molecular machines (L3)
- compare Rotaxanes and Catenanes as artificial molecular machines. (L4)
- classify different types of switching. (L4)

Text Books:

1. P.C. Jain and M. Jain, Engineering Chemistry, 15th Dhanapat Rai & Sons, Delhi (2014).
2. Electronic wastes by Hugo Marce;oveit and Andrea Moura , Bernardes,Springer,2015,(ISBN978-319-15713-9)
3. O G Palanna, Engineering Chemistry, Tata McGraw Hill Education Private Limited, New Delhi, 2009.

References:

1. Sashi chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, Delhi.
2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press.
3. Ben L. Feringa and Wesley R. Browne, Molecular Switches, 2/e, Wiley-VCH, 2011.
4. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
5. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
6. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

COURSE OUTCOMES:

After completion of course, the student will be able to

- define electrochemical sensors. (L1)
- classify the different types of liquid crystals. (L2)
- apply the concepts of superconductors (L3)
- apply hazardous materials reduction. (L3)
- explain artificial molecular machines (L5)

19EHS405: OPERATIONS RESEARCH

L	T	P	C
2	1	0	3

This course is to aid decision making and improving efficiency of the system by applying advanced analytical methods. This course addresses a number of quantitative tools and techniques, and provides students with knowledge and skills needed to apply these tools and techniques for decision making in organizations.

Course Objectives:

- To Introduce the basics of Operations research, formulation and solution of Linear Programming Problems using different methods
- To Learn Formulation and solve problems of optimization problems in transportation and assignment of jobs.
- To explore different queuing models and sequencing techniques for optimal schedule of jobs on machines
- To impart knowledge on replacement policies for estimation of economic life of equipment and the concept of game theory to arrive at the optimal business strategy for a given situation.
- To introduce basic inventory models to optimize inventory costs and Project scheduling techniques – CPM & PERT for optimum time and costs

UNIT I **10L**

Basics of Operations Research: History, definition, operations research models, phases of implementing operations research in practice.

Linear Programming: Introduction, formulation, graphical solution, simplex method, artificial variable techniques – Big M and Two Phase methods, concept of duality, dual simplex method.

Learning Outcome:

After completion of Module-I, the students will be able to:

- recognize the significance of Operations Research and mathematical modelling while analysing the practical problems in industry (L1)
- formulate the various linear Programming Models (L6)
- evaluate the optimal solution to simple linear programming problems (L4)

UNIT II **8L**

Transportation Model: Formulation, methods for initial feasible solution, optimal solution – MODI method, unbalanced transportation problems, degeneracy in transportation problems.

Assignment Model: Formulation, optimal solution, Hungarian method, travelling salesman problem.

Learning Outcome:

After completion of Module-II, the students will be able to:

- formulate the linear programming problem as a Transportation model (L6)
- formulate the linear programming problem as an Assignment model (L6)
- evaluate the optimal solution to Transportation Problems (L4)
- evaluate the optimal solution to Assignment Problems (L4)

UNIT III **8L**

Queuing Models: Introduction, Kendall's notation, classification of queuing models, single server and multi-server models, Poisson arrival, exponential service, infinite population

Sequencing Models: Introduction, assumptions, processing n-jobs through two machines, n-jobs through three machines, n-jobs through m-machines, graphic solution for processing 2 jobs through n machines with different order of sequence

Learning Outcome:

After completion of Module-III, the students will be able to:

- define the various queuing models(L1)
- calculate Queue length & waiting time of a given queue system(L3)
- evaluate the optimal sequence of the jobs on machines for minimum cycle time(L4)

UNIT IV **9L**

Replacement Models: Introduction, replacement of items that deteriorate with time - value of money unchanging and changing, simple probabilistic model for replacement of items that fail completely.

Game Theory: Introduction, game with pure strategies, game with mixed strategies, dominance principle, graphical method for 2xn and mx2 games, linear programming approach for game theory.

Learning Outcome:

After completion of Module-IV, the students will be able to:

- analyze the replacement and maintenance costs of items under various replacement policies (L4)
- evaluate the optimal replacement policy of items (L4)
- analyze the players' strategies and thereby Evaluate optimal business strategies for the players (L4)

UNIT V **9L**

Inventory Models: Introduction, inventory costs, Economic Order Quantity (EOQ) and Economic Batch Quantity (EBQ) models with and without shortages, inventory models with quantity discounts

Project Management: Introduction, phases of project management, network construction, numbering the events-Fulkerson's rule, Critical Path Method (CPM), Programme Evaluation and Review Technique (PERT)

Learning Outcome:

After completion of Module-V, the students will be able to:

- recognize the significance of Inventory models & Project Management in real world industrial scenarios (L1)
- differentiate between the critical and non-critical activities of a given project (L4)

- propose the optimal schedule of the activities involved in a project (L6)
- evaluate the optimal order/batch quantity for minimum inventory cost (L4)

Text Book(s):

1. Gupta P K. & Hira D.S., Operation Research, 6/e, S Chand Publishers, 2006.
2. Paneerselvam R., Operations Research, 2/e, Prentice Hall of India, 2010.

Course Outcomes:

After successful completion of this course, the students will be able to

- develop the mathematical models and Propose the optimal resource allocation (L3&L6)
- formulate and solve transportation & assignment models for optimum resources (L6&L3)
- analyze the queue system and to propose the optimal sequence of jobs on machines (L4 & L6)
- evaluate the optimal replacement policy of the equipment and to analyze the strategic interaction between rational decision-makers (L6&L4)
- design the inventory systems and to plan the project activities (L6)

19EME371: QUANTITATIVE TECHNIQUES FOR MANAGEMENT

L	T	P	C
2	1	0	3

Course Objectives:

- To study the fundamentals of linear programming and its application to special cases like transportation and assignment models.
- To understand the complex nature of operations research, problem, define the problem, formulate and solve the model and to perform the follow-up procedures.
- Demonstrate how analytical techniques and statistical models can help enhance decision making by converting data to information and insights for decision-making.
- Categorize and construct multistage decision analysis problems using decision trees.
- Categorize and construct multifactor problems with multiple objectives and uncertainty.
- Critically evaluate decisions of others and develop ways they could have improved their decision making

UNIT I **10 L**

Introduction, Measures of Central Tendency Mean, Median, Mode, Concept of Testing of Hypothesis, Types of Errors, Confidence intervals, Z- test for Means, Standard deviations and Proportions; T-test; F-test for two variances.

Learning outcomes:

After completing this unit, the student will be able to

- memorize how statistical data can be read for analysis and give valid inferences.(L1)
- describe and discuss the key terminology, concepts tools and techniques used in business statistical analysis.(L2)
- analyze the data and give valid inferences.(L4)
- design, conduct and analyze the experiments more efficiently and effectively.(L6)

UNIT II **8 L**

Chi- Square test for goodness of fit and independent of Attributes and their Applications, Correlation and Types, Scatter Diagram Method, Karl Pearson's Coefficient of Correlation and its properties, Spearman's Rank Correlation Coefficient, Regression & Multivariate Analysis.

Learning outcomes:

After completing this unit, the student will be able to

- explain and critically discuss the issues surrounding sampling and significance(L2)
- apply Regression analysis based on the experimental data and give valid inference.(L3)
- determine the influential factors and also the interaction effects on the response function(L5)

UNIT III 8 L

Decision analysis, Decisions under risk, Decision trees- Decision analysis with experimentation, Utility theory, Decisions under uncertainty.

Learning outcomes:

After completing this unit, the student will be able to

- understand the need of decision analysis apply mathematical techniques in engineering decision making(L2)
- understand the need of decision analysis(L3)
- correlate the applications of decision making principles to different environments like uncertain and risky(L4)

UNIT IV **10 L**

Introduction to multi-objective decision making, Concept of Pareto optimality, Goal programming formulation, the weighting method of solution, Analytic hierarchy process

Learning outcomes:

After completing this unit, the student will be able to

- To correlate the applications of decision making principles to different environments like uncertain and risky.(L2)
- To apply the multi-objective solving concepts like utility and analytic hierarchy process.(L3)
- To apply the multi-objective solving concepts like utility and analytic hierarchy process.(L5)

UNIT V **12 L**

Linear Programming: Introduction, Formulation, Graphical solution, Simplex method Transportation Problem-Formulation, Initial Feasible Solution Assignment Models- Formulation, Optimal solution-Hungarian method

Learning outcomes:

After completing this unit, the student will be able to

- define, contrast between the different terminologies of real time field.(L1)
- outline the wide applicability of operations research technology from agriculture to defense, covering almost all domains of science, arts, commerce and technology.(L2)
- develop optimum solution for numerous problems of operations research by systematic defining, formulating, analyzing, developing an optimum solution and further refining the solution.(L3)
- anticipate a high level of mathematical, analytical and problem solving skills for problems that are of spontaneous nature, whose solution will be individualistic in application.(L6)

Text Book:

1. Anderson, Sweeney, Williams, 2005, An introduction to management science Thomson South Western
2. Barry Render, Ralph M Stair Jr, Michael E Hanna, 2005, Quantitative analysis for management,Pearson Education

Reference Books:

1. Charles A. Gallagher Hugh. J.Watson , 1985, Quantitative Methods for Business Decisions, McGraw Hill international Book Company
2. Frederic S.Hillier, Gerald J.Liberman,2005 Introduction to Operations Research, A Tata McGraw-Hill
3. Gupta M.P. and R.B. Khanna, 2004, Quantitative Techniques for Decision Making, Prentice Hall of India
4. Sharma J.K, 2006, Operations Research Theory and Practice, Macmillan India Ltd.

Course Outcomes:

Upon completion of this course, the students will be able to

- formulate the real life problems as mathematical programming problems(L6)
- use appropriate mathematical techniques in engineering decision making. (L3)
- use Operations Research Techniques/ Models like Linear Programming, Transportation Model, Project management, for optimal allocation of resources. (L3)
- understand and apply the characteristics of different types of decisions making capabilities. (L3)
- identify real-life problems and choose appropriate tool/technique to model them, being aware of the assumptions underlying the tools.(L3)

19ECE371: DISASTER MANAGEMNET

L	T	P	C
2	1	0	3

Most of the hazards turn into disasters due to unsustainable activities of human beings and cannot be completely avoided. However, the impact can be mitigated by proper planning, preparedness and organizing at various levels. Civil Engineers may have to work in varied locations where in they have to encounter a variety of disaster scenarios. Hence, they need to have adequate knowledge to deal with these disasters. This subject is aimed at providing a detailed understanding of various phases of disaster management, vulnerability profile and organizational structure of disaster management in India, and applications of science & technology for better disaster management.

Course objectives

- Familiarize Disaster management activities and phases
- Demonstrate the Vulnerability profile of India towards various disasters
- Explain the Components of disaster relief, disaster management policies
- Enable latest trends in disaster management
- Expose outcomes from various disasters in India

UNIT I **9 L**

Introduction to disaster management: Basic terminology (hazard, vulnerability, disaster, risk, exposure, resilience, capacity), classification of disasters, disaster mitigating agencies and their organizational structure at different levels (NDMA, NDRF, SDMA, DDMA), disaster management cycle.

Learning outcomes

After completion of Unit-I, students will be able to

- list various terms related to disaster management (L-1).
- classify various types of disasters (L-2).
- illustrate the organizational structures of disaster mitigating agencies (L-2).
- outline the significance of Disaster Management Cycle (L-2).
- explain the disaster management cycle (L-3).

UNIT II **8 L**

Vulnerability of profile of India: Vulnerability towards wind and cyclone, floods, earthquakes, heat waves, cold waves, dust storms, droughts, tsunamis, landslides, forest fires.

Learning outcomes

After completion of Unit -II, students will be able to

- explain the vulnerability scenario of India with respect to various disasters (L-2).
- select the vulnerable zones with respect to various disasters in India (L-3).

UNIT III **8 L**

Components of disaster relief: Water, food, shelter, protection and security, sanitation, health, waste management, financial assistance.

Institutional arrangements: Disaster management act 2005 and national policy on disaster management 2009.

Learning outcomes

After completion of Unit -III, students will be able to

- state the components of disaster relief (L-1).
- illustrate the significance of disaster relief components (L-2).
- explain the significance of institutional arrangements (L-2).

UNIT IV **9 L**

Applications of science and technology for disaster management: Geo-informatics in disaster management (RS, GIS, GPS), disaster communication system (early warning and its dissemination), land use planning and development regulations, disaster safe designs and constructions, structural and non-structural mitigation of disasters.

Learning outcomes:

After completion of Unit -III, students will be able to

- explain the significance of Geo-informatics in disaster management**,** disaster safe designs andconstructions (L-2).
- demonstrate the functioning of disaster communication system (L-2).
- outline the land use planning and development regulations (L-2).

UNIT V **8 L**

Case studies: Related to various recent disasters of earthquake, tsunami, cyclone, flood, drought, landslides, volcanic eruption, forest fire, heat wave, cold wave.

Learning outcomes

After completion of Unit -III, students will be able to

- name various disasters occurred in India and worldwide (L-1).
- identify major disasters in each category (L-3).
- analyze various disaster management case studies (L-4).

Text BooK

1. R.B.Singh, Disaster Management, Rawat Publications, 2000.

Reference Book

1. Iyengar, Natural Hazards in the Urban Habitat, C.B.R.I., Tata McGraw Hill, 1997.
2. Jon Ingleton, Natural Disaster Management, Tulor Rose Holdings Pvt. Ltd., 1999.

Course outcomes:

After the completion of the course, the student will be able to

- classify various types of disasters and explain disaster management cycle (L-2).
- explain the vulnerability scenario of India with respect to various disasters (L-2).
- demonstrate the significance of disaster relief components, institutional arrangements (L2).
- apply the knowledge of geo-informatics, communication system in disaster Management (L-3).
- analyse various disaster management case studies (L-4).

19ECS391- COMPREHENSIVE SKILL DEVELOPMENT -IV

Soft Skills and Quantitative Aptitude	**L**	**T**	**P**	**A**	**C**
	0	0	0	6	1

Course objectives:

- To encourage the all round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Part-1

A. Verbal and Soft Skills:

Vocabulary Builder, Reading Comprehension, Fill-in-the-Blanks, General Usage

B. Quantitative Aptitude and Reasoning Puzzles, Arithmetic, Geometry, Mensuration.

Part-2

Coding: -Medium Level problem solving techniques:

Permutations and Combination, Probability, Hash Tables, Heap, Greedy Method, Backtracking

Course Outcomes:

- On completion of the course, student will be able to– Effectively communicate through verbal/oral communication and improve the listening skills
- Write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
- Student will be able to understand the problems and develop his competitive coding skills.
- Apply the skills in various domains and will be able to solve complex problems faced by the industry.
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality

19ECF431: Digital Forensics

L	T	P	C
3	1	0	4

Digital Forensics is a scientific method of investigation and analysis in order to gather evidence from the digital devices or computer networks and components which is suitable for presentation in a court of law or legal body. It involves performing a structured investigation while maintaining a documented chain of evidence to find out exactly what happened on a computer and who was responsible for it.

Course objectives:

1. To understand digital forensics techniques and digital crime. for conducting the forensic examination on different digital devices.
2. To understand digital forensics practitioners responsibility and forensics process.
3. To understand digital artifacts and file system in the context of digital crime and analyse computer forensic evidence.
4. To apply forensic techniques and procedures to perform a digital investigation.
5. To explore on and apply forensic analysis tools to recover important evidence in the context of digital crime.

Module I: Number of hours(LTP) 9 3 0

Introduction to digital forensics:

Computer forensics and investigations as a profession, understanding digital forensics. A brief History of computer Forensics, Locard's exchange principle, Crime Reconstruction, Investigations, Evidence Dynamics. Understanding case laws, understanding law enforcement agency and investigations.

Case studies: The Aaron Caffrey case and The Julie Amero case.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the concept digital forensics.
2. Understand law enforcement agency investigations.
3. Explain the legal process.

Module II: Number of hours(LTP) 9 3 0

Digital Forensics and Its Environment: Definitions of digital forensics, Forensic Soundness and Fundamental Principles, The role of digital forensic practitioners and the challenges.**Digital Forensics Process:** Introduction, Identification Phase, Collection Phase, Examination Phase, Analysis Phase and Presentation Phase.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand principles of digital forensics.
2. Understand the role and challenges of forensic practitioners.
3. Understand and explain digital forensics process.

Module III: Number of hours(LTP) 9 3 0

Operating system and File system:

Windows systems and artifacts: Introduction, Describing files systems that contain evidence - File Allocation Table, New Technology File System. Locating evidence in file systems - Registry, Event Logs, prefetch Files, Shortcut Files, Windows Executables. Explaining password security, encryption, and hidden files.

Case studies: Linking the evidence to the user.

Learning Outcomes:
After completion of this unit, the student will be able to:
1. Understand file system and registry.
2. Understand the significance of locating evidence.
3. Understand and explain file security and encryption.

Module IV: Number of hours(LTP) 9 3 0

Digital Evidence: Defining digital evidence and its characteristics, The technical complexities of digital evidence, Determining the value and admissibility of digital evidence, Recovering digital evidence through forensic imaging processes.

Network Forensics: Definition, Classification of network forensic systems, Recent trends in network forensics, Challenges in network forensic analysis, Network forensic frameworks.

Learning Outcomes:
After completion of this unit, the student will be able to:
1. Understand the characteristics of digital evidence.
2. Apply forensics process to identify and retrieve digital evidences.
3. Understand network forensics and challenges.

Module V: Number of hours(LTP) 9 3 0

Examining Browsers, E-mails and Mobile Phones: Locating evidence from Internet and Messaging systems, E-mail analysis and the processing of large e-mail databases, Ontology's for Mobile and Embedded Forensics, Challenges of evidence recovery from mobile phones and handheld devices. Computer forensics tools – Software and hardware tools.

Case study: Mobile phone evidence in a bomb hoax.

Learning Outcomes:
After completion of this unit, the student will be able to:
1. Understand internet and messaging system in the context of digital evidence.
2. Analyse large messaging database to identify and retrieve digital evidence.
3. Understand mobile and embedded devices to locate and retrieve artifacts.

Text Books(s)

1. Practical Digital Forensics by Richard Boddingtion. May 2016.
2. Digital Forensics by Andre Ames. 2018.

Reference Book(s)

1. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Fourth Edition, Course Technology.
2. Angus M.Marshall, "Digital forensics: Digital evidence in criminal investigation", John –Wiley and Sons, 2008.

Course Outcomes:
1. Understand Forensic Science and Digital Forensics
2. Understand and apply OS and File System Forensics
3. Analyze Digital Evidence and Network Forensics
4. Analyze Web Forensics and Mobile Device Forensics
5. Implement the concepts of Digital Forensics.

19EIO 431: EMBEDDED SYSTEMS AND ITS APPLICATIONS

L	T	P	C
3	0	2	4

The aim of this course is to enable students develop theoretical knowledge about embedded systems hardware and find the solutions for the challenges in designing embedded processors. The course introduces the embedded system components and design examples.

Course objectives:

1. Introduce Embedded system components and design procedure
2. Program the devices to be connected with Embedded processor and performance evaluation
3. Introduce the system level activity such as Assembling, loading, linking, testing and analysing the performance.
4. Introduce the necessary Operating system used with embedded systems.
5. Introduce the design methodologies and networking principles of Distributed Embedded systems.

Module I: Embedded Computing Number of hours(LTP) 8 0 0

Introduction, Complex Systems and Microprocessors, Embedded system design process, Design Example, Instruction sets: Preliminaries, ARM Processor, TI C55x DSP

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the overview of Embedded systems.
2. Explain the design process followed for the embedded system design.
3. Explain the instruction sets of example processors used in Embedded systems.

Module II: CPUs Number of hours(LTP) 10 0 0

Introduction, Programming Input and output, Supervisor mode, Exceptions and Traps, Coprocessors, Memory system mechanisms CPU performance and power consumption, Design Example.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the principles of Programming the I/O units in embedded systems.
2. Describe the Memory subsystems of embedded systems
3. Evaluate the Power and performance of embedded system processors.

Module III: Program Design and Analysis Number of hours(LTP) 9 0 0

Components for Embedded programs, Model Programs, Assembling, Linking and Loading, Compilation Techniques, Program level Performance analysis, Software performance optimization, Analysis and Optimization of program size, Program Validation and Testing, Design Example

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the various phases of embedded system program development and implementation.
2. Analyse the program level performance.
3. Optimize the software performance and program size.
4. Validate and test the embedded system programs.

Module IV: Processes and Operating Systems Number of hours(LTP) 9 0 0

Multiple tasks and multiple processes, Multirate systems, Pre-emptive real-time OS, Priority based scheduling, Interprocess communication mechanisms, Evaluating operating system performance, power optimization strategies for processes, Design Examples.

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Explain the multiple tasks and processes in view of embedded systems
2. Introduce real time Operating system and scheduling strategies.
3. Evaluate Operating system performance and power optimization strategies for Embedded system processors.

Module V:	System Design Techniques, Networks and Multiprocessors	Number of hours(LTP)	9	0	0

Design Methodologies, Requirement analysis, Specifications, System analysis and architecture design, Networks and Multiprocessors: Why Networks and multiprocessors?, categories of multiprocessors, Distributed Embedded systems, Design and Application Example.
Learning Outcomes:
After completion of this unit, the student will be able to:

1. Follow the design methodology for the embedded systems.
2. Explain the categories of multiprocessors and distributed embedded systems.

Text Books(s)

1. Marilyn Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman, Third Edition, 2012.

Reference Book(s)

1. Shibu K V, Introduction to Embedded Systems, Tata McGraw Hill Education Private Limited, 2nd Edition.

Course Outcomes:

1. Explain the Design principles of Embedded systems and Instruction sets of selected Embedded system processors.
2. Describe the processor architecture and evaluate the processor performance
3. Design and analyse the Embedded system programs
4. Distinguish the processes and Process level activities of Embedded systems.
5. Follow the system design techniques for the embedded systems and interconnection of the components.

19EAI433: BIG DATA ANALYTICS

L	T	P	C
3	0	2	4

Big Data Analytics largely involves collecting data from different sources, manipulate it in a way that it becomes available to be consumed by analysts and finally deliver data products useful to the organization business. It is mainly useful to know how organizations harness data insights in real time to improve decision-making, enter new markets, and deliver better customer experiences.

Course objectives:

1. Optimize business decisions and create competitive advantage with Big Data analytics.
2. Learn Java concepts required for developing map reduce programs.
3. Derive business benefit from unstructured data.
4. Imparting the architectural concepts of Hadoop and introducing map reduce paradigm.
5. To introduce programming tools Hbase & HIVE in Hadoop echo system.

Module I: Number of hours(LTP) 9 0 6

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Demonstrate big data concepts and its uses (L2)
2. Identify various marketing areas that fit the bigdata (L3)
3. Explain about Hadoop and its related technologies (L5)

Module II: Number of hours(LTP) 9 0 6

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemeless databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Develop data models for commercial problems (L6).
2. Create databases and apply constraints for bigdata problems using NoSQL (L6).
3. Elaborate map-reduce concepts and implement them (L6).

Module III: Number of hours(LTP) 9 0 6

Data format, analysing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Demonstrate the design of Hadoop file systems and its concepts (L2).
2. Adapt map reduce concepts on real world data (L6).
3. Analyse the file handling issues (L4).

Module IV: **Number of hours(LTP) 9 0 6**

MapReduce workflows, Unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain anatomy of map reduce and its notions (L5).
2. Apply map reduce notions on real world data (L3).
3. Illustrate Map reduce framework (L2).

Module V: **Number of hours(LTP) 9 0 6**

HBase, data model and implementations, HBase clients, HBase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Develop data models and implement them using HBase (L6).
2. Elaborate hive data types and file formats (L6).
3. Analyse the data manipulations using Hive (L4).

Text Books(s)

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage, M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2014.
3. Tom White, "Hadoop: The Definitive Guide", 3/e,4/e O'Reilly, 2015.

Reference Book(s)

1. Big data: Black book DT Editorial services, Dreamtech press, 2016

Course Outcomes:

After completion of this course, the student will be able to:

1. Classify the big data concepts for real world data analysis (L4).
2. Adapt NoSQL concepts for developing databases (L6).
3. Experiment with Map Reduce concepts through Java (L2).
4. Apply Map reduce framework for real world data(L4).
5. Solve the problems using HBase and Hive technologies (L6).

19ECF433: Mobile Application Security

L	T	P	C
3	1	0	4

Mobile application security focuses on the software security posture of mobile apps on various platforms like Android, iOS, and Windows Phone. This covers applications that run both on mobile phones as well as tablets. It involves assessing applications for security issues in the contexts of the platforms that they are designed to run on, the frameworks that they are developed with, and the anticipated set of users (e.g., employees vs. end users). Mobile applications are a critical part of a business's online presence and many businesses rely entirely on mobile apps to connect with users from around the world.

Course objectives:

1. Learn the evolution of mobile application and its security.
2. Understand IOS Applications and its security
3. Familiarize android applications and its security.
4. Analyze the mobile application security in windows mobile OS,IOS and Android

Module I: Mobile Application security Number of hours(LTP) 9 3 0

Introduction to mobile application in security, The evolution of mobile applications, Mobile application security, Analyzing IOS Applications: security Model, Understanding IOS Applications, Jail Breaking, data protection API, IOS Key chain, Touch ID, Reverse Engineering IOS binaries.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand mobile application security (L1)
2. Analysing IOS application (L3)

Module II: Attacking IOS Applications Number of hours(LTP) 9 3 0

Introduction to transport security, identifying insecure storage, Patching IOS Applications with HOPPER, Attacking IOS Runtime, inter process communication, Attacking using injection IOS Applications Security: IOS implementation Insecurities, Disclosing Personally Identifiable Information, Data Leaks, Memory Corruption, Protecting Data, Avoiding Injection Vulnerabilities, Securing Your Application with binary protections

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Practice attacking the IOS Applications. (L3)
2. Explain IOS application security techniques(L4)

Module III: Analysing Android Applications Number of hours(LTP) 9 3 0

Creating Android Environment. Understanding Android Applications, Understanding Security Model, Reverse-Engineering Applications. Attacking Android Applications Exposing Security Model Quirks, Attacking Application Components, accessing storage and logging, Misusing Insecure Communications, Exploiting other vectors, Additional testing techniques.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Analyse android applications (L3)
2. Implement techniques to attack android applications (L6)

Module IV: Android Applications security Number of hours(LTP) 8 3 0

Reviewing pre-installed Applications, Exploiting Devices, infiltrating user data, Principle of least exposure, Essential Security Mechanisms, Advanced Security Mechanisms, Slowing down a reverse engineer.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand android application security (L1)
2. Analyse android application security (L4)

Module V: Analyzing windows Phone Applications: Number of hours(LTP) 10 3 0

Understanding Security Model, Understanding Windows Phone 8.x Applications, Analyzing application Binaries. Cross platform Applications: Introduction. Bridging Native Functionality, Exploring Phone Gap and Apache Cordova.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Analyse windows phone applications (L4)
2. Learn various cross platform application (L6).

Text Books(s)

1. Dominic Chell, Tyrone Erasmus, The Mobile Application Hacker's Handbook, Wiley Publication ,1e

Reference Book(s)

1. Fundamentals of Information Security: A Complete Go-to Guide for Beginners to Understand All the Aspects of Information Security Paperback November 2020 by Sanil Nadkarni.
2. Mobile Communications | Second Edition | By Pearson Paperback – 1 January 2008 by Schiller

Course Outcomes:

1. After completion of this course, the student will be able to Define Mobile security(L1)
2. Understand evolution of mobile applications and its security. (L2)
3. Analyse IOS, Android and Windows mobile applications. (L3)
4. Implement security methodologies in IOS, Android and Windows mobile applications. (L6)
5. Understand various cross platform mobile applications (L3)

19EIO433: Cloud Based IOT

L	T	P	C
3	0	2	4

Preamble/Course introduction

This course covers the fundamentals of IoT and provides skills for IoT based product development. The skills students learn in this subject include the selection of sensors, protocols, hardware boards, interfacing, and implementation for product building. This course provides the basic principles of cloud computing, Cloud computing Architecture, cloud native application development and Deployment.

Course objectives:

1. To study the fundamentals about IoT
2. To study about IoT Access technologies
3. To study the design methodology and different IoT hardware platforms.
4. This course introduces the basic principles of cloud computing, cloud native application development and deployment, containerization principles, micro-services and application scaling.
5. It will also equip the students to understand major industry players in the public cloud domain for application development and deployment.

Module I: **Introduction to IoT** Number of hours (LTP) 9 0 6

What is IoT, Genesis of IoT, Understanding IoT Devices, IoT and Digitization, IoT Architecture, IoT Impact, Convergence of IT and IoT, IoT Challenges, Layers of IoT, Understanding IoT Components, IoT Network Architecture and Design, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Learning Outcomes:

After completion of this unit, the student will be able to Learn about:

1. Architecture of IOT
2. Various Components of IOT

Module II: **IoT Architecture & Technologies** Number of hours (LTP) 9 0 6

IoT architecture layers, IoT sensors types, actuator types, and RFID types, IoT device platforms- Arduino, Raspberry Pi, and Beagle Board.

Learning Outcomes:

After completion of this unit, the student will be able understand about:

1. Sensors and actuators in IOT
2. Various microprocessors available in IOT

Module III: **Protocols for IoT** Number of hours (LTP) 9 0 6

Infrastructure protocol (IPV4/V6/RPL), Identification (URIs), Transport (Wifi, Lifi, BLE), Discovery, Data Protocols, Device Management Protocols. – A Case Study with MQTT/CoAP usage-IoT privacy, security and vulnerability solutions.

Learning Outcomes:

After completion of this unit, the student will be able to understand:

1. About Internet Protocols
2. About Device Management Protocols

Module IV: **Cloud Computing** Number of hours (LTP) 9 0 6

Introduction to Cloud Computing-Definition, Characteristics, Components, Introduction to Microsoft Azure, Cloud provider, SAAS, PAAS, IAAS and other Organizational scenarios of clouds.

Learning Outcomes:

After completion of this unit, the student will be able to learn and understand:

1. Basics of Cloud Computing
2. Deployment Models of Cloud Computing

Module V: **IoT and the Cloud** Number of hours (LTP) 9 0 6

Role of Cloud Computing in IoT – AWS Components – S3 – Lambda – AWS IoT Core - Connecting a web application to AWS IoT using MQTT- AWS IoT Examples.

Learning Outcomes:

After completion of this unit, the student will be able to understand:

1. About AWS Components
2. About MQTT

Text Books(s)

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands on Approach", Universities Press, 2015.
2. Kevin, Townsend, Carles, Cufí, Akiba and Robert Davidson, "Getting Started with Bluetooth Low Energy" O'Reilly
3. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman, CRC Press.
4. Adrian McEwen, Designing the Internet of Things, Wiley, 2013.
5. https://docs.aws.amazon.com/greengrass/index.html

Reference Book(s)

1. Madhur Bhargava "IoT Projects with **Bluetooth Low Energy**, Packet Publishing, August 2017.

2. Robin Heydon," Bluetooth **Low Energy**: The Developer's Handbook", Pearson, October 2012

3. Kumar Saurabh," Cloud Computing", Wiley India, 1st Edition, 2016.

19EHS403: Organizational Behaviour

	L	T	P	C
	3	0	0	3

Module I: Number of hours(LTP) 8 0 0

Introduction; Definition of Organization Behaviour and Historical development, Environmental Context (Information Technology and Globalization), Diversity and Ethics, Design and Cultural, Reward Systems. The Individual: Foundation of individual behaviour, Ability

Module II: Module Name(if any) Number of hours(LTP) 8 0 0

Learning: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social Making, learning theory, continuous and intermittent reinforcement. Perception: Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect.

Module III: Module Name(if any) Number of hours(LTP) 8 0 0

Motivation: Maslow's Hierarchy of Needs, Mc. Gregory's theory X and Y, Herzberg's motivation Hygiene theory, David Mc Cleland three needs theory, Victor vroom's expectancy theory of motivation.

Module IV: Module Name(if any) Number of hours(LTP) 8 0 0

Values and attitudes: Definitions – values, Attitudes: Types of values, job satisfaction, job involvement, professional Ethics, Organizational commitment, cognitive dissonance. Conflict Management: Definition of conflict, functional and dysfunctional conflict, stages of Conflict process.

Module V: Module Name(if any) Number of hours(LTP) 8 0 0

Leadership: Definition, Behavioural theories – Blake and Mouton managerial grid, Contingency theories – heresy - Blanchard's situational theory, Leadership styles – characteristics, Transactional, transformation leaders. The Organization: Mechanistic and Organic structures, Minitberg's basic elements of organization, Organizational Designs and Employee behaviour, organization development – quality of work life (QWL)

Text Books(s)

1. Stephen P Robbins -Organizational Behaviour, Pearson Education Publications,ISBN– 81–7808–561-5, 9th Edn. 2012.
2. Fred Luthans -Organizational Behaviour, Mc Graw Hill International Edition,ISBN–0–07–20412–1, 11th Edn. 2006.

Reference Book(s)

1. Hellriegel, Srocum and woodman, Thompson Learning -Organization Behaviour, Prentice Hall India, 9th Edition -2001.
2. Aswathappa -Organizational Behavior, Himalaya Publishers. 2001.
3. VSP Rao and others -Organizational Behaviour, Konark Publishers 2002.
4. Organizational Behaviour- (Human behaviour at work) John Newstron / Keith Davis 9th Edition 2002.
5. Paul Henry and Kenneth H. Blanchard -Management of Organizational Behaviors, Prentice Hall of India, 1996.

19ECS491: Project Phase I

L	T	P	C
0	0	2	1

Project Phase I intended to train the students to identify a problem of practical significance related to

- *i) Software design process*
- *ii) Research in specific domain*
- *iii) Application/ software development*

The student is encouraged to study of literature based on the guidance received by a project supervisor and identify a specific problem and works for a solution. At the end he is expected to submit a report based on his findings.
The project can be done as a group consisting maximum of four persons.

19ECS493: Industrial Training /Internship /Research Projects in - National Laboratories or Academic Institutions

L	T	P	C
0	0	0	1

This course is designed to expose the students to industrial practices or working on research problems. The student is expected to correlate his theoretical knowledge gained all the way to the industrial needs and or solving practical/ research problems for the benefit of the humanity.
The student goes through the training during the summer after his pre-final year. He has to maintain a dairy of findings he experienced and submit a detailed report after completion of the training.

19ECS495 – COMPREHENSIVE SKILL DEVELOPMENT - VI

L	T	P	A	C
0	0	0	6	1

OPTION-I (DATA VISUALIZATION USING TABLEAU / POWER BI / ADVANCED EXCEL)

Data Visualization is one of the prime tasks in current scenarios of Business Applications/ any product based tasks. Business Analytics is to project the data effectively in order to communicate and present moreeffectively for better understanding of stakeholders both technical and non-technical in simple manner.By the end of the course the student is able to learn how to apply and present the data in order communicating business relevant implications and also the student is able to structure the data analytics projects that ensures better outcome.The aim of this course is in designing and persuasively presenting business data stories through various approaches such as visualizations, capitalizing on business testing methods and design principles in practical approach.

Course objectives/learning outcomes:

1. To understand the data and its variants, present the data.
2. Discuss concepts and principles of data visualization particularly related to decision making, data modeling and compare and contrast
3. Investigate technologies and practices for visualizing data as part of a data management and analytics system.
4. Apply user interface design principles and practices to develop interactive data visualizations, mapping data
5. Design effective dashboard for decision making at various levels.
6. Conduct research on relevant data visualization topics and telling your own data story
7. Project presentations

Module 1:Understanding Data

What is data, where to find data, Types and variants of data and representations, Foundations for building Data Visualizations

Module 2: Creating Your First visualization

Getting started with Tableau Software, Using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Treemaps), Using the Show me panel

Module 3: Tableau Calculations

Overview of SUM, AVR, and Aggregate features, creating custom calculations and fields, Applying new data calculations to your visualization

Module 4: Formatting Visualizations

Formatting Tools and Menus, Formatting specific parts of the view, Editing and Formatting Axes

Module 5: Manipulating Data in Tableau

Cleaning-up the data with the Data Interpreter, Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data Module 6: Advanced Visualization Tools

Using Filters, Using the Detail panel, Using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors

Module 7: Creating Dashboards & Stories

Using Storytelling, Creating your first dashboard and Story, Design for different displays, Adding interactivity to your Dashboard

Module 8: Distributing & Publishing Your Visualization

Tableau file types, Publishing to Tableau Online, Sharing your visualization, Printing, and exporting

MORE ACCURATELY WHAT ALL WE COVER

Introduction (1 Hours)

- Course Introduction

Field Types and Visual Cues (2 hours)

Tableau Desktop, ScenarioObjectives, Application Terminology and Definitions, Opening and Closing Tableau Data Source Page, Tableau Workspace, Files and Folders, Getting Started with Tableau, View Terminology and Definitions, View Sections, Data Terminology and Definitions, Data Types, Data Roles: Dimension vs. Measure, Data Roles: Continuous vs. Discrete, Changing Data Roles, Visual Cues for Fields, Visual Cues for Fields in the Data Pane, Visual Cues for Fields in the Rows or Column Shelves

Data Connection in Tableau Interface (4 Hours)

Data Connections in the Tableau, Connecting to Tableau Data Server, What is a Join, Types of Joins
When to Use Joining, Enabling Right Outer Join, Right Outer Join and Custom SQL Enabled
What is Data Blending, When to Use Data Blending, Data Blending in Tableau, Differences Between Joining and Blending, Joining vs. Blending, Writing Custom SQL, Prepare your Data for Analysis

Organizing and Simplifying Data (5 hours)

Organizing and Simplifying Data, Objectives, Filtering Data, What is a Filter, Applying a Filter to a View
Filtering on Dimensions, Filtering on Dimensions Functions, Aggregating Measures, Filtering on Measures
Filtering on Dates, Quick Filters, Sorting of Data, What is Sorting, Sorting Data in Tableau, Types of Sorting
Creating Combined Fields, Combined Fields, Creating Groups and Defining Aliases, What is a Group
What are Aliases, Defining an Alias, Working with Sets and Combined Sets, Sets, Combined Sets
Working with Groups and Sets, Drill to Other Levels in a Hierarchy, Grand totals and Subtotals
Adding Totals, Adding Totals, How to Define Aggregations, Changing Aggregation Function
Tableau Bins, Bins, Fixed Sized Bins, Variable Sized Bins

Formatting and Annotations (5 hours)

Formatting and Annotations, Custom Geocoding, Adding Caption to Views, Click Interaction Adding Title to View, Click Interaction2 Adding Captions to View, Using Titles Captions and Tool tips, Adding Tooltips to Views, Using Title Caption and Tooltip, Formatting the Axes, Edit Axis Option, Formatting Views with Labels and Annotations, Format Window, Format Mark Labels, Annotations, Format Manipulations

Special Field Types (4 hours)

Special Field Types, Date Hierarchies, Drilling in the Time Hierarchy, Pivoting Date Parts on Shelves, Differentiate Between Discrete and Continuous Dates, Using Continuous Dates, Using Discrete Dates, Working with Discrete and Continuous dates, What are Custom Dates, Creating and Using Custom Dates, Fiscal Year, Define a Date Field on a Fiscal Year, Relative Date Filters, Importing Date Dimensions in Tableau from a Cube

Work with Date Hierarchies on Cubes, Dates in Cube (Multidimensional) Data Sources, Dates in Cubes Vs. Relational Data Sources

Tableau Generated Fields (2 hours)

Tableau Generated Fields, Using Measure Values and Measure Names, Using Multiple Measures in a View, Using the Number of Records Measure, Using Latitude and Longitude Fields

Chart Types (2 hours)

Chart Types, Working with Combined Axis, Working with Combination Charts, Understanding geocoding and geographic mapping in tableau, Combined Axis Graph and Scatter Plot, Describe text and highlight tables Work with Pages Shelf and Create Motion Charts, Heat Maps, Using Bins and Histograms, Using Histograms, Using Pie Charts, Compare Measures Using Bullet Charts, Using Bar in Bar Charts, Define Advanced Chart Types, Using Pareto Charts, Creating Pareto Charts, Using Waterfall Charts, Using Gantt Charts, Working with box plots, Using Sparkline Charts

Calculations (2 hours)

Calculations, Objectives, Strings Date Logical and Arithmetic Calculation, Working with Strings Date Logical and Arithmetic Calculations, Using Strings Date Logical and Arithmetic Calculations, Working with Arithmetic Calculations, Aggregation Options, Working with Aggregation Options, Grand Totals and Sub-Totals, Quick Table Calculations, Creating Quick Table Calculations, Working with Quick Table Calculations, Automatic and Custom Split, Ad-hoc Analytics
LOD Calculations

Creating and using Parameters (2 hours)

Creating and using Parameters, Objectives, What is a Parameter, Creating a Parameter, Exploring Parameter Controls, Work with Parameters, Click Interaction Working with Parameters

Mapping (2 hours)

Mapping, Objectives, Modifying Locations within Tableau, Importing and Modifying Custom Geocoding, Working with Symbol Map and Filled Map, Using Background Image, Exploring Geographic Search, Perform Pan Zoom Lasso and Radial Selection, Working with WMS Server Maps

Statistics (3 hours)

Statistics, Objectives, Add Reference Lines Bands and Distribution, Adding Reference Lines, Adding Reference Bands, Adding Reference Distribution, Working Reference Lines Bands and Forecasting Trend lines and Trend Models, Understanding Trend Lines, Enabling Trend lines, Click Interaction Understanding Trend Models, Working with Describe Trend Model Window, Working with Trend Lines Statistical Summary Card, Perform Drag and Drop Analytics, Explore Instant Analysis, Forecasting.

Dashboards (3 hours)

Dashboards, Objectives, Build Interactive Dashboards, What is a Dashboard, Building Dashboards, Best practices for creating effective dashboards, Comprehending Best Practices, Creating a Dashboard and Importing Sheets, Interaction Exploring Dashboard Actions, Use of Running Actions, Using Dashboard Actions, Sharing your Work, How to Share your Reports, Exporting your Work

Case Study (Assignment)

- Project

Option –II (ROBOTIC PROCESS AUTOMATION)

L	T	P	A	C
0	0	0	6	1

About Course

Robotic Process Automation training using UiPath will prepare you for Ui Path's RPA Developer Advanced Certification exam so that you can drive RPA initiatives in your organization. This RPA Certification course using UiPath helps you master the key concepts of RPA, Image and Text automation, Computer Vision activity, Object Repository, Data Manipulation using RPA bots, managing your processes from UiPath Orchestrator, and building a solution with Reframe work. Throughout this online Instructor-led RPA training, you will be working on real-life industry use cases. Enroll now to get started!

RPA Training Curriculum

Introduction to Robotic Process Automation

Goal: In this module, you will learn about the evolution and future of Robotic Process Automation.

Youwill also learn how Robotic Process Automation works and its components.

Objectives: In this module, you will:

- Understand the emergence of Robotic Process Automation (RPA) and its future scope Learn the concepts of RPA and distinguish it from Automation
- Understand the types of Bots Discuss how RPA works
- Gain insights into the RPA development methodology and identify its application areas Get an overview of the relevant RPA tools and their selection criteria

Outcomes:

After completing this module, you should be able to:

- Comprehend the necessity of RPA
- Distinguish between different types of bots in RPA
- Get acquainted with different types of tools used in RPA
- Topics:
- Emergence of Robotic Process Automation (RPA)Evolution of RPA
- Future of RPA
- Differentiating RPA from Automation
- Defining Robotic Process Automation & its benefits
- What RPA is Not Types of Bots
- How Robotic Process Automation works
- RPA development methodology and key considerations Application areas of RPA
- List of Robotic Process Automation Tools

Hands On:

- Demonstrate a typical automation process by developing a process using UiPath to identify elements from website related to a course search and store the results of the searchin a local file.
- Discuss a real-world implementation use case of RPA where involving a large telecommunication and media company. Examine how its critical business processes are automated with the help of UiPath and the benefits achieved by this automation.

Process Components and Activities

Goal: In this module, you will understand the main components of a process namely variables,

arguments and activities. You will learn activities related to UI Automation, System activities and various User Events.

Objectives: In this module, you will:

- Identify key UI Elements required for automation
- Know what UI Automation is and the activities involved in it
- Learn System Activities and implement its features in your workflow Create and manage variables in your workflow
- Create and import arguments from different workflows
- Use Import Panel to add or edit your arguments
- Perform User Event activities to create triggers

  Outcomes:

- After completing this module, you should be able to: Perform UI Automation activities on different UI Elements
- Automate browser activities, such as opening and typing into a field Perform click, type into and various element activities

  Topics:

- UI Automation Activities System Activities Variables
- Arguments Imports Panel User Events

  Hands On:

- Build a process in UiPath using UI Automation Activities Create an automation process using key System Activities Using Variables and Arguments
- Automation using System Trigger

Overview of UiPath

Goal: In this module, you will learn about the features and layout of UiPath Studio.

Objectives: In this module, you will:

- Understand what is UiPath and its platform components Install and activate UiPath Community Edition Software
- Get an overview on the types of Projects and Templates in UiPath Get familiarized with the components of the user interface
- Know the usage of Activities Panel and identify different categories Automation Activities Understand the types of workflows

Outcomes:

- After completing this module, you should be able to: Create your own sequence
- Identify different components of UiPath Studio
- Get an overview of user interface and domain activities in UiPath Use different types of workflow

  Topics:

- Introduction to UiPath platform and its components Installation details of UiPath's Community Edition Types of Templates
- User Interface Domains in Activities
- Workflow Files in UiPath

Hands On:

- Setup and Configure UiPath Studio Understand the user interface of UiPath Studio
- Create a Sequence to obtain user inputs, display them using a message box Create a Flowchart to navigate to a desired page based on a condition
- Create a State Machine workflow to compare user input with a random number

Data Manipulation & PDF Automation
Goal: In this module, you will learn about Data Manipulation, virtual machines, Citrix, text, imageand PDF Automation.
Objectives: In this module, you will:

- Create and reuse elements from your object repository Manipulate Scalar, Collection & Table Data
- Get an overview of Native Citrix Automation feature of UiPath Understand how Text and Image Automation works
- Install and use PDF activities package Perform PDF Automation
- Use Computer Vision activity to identify UI Elements

Outcomes:
After completing this module, you should be able to:

- Manipulate your data
- Extract text from PDF files Perform Image automation

Topics:

- Object Repository Data Manipulation
- Automation of Virtual Machines Introduction to Native Citrix Automation
- Text and Image Automation
- PDF Automation Computer Vision

Hands On:

- Data manipulation in the workbook PDF Data Extraction

App Integration, Recording and Scraping
Goal: In this module, you will learn about Recording, Scraping Data and integrate these activities with the corresponding apps.
Objectives: In this module, you will:

- Perform App Integration activities, such as Excel and Mail Record your mouse and keyboard actions
- Implement or edit Selectors of activities Get familiar with UI Explorer
- Scrape data from websites
- Use different types of Recording and Scraping methods

Outcomes:

- After completing this module, you should be able to:
- Collect data from different websites by using data scraping
- Perform different operations on different apps using App Integration Use Excel and Mail Activities

Topics:

- App Integration Recording Scraping Selector
- Workflow Activities

Hands On:

- Automate login to your (web)Email account
- Recording mouse and keyboard actions to perform an operation Scraping data from website and writing to CSV

Programming, Debugging and Logging
Goal: In this module, you will learn about Programming in UiPath, organizing projects, debugging

projects and handling exceptions.
Objectives: this module, you will:

- Use Programming Activities
- Perform Debugging of UiPath Projects Manage and use logs in UiPath
- Understand Error Handling in UiPath processes
- Perform automation in third-party applications using available UiPath Extensions Understand Project Organization and its best practices

Outcomes:

- After completing this module, you should be able to:
- Execute conditional clauses
- Monitor your workflow with debug activity
- Implement message logs to keep track of your workflow Amend your errors in the workflow

Topics:

- Programming Debugging Error Handling Logging Extensions
- Project Organization

Hands On:

- Using Programming Activities in UiPath Debugging errors in a UiPath Project Different ways of Error Handling in UiPath
- Browse through the log files related to UiPath Project

Orchestrator Community Edition and Other RPA Tools

Goal: In this module, you will learn about Orchestrator Community Edition (CE) and other leading RPA tools.

Objectives: In this module, you will:

- Know the capabilities of UiPath Orchestrator Use Orchestrator Activities from UiPath Studio
- Login to the Orchestrator Community Edition
- Understand the different components of Orchestrator Community Edition
- Create & Manage Robots, Processes, Jobs, Schedules & Assets from the Orchestrator Community Edition
- Learn about the different RPA tools available in the market

Outcomes:

- After completing this module, you should be able to:
- Implement various features of orchestrator Register your local machine to orchestrator Connect your bot with the local machine

Topics:

- UiPath Orchestrator Overview Orchestrator activities Introduction to Orchestrator CE Orchestrator CE
- Other RPA tools

Hands On:

- Using various components of Orchestrator Create an automated Gmail Login application
- Create an automated Remote Data Entry application

Implementing REFramework

Goal: In this module, you will learn how to use the REFramework template in UiPath for creatingBusiness processes and understand the various components involved in it.

Objectives: In this module, you will:

- Know the purpose of REFramework
- Understand the framework component functions Use the state machine layout and itsstates
- Apply the workflows available at different states
- Implement exception handling and logging at different states
- Develop a process using the REFramework using the

common development rulesOutcomes:

- After completing this module, you should be able to: Develop your own framework
- Use various activities from different domains to execute your workflow Effectively usemessage logs and debugging activities to monitor your workflow

- Topics:

- Introduction to REFramework About REFramework
- Purpose of REFramework Using State Machine Layout States of the State Machine Workflows Involved Workflows of the Framework Exception Handling & Logging
- Rules of Developing a Process using REFramework
- Build a business process based on REFramework and utilizing various components ofthis framework such as its workflows, states, variables and exceptions

Overview of UiPath Products (Self-Paced)

Goal: In this module, you will get an overview on different products such as App Studio, AI Fabric,etc. and learn how to use them with your workflows.

Objectives: In this module, you will:

- Explore UiPath Marketplace and import packages in your workflow Create a smallapplication using UiPath Apps Studio
- Enable AI Fabric and use ML packages in your workflow Get an overview of Taskcapture and Automation Hub
  Outcomes: After completing this module, you should be able to

- Import packages from Marketplace to your workflow Use packages offered by AI Fabric
- Develop applications that can be used with your workflowTopics:

- Marketplace Apps
- AI Fabric Task capture

- Automation Hub
- Develop complex automation processes with the help of components offered byMarketplace Develop an application using UiPath Apps Studio **Projects.** Which projects will be a part of this RPA with UiPath Course?

Project 1: Candidate Onboarding

Problem Statement – Candidate onboarding process involves tracking candidate's mandatory joiningdocuments, sending them timely reminders, and handling other tasks. Once all the documents are received, then the candidate needs to be sent a formal joining email asking him to join the company.

- We will build a workflow that will automate these entire processes using UiPath. Toachieve this, we will perform the following:
- Create a transactional workflow
- Collecting candidate data using Web Recording Operations on the candidate data usingExcel activities
- Send automated emails for verification and onboarding purposes Publish the project toUiPath Orchestrator
- This is an ongoing project throughout the course designed to implement the concepts asyou learn.

Project 2: GST Verification

Problem Statement – You work in the Risk and Compliance Department for a large trading organization. As a part of the job, it is required to determine the validity of the GST number from GST invoices to verify the details of the vendors who are empaneled in your organization and save these details in a text file.

- Your team has planned to build an automation workflow to verify GST details. To designthe workflow, you will perform the following:
- Use REFramework template for this project Read vendor data from Orchestrator Queues
- UI automation on the given resource for verification
- Write the details on a text file
- Publish the project to UiPath Orchestrator to manage the process and execute with thehelp of bots
- What are the system requirements for this course?
- Your system should have a minimum of 4GB of RAM, a Dual-Core processor, a Windows 7 operating system, and a display resolution of 1024x768.
- CPU:Minimum Requirement – Dual Core 1.8GHz 32-bit (x86) Recommended – QuadCore 2.4GHz 64-bit (x64)
- RAM:4GB (Rercommended 8 Gb)
- Operating System:Minimum Version – Windows 7 Maximum Version – Windows 10
- .Net Framework:Minimum version - 4.6.1
- For Mac users:You can use a Virtualization software like Virtual Box or VMware toinstall Windows as a virtual machine and run the UiPath Studio on it.

19ECS492: Project Phase II

L	T	P	C
0	0	12	6

The findings of Project Phase I is further carried out on the problem with the goal of contributing towards industry ready experience in design, development, testing, and maintenance of software and managing employees.
The students are expected to show their progress in periodic reviews under the guidance of project supervisor.
At the end of the final semester, he is expected to submit either project report.
The project can be done as a group consisting maximum of four persons.

GSS115: Gandhi for the 21st Century

L	T	P	C
0	0	0	1

The course will provide an overall understanding of Gandhi's life, his political contributions, and his basic philosophical thoughts. It also discusses how Gandhi influenced the entire world to think about non-violent resistance as a political strategy to bring and establish world peace

Course objectives:

1. To provide the basic knowledge of Gandhi's life, thought and works
2. To analyse the political contributions of Gandhi towards India's independence
3. To examine the significance of Gandhian principles in the contemporary scenario
4. To educate the students about the necessity of world peace and sustainable development
5. To provide understanding about the life of eminent world leaders who were influenced by Gandhi

Module I:

Introduction to the course: Gandhi's Early Childhood-Beginning of Satyagraha in South Africa-Entry to Indian Politics-Major Movements

Module II:

Gandhi's Political Philosophy: Eleven Vows and their significance, Gandhi's Constructive Programmes and their significance, Sarvodayaand Satyagraha

Module III:

Gandhian Way of Management: Management lessons from Gandhi, his views on education and its significance, Gandhian Economics and Sustainability

Module IV:

Gandhi and his contemporaries-Gandhi and Tagore, Ambedkar, Subhash Chandra Bose, Muhammed Ali Jinnah, Gandhi Mandela, and Martin Luther King Jr.

Module V:

Gandhi and Ecology: Ideas from Hind Swaraj-Environmental movements and Gandhian Environmentalism-World Peace and Gandhi-Conflict resolution and Gandhian principles.

Journal(s)

1. Gandhimarg, Gandhi Peace Foundation, New Delhi.
2. GITAM Journal of Gandhian Studies, GITAM University, Visakhapatnam.

Reference Book(s)

1. Allen, Douglas. (2019). Gandhi after 9/11: Creative Non-violence andSustainability. New Delhi: Oxford University Press.
2. Chandra, B. (2009). History of Modern India. New Delhi: Orient Blackswan.
3. Gandhi, M K. (1941). Constructive Programme. Ahmadabad: Navjivan Publishing House
4. Gandhi, M. K. (1948). The Story of My Experiments with Truth. Ahmadabad: NavjivanPublishing House.
5. Gandhi, M K. (1968). Satyagraha in South Africa. Ahmadabad: Navjivan Publishing House.
6. Hardiman, David. (2004). Gandhi in His Times and Ours: The Global Legacy of His Ideas.New York: Columbia University Press.

Course Outcomes:

1. Understand the life and works of Gandhi
2. Understand and appreciate the political contributions of Gandhi
3. Analyse the contemporary issues and connect it with Gandhian solutions
4. Analyse the issues related to world peace and to think about possible alternatives
5. Understand and appreciate the role of eminent world leaders towards non-violent social and political transformation.

19EAI441: Web Mining

L	T	P	C
2	0	2	3

Course objectives:

1. To describe web mining and understand the need for web mining.
2. To differentiate between Web mining and data mining.
3. To understand the different application areas for web mining.
4. To describe objectives and benefits of web mining.
5. To understand the methods of Web usage mining.

Module I: Number of hours(LTP) 6 0 6

Information Retrieval and Web Search – Basic Concepts of Information Retrieval, IR Models-Boolean Model, Vector Space Model, Statistical Language Model, Relevance Feedback, Evaluation Measures. Text and Web Page Pre-Processing- Stop word removal, Stemming, other Pre-Processing Tasks for Text, Web Page Pre-Processing, Dupli cate detection.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the Basic concepts of IR (L2).
2. Build and managing Models (L6).
3. Identify duplicates and pre-processing (L1).

Module II: Number of hours(LTP) 6 0 6

Inverted Index and its Compression-Inverted index, Search using an inverted index, index construction and index compression. Latent Semantic Indexing-Singular value Decomposition, Query and retrieval, an example. Web Search, Meta-Search: Combing Multiple Rankings - Combination using similarity scores, Combination using Rank Positions. Web Spamming – Content Spamming, Link Spamming, Hiding Techniques and Combating Spam.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Define Inverted index (L1).
2. Compose Queries (L6).
3. Integrate spamming Techniques (L3).

Module III: Number of hours(LTP) 6 0 6

Social Network Analysis – Centrality, Prestige. Co-citation and Bibliographic Coupling-co-citation, Bibliographic Coupling. Page Rank- Page Ranking Algorithm, Strengths and weaknesses of Page rank and Timed Page rank and recency search. HITS- HITS Algorithm, Finding other eigenvectors, relationships with co-citation and Bibliographic coupling, Strengths, and weaknesses of HITS. Community Discovery – Problem definition, Bipartite core communities, maximum flow communities, Email Communities based on betweenness and Overlapping communities of named entities.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Creating new page ranking algorithm (L6).
2. Test relationships with co-citation (L5).
3. Highlight Strengths and Weaknesses (L1).

Module IV: Number of hours(LTP) 6 0 6

Web Crawling – A basic Crawler Algorithm: Breadth-First Crawlers and Preferential Crawlers. Implementation Issues – Fetching, Parsing, stop word removal and stemming, link extraction and canonicalization, spider traps, Page repository and concurrency.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Identify set of implementation issues (L1).
2. Examine breadth-first crawlers (L3).
3. Manage various spider traps (L6).

Module V: Number of hours(LTP) 6 0 6

Universal Crawlers – Scalability, Coverage vs Freshness vs Importance. Focused Crawlers, Topical Crawlers – Topical locality and cues, Best-First Variations, Adaptation, Evaluation, Crawler ethics and Conflicts.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Examine Scalability (L3).
2. Identify ethics and conflicts (L1).
3. Validate crawlers (L5).

Course Outcomes:

1. Understand the basic concepts of IR and building models.
2. Composing queries and integrating spanning techniques.
3. Highlight strengths and weaknesses of IR techniques.
4. Examining breadth-first-crawlers.
5. Identifying ethics and conflicts.

Text Books(s)

1. Web Data Mining - Exploring Hyperlinks, Content, and Usage Data, by Bing Liu - 2edition, Springer.

Reference Book(s)

1. Data Mining Techniques for Marketing, Sales, and Customer Relationship Management, Third Edition, by Michael Berry and Gordon Linoff, John Wiley, 2011.
2. Data Mining: Practical Machine Learning Tools and Techniques, by Ian Witten and Eibe Frank, 3rd Ed., Morgan Kaufmann, 2011

19ECF441: Cloud Security

L	T	P	C
2	1	0	3

This course will provide a foundational understanding of what is required to secure a cloud ecosystem, regardless of the vendor. The concepts and principles discussed will help bridge the gaps between traditional and cloud architectures while accounting for the shifting thought patterns involving enterprise risk management

Course objectives:

1. Understand core cloud computing concepts and fundamental principles, including standard delivery models and service designs.
2. Understand the foundational security practices that are required to secure modern cloud computing infrastructures.
3. Understand the differences between traditional data security practices and cloud-based data security methodologies.
4. Understand the identity and access management practices of both cloud providers and consumers.

Module I: Number of hours(LTP) 6 3 0

Introduction to Cloud : Cloud Delivery Models, Cloud Deployment Models

Cloud Computing Software Security Fundamentals : Cloud Information Security Objectives, Cloud Security Services

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the basic Cloud computing concepts
2. Understand the fundamentals and objectives of Cloud Security

Module II: Number of hours(LTP) 6 3 0

Cloud Security Principles in all steps : Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation and Decomposition, Secure Cloud Software Testing, Cloud Penetration Testing

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the Cloud Security Principles in all steps
2. Learn the Security approaches required to be implemented across the different stages of Cloud development and maintenance

Module III: Number of hours(LTP) 6 3 0

Cloud Computing Risk Issues : The CIA Triad, Privacy and Compliance Risks, Common Threats and Vulnerabilities ,Cloud Access Control Issues, Cloud Service Provider Risks

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the risks associated in Cloud environment
2. Learn the common issues, threats which will be faced in the Cloud

Module IV: Number of hours(LTP) 6 3 0

Cloud Computing Security Challenges:

Security Policy Implementation, Policy Types, Computer Security Incident Response Team (CSIRT), VM Security Recommendations

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Learn the Security challenges in Cloud computing

Module V: Number of hours(LTP) 6 3 0

Cloud Computing Security Architecture and Design patterns

Architectural Considerations, Trusted Cloud Computing, Secure Execution Environments and Communications, Identity Management and Access Control, Autonomic Security, Introduction to Desing Patterns, Security Patterns for Cloud Computing

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand the Cloud Security Architecture
2. Learn the Security Execution and implementation of various Security mechanisms in Cloud computing.

Text Books(s)

1. Ronald L. Krutz Russell Dean Vines , Cloud Security - A Comprehensive Guide to Secure Cloud Computing Published by Wiley Publishing, Inc.
2. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier)

Reference Book(s)

1. Chris Dotson ,Practical Cloud Security: A Guide for Security Design and Deployment, Published by O′Reilly,1st Edition.
2. John Vacca, Cloud Computing Security: Foundations and Challenges, 2nd Edition CRC Press
3. Cloud Computing Design Patterns by Thomas Erl (Prentice Hall)

Course Outcomes:

1. Understand how to protect data-at-rest, data-in-transit, and data-in-use within a cloud environment.
2. Understand standard cloud security network designs and architecture models.
3. Understand the complexity of cloud threat actors and techniques used to attack a cloud computing infrastructure
4. Understand the regulatory requirements needed to secure data in the cloud and the difficulties in meeting those requirements.

Suggested Experiments for tutorial classes

This course covers the techniques to implement security controls and threat protection, managing identity and access, and protecting data, applications, and networks in cloud and hybrid environments as part of an end-to-end infrastructure. Topics include maintaining the security posture, identifying, and remediating vulnerabilities by using a variety of cloud security tools, implementing cloud threat protection, and responding to cloud security incident escalations in both Amazon Web Services (AWS) and Microsoft Azure cloud environments.

1. Virtualization Concepts –AWS Products

2. Infrastructure Security – Edge, Network, Compute in the Cloud

3. Security Operations – Monitoring & Alerting

4. Security Operations – Logging Solution in AWS

5. Identity & Access Management – AWS Authorization and Authentication System

6. Identity & Access Management – Manage Application Access

7. Identity & Access Management – Manage Access Control

8. Data Protection – AWS Key Management and Data Encryption

9. Virtualization Concepts – Azure products

10. Infrastructure Security – Edge, Network, Compute in the Cloud

11. Security Operations – Monitoring & Alerting

12. Security Operations – Logging Solution in Azure

13. Identity & Access Management – Azure Active Directories Identities

14. Identity & Access Management - Configure Secure Access with Azure AD

15. Data Protection – Azure Storage and Database Security

16. Data Protection – Azure Key Vault

17. Simulate a cloud security scenario using CloudSim

Upon successful completion of this lab, the student will be able to do the following:

1. Demonstrate an understanding of specialized data classifications and AWS data protection mechanisms.

2. Demonstrate an understanding of data-encryption methods and AWS mechanisms to implement them.

3. A working knowledge of AWS security services and features of services to provide a secure production environment.

4. Demonstrate an understanding of cloud security operations and risks

19ECF 443: IoT Security

L	T	P	C
2	1	0	3

The purpose of this course is to expose students to new developments in the area of cyber security for the Internet of Things (IoT). In this course, the topics to be covered include security management and Cryptology, IoT Attacks and Threat management, Protocols to provide IoT security. IoT case studies and security concerns related to the applications are discussed.

Course objectives:

1. Introduce the IoT security issues and countermeasures.
2. Introduce the cryptology principles related IoT security.
3. Introduce the embedded devices and security attacks
4. Introduce the IoT protocol and Built-in security features
5. Provide the details of selective IoT case study and their security challenges.

Module I: Introduction Number of hours(LTP) 6 3 0

Introduction to IoT Security – Vulnerabilities, Attacks and Countermeasures. Information Assurance. Attack types. New security threats and vulnerabilities. Fault Trees and CPS. Countermeasures to thwart attack. Threat Modeling.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the IoT security-vulnerabilities, attacks and counter measures.
2. Describe the Fault trees and Threat model.

Module II: Security Management & Cryptology Number of hours(LTP) 6 3 0

Security Controls - Authentication, Confidentiality, Integrity; Access Control, Key Management and Protocols, Cipher – Symmetric Key Algorithms, Public Private Key Cryptography; Attacks – Dictionary and Brute Force, Lookup Tables, Reverse Look Tables, Rainbow Tables, Hashing – MDS, SHA256. SHA 512, Ripe MD, WI, Data Mining.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Manage the IoT security challenges using key management techniques.
2. Discuss various security Attacks and counter measures
3. Illustrate various Hashing algorithms.

Module III: Attack Surface & Threat Assessment Number of hours(LTP) 6 3 0

Embedded Devices – UART, SPI, I2C, JTAG, Attacks – Software and cloud components, Firmware devices, Web and Mobile Applications.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Discuss various Embedded devices, firmware devices
2. Explain Attacks –software and cloud components.

Module IV: IoT Protocol Number of hours(LTP) 6 3 0

IoT Protocol Built-in Security Features – Transport Layer, SSL/TLS and DTLS, Kerberos, Cloud security for IoT

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Discuss various built-in security features.
2. Explain cloud security for IoT

Module V: IoT Case study Number of hours(LTP) 6 3 0

Case Studies and Discussion: Smart Agriculture, Cities, Grid, Healthcare, Homes, Supply Chain, and Transportation, Application of Security Concepts to Create IoT system.

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Complete various case study and the security challenges of IoT application

Text Books(s)

1. Brian Russell & D. Van Duren, Practical Internet of Things Security, Packt Publishing, 2016.

2.Shancang Li, Li Da Xu, Securing the Internet of Things, Elsevier, 2017.

Reference Book(s)

1. Internet of Things: Privacy & Security in a Connected World, Federal Trade Commission, 2015

Course Outcomes:

1. Explain the various IoT security issues and corresponding countermeasures
2. Discuss the principles of cryptology to enhance the IoT security.
3. Explain the embedded devices of IoT systems and related security attacks.
4. Explain the IoT protocol and Built-in security features
5. Complete selective IoT case study and their security challenges.

19ECF445: Android Security Internals

L	T	P	C
2	1	0	3

There are more than one billion Android devices in use today, each one a potential target. Unfortunately, many fundamental Android security features have been little more than a black box to all but the most elite security professionals—until now. This course takes learners under the hood of the Android security system. This course describes Android security architecture from the bottom up, delving into the imple-mentation of major security related components and subsystems, like Binder IPC, permissions, cryptographic providers, and device administration.

Course objectives:

1. To study the Android's frameworks, security model and applications
2. To learn the fundamentals of package format and verifications and user management process
3. To understand the JCA providers and android JSSE implementation
4. To implement online account management and its security
5. To study various secure elements in NFC and Various SELinux policies

Module I: Number of hours(LTP) 6 3 0

Android's Architecture: Linux Kernel, Native User space, Dalvik VM, Java Runtime Libraries, System Services, Inter-Process Communication, Binder, Android Framework Libraries, Applications. **Android's Security Model:** Application Sandboxing, Permissions, Code Signing and Platform Keys, Multi-User Support, SELinux, System Updates, Verified Boot.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. define Linux Kernel, java runtime libraries and various services
2. outline the Inter-Process Communication and binder
3. present the Android Framework Libraries
4. explain Security model features and applications.
5. present the multi user support and updates
6. summarize the android architecture and its security model

Module II: Number of hours(LTP) 6 3 0

Package Management: Android Application Package Format, Code Signing, APK Install Process, Package Verification. **User Management:** Multi-User Support Overview, Types of Users, Command-Line Tools, User States and Related Broadcasts, User Metadata, User System Directory, Per-User Application Management, External Storage, Other Multi-User Features.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. explain the package format and verification for android applications
2. illustrate the APK install process
3. outline the types of users and their states.
4. define the user metadata and its system directory
5. explain the storage requirement for user management.

Module III: Number of hours(LTP) 6 3 0

Cryptographic Providers: JCA Provider Architecture, JCA Engine Classes, Android JCA Providers, Using a Custom Provider. **Network Security and PKI**: PKI and SSL Overview, JSSE Introduction, Android JSSE Implementation. **Credential Storage:** VPN and Wi-Fi EAP Credentials, Credential Storage Implementation, Public APIs

Learning Outcomes:

After completion of this unit, the student will be able to:
1. explain the working flow of JCA provider
2. overview of PKI, SSL and JSSE
3. illustrate network security using android JSSE implementation
4. present various credential information for VPN and Wi-Fi EAP

Module IV: Number of hours(LTP) 6 3 0

Online Account Management: Android Account Management Overview, Account Management Implementation, Google Accounts Support. **Enterprise Security:** Device Administration, VPN Support, Wi-Fi EAP. **Device Security:** Controlling OS Boot-Up and Installation, Verified Boot, Disk Encryption. Screen Security, Secure USB Debugging, Android Backup.

Learning Outcomes:

After completion of this unit, the student will be able to:
1. explain how to manage online android account
2. illustrate account management application using google account support
3. presents the security issues in VPN and Wi-Fi EAP
4. explain the OS Boot-Up security

Module V: Number of hours(LTP) 6 3 0

NFC and Secure Elements: NFC Overview, Secure Elements, Software Card Emulation SELinux, SELinux Introduction, Android Implementation, Android 4.4 SELinux Policy
System Updates and Root Access: Bootloader, Recovery, Root Access, Root Access on Production Builds.

Learning Outcomes:

After completion of this unit, the student will be able to:
1. define the NFC, SELinux
2. explain the secure elements in NFC and Various SELinux policies
3. present the system updates, recovery in Bootloader
4. illustrate root access on production builds

Text Books(s)
1. Nikolay Elenkov, "An In-Depth Guide to Android's Security Architecture", October 2014.

Reference Book(s)
1. Karim Yaghmour, "Embedded Android", O'Reilly Media, Inc., 2013, 412 pp; WSU Safari Books Online 9781449327958
2. Joseph Annuzzi, Jr., Lauren Darcey, Shane Conder, "Introduction to Android Application Development: Android Essentials", Fourth Edition, Addison-Wesley Professional, 2013

Course Outcomes:
1. To understand Android architecture and its process
2. To understand the fundamentals of package and user management
3. To overview the network security and its credential storage implementation
4. To incorporate the security in online account management
5. To understand secure elements in NFC and system updates.

19EDS441: Health Analytics

L	T	P	C
2	1	0	3

The ability to understand, analyze, and interpret businesses from data has become increasingly important in the healthcare area. Big data analytics is becoming central to the healthcare industry, both regarding delivering effective outcomes and controlling escalating costs. Health analytics encompasses the technologies and skills used to deliver business, clinical, and programmatic insights into the complex interdependencies that drive medical outcomes, costs, and oversight. Through modeling, optimization, predictive analytics, and business intelligence, organizations can gain insights to strengthen financial and budgetary performance, deepen consumer-centric relationships and improve the way healthcare is conceived and delivered for better outcomes across the entire spectrum of health industries

Course objectives:

1. To explore the various forms of electronic health care information.
2. To learn the techniques adopted to analyse health care data.
3. To understand the predictive models for clinical data
4. Apply analytical methods and tools to solve selected healthcare problems

Module I: Number of hours(LTP) 8 0 0

Introduction: Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges- Phenotyping Algorithms.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Discuss the type of healthcare dataset(s) used in healthcare

Module II: Number of hours(LTP) 7 0 0

Analysis: Biomedical Image Analysis- Mining of Sensor Data in Healthcare- Biomedical Signal Analysis- Genomic Data Analysis for Personalized Medicine.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand how data is organized to facilitate analysis in the healthcare setting.

Module III: Number of hours(LTP) 9 0 0

Analytics: Natural Language Processing and Data Mining for Clinical Text- Mining the Biomedical-Social Media Analytics for Healthcare.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Analyze the role of Natural Language Processing (NLP) in healthcare
2. Examine social media and analysis for healthcare analytics

Module IV: Number of hours(LTP) 11 0 0

Advanced Data Analytics: Advanced Data Analytics for Healthcare– Review of Clinical Prediction Models- Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive Models for Integrating Clinical and Genomic Data- Information Retrieval for Healthcare- Privacy-Preserving Data Publishing Methods in Healthcare.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Integrate advanced data analysis techniques with public health practices to facilitate effective decision making
2. Discuss visual analytics for healthcare

Module V: Number of hours(LTP) 10 10 0

Applications: Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Examine data analytics for fraud detection in healthcare
2. Discuss data analytics for pharmaceutical discoveries

Text Books(s)

1. Chandan K. Reddy and Charu C Aggarwal, "Healthcare data analytics", Taylor & Francis, 2015

Reference Book(s)

1. Hui Yang and Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement", Wiley, 2016.
2. Christo El Morr Hossam Ali-Hassan Analytics in Healthcare A Practical Introduction

Course Outcomes:

1. Analyse health care data using appropriate analytical techniques.
2. Apply analytics for decision making in healthcare services.
3. Apply data mining to integrate health data from multiple sources and develop efficient clinical decision support systems.

19ECS459: BLOCKCHAIN TECHNOLOGY

	L	**T**	**P**	**C**
	2	1	0	3

The course enables learners to grasp the concepts of Blockchain Technologies underlying cryptocurrency creation, smart contracts, transactions, storage, verification mechanisms. Cryptography foundation and consensus algorithms for creation of blockchains are elaborated in the course. Bitcoin, Etherium protocols are introduced with practice. Transformation of traditional businesses with blockchains is illustrated through examples.

Course objectives:

1. Understand concepts of blockchain technology
2. Acquire knowledge of bitcoin, Etherium protocols
3. Learn to program and implement Blockchain
4. Develop blockchain applications
5. Analyse blockchain use cases

Module I:	Blockchain Fundamentals	Number of hours(LTP)	6	3	0

Tracing blockchain Origin: The Double Spend problem, Byzantine Generals' Computing Problems. Blockchain concepts: How Blockchain works, Centralization vs. Decentralization, Distributed Consensus, Consensus without identity using a blockchain, Incentives and proof of work, Cryptocurrency, NFTs, Mining.
Types of blockchains: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains. Blockchain Vulnerabilities.

Lab:
Blockchain Case study analysis (identification and learning of tools for blockchain implementation) Creation of sample blocks to understand blockchain concepts.

- How Blockchain Works: https://andersbrownworth.com/blockchain/
- Build a Blockchain in Python: https://www.activestate.com/blog/how-to-build-a-blockchain-in-python/

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand the origin and motivation behind blockchain implementation (L1)
2. Interpret different blockchain concepts (L2)
3. Illustrate the essential components of a blockchain platform. (L3)
4. Analyse blockchain technology impact on traditional applications (L4)
5. Develop roadmap for blockchain implementation(L5)

Module II:	Cryptography and types of consensus algorithms for Blockchain	Number of hours(LTP)	6	3	0

Cryptographic Hash Functions, SHA256, Hash Pointers and Data Structures, Merkle tree, Distributed Ledger.
Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof of Elapsed Time.

Lab: Generate Hash Using Hash function, Working of Distributed Ledger, Working of Blockchain Transaction, Create Blockchain Network. Explore consensus mechanisms
Using the Basic Blockchain, students can implement some projects on top of it.
https://www.activestate.com/blog/how-to-build-a-blockchain-in-python/

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand relationship between Cryptography and blockchain (L1)
2. Distinguish different Cryptographic methods(L2)
3. Learn to use different types of Consensus algorithms (L3)
4. Analyse requirements to implement Securing Messages (L4)
5. Develop sample application with hashing and consensus algorithms(L5)

Module III:	Bitcoin Blockchain	Number of hours(LTP)	6	3	0

Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model:
How does Bitcoin work? What makes Bitcoin different? How secure are Bitcoins?
Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Bitcoin network, Bitcoin Mining, Bitcoin Wallets.
Cryptocurrency Regulations

Lab: Understand/ Install a Software Wallet, Generate a Paper Wallet/Web Wallet, Review and Analyse a Bitcoin Block on Explorer, Analyse a Bitcoin Transaction, Understand/ conduct a Transaction Using Electrum Wallet

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand relationship between bitcoin and blockchain (L1)
2. Distinguish different bitcoin terminologies(L2)
3. Illustrate bitcoin mechanism (L3)
4. Analyse requirements to implement bitcoin transactions (L4)
5. Develop roadmap for secure bitcoin implementation(L5)

Module IV:	Etherium Blockchain and DApps	Number of hours(LTP)	6	3	0

Etherium Blockchain: Smart Contracts: Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract; Ethereum Structure, Operations, Consensus Model, Incentive Model
Introduction to Ethereum Higher-Level Languages, DApps: Distributed Application development.

Lab: Building A Simple Smart Contract with Solidity, Solc-Compiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.
(Or using Viper -
Smart Contracts in Vyper: https://vyper.readthedocs.io/en/stable/
Learn Vyper: https://learnxinyminutes.com/docs/vyper/
Vyper Examples: https://github.com/vyperlang/vyper/tree/master/examples)
Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand Etherium Protocol (L1)
2. Distinguish different smart contracts(L2)
3. Illustrate the essential components of Etherium (L3)
4. Analyse requirements to implement smart contract (L4)
5. Use the working of an immutable distributed ledger and trust model that defines blockchain. (L5)

Module V:	Open source Blockchains, Use cases of Blockchain	Number of hours(LTP)	6	3	0

Traditional Blockchain Challenges: Security, Performance perspectives.
Introduction to Hyperledger (Linux Foundation), NFTs

New generation blockchain platforms: Solana, Flow, Avalanche, Cosmos, Polkadot, Corda, Openchain, Multichain blockchains
Block Chain Use cases in Healthcare, Government, Finance, Supply Chain, Food traceability, Water Management
Lab: Decentralized app creation: Creating a Hospital Smart Contract / Banking application/ any other domain specific smart contract
Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand various open source blockchain technologies (L1)
2. Distinguish different operating models of open source technologies(L2)
3. Relate the shortcomings of blockchain technology and their corresponding solutions(L3)
4. Develop abilities to build a smart contract in a particular domain(L4)
5. Design and develop a cryptocurrency based application(L5)

Text Books(s)

1. Manav Gupta, BlockChain for dummies, 2nd IBM Limited Edition, Published by John Wiley & Sons, Inc, 2018.
2. Andreas M. Antonopoulos, Mastering Bitcoin: Programming the Open Blockchain, O'Reilly Media, 2/e, 2017.
3. Andreas Antonopoulos and Gavin Wood Mastering Ethereum: Building Smart Contracts and Dapps
Shroff Publisher/O'Reilly Publisher, 2018
4. Imran Bashir, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, Packt Publishing (2017).

Reference Book(s)

1. Melanie Swan ,Blockchain: Blueprint for a New Economy, O'Reilly Media, 1/e, 2015.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies, 2016.
3. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing. 2018
4. Tiana Laurence, Blockchain for Dummies, 2nd Edition, John Wiley & Sons, 2019
5. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House, 2018

Online Resources:

1. https://www.coursera.org/specializations/blockchain
2. https://nptel.ac.in/courses/106105184/
3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview
4. https://www.edx.org/course/blockchain-and-fintech-basics-applications-andlimitations

Course Outcomes:

1. Distinguish between different types of blockchain platforms.
2. Understand the working and importance of smart contracts.
3. Develop blockchain based application.
4. Apply blockchain technology to provide solutions to some real-life problems.
5. Understand the security and performance perspective of blockchain technology.

YouTube Links and Other web references

- ✓ Blockchain: What It Is, What It Isn't, and What It Means for The Produce Industry https://www.pma.com/content/articles/blockchain

- ✓ Learn Web3

https://questbook.notion.site/Questbook-Learn-Web3-a5f4be8b107f4647a91fe84e6aa7e722

- ✓ What is Etherium
  https://ethdocs.org/en/latest/introduction/what-is-ethereum.html
- ✓ Introduction to Smart Contracts — Solidity 0.7.0 documentation
  https://solidity.readthedocs.io/en/v0.7.0/introduction-tosmart-contracts.html
- ✓ How Smart Contracts Will Change the World | Olga Mack | TEDxSanFrancisco
  (17 minutes. Smart Contracts starts at about 6 minute mark)
  https://www.youtube.com/watch?v=pA6CGuXEKtQ
- ✓ Ethereum Tutorial For Beginners
  https://www.youtube.com/watch?v=uneCaqD6Etk

- ✓ How Bitcoin Works in 5 Minutes (Video, YouTube, 5 minutes)
  https://www.youtube.com/watch?v=l9jOJk30eQs

- ✓ What is an NFT? — properties of blockchain-based non-fungible tokens
  by Devin Finzer
  https://opensea.io/blog/guides/non-fungible-tokens/#What_is_a_non-fungible_token
- ✓ Create a NFT Minting Website:
  https://openquest.xyz/?github_url=https://raw.githubusercontent.com/vamsisol/create_candy_machine_for_minting_nft/main
- ✓ How to Mint a Pokemon on Solana:
  https://openquest.xyz/?github_url=https://raw.githubusercontent.com/vamsisol/create_nft_minting_website/main

- ✓ What is Hyperledger
  https://www.youtube.com/watch?v=Y177TCUc4g0

- ✓ What is Corda? | Enterprise Blockchain
  https://www.youtube.com/watch?v=FHfZ5X7qn1I

- ✓ Openchain for Blockchain
  https://www.blockchain-council.org/blockchain/openchain-technology-features-working/

- ✓ Multichain for Blockchain
  https://www.multichain.com/developers/
- ✓ BLOCKCHAIN TECHNOLOGY IN THE DEPARTMENT OF DEFENSE
  https://calhoun.nps.edu/handle/10945/61355

- ✓ How blockchain will kill fake news (and four other predictions for 2020)
  https://www.computerworld.com/article/3481633/howblockchain-will-kill-fake-news-and-four-other-predictionsfor-2020.html

- ✓ 8 Reasons why crypto art > art — and the new economy of digital creativity
  by Scott Belsky
  https://scottbelsky.medium.com/the-furry-lisa-cryptoart-the-new-economy-of-digital-creativity-6cb2300ea081

19EIO441: IoT for Industries

L	T	P	C
2	0	2	3

This course provides the learner to assess, select and customize communication and networking technologies for IoT applications across Industries. In this course, the leaner will develop a deeper understanding of the IoT protocols for Industries that require data generated or acquired across geographically dispersed components to be processed collaboratively which is achieved using appropriate communication systems and networks. The learner gains insights into the characteristics of the complementary and competing technologies, analyses vulnerabilities and design network solutions for Industrial IoT.

Course objectives:

1. Students will learn the new evolution in hardware, software, and data.
2. While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.
3. Students acquire upcoming Industrial IoT: Roadmap to the Connected World Course offers important insights on overcoming the challenges and thrive in this exciting space.

Module I: Number of hours(LTP) 6 0 6

Introduction & Architecture: What is IIoT and connected world? the difference between IoT and IIoT, Architecture of IIoT, IoT node, Challenges of IIOT.

Learning Outcomes:

After completion of this unit, the student shall be able to:

1. Sketch the communication architecture for Industrial Internet of Things (L2)
2. Interpret the impact and challenges posed by IoT networks in Industries leading to new architectural models (L2)
3. Compare and contrast the deployment of smart objects and the technologies used to connect them to network (L2)

Module II: Number of hours(LTP) 6 0 6

IIOT Components: Fundamentals of Control System, introductions, components, closed loop & open loop system, Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basic Sensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the working of various devices like sensors, actuators, and various processing paradigms for IIoT (L2)
2. Compare and assess different network models and techniques of IoT systems (L2)
3. Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security. (L3)

Module III: Number of hours(LTP) 6 0 6

Communication Technologies of IIoT: Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID Industry standards communication technology (LoRAWAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network communication.

Learning Outcomes: After completion of this unit, the student will be able to:

1. List common communication protocols of Industrial IoT (L1)
2. Experiment relevant communication protocols to design and deploy applications (L3)
3. Demonstrate the use of wireless technologies for IoT (L5)

Module IV: Number of hours(LTP) 6 0 6

Visualization and Data Types of IIoT: Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud data base, Could computing, Fog or Edge computing, Programmable logic controller (PLC), Real-time control system.

Learning Outcomes: After completion of this unit, the student will be able to:

1. Compare and contrast relevant protocols (L2)
2. Describe networking technologies (L2)
3. Examine technological developments that will likely shape the industrial landscape in the future (L3)

Module V: Number of hours(LTP) 6 0 6

Applications: Health monitoring, Iot smart city, Smart irrigation, Robot surveillance, UAV, Autonomous Vehicles.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand how to develop and implement own IoT technologies, solutions, and applications (L2)
2. At the end of the program, students will be able to understand how to develop and implement their own IoT technologies, solutions, and applications (L2)
3. Demonstrate the application of REST APIs in IoT environment (L3)

Text Books(s)

1. Industrial Internet of Things: Cybermanufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
2. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

Reference Book(s)

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)

Course Outcomes:

CO-1: Explain the fundamental communication architectures and networking concepts of Industrial IoT (L2)

CO-2: Identify and describe the basic concepts of networking devices in Industries (L2)

CO-3: Compare and assess different network models and techniques of Industrial IoT systems (L2)

CO-4: Describe the working of different protocols at different layers (L2)

CO-5: Demonstrate the application of different fields under the subset of Industrial IoT environment (L3)

List of Experiments:

1. Introduction to Arduino, ESp8266, Introduction to raspberry Pi.
2. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
3. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.
4. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.
5. Establish RFID communication.
6. Demonstration of MQTT communication.
7. Demonstration of LoRa communication.
8. Demonstrate gateway architecture.
9. Demonstrate K-Map clustering for different nodes.
10. Device control using CoAP.
11. Home Appliances Control Using Blynk Application

19EIO443 : IoT Technologies and Applications

L	T	P	C
2	0	2	3

This course provides the learner to assess, select and customize networking technologies for IoT applications across a broad spectrum of domains. In this course, the leaner will develop a deeper understanding of the IoT applications that require data generated or acquired across geographically dispersed components to be processed collaboratively which is achieved using appropriate communication systems and networks. The learner gains insights into the characteristics of the complementary and competing technologies, analyses vulnerabilities and design network solutions.

Course objectives:

1. To understand about the fundamentals of Internet of Things and its building blocks along with their characteristics
2. To understand the recent application domains of IoT in everyday life
3. To understand the protocols and standards designed for IoT and the current research on it.
4. To understand the other associated technologies like cloud and fog computing in the domain of IoT
5. To develop the skills and analyse the working of applications at different layers.

Module I: Number of hours(LTP) 6 0 6

What is IoT, IoT Network Architecture and Design, Drivers Behind New Network Architectures, The Core IoT Functional Stack, IoT Data Management and Compute Stack, IoT Protocol Stack.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Sketch the communication architecture for Internet of Things (L2)
2. Interpret the impact and challenges posed by IoT networks leading to new architectural models (L2)
3. Compare and contrast the deployment of smart objects and the technologies used to connect them to network (L2)

Module II: Number of hours(LTP) 6 0 6

Protocol Standardization for IoT –Efforts –M2M and WSN Protocols –SCADA and RFIDProtocols, WebSocket, XMPP Extensible Messaging and Presence Protocol, CAoP: Constrained Application Protocol (CoAP), MQTT: MQ Telemetry Transport (MQTT).

Learning Outcomes:

After completion of this unit, the student will be able to:

1. List common communication technologies of IoT (L1)
2. Experiment relevant communication protocols to design and deploy applications (L3)
3. Demonstrate the use of wireless technologies for IoT (L5)

Module III: Number of hours(LTP) 6 0 6

IEEE 802.15.4e, IEEE 802.11 ah, WirelessHART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, LTE-A, DASH7,HomePlug, G.9959, LoRaWAN

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Compare and contrast relevant protocols (L2)
2. Describe networking technologies (L2)
3. Explain security solutions for different applications requirements (L2)

Module IV: Number of hours(LTP) 6 0 6

RPLRouting Protocol for Low-Power and Lossy Networks, CORPLcognitive RPL, CARPChannel-Aware Routing Protocol (CARP) Encapsulation Protocols: 6LoWPAN, 6TiSCH, 6Lo, IPv6 over G.9959, IPv6 over Bluetooth Low Energy

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Compare and assess different network models and techniques of IoT systems (L2)
2. Explain and analyse different Network Layer Routing Protocols And Encapsulation Protocols (L3)
3. Interpret Real Time Iot Communication Protocols and Its Use Cases (L2)

Module V: Number of hours(LTP) 6 0 6

IoT applications: Future Factory Concepts, VANeT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT-Agriculture, smart city, smart grids.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. The students will be thorough about the technology behind the IoT and associated technologies
2. The students will be able to use the IoT technologies in practical domains of society
3. The students will be able to gain knowledge about the state of the art methodologies in IoT application domains.

Text Books(s)

1. "Designing the Internet of Things" by Adrian McEwen, Hakim Cassimally, ISBN: 978-1-118-43062-0
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

Reference Book(s)

1. Rolando Herrero, Fundamentals of IoT Communication Technologies, Springer publisher, 1st edition, 2022
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)
3. Olivier Hersent, David Boswarthick and Omar Elloumi, *The Internet of Things: Key applications and Protocols*, Wiley

Course Outcomes:

1. Discuss the Principle of IoT and apply on connected devices
2. Analyze architectural view of communication protocols
3. Categorize the Routing Protocols and apply in IoT Application
4. Demonstrate the communication protocols in IoT
5. Applications and key area of communication protocols in real time

List of Experiments:

1. Introduction to Arduino, ESp8266, Introduction to raspberry Pi.
2. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
3. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.
4. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.
5. Establish RFID communication with a gateway (preferably raspberry Pi).
6. Demonstrate gateway architecture.
7. Demonstrate LEACH clustering for different nodes.
8. Demonstration of MQTT communication.
9. Device control using mobile Apps or through Web pages.
10. Demonstrate an application using CoAP.

19ECS443: Natural Language Processing

L	T	P	C
2	0	2	3

Ability to understand and interpret complex language utterances is a crucial part in design of intelligent agents. Natural language processing is the sub-field of linguistics and computer science which helps in interpreting the human language by a machine. More specifically, natural language processing is the computer understanding, analysis, manipulation, and/or generation of natural language. This course enables the students to learn Natural language processing at different levels like Morphological Level, Syntactic Level, Semantic Level, Discourse Level and Pragmatic Level.

Course objectives:

1. To understand the architecture and design of Natural language processing
2. To analyse various tagging techniques
3. To adopt concepts of Context free grammars for NLP
4. To provide knowledge on semantic properties of embeddings
5. To implement and learn the applications like sentiment analysis

Module I: Number of hours (LTP) 6 0 6

Introduction to natural language processing, ambiguities in language, Regular expression, words, morphology, morphology parsing, word tokenization, lemmatization & stemming, edit distance. N-grams language models, smoothing-Laplace smoothing, Good-Turing discounting, Interpolation-Backoff, and perplexity

Learning Outcomes:

After completion of this unit, the student will be able to:

1. acquire a basic understanding of the natural language processing (L2)
2. have the understanding of tokenization. (L2)
3. explain lemmatization and stemming (L2)
4. differentiating smoothing and Laplace smoothing(L4)
5. illustrate Good Turing discounting (L2)

Module II: Number of hours (LTP) 6 0 6

Introduction, English word classes, tagsets in English, rule-based part of speech tagging, HMM part of speech tagging, transformation-based part of speech tagging, Evaluation and error analysis, Issues- tag indeterminacy and tokenization, Unknown words

Learning Outcomes:

After completion of this unit, the student will be able to:

1. experiment with tagging (L3)
2. make use of the part of speech tagging(L3)
3. outline the knowledge of issues of tagging (L2)
4. understand tag indeterminacy (L2)
5. make use of evolution and error analysis(L3)

Module III: Module Name (if any) Number of hours (LTP) 6 0 6

Syntactic Parsing, Ambiguity, CKY parsing, Early parsing, probabilistic context free grammar, PCGFS for language modelling, Probabilistic CKY parsing of PCFGs, ways to learn rule probability, Problems with PCFGs

Learning Outcomes:

After completion of this unit, the student will be able to:

1. understand the problems with PCFGs (L2)
2. visualize probabilistic CKY parsing (L3)
3. experiment with context free grammar(L3)
4. apply rule of probability (L3)

5. define parsing(L1)

Module IV: Number of hours (LTP) 6 0 6

Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, word2Vec, Visualizing Embeddings, semantic properties of embeddings, bias and embeddings, Evaluating vector models.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. apply lexical semantics (L3)
2. understand semantic properties of embeddings (L2)
3. illustrate cosine similarity (L2)
4. differentiate between lexical and vector semantics (L2)
5. explain about how to evaluate vector models (L2)

Module V: Discourse Analysis Number of hours (LTP) 6 0 6

Coreference Resolution - Text Coherence - Discourse Structure, word sense disambiguation, semantic role labelling. Machine Translation -Transfer Metaphor–Interlingua- Statistical Approaches- IBM1 model. Application of NLP: Sentiment classification, Text summarization and Factoid Question Answering

Learning Outcomes:

After completion of this unit, the student will be able to:

1. have a basic understanding of discourse coherence (L2)
2. have the understanding disambiguation (L2)
3. infer co-reference resolution (L2)
4. understanding sentiment classification (L2)
5. make use of NLP for text summarization (L3)

Text Books(s)

1. Daniel Jurafsky, James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2/e, Prentice Hall, 2008.
2. C. Manning, H. Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, MA, 1999.
3. Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press, 2019.

Reference Book(s)

1. Jalaj Thanaki, Python Natural Language Processing: Explore NLP with machine Learning and deep learning Techniques, Packt, 2017.

Course Outcomes:

1. Understand the morphology, morphology parsing, word tokenization, lemmatization & stemming
2. Understand the concepts tag indeterminacy and tokenization
3. Apply various parsing techniques for natural language processing processors
4. Distinguish and apply lexical and vector semantics to design word embeddings
5. Design a statistical model for IBM1 and sentimental analysis

19ECS352: IMAGE PROCESSING

L	T	P	C
2	0	2	3

This course, image processing, emphasizes on an area of information science and engineering whose importance is growing with a wide range of applications. Image processing deals with processing of images which are digital in nature and provides basic concepts, methodologies and algorithms of digital image processing focusing on the major problems concerned with digital images.

Course objectives:

- To study the fundamental concepts involved in Digital Image Processing
- To implement image enhancement techniques in spatial domain.
- To implement image enhancement techniques in frequency domain.
- To work with various image compression techniques.
- To understand morphological and segmentation techniques.

UNIT I: Introduction 8 L

Digital image representation, fundamental steps in digital image processing, elements of digital image processing systems. Digital Image Fundamentals: Elements of visual perception, a simple image model, image sensing and acquisition, image sampling and quantization, basic relationships between pixels, mathematical operations used in digital image processing.

Learning Outcomes:

After completion of this unit, the student will be able to:

- learn creation and manipulation of digital images (L3).
- describe different modalities and techniques in image acquisition (L2).
- describe the ways of representing digital images and storing it efficiently depending on the desired quality (L4).
- learn the representation of images in two-dimensional data form (L2).

UNIT II: Image Enhancement in Spatial Domain and Fourier Transform 8 L

Image Enhancement in Spatial Domain: Basic intensity transformation, histogram processing, histogram equalization, histogram matching, fundamentals of spatial filtering, smoothing filters, sharpening filters.

Fourier Transform: Discrete Fourier Transform (DFT) on one variable and two variables, Properties of DFT.

Learning Outcomes:

After completion of this unit, the student will be able to:

- use the mathematical principles of digital image enhancement (L3).
- apply the concepts of feature detection and shape finding algorithms (L3).
- enhance image characteristics by adjusting the image intensity and isolating the region of interest (L4).
- understand how block processing works and investigate the implementation of spatial domain filters(L2).

UNIT III: Image Enhancement in Frequency Domain 6 L

Image Enhancement in Frequency Domain: Basics of filtering in the frequency domain, smoothing filters, sharpening filters, homomorphic filters. Color Image Processing: Color fundamentals, color models, smoothing and sharpening.

Learning Outcomes:

After completion of this unit, the student will be able to:

- understand how block processing works and investigate the implementation of frequency domain filters (L2).
- reduce the effects of unwanted distortions, such as noise, blurring, and background illumination (L3).

- enhance image characteristics by adjusting the image intensity and isolating the region of interest (L4).

UNIT IV: Image Compression 6 L

Image Compression:. Image compression: Fundamentals, basic compression methods: Huffman coding, arithmetic coding, run length coding, LZW coding, contour coding, predictive coding,wavelet coding.

Learning Outcomes:

After completion of this unit, the student will be able to:

- understand the fundamental algorithms and how to implement them (L2).
- apply Image transforms used in digital image processing (L3).
- design and implement algorithms that perform basic image processing (L4).

UNIT V: Morphological Image Processing and Segmentation 8 L

Morphological Image Processing: Erosion and dilation, opening and closing, hit or miss transform morphological algorithms, grey level morphological processing.

Segmentation: Image Segmentation: Fundamentals, point, line, and edge detection, basic global thresholding, region-based segmentation, watersheds, image segmentation based on color.

Learning Outcomes:

After completion of this unit, the student will be able to:

- extract image features and measurements using different segmentation and edge detection methodologies (L4).
- familiar with Morphological Image Processing, Image Segmentation (L2).
- acquaint the representation and description of image processing techniques and object recognition (L4).

Text Books(s)

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image processing, 3/e, Pearson Education, 2009.

Reference Book(s)

1. B. Chanda, D. Dutta Majumder, Digital Image Processing and Analysis, PHI Publications, 2006.
2. A.K. Jain, Fundamentals of Digital Image Processing, PHI Publications, 2006.
3. Qidwai and Chen, Digital Image Processing, An algorithmic approach with MATLAB, Taylor & Francis,2010.
4. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing using MATLAB, TMH Publications, 2011.

Course Outcomes:

- illustrate the fundamental concepts involved in Digital Image Processing (L2).
- To implement image enhancement techniques in spatial domain (L3).
- To implement image enhancement techniques in frequency domain (L3).
- To analyse with various image compression techniques (L4).
- To apply morphological and segmentation techniques (L3).

For Laboratory courses: List of Experiments:

1. To create a program to display grayscale image using read and write operation.
2. To create a program to display basic image processing operations and histogram algorithms
3. To create a vision program for application of smoothening filters
4. To create a vision program to determine the edge detection of an image using different edge enhancement techniques.
5. To create a program which performs Discrete Fourier transform on image

6. To create a program to eliminate the high frequency components of an image.
7. To create a program for conversion of RGB image to CYK image using a color box
8. To create a program that performs Erosion and Dilation on an image
9. To create a program for coding a image using Huffman coding
10. To create a program for segmentation of an image using Region based technique

19ECF447: Intrusion Detection and Prevention Systems

L	T	P	C
2	1	0	3

An Intrusion Detection System (IDS) is a system that monitors network traffic for suspicious activity and issues alerts when such activity is discovered. It is a software application that scans a network or a system for the harmful activity or policy breaching. Any malicious venture or violation is normally reported either to an administrator or collected centrally using a security information and event management (SIEM) system. Intrusion Prevention System is a network security application that monitors network or system activities for malicious activity. Major functions of intrusion prevention systems are to identify malicious activity, collect information about this activity, report it and attempt to block or stop it.

Course objectives:

1. provide knowledge how to monitor network from harmful sources
2. learn different Intrusion Detection Systems for hosts and networks
3. design a strong Intrusion Prevention Systems
4. understand the different Intrusion Detection Systems architectures
5. analyse the alerts and predict future attacks

Module I: Number of hours(LTP) 6 3 0

Introduction to Intrusion

Attack taxonomies – Probes – Privilege Escalation Attacks – DoS and DDoS Attacks – Active attacks – Passive attacks - Malicious Attacks – Insider Attacks – Sniffer Attacks - Side Channel Attacks – Worm Attacks - Distributed Attacks - IDS types.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Identify whether attack occurred or not (L3).
2. Classify the attack and attack types (L4).
3. Illustrate intrusion detection system (L2).
4. Explain the IDS types (L2).

Module II: Number of hours(LTP) 6 3 0

Intrusion Detection Approaches and Systems

Detection approaches – Misuse detection – anomaly detection – specification-based detection – hybrid detection Theoretical Foundations of Detection: Taxonomy of anomaly detection system – fuzzy logic – Bayes theory – Artificial Neural networks – Support vector machine – Evolutionary computation – Association rules – Clustering

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Elaborate intrusion detection systems (L6).
2. Distinguish between detection approaches (L4).
3. Analyse data mining and machine learning approaches (L4).
4. Design IDS using the best approach (L6).

Module III: Number of hours(LTP) 6 3 0

Intrusion Detection and Prevention Technologies:

Host-based intrusion detection system (HIDS), Network-based IDS, Information Sources for IDS, Host and Network Vulnerabilities and Countermeasures. Intrusion detection techniques, misuse detection: pattern matching, rule-based and state-based anomaly detection: statistical based, machine learning based, data mining-based hybrid detection.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. List different intrusion detection techniques (L4).
2. Interpret the intrusion detection system for host or network (L5).
3. Determine information resources, vulnerabilities and countermeasures for IDS (L5).
4. Apply data mining and machine learning techniques for prevention systems (L3).

Module IV: **Number of hours(LTP) 6 3 0**

Intrusion Detection and Prevention Systems Architecture

Tiered architectures, Single-tiered, Multi-tiered, Peer-to-Peer. Sensor: sensor functions, sensor deployment and security. Agents: agent functions, agent deployment and security. Manager component: manager functions, manager deployment and security. Information flow in IDS and IPS, defending IDS/IPS, Case study on commercial and open-source IDS.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Choose a particular tiered architecture (L3).
2. Develop and deploy agent component (L6).
3. Develop and deploy manager component (L6).
4. Identify the information flow in IDS and IPS (L3).

Module V: **Number of hours(LTP) 6 3 0**

Alert Management and Correlation Data fusion:

Alert correlation, Pre-process, Correlation Techniques, Post-process, Alert Correlation architectures. Cooperative Intrusion Detection, Cooperative Discovery of Intrusion chain, Abstraction-based Intrusion Detection, Interest-based communication and cooperation, agent-based cooperation.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Outline the false alerts in IDS (L2).
2. Analyse the correlation function to identify attack (L4).
3. Explain different correlation techniques and their architectures (L2).
4. Classify approaches to cluster, merge and correlate alerts (L4).

Text Books(s)

1. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.
2. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

Reference Book(s)

1. Carl Enrolf, Eugene Schultz, Jim Mellander, "Intrusion detection and Prevention", McGraw Hill, 2004
2. Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall , 2001.
3. Ankit Fadia and Mnu Zacharia, "Intrusiion Alert", Vikas Publishing, Ltd, 2007.

Course Outcomes:

After completion of this course, the student will be able to:

1. Interpret different types of attacks and Intrusion Detection Systems (L5).
2. Analyse and apply data mining and machine learning approaches for detecting attacks (L4).
3. Apply different intrusion detection techniques for host and network systems (L3).
4. Determine IDPS architecture and deploy agent and manager components (L5).
5. Predict the upfront attack by correlating the alerts (L6).

19ECF449 : Threat Intelligence

L	T	P	C
2	1	0	3

Preamble/course introduction(Italics)

Threat intelligence can help organizations gain valuable knowledge about threats, build effective defense mechanisms and mitigate the risks that could damage their bottom line and reputation. After all, targeted threats require targeted defense, and threat intelligence delivers the capability to defend more proactively.

Course objectives:

1. IIntroduce the concepts of threat intelligence and its life cycle.
2. Learn threat intelligence for security operations and incident response.
3. Know about how to Identify and create intelligence requirements through practices such as threat modeling.
4. Understand and develop skills in tactical, operational, and strategic-level threat intelligence.
5. Generate threat intelligence to detect, respond to, and defeat focused and targeted threats.

Module I: Number of hours(LTP) 6 3 0

What Is Threat Intelligence?: What Have You Heard About Threat Intelligence?, Why Is Threat Intelligence Important?, Who Can Benefit From Threat Intelligence?, Data and Information Are Not Intelligence, Two Types of Threat Intelligence, Operational Threat Intelligence, Strategic Threat Intelligence, The Role of Threat Data, Feeds, The Role of Private Channels and the Dark Web; **The Threat Intelligence Lifecycle:** The Six Phases of the Threat Intelligence Lifecycle, Direction, Collection, Processing, Analysis, Dissemination, Feedback, Tools and People.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain why threat intelligence is important. (L2)
2. Describe operational and strategic threat intelligence. (L2)
3. Explore the role of threat feeds and the value of monitoring private channels. (L2)
4. Examine the phases of the threat intelligence lifecycle. (L2)
5. Review sources of threat intelligence. (L2)

Module II: Number of hours(LTP) 6 3 0

Threat Intelligence for Security Operations: Responsibilities of the SOC Team, The Overwhelming Volume of Alerts, **Context Is King:** Triage requires lots of context, Use case: Correlating and enriching alerts, Improving the “Time to No”, Beyond Triage;

Threat Intelligence for Incident Response: Continuing Challenges; A skills gap; Too many alerts; too little time; Time to response is rising; A piecemeal approach; The Reactivity Problem; **Minimizing Reactivity in Incident Response:** Identification of probable threats, Prioritization; Strengthening Incident Response With Threat Intelligence; **Threat Intelligence in Action:** Use case: Prepare processes in advance, Use case: Scope and contain incidents; **Essential Characteristics of Threat Intelligence:** for Incident Response, Comprehensive, Relevant, Contextualized, Integrated.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the value of context for improving triage. (L2)

2. Describe how threat intelligence can lead to less wasted time and better decisions by the SOC team. (L2)
3. Learn how threat intelligence can minimize reactivity. (L2)
4. Review characteristics of threat intelligence solutions that make them effective for meeting incident response challenges. (L2)
5. Analyze use cases for using threat intelligence for incident response. (L2)

Module III: Number of hours(LTP) 6 3 0

Threat Intelligence for Vulnerability Management: The Vulnerability Problem by the Numbers: Zero day does not mean top priority, Time is of the essence; **Assess Risk Based on Exploitability:** Severity ratings can be misleading; **The Genesis of Threat Intelligence:** Vulnerability Databases: Exploitability versus exploitation, Next week versus now; **Threat Intelligence and Real Risk:** Internal vulnerability scanning, Risk milestones for vulnerabilities, Understanding the adversary; Sources of Intelligence; Use Case: Cross-Referencing Intelligence; Bridging the Risk Gaps Between Security, Operations, and Business Leadership. **Threat Intelligence for Security Leaders: Risk Management:** Internal data is not enough, Sharpening the focus; **Mitigation: People, Processes, and Tools:** Early warnings; Investment; Communication; Supporting Security Leaders; The Security Skills Gap; Intelligence to Manage Better.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. List the current challenges in addressing vulnerabilities based on actual risk. (L2)
2. Describe how vulnerability intelligence delivers insights into threat actor behaviors. (L2)
3. Explain how risk-based intelligence streamlines the operational elements of vulnerability management. (L2)
4. Describe how threat intelligence helps mitigate the security skills gap. (L2)
5. Identify various risk mitigation tools. (L2)

Module IV: Number of hours(LTP) 6 3 0

Threat Intelligence for Risk Analysis: The FAIR Risk Model: Measurements and transparency are key; Threat Intelligence and Threat Probabilities; Threat Intelligence and the Cost of Attacks; **Threat Intelligence for Fraud Prevention:** Stand and Deliver; Know Your Enemy; **Criminal Communities and the Dark Web:** Gated communities, A strength — and a weakness; **Connecting the Dots for Fraud Prevention:** Use case: Payment fraud, Use case: Compromised data, Use case: Typosquatting and fraudulent domains.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the value of risk models like the FAIR framework. (L2)
2. Enlist right and wrong ways to gather data about risk. (L2)
3. Describe threat intelligence role in providing hard data about attack probabilities and costs. (L2)
4. Discuss how cybercriminals organize themselves to execute fraud and extortion. (L2)

5. List types of cyber fraud you can combat by applying relevant threat intelligence. (L2)

Module V: Number of hours(LTP) 6 3 0

Third-Party Risk Looms Large; Traditional Risk Assessments Fall Short; **Three Things to Look for in Threat Intelligence:** Automation and machine learning, Real-time updates to risk scores, Transparent risk assessments; Responding to High Third-Party Risk Scores; **Threat Intelligence for Digital Risk Protection:** Being Online Is Being at Risk; Types of Digital Risk; Uncovering Evidence of Breaches on the Web; Uncovering Evidence of Brand Impersonation and Abuse; Critical Qualities for Threat Intelligence Solutions.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Explain the impact of increasing third-party risk. (L2)
2. Discuss why static assessment of third-party risk falls short. (L2)
3. Describe use of real-time and automated threat intelligence is the best way to mitigate third-party risk. (L2)
4. Explain how threat intelligence identifies many types of digital risk so they can be remediated. (L2)
5. Enlist critical qualities for threat intelligence solutions. (L2)

Text Books(s)

1. Zane Pokorny, The Threat Intelligence Handbook: Moving Toward a Security Intelligence Program", 2nd Edition, CyberEdge Group, 2019

Coursera Courses:

1. https://www.coursera.org/learn/ibm-cyber-threat-intelligence

Reference Book(s)

1. Ali Dehghantanha, Mauro Conti, Tooska Dargahi, Cyber Threat Intelligence, Springer, 2018.
2. The Threat Intelligence Handbook: A Practical Guide for Security Teams to Unlocking the Power of Intelligence, CyberEdge Group, 2018.
3. www.cyber-edge.com

Course Outcomes:

CO-1: Define the basic concepts, terminology and Threat Intelligence life cycle. (L2)

CO-2: Discuss various applications and characteristics of Threat Intelligence. (L2)

CO-3: Examine Vulnerabilities, Risks, and Mitigation strategies. (L2)

CO-4: Explore fraud prevention systems and risk models. (L2)

CO-5: Review third-party risk and various forms of digital risks. (L2)

For tutorial classes: List of exercises.

1. An Overview of key security tools such as Firewalls, anti-virus and cryptography.
2. Perform Malware analysis using open source tools
3. Demonstrate Kill Chain Analysis
4. Overview of different intelligence sharing platforms (STIX, MISP)
5. Case study on Network Protocol Analyzers
6. Demonstration on SIEM Deployment

19ECS441: Information Retrieval Systems

L	T	P	C
2	0	2	3

The explosive growth of available digital information (e.g., Web pages, emails, news, scientific literature) demands intelligent information agents that can sift through all available information and find out the most valuable and relevant information. Web search engines, such as Google, Yahoo!, and MSN, are several examples of such tools. This course studies the basic principles and practical algorithms used for information retrieval and text mining. The contents includes: statistical characteristics of text, several important retrieval models, text categorization, recommendation system, clustering, information extraction, etc. The course emphasizes both the above applications and solid modeling techniques (e.g., probabilistic modeling) that can be extended for other applications.

Course objectives:

1. Introduce the terminologies and fundamentals of information retrieval systems.
2. Learn about information retrieval models.
3. Familiarize information retrieval evaluation and query languages.
4. Explore various query operations.
5. Understand indexing and searching operations employed in information retrieval systems.

Module I: Information to Information Retrieval Systems — Number of hours(LTP) 6 0 6

Motivation: Information versus Data Retrieval, Information Retrieval at the Center of the Stage. **Basic Concepts:** The User Task, Logical View of the Documents. **Past, Present, and Future:** Early Developments, Information Retrieval in the Library, The Web and Digital Libraries, Practical Issues. **The Retrieval Process**. **Introduction to modeling**; **A Taxonomy of Information Retrieval Models**; **Retrieval: Ad Hoc and Filtering**; **A Formal Characterization of IR Models**; **Classic Information Retrieval**: Basic Concepts, Boolean Model, Vector Model, Probabilistic Model, Brief Comparison of Classic Models.

Learning Outcomes:

After successful completion of this module the student shall be able to:

1. Differentiate between information retrieval and data retrieval. (L2)
2. Sketch the logical view of the documents in information retrieval systems. (L2)
3. Summarize the taxonomy of information retrieval models. (L2)
4. Describe formal characters of information retrieval models. (L2)
5. Enlist various classical information retrieval techniques. (L2)

Module II: Introduction to Modeling — Number of hours(LTP) 6 0 6

Alternative Set Theoretic Models: Fuzzy Set Model, Extended Boolean Model. **Alternative Algebraic Models**: Generalized Vector Space Model, Latent Semantic Indexing Model, Neural Network Model. **Alternative Probabilistic Models**: Bayesian Networks, Inference Network Model, Belief Network Model, Comparison of Bayesian Network Models, Computational Costs of Bayesian Networks, On the Impact of Bayesian Network Models. **Structured Text Retrieval Models**: Model Based on Non-Overlapping Lists, Model Based on Proximal Nodes. **Models for Browsing**: Flat Browsing, Structure Guided Browsing, The Hypertext Model.

Learning

Outcomes:
After completion of this module, the student shall be able to:

1. Discuss the set theoretic models used in informal retrieval models. (L2)
2. Explain algebraic models of information retrieval systems. (L2)
3. Summarize probabilistic models of information retrieval systems. (L2)
4. Comprehend structured text retrieval models of information retrieval systems. (L2)
5. Describe the working of browsing models. (L2)

Module III:	Information Retrieval Evaluation and Query Languages	Number of hours(LTP)	6	0	6

Introduction to Retrieval Evaluation; **Retrieval Performance Evaluation**: Recall and Precision, Alternative Measures. **Reference Collections**: The TREC Collection, The CACM and CISI, Collections, The Cystic Fibrosis Collection. **Introduction to Query Languages**; **Keyword Based Querying**: Single-Word Queries, Context Queries, Boolean Queries, Natural Language; **Pattern Matching**; **Structural Queries**: Fixed Structure, Hypertext, **Hierarchical Structures**: A Sample of Hierarchical Models, Discussion; Query Protocols

Learning
Outcomes:
After completion of this module, the student shall be able to:

1. Describe the retrieval performance evaluation techniques. (L2)
2. Identify techniques of reference collections. (L2)
3. Enlist various query languages and compare keyword based querying techniques.(L2)
4. Discuss pattern matching techniques. (L2)
5. Compare hierarchical information retrieval models. (L2)

Module IV:	Introduction to Query Operations	Number of hours(LTP)	6	0	6

Introduction; **User Relevance Feedback**: Query Expansion and Term Reweighting for the Vector Model, Term Reweighting for the Probabilistic Model, A Variant of Probabilistic Term Reweighting, Evaluation of Relevance Feedback Strategies. **Automatic Local Analysis**: Query Expansion Through Local Clustering, Query Expansion Through Local Context Analysis. **Automatic Global Analysis**: Query Expansion based on a Similarity Thesaurus, Query Expansion based on a Statistical Thesaurus.

Learning
Outcomes:
After completion of this module, the student shall be able to:

1. Illustrate the query expansion and reweighting for vector model. (L2)
2. Apply the query expansion and reweighting for vector model. (L3)
3. Describe the techniques employed for evaluation of feedback strategies. (L2)
4. Explain the working of automatic local analysis techniques. (L2)
5. Summarize the working of automatic global analysis techniques. (L2)

Module V:	Indexing and Searching	Number of hours(LTP)	8	0	6

Introduction to indexing and searching. **Inverted Files**: Searching, Construction. **Other Indices for Text:** Suffix Trees and Suffix Arrays: Structure, Searching, Construction in Main Memory, Construction of Suffix Arrays for Large Texts. **Signature Files**: Structure, Searching, Construction. Boolean Queries. **Sequential Searching**: Brute Force, Knuth-Morris-Pratt, Boyer-Moore Family, Shift-Or, Suffix Automaton, Practical Comparison, Phrases and

Proximity. **Pattern Matching: String Matching Allowing Errors:** Dynamic Programming, Automaton, Bit-Parallelism, Filtering. **Regular Expressions and Extended Patterns. Pattern Matching using Indices:** Inverted Files, Suffix Trees and Suffix Arrays, **Structural Queries, Compression:** Sequential Searching, Compressed Indexing.

Learning
Outcomes:

After completion of this module, the student shall be able to:

1. Describe the terminologies indexing, searching and construction of inverted files and compare different techniques used to index text. (L2)
2. Use various sequential pattern searching techniques. (L3)
3. Apply various pattern matching techniques. (L3)
4. Demonstrate application of regular expressions in pattern searching. (L3)
5. Discuss indexing techniques for compressed information. (L2)

Text Books(s)

1. Baeza-Yates and Ribeiro-Neto, Modern Information Retrieval , ACM Press, Addison-Wesley, New York, 1999.

Reference Book(s)

- C.J. van Rijsbergen, Butterworths, Information Retrieval, 1979 (second edition). on-line (http://www.dcs.gla.ac.uk/Keith/Preface.html)
- Richard, K. Belew, Finding Out About: Search Engine Technology from a cognitive Perspective, Cambridge University Press, 2000. On-line (https://cseweb.ucsd.edu/~rik/foa/)
- Robert R. Korfhage, Information Storage and Retrieval, John Wiley & Sons, 1997

Course Outcomes: After successful completion of the course the student shall be able to:

1. Explain the working of basic information retrieval models. (L2)
2. Describe various in advanced information retrieval models. (L2)
3. Comprehend and classify information retrieval evaluation systems and query languages. (L2)
4. Discuss different methods of evaluating feedback strategies. (L2)
5. Apply regular expressions to match simple and extended patterns. (L3)

19ECS344: MACHINE LEARNING

L	T	P	C
2	0	2	3

Machine Learning is a flourishing subject in Computer Science which devises models that can automatically learn from data and detect patterns from data. The applications of machine learningare diverse ranging from self-driven cars to disaster management systems. With easy availability of data from different devices and measurements, machine learning techniques become imperative in analysing trends hidden in the data. This course focuses on the major tasks of machine learning viz., supervised and unsupervised learning approaches that can robustly address data that is non-linear, noisy as well as high-dimensional in nature.

Course objectives:

- Objective 1: Introduce the concepts of machine learning and the complete process model for working with real data
- Objective 2: Impart the various approaches to supervised learning.
- Objective 3: Demonstrate unsupervised learning approaches.
- Objective 4: Illustrate the performance of ensemble models and familiarize with dimensionality reduction techniques
- Objective 5: Differentiate between shallow and deep neural networks.

Module I: Machine Learning Fundamentals 6L6P

Details of module I: **Machine Learning Fundamentals:** Use of Machine Learning, Types of machinelearning systems, machine learning challenges, testing and validating, working with real data, obtaining the data, visualizing the data, data preparation, training and fine tuning the model.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Identify different machine learning approaches and applications (L1)
- Demonstrate basic machine learning approach using real world data (L2)
- Use machine learning approach to train and fine tune a learner (L3)

Module II: Supervised Learning 6L6P

Supervised Learning: Classification, training a binary classifier, performance measures, multiclass classification, error analysis, multi label classification, multi output classification.

Linear Regression, Gradient Descent, Polynomial Regression, learning curves, regularized linear models, logistic regression.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Demonstrate various supervised learning approaches(L2)
- Describe classification techniques for real-time data. (L2)
- Apply regression to make good predictions (L3)

Module III: Unsupervised Learning 6L6P

Unsupervised Learning: Clustering, K-Means, Using clustering for image segmentation, Semi-supervised learning, DBSCAN, other clustering algorithms.

Gaussian Mixtures, anomaly detection, selecting number of clusters, Bayesian Gaussian Mixture Models, anomaly and novelty detection algorithms.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Illustrate various clustering techniques (L2)
- Construct Gaussian Mixture Models to implement anomaly detection (L3)

- Analyze suitability of different clustering techniques for real-time data (L4)

Module IV: Dimensionality Reduction&Ensemble Learning 6L6P

Dimensionality Reduction: The curse of dimensionality, main approaches for dimensionality reduction, PCA, Kernel PCA, LLE, other dimensionality reduction techniques.

Ensemble Learning: voting classifiers, bagging, random patches and random spaces, random forests, boosting, stacking.

Learning Outcomes:

After completion of this unit, the student will be able to:

- choose best features defining a dataset through dimensionality reduction (L3)
- apply PCA and its variants to find the significant feature subset (L3)
- compare the performance of ensemble learners to weak learners (L4)

Module V: Neural Networks&Deep Neural Networks 6L6P

Neural Networks: From biological to artificial neurons, implementing MLPs with Keras, fine tuning neural network hyperparameters.

Deep Neural Networks: Vanishing/Exploding Gradients Problem, reusing pretrained layers, faster optimizers, avoiding overfitting through regularization.

Learning Outcomes:

After completion of this unit, the student will be able to:

- Show the working of neural networks (L3)
- Differentiate between shallow and deep neural networks(L4)
- Evaluate the performance of deep neural networks on real time data (L5)

Text Books(s)

1 AurelionGeron, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools and Techniques to build Intelligent Systems, 2/e, O'Reilly Media, 2019.

Reference Book(s)

1. Tom M. Mitchell, Machine Learning, McGraw Hill, 2017.
2. EthemAlpaydin, Introduction to Machine Learning, 3/e, PHI, 2015.

Course Outcomes:

- Describe different machine learning categories (L2)
- Apply supervised learning approaches on real-time problems (L3)
- Utilize unsupervised learning approaches for applications such as anomaly detection(L3)Analyze ensemble models for performance improvement (L4)
- Estimate significant feature subset to handle high dimensionality issue (L5)Construct deep neural networks for computer vision applications (L6)

For Laboratory courses: List of Experiments:

1. Introduction to Python libraries- Numpy, Pandas, Matplotlib, Scikit-learn, Tensorflow andKeras.
2. Build classification models and evaluate performance measures on them.
3. Implement Linear Regression
4. Implement Logistic Regression
5. Apply unsupervised learning algorithms for Anomaly detection.
6. Demonstrate clustering on image segmentation application.
7. Build models using different ensemble models.
8. Tackle the curse of dimensionality by implementing PCA algorithm on a high dimensionaldataset.
9. Implement Multilayer Perceptron.
10. Implement Deep Neural Network for Computer Vision applications.

19EIO442: Edge Computing

L	T	P	C
2	1	0	3

This course will provide a foundational understanding of the Edge Computing technology. This course covers different topics such as Architecture, Middleware, Computing, different types of deployments, etc. This course will teach students how to do modeling and computing of data at edge devices and also how to integrate Fog, Cloud and IoT into Edge computing.

Course objectives:

1. Understand the hierarchy of edge computing environments, challenges and opportunities offered by Edge computing.
2. Understand the various middleware and modeling techniques for integrating the various cutting edge technologies
3. Familiarize the students with various applications and how to process data at the edge devices
4. Enable the students to create edge environment and do the modeling at the edge.

Module I: Number of hours(LTP) 9 0 0

Introduction to Fog and Edge Computing: Advantages of FEC: SCALE, How FEC Achieves, These Advantages: SCANC, Hierarchy of Fog and Edge Computing, Addressing the Challenges in Federating Edge Resources.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understanding Edge and Fog
2. Understanding of Challenges and future research directions in terms of Edge Computing
3. Understanding of networking, Management and resource and modeling challenges

Module II: Number of hours(LTP) 9 0 0

Optimization Problems in Fog and Edge Computing, Middleware for Fog and Edge Computing: Design Issues, Middleware for Fog and Edge Computing: Design Issues, A Lightweight Container Middleware for Edge Architectures

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understanding of generic framework for optimization
2. Problems in Edge computing with objectives
3. Different aspects for designing Middleware for Edge Computing

Module III: Number of hours(LTP) 9 0 0

Data Management in Fog Computing, Integrating IoT + Fog + Cloud Infrastructure: System Modeling and Research Challenges, Management and Orchestration of Network Slices in Fog and Edge.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the architecture for the data management
2. Understand the various modeling techniques to evaluate an integrated IoT system comprising Edge computing

Module IV: Number of hours(LTP) 9 0 0

Applications and Issues: Predictive Analysis to Support Edge and Fog Application Deployment, Edge Computing Realization for Edge Data Analytics, Applications such as Health Monitoring, Smart Surveillance Video Stream + Processing at the Edge, Legal Aspects of Operating Applications in the Edge/Fog, Modeling and Simulation of Edge/Fog Computing Environments Using iFogSim Toolkit

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the various prototypes that supports application deployment
2. Understand the processing capabilities, maintain the QoS requirement of an application
3. Learn the simulator to create the Edge environment and how to do modeling

Text Books(s)

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama.

Reference Book(s)

1. Edge Computing: Fundamentals, Advances and Applications, K. Anitha Kumari, G. Sudha Sadasivam , D. Dharani, M. Niranjanamurthy, CRC Press,1st edition, December 2021.
2. Edge Computing For Dummies, Stratus Special Edition, John Wiley & Sons, Inc.

Resources:

1. AWS IoT: Developing and Deploying an Internet of Things (www.coursera.org/learn/aws-iot-developing-and-deploying-an-internet-of-things)

Course Outcomes:

1. Understand the working Edge and Fog networking with varoious architectures
2. Students get to know about how to choose middleware to integrate various technologies at Edge
3. Students get familarize with various applications and their modelling at Edge
4. Learn the various tools to design the edge environment, compute the data and do the analytics

19EEC475: MICROCONTROLLERS AND INTERFACING

L	T	P	C
2	1	0	3

The knowledge on Microcontroller based embedded system design is much essential in the field of automation. This course begins with the detailed discussion of the architecture and on-chip resources of 8051 followed by complete instruction set and assembly language programming. Further, this course covers C programming for 8051 which is the common platform that any designer would use to program a microcontroller. Concepts of interfacing peripherals like LCD, keypad DAC, ADC and sensors to 8051 are also discussed in the course.

Course Objectives:

- To explain the detailed architecture of 8051 microcontrollers and on chip resources.
- To familiarize with 8051 Instruction set and addressing modes.
- To get acquainted with the C programming model of 8051 microcontroller.
- To explain the functionality of serial communication, timers and other peripherals
- To design an embedded system using 8051 microcontroller.

UNIT-I **10L**

The 8051 Microcontroller: Microcontrollers and embedded processors, overview of the 8051 family, 8051 architecture-on chip resources, internal and external memory configuration, 8051 register banks, PSW, clock generator, other special function registers and their purpose, 8051 pin description.

Learning Outcomes*:*

After completion of this unit, the student will be able to

- state architectural differences between microprocessors and microcontrollers (L1).
- describe the features of 8051 and compare features of family of 8051 (L2).
- understand the purpose of on chip resources and register banks (L2).
- illustrate the structure and purpose of different SFRs.(L3)
- interpret the functionalities of different pins of 8051(L4)

UNIT-II **8L**

8051 assembly language programming: Addressing modes, Instruction set: arithmetic instructions and programs, signed number concepts, logic and compare instructions, rotate instructions and data serialization, BCD, ASCII and other application programs, branch instructions-JUMP, LOOP, CALL instructions and programs.

Learning Outcomes:

After completion of this unit, the student will be able to

- demonstrate the purpose of different types of instructions supported by 8051 (L2).
- interpret the operations of arithmetic, logical, branch and other instructions (L2).
- construct assembly language programs to access SFRs & other on-chip resources (L3).
- estimate the execution time of an assembly language program (L6).

UNIT-III **8L**

8051 programming in C: Data types and time delay in 8051 C, I/O programming in 8051 C, logic operations in 8051 C, accessing code ROM space in 8051 C, data serialization using C.

Learning Outcomes:

After completion of this unit, the student will be able to

- identify the data types that are used for different variables (L1).
- apply time delay functions to generate different amount of delays (L3).
- demonstrate 8051 C program to perform logical operations (L3).
- develop 8051 C program to send data serially (L3).

UNIT-IV **8L**

Timers, serial port, Interrupts programming in C: Programming 8051 timers, counter programming, basics of serial communication, 8051 connections to RS232, serial port programming in assembly and C, 8051 interrupts, interrupt priority and interrupt programming in C.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the functions of timers, serial communication and interrupts of 8051 (L1).
- develop C programs for serial communication and delay generation (L3).
- state different sources of interrupts supported by 8051 and their importance in embedded applications (L1).

UNIT-V **8L**

Interfacing: LCD interfacing, keyboard interfacing, ADC, DAC and sensor interfacing, 8051 interfacing to external memory.

Learning Outcomes:

After completion of this unit, the student will be able to

- explain the functions of different pins, control signals of LCD (L2).
- discuss the basic operation of keyboard and describe the key press and detection mechanisms with key de bouncing (L2).
- illustrate the features and basic operations of DAC, ADC, and temperature sensor (L3).
- demonstrate the interfacing and LCD, 4X4 keypad, ADC, DAC and sensors with the 8051 (L5).

Text Book:

Mazidi and Mazidi, The 8051 Microcontroller and Embedded Systems – Using Assembly and C, 2nd Edition, Pearson Education, 2002.

References:

1. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and applications.
2. Raj kamal, Microcontrollers - Architecture, Programming, Interfacing and System Design- 2e- Pearson education.

Course Outcomes:

After successful completion of this course, the student will be able to

- explain the detailed architecture of 8051 micro controllers and on chip resources (L1).
- write 8051 Instruction sets and addressing modes (L1)
- illustrate the C programming model of 8051 microcontroller (L3).
- explain the functionality of serial communication, timers and other peripherals (L1).
- develop the on chip hard ware for the embedded system using 8051 microcontroller (L3).

19EEI471: ROBOTICS AND AUTOMATION

L	T	P	C
2	**1**	**0**	**3**

Robotics and automation is a branch of engineering that involves the design, manufacturing and operation of robots. It overlaps many fields of engineering including electronics, computer science, artificial intelligence, automation and nanotechnology. This course has its applications in industries related to aerospace, defense contractors, entertainment, manufacturing and medical research (development of prosthetic parts).

Course Objectives:

- To be familiar with history of robotics, technological advances and to gain insight on different types of End Effectors.
- To learn about different robotic drive systems, actuators and their control.
- To analyze the robotic kinematics in different degrees of freedom.
- To study the principles of various sensors used in robotics
- To explore industrial applications of robotics.

UNIT I **9L**

Introduction: Historical robots, robots in science fiction, future trends of robots, definitions of robots, present application status.

Robot End Effectors: Classification of end effectors, drive systems for grippers, mechanical grippers, magnetic grippers, vacuum grippers, adhesive grippers, hooks, scoops and other miscellaneous devices, active and passive grippers.

Learning Outcomes:

After completion of this unit, the student will be able to

- list important developments of robot history and future trends of robots (L1).
- classify robot end effectors (L3).
- identify appropriate grippers for a given application (L2).
- compare active and passive grippers (L4).
- discuss merits and demerits of grippers (L2).

UNIT II **9L**

Robot Drives, Actuators and Control: Functions of drive systems, general types of control, pump classification, introduction to pneumatic systems, electrical drives, dc motors and transfer functions, stepper motor, drive mechanisms.

Learning Outcomes:

After completion of this unit, the student will be able to

- list the functions of robot drive system (L1).
- classify robot Pump mechanisms in hydraulic system (L3).
- explain the principle operations of DC motor and stepper motor (L2).
- discuss merits and demerits of Robot actuators (L2).
- choose an apt drive mechanism for a robot application (L2).

UNIT III **7L**

Robot Kinematics: Forward and reverse kinematics of 3 degrees of freedom robot arm, forward and reverse kinematics of a 4 degree of freedom, arm manipulator in 3-D, homogeneous transformations.

Learning Outcomes:

After completion of this unit, the student will be able to

- define forward and reverse kinematics of a robot (L2).
- contrast between forward and reverse kinematics of a robot (L4).
- compare a 3 degree of freedom of robot with a 4 degree of freedom of robot (L4).
- analyze the robotic Kinematics in different degrees of freedom (L4).
- apply homogenous transformation in deriving kinematics of a robot (L3).

UNIT IV **9L**

Robot Sensors: Need for sensors, types of sensors, robot vision systems, robot tactile systems, robot proximity sensors, robot speech and hearing, speech synthesis, noise command systems, speech recognition systems.

Learning Outcomes:

After completion of this unit, the student will be able to

- understand the need of sensors in robot development (L2).
- classify types of sensors used in robot development (L2).
- identify appropriate sensor for a given robot application (L2).
- explain the principles of various Sensors used in robotics (L2).
- elaborate robot vision system and speech recognition system (L2).

UNIT V **9L**

Robot Applications: Capabilities of robots, materials handling, machine loading and unloading, machining and fettling, robot assembly, welding, future applications.

Learning Outcomes:

After completion of this unit, the student will be able to

- list capabilities of robots (L1).
- contrast between machine loading and unloading (L4).
- explain different industrial applications of robotics (L2).
- discuss future applications of robot (L2).

Text Book:

1. S.R. Deb, Robotics Technology and Flexible Automation, TMH, 2010.

References:

1. Satya Ranjan, Robotics Technology and Flexible Automation, TMH, 2001.
2. James L.Fuller, Robotics: Introduction, Programming and Projects, Maxwell Macmillan, 2000

Course Outcomes:

After successful completion of the course, the student will be able to

- explain the history of robotics, technological advances and many types of end effectors (L2).
- acquire knowledge on different robotic drive systems, actuators and their control (L2).
- understand the robotic kinematics (robotic movements, position and orientation) (L2).
- select the sensors based on different applications (L4).
- understand industrial applications of Robotics (L2).

19EEC473: FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

L	T	P	C
2	1	0	3

Signal processing is an area of engineering that has developed rapidly over the past few decades. Starting with a review of discrete time systems, the course proceeds to discrete Fourier transform, fast Fourier transform algorithms, digital filter design, its implementation, filter analysis and the architectural features of DSP processor.

Course Objectives:

- To discuss about the characteristics of LTI discrete time systems.
- To explain the frequency analysis of DT signals and systems using DFT and FFT.
- To make the students understand various techniques for IIR filter design.
- To make the students understand various techniques for FIR filter design.
- To introduce the students the architectural features of DSP.

UNIT I **9L**

Discrete-Time Signals and Systems: Discrete time signals, linear shift invariant systems, stability and causality, frequency domain representation of discrete time signals and systems described by linear constant coefficient difference equations.

Learning Outcomes:

The students will be able to

- analyse the discrete time LTI systems in frequency domain (L4)
- determine the stability and causality of LTI systems(L3)
- solve the transfer function of systems described by difference equations (L3)

UNIT II **9L**

Discrete Fourier Transform: The discrete Fourier transform, properties of discrete Fourier transform, linear convolution using circular convolution, Radix - 2 Decimation-in-time (DIT) FFT algorithms and Decimation-in-frequency (DIF) FFT algorithms.

Learning Outcomes:

The students will be able to

- explain and apply the properties of Discrete Fourier Transform (L2).
- demonstrate the methods of computing DFT/ FFT values (L2).

- calculate the circular convolution, linear convolution and output response of discrete time LTI system using DFT (L6).

UNIT III **9L**

IIR Filter Design: Design of analog low pass and high pass filters using Butterworth approximation, design of IIR digital low pass and high pass filters using Bilinear transformation.

Learning Outcomes:

The students will be able to

- design low pass and high pass analog Butterworth filters (L5)
- apply the analog to digital transformation techniques (L3)
- design digital IIR Butterworth filter using Bilinear transformation (L5)

UNIT IV **9L**

FIR Filter Design: Properties of FIR digital filters, design of FIR filters using rectangular and hamming windows, comparison of IIR and FIR digital filters.

Learning Outcomes:

The students will be able to

- interpret the concept of linear phase of FIR Filters (L2)
- design linear phase FIR filters using rectangular and hamming windows (L5)
- compare IIR and FIR digital filters (L4)

UNIT V **6L**

DSP Processors Architecture: DSP architecture for signal processing - Harvard architecture, pipelining, hardware multiplier-accumulator.

Learning Outcomes:

The students will be able to

- explain about the Harvard architecture of DSP Processors (L2)
- illustrate pipelining in DSP processors and hardware multiplier- accumulator (L3)

Text Books:

1. A.V. Oppenheim, R. W. Schafer, Discrete-Time Signal Processing, 2/e, Prentice Hall of India, 2004.
2. Ifeachor E.C, Jervis B.W, Digital Signal Processing – A Practical Approach, 2/e, Pearson Education, 2002.

References:

1. Sanjay K.Mitra, Digital Signal Processing - A Computer based Approach, 4/e, TMH Publications, 2011.
2. J.G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4/e, Pearson Education, 2007.

Course Outcomes:

By the end of the course, the students will be able to

- identify the characteristics of LTI discrete time systems.
- compute the DFT of a sequence using DFT and FFT algorithms (L6)
- identify and design the IIR filter from the specifications (L4)
- identify and design the FIR filter from the specifications (L4)
- explain the architectural features of DSP processors (L2)

19EBT473: Introduction To Bioinformatics

L	T	P	C
2	1	0	3

Modern high throughput methods generate vast amounts of biological data. Bioinformatics enables us to validate, store, retrieve and analyse these data sets. This course introduces the data structures and algorithms that enable us to compare, classify and predict the function of biological sequences.

Course objectives:
1. describe nature and type of information available in biological databases (L1)
2. explain the principles of sequence alignment (L2)
3. analyze the algorithms for phylogenetic analysis (L3)
4. explain the principles of protein structure prediction (L2)
5. explain the principles of structural and functional genomics (L2)

Module I: Module Name (if any) Number of hours(LTP) 6 0 6
Introduction to Biological data types and databases.
Brief introduction to information available in the following databases: NCBI-Genebank, PIR, PFAM, PDB.
Sequence analysis: concepts of sequence alignment.
BLAST Tool for searching sequence databases. Description of the BLAST algorithm
Learning Outcomes:
After completion of this unit, the student will be able to:
1. summarize the advantages of storing information in databases (L2)
2. identify the most appropriate database for each type of biological entity (L5)
3. calculate similarity of two aligned sequences (L3)
4. summarize the principles of the BLAST algorithm (L2)
5. describe the applications of BLAST and its variants (L1)

Module II: Module Name(if any) Number of hours(LTP) 6 0 6
Pairwise sequence alignment using dynamic programming. Needleman & Wunsch algorithm for global alignment. Smith-Waterman algorithm for local alignment.
Searching for repeats and partial overlaps using dynamic programming.
Multiple sequence alignment. Multidimensional dynamic programming.
Learning Outcomes:
After completion of this unit, the student will be able to:
1. apply dynamic programming for pairwise sequence alignment algorithms (L3)
2. evaluate the score for optimal global alignment of a pair of sequences (L5)
3. evaluate the score for optimal local alignment of a pair of sequences (L5)
4. evaluate the score for optimal end overlap alignment of a pair of sequences (L5)
5. predict the optimal alignment to find repeats of one sequence in another (L2)

Module III: Module Name(if any) Number of hours(LTP) 6 0 6
Phylogenetic analysis. Distance based methods: UPGMA and Neighbour joining.
Classical parsimony and weighted parsimony methods.
Branch and bound for phylogenetic analysis.
Sankoff and Cedergren method for Simultaneous alignment and phylogeny.
Learning Outcomes:
After completion of this unit, the student will be able to:
1. describe the principles and algorithms used for molecular phylogenetic analysis (L1)
2. describe algorithm for simultaneous alignment and phylogeny (L1)
3. compare the distance based and character-based algorithms for phylogenetic analysis (L5)
4. apply distance-based algorithms for phylogenetic analysis (L3)

5. apply character based algorithms for phylogenetic analysis (L3)

Module IV: Module Name(if any) Number of hours(LTP) 6 0 6

Prediction of transmembrane helices. Prediction of secondary structure from protein sequence – Chou-Fasman rules, neural networks. Prediction of protein conformation from protein sequence. Protein structure prediction with Homology, Threading and Neural Networks. Protein structure prediction with Force fields. Virtual screening for drug discovery.

Learning Outcomes:

After completion of this unit, the student will be able to:

6. compare the methods for prediction of transmembrane helices and secondary structure (L5)
7. describe the principles of neural networks (L1)
8. describe the concepts related to force fields (L1)
9. compare the information theoretical and force field-based methods for protein structure prediction (L5)
10. describe the principles of virtual screening (L1)

Module V: Module Name(if any) Number of hours(LTP) 6 0 6

Computational problems in genome sequencing. Graph theoretical formulation of the fragment assembly problem. Hamiltonian path and Eulerian path-based algorithms for fragment assembly. Gene and promoter prediction from genome sequence using Position Specific Score Matrices. K-means and SOM algorithms for analysis of gene expression data.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. understand the computational problems and concepts of structural and functional genomics (L2)
2. compare the algorithms available for structural and functional genomics (L4)
3. predict genomic sequence from fragment sequence data by using a Hamiltonian path-based algorithm (L6)
4. predict genomic sequence from fragment sequence data by using a Eulerian path-based algorithm (L6)
5. predict promoter sites by using genomic sequence data and a position specific score matrix (L6)

Textbook(s)

1. R. Durbin, S. Eddy, A. Krogh, G. Mitchison, Biological sequence analysis: Probabilistic models of proteins and nucleic acids, Cambridge University Press. 1998.
2. P. Pevzner and R. Shamir. Bioinformatics for Biologists. Cambridge University Press. 2011.

Reference Book(s)

1. A. Leach, Molecular modelling: principles and applications, 2/e, Pearson, 2009.
2. Teresa K. Attwood, Stephen R. Pettifer, David Thorne. Bioinformatics Challenges at the Interface of Biology and Computer Science: Mind the Gap. John Wiley & Sons, 2016. 047003548X, 9780470035481.
3. D. Mount, Bioinformatics: Sequence and Genome analysis, 2/e. CBS publishers. 2005.

Course Outcomes:

1. list biological databases related to biochemicals, proteins and nucleic acids (L1)
2. assess similarity of biological sequences (L5)
3. solve problems in phylogenetic analysis (L6)
4. predict protein structure based on sequence information and structure of homologs (L6)
5. construct genomic sequences from fragments (L6)

19EPH471-QUANTUM COMPUTING **L T P C**
2 1 0 3

Course objectives

The objective of this course is to impart necessary knowledge to the learner so that he/she can implement the well-known algorithms of quantum computing.

Unit 1: Introduction to quantum computing (9 hours)

Motivation for studying Quantum Computing
Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.)
Origin of Quantum Computing
Overview of major concepts in Quantum Computing

- Qubits and multi-qubits states,
- Bra-ket notation.
- Bloch Sphere representation
- Quantum Superposition
- Quantum Entanglement

Learning outcomes

After completion of this unit the student will be able to

1. ***relate*** *to the relevance of the emerging field of quantum computing (L1)*
2. ***interpret*** *the basics of quantum computing (L2)*
3. ***summarize*** *the concept of quantum entanglement (L2)*

Unit 2: Mathematical foundation for quantum computing (9 Hours)

Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, eigenvalues and eigenvectors.

Learning outcomes

After completion of this unit the student will be able to

1. ***interpret*** *the basis, and their properties over Hilbert spaces (L2)*
2. ***apply*** *unitary operators (L3)*
3. ***make use of*** *the braket notation of Dirac (L3)*
4. ***solve*** *for eigenvalues and eigenvectors of a matrix (L3)*

Unit 3: Building blocks for quantum program (9 Hours)

Architecture of a Quantum Computing platform
Details of q-bit system of information representation:

- Bloch sphere
- Multi-qubits states
- Quantum superposition of qubits (valid and invalid superposition)
- Quantum entanglement
- Useful states from quantum algorithmic perspective e.g. Bell states
- Operation on qubits: Measuring and transforming using gates.
- Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc.

Programming model for a quantum computing program

- Steps performed on classical computer
- Steps performed on quantum computer
- Moving data between bits and qubits

List of Practicals
1. Building Quantum dice
2. Building Quantum Random No. Generation
3. Composing simple quantum circuits with q-gates and measuring the output into classical bits.

Learning outcomes
After completion of this unit the student will be able to
1. ***explain*** *Bloch sphere representation. (L2)*
2. ***interpret*** *the concepts of quantum bits, their superposition and quantum entanglement. (L2)*
3. ***make use of*** *various quantum logic gates. (L3)*
4. ***compare*** *the programming model of a classical and quantum computer. (L2)*
5. ***generate*** random numbers and ***evaluate*** simple quantum circuits (L5, L6)

Unit 4: Techniques for quantum algorithms (9 Hours)
Basic techniques exploited by quantum algorithms.
- Amplitude amplification
- Quantum Fourier transform
- Phase kick-back
- Quantum phase estimation
- Quantum walks

List of Practicals
1. Simulate quantum walks using numpy/scipy

Learning outcomes
After completion of this unit the student will be able to
1. ***interpret*** *the idea of amplitude amplification used for many, including Grover's search algorithm*(L3)
2. ***make use of*** *the idea of quantum Fourier transform that is used in Shor's algorithm* (L3)
3. ***relate*** *phase kick-back to quantum phase estimation* (L3)
4. ***summarize*** *the quantum walks and compare them to classical random walks* (L2)
5. **generate** quantum walks and compare with classical random walk (L5)

Unit 5: Quantum algorithms and toolkits (9 Hours)
Major Algorithms
- Shor's Algorithm
- Grover's Algorithm
- Deutsch's Algorithm
- Deutsch -Jozsa Algorithm

OSS Toolkits for implementing Quantum program
- IBM quantum experience
- Rigetti PyQuil (QPU/QVM)

List of Practicals
1. Implementation of Shor's Algorithms
2. Implementation of Grover's Algorithm

3. Implementation of Deutsch’s Algorithm
4. Implementation of Deutsch-Jozsa’s Algorithm
5. Mini Project such as implementing an API for efficient search using Grover’s Algorithms or Integer factorization using Shor’s Algorithm

Learning outcomes

After completion of this unit the student will be able to

1. ***apply*** *the widely used quantum algorithms for several basic problems (L3).*
2. **assess** Shor's quantum algorithm used for integer factorization and discrete logarithm computation (L5).
3. ***examine*** *the deterministic algorithms* - Deutsch’s and Deutsch -Jozsa algorithm (L4).
4. **compare** two well-known opensource toolkits (L2).

Course Outcomes

At the end of this course, the students will be able to:

- **explain** the working, architecture and program model of a quantum computer. (L2).
- **interpret** and **make use of** quantum logic gate circuits. (L2, L3).
- **make use of** several quantum algorithms (L3).
- **experiment with** quantum algorithm on major toolkits (L3).

Text Books:

1. Michael A. Nielsen, “Quantum Computation and Quantum Information”, Cambridge University Press.
2. David McMahon, “Quantum Computing Explained”, Wiley
3. IBM Experience: https://quantumexperience,ng,bluemix.net
4. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit
5. Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/

19EME456: Optimization Techniques

L	T	P	C
2	1	0	3

This course exposes the evaluation of the best possible solution for various engineering planning and design problems. The aim of the course is to train the students to develop a mathematical model and to solve the model by applying an appropriate mathematical programming technique. This course also covers advanced optimization techniques to solve dynamic and integer programming problems.

Course objectives:

1. To illustrate the importance of optimization techniques in theory and practice.
2. To formulate and solve engineering design problems in the industry for optimal results
3. To test the analytical skills in solving real engineering problems by applying appropriate optimization technique
4. To demonstrate various advanced optimization techniques being developed in recent times.
5. To develop and promote research interest in problems of Engineering and Technolog

Module I: Introduction to optimization; Classical Optimization techniques; Number of hours(LTP) 9 0 0

Introduction to optimization Introduction, engineering applications of optimization, statement of an optimization problem-design vector, design constraints, constraint surface, objective function, classification of optimization problems.

Classical Optimization techniques Introduction, single variable optimization, multi variable optimization with no constraints, multi variable optimization with equality and inequality constraints.

Module II: One Dimensional Minimization Methods Number of hours(LTP) 9 0 0

One Dimensional Minimization Methods Introduction, unimodal function, elimination methods-exhaustive search, interval halving method, Fibonacci method, golden section method, interpolation methods-quadratic & cubic interpolation methods, direct root methods-Newton method, secant method.

Module III: Unconstrained Minimization Methods Number of hours(LTP) 9 0 0

Unconstrained Minimization Methods: Introduction, Direct Methods- random search methods, univariate method, Powell’s method. Descent method - steepest descent method (Cauchy’s method)

Module IV: Dynamic Programming Number of hours(LTP) 9 0 0

Dynamic Programming Introduction, Bellman’s optimality principle, application of Dynamic Programming - Shortest Path Problem, cargo-loading problem, optimal subdividing problem, Linear programming problem.

Module V: Integer Programming Number of hours(LTP) 9 0 0

Integer Programming Introduction, All Integer and Mixed Integer Programming problems-Gomory’s cutting plane method & Branch-and-bound method. Balas algorithm for zero-one programming.

Text Books(s)

1. S.S.Rao, Engineering optimization theory and practice,3rd Edition, New age international,2007

Reference Book(s)

1. H.A.Taha, Operations Research, 9th Edition, Prentice Hall of India, 2010
2. F.S.Hillier, and G.J.Lieberman, Introduction to Operations Research, 7th Edition, TMH, 2009.

Course Outcomes:

1. classify optimization problems and apply classical optimization techniques to solve NLPPs having differentiable functions [L2&L3]
2. apply the concept of uni-modal function to solve one dimensional minimization problems [L3]
3. solve any multi variable optimization problems[L3]
4. solve any complex optimization problem as a dynamic programming problem and analyze its solution [L3&L4]
5. recognize the significance of integer and/or binary solutions and apply a suitable algorithm for better decision making [L1&L3]

19EAI442: Computer Vision

	L	T	P	C
	2	1	0	3

Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This course introduces the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving.

Course Objectives:

1. Understand camera models and image formation in single view and multiview environment
2. Understand and apply image restoration and enhancement with linear and non-linear filters in spatial and frequency domain
3. Learn about different edge, corner, and shape extraction techniques
4. Learn about human vision & attention models and apply them for object segmentation
5. Learn about motion parameter estimation and apply them in tracking of objects.

Module I:	Camera Models	Number of hours (LTP)	**6**	3	0

CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Image formation, Orthographic & Perspective Projection, Depth estimation and Multi-camera views Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, 3-D reconstruction framework; Auto-calibration.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand about working of camera model and radiometry (L1)
2. Understand the image formation (L1)
3. apply transformation in the image (L3)
4. understand the 3D image formation from multi-camera perspective (L1)

Module II:	Image restoration and Enhancement	Number of hours (LTP)	**6**	3	0

Fourier transform, convolution, basic linear filtering, non-linear filtering, morphological filtering, Wavelet denoising, Image restoration, multi-channel image recovery, Motion detection and estimation.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand about spatial and frequency transformations (L1)
2. Perform image enhancement and restoration with linear and non-linear filters (L3)
3. Perform multi-channel image recovery (L3)

Module III:	Feature Extraction	Number of hours (LTP)	**6**	3	0

Estimating Derivatives, Detecting Edges, Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, HOG, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, shapes from textures, Gabor Filters and DWT.

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Perform detection of Edges, corners and shape (L3)
2. Perform texture analysis (L3)
3. Extract shape features in frequency domain (L3)

Module IV:	Human Vision and Segmentation	Number of hours (LTP)	**6**	3	0

Human Vision: Grouping and Getstalt, Saliency Detection, Segmentation by Clustering: What Is Segmentation? Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Object detection.

Learning Outcomes:
After completion of this unit, the student will be able to:

1. understand the human vision and attention models (L2)
2. Perform segmentation for object extraction (L3)
3. Perform shape model-based object detection (L3)

Module V:	Motion Analysis	Number of hours (LTP)	**6**	3	0

Motion Analysis: Shot Boundary detection, Background Subtraction and Modeling, Optical Flow, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation. Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples. Shape from X Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Understand the motion parameter (L2)
2. Apply motion analysis and estimation for spatio-temporal analysis of video (L3)
3. Track object in video (L3)
4. Extract shape using the lighting model at surface (L3)

Textbooks(s)

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.
2. Alan Bovik, Handbook of Image and video processing, Academic Press, 2010.

Reference Book(s)
1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. Szeliski, Computer Vision: Algorithms and Applications, Springer.

Course Outcomes:

1. To understand camera models and image formation in single and multi-view environment (L1)
2. To apply linear and non-linear filtering techniques for image restoration and enhancement (L3)
3. To apply and analyze different feature extraction technique for object extraction (L4)
4. To create segmentation model using human vision and attention model (L6)
5. To create object tracking model utilizing motion analysis (L6)

suggested Experiments for tutorial classes

1. Write program to perform geometric transformation like scaling, cropping, and affine transformation.
2. Write a program for image enhancement considering order-statistics filter, Gaussian smoothing, Difference of Gaussian and Laplace of Gaussian Filters.
3. Write a program for image restoration of an given image considering the noise model as:
   a) Rayleigh distribution
   b) Gamma Distribution
   c) log Normal distribution.

   Compare the obtained result.
4. Write a program to implement the sobel and canny edge detection algorithm
5. Write a program to compute the gray level co-occurrence matrix and in turn compute the texture features like homogeniety, entropy, contrast and energy. Use obtain feature for graph cut segmentation.
6. Write a program for corner identification using affine transformation and SIFT features
7. Write a program HOG feature extraction and human identification
8. Write a program to implement snake algorithm for object identification.
9. Write a program for background subtraction for moving object identification
10. Write a program to design a Kalman filter based object tracking model

19ECF448 : Fundamentals of IOS Security

L	T	P	C
2	1	0	3

This course will provide a foundational understanding of iOS security. The concepts discussed will help in understanding the vulnerabilities and ways to mitigate those vulnerabilities. This will help in designing secure iOS applications with minimal vulnerabilities.

Course objectives:

1. Understand the security model of the iOS Applications.
2. Understand the foundational security practices that are required to secure iOS Application.
3. Understand the ways in which the iOS applications can be abused.
4. Understand the techniques needed to mitigate the vulnerabilities in iOS Applications

Module I: Number of hours(LTP) 6 3 0

THE IOS SECURITY MODEL, Secure Boot, Limiting Access with the App Sandbox, Data Protection and Full-Disk Encryption, Native Code Exploit Mitigations: ASLR, XN, and Friends, Jailbreak Detection, How Effective Is App Store Review?, Key iOS Programming Terminology, Dissecting an Objective-C Program, How Objective-C Manages Memory

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the iOS security model
2. Understand the fundamentals of iOS programming

Module II: Number of hours(LTP) 6 3 0

IOS APPLICATION ANATOMY, Dealing with plist Files, The Bundle Directory, The Data Directory, The Shared Directory. Building your test platform, Network and Proxy Setup, Xcode and Build Setup

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the basic structure of iOS application
2. Learn the methods to build the testing platform

Module III: Number of hours(LTP) 6 3 0

DEBUGGING WITH LLDB AND FRIENDS, Useful Features in lldb, Using lldb for Security Analysis, BLACK-BOX TESTING, Installing Third-Party Apps, Reverse Engineering from Decrypted Binaries, Defeating Certificate Pinning, Hooking with Cydia Substrate, Automating Hooking with Introspy

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand the methods for debugging the iOS Applications
2. Learn the ways to perform the black box testing of the iOS Applications

Module IV: Number of hours(LTP) 6 3 0

IOS-TARGETED WEB APPS, Using (and Abusing) UIWebViews, Rewards and Risks of JavaScript-Cocoa Bridges, Enter WKWebView, DATA LEAKAGE, The Truth About NSLog and the Apple System Log, How Sensitive Data Leaks Through Pasteboards, Keylogging and the Autocorrection Database, Dealing with Sensitive Data in Snapshots, Leaks Due to State Preservation

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Learn the methods that are used for abusing the iOS applications
2. Understand how the sensitive information is leaked from the iOS applications

Module V: Number of hours(LTP) 6 3 0

LEGACY ISSUES AND BAGGAGE FROM C, Format Strings, Buffer Overflows and the Stack, Integer Overflows and the Heap,
INJECTION ATTACKS, Client-Side Cross-Site Scripting, SQL Injection, XML Injection

Learning Outcomes:
After completion of this unit, the student will be able to:

1. Learn how to attack iOS applications which have be inherited from the C Language
2. Understand the techniques used to perform injection attacks on the iOS Applications

Text Books(s)

1. David Thiel, iOS Application Security-The Definitive Guide for Hackers and Developers, No Starch Press,2016.

Reference Book(s)

1. Kunal Relan, iOS Penetration Testing-A Definitive Guide to iOS Security, Apress Publications,2017
2. Jonathan Zdziarski, Hacking and Securing IOS Applications, O'Reilly Media,2012

Course Outcomes:

1. Learn the fundamental security model of iOS.
2. Learn the basic structure and testbed of iOS.
3. Understand different kind of testing and debugging methodologies.
4. Understand the application abuses and data leakages by applications running on iOS.
5. Analyse the vulnerabilities through different kinds of injection attacks.

19EDS442: Social Media Analytics

L	T	P	C
2	0	2	3

The rapid growth of social media has given the mass consumers a powerful tool to create knowledge and propagate opinions. At the same time, social media has created an unprecedented opportunity for companies to engage real-time interactions with consumers. In addition, the size and richness of social media data has provided companies an unusually deep reservoir of consumer insights to transform the business and marketing operations.

The social media analytics course will enable students to grasp the analytics tools to leverage social media data. The course will introduce tools such as engagement analytics, sentiment analysis, topic modelling, social network analysis, identification of influencers and evaluation of social media strategy.

Course objectives:

- Define the role of social media data and analytics in helping organizations achieve their goals. [**Knowledge Level**]
- Identify the key performance indicators to accurately measure the success of social media efforts. [**Comprehension Level**]
- Illustrate social media data using native analytics (e.g., Facebook, Twitter) and social media measurement tools. [**Application Level**]
- Demonstrate meaningful insights with actionable and strategic recommendations based on thorough social media data analysis. [**Application Level**]

Module I: Number of hours (LTP) 6 0 6

Introduction to Social Media Analytics: Introduction to the Latest Social Media Landscape and importance, Introducing Social Graph, delving into social data, Understanding the process, working environment, Getting analysing and visualizing the data, Getting started with the toolset. Need for SMA, SMA in Small organizations; SMA in large organizations; Applications of SMA in different areas. Connecting, Capturing and Cleaning of Social Data, APIs in nutshell, Introduction to authenticate techniques, Parsing API outputs, Basic cleaning techniques.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Understand about social media analytics
2. Understand about overview of social network analysis process

Module II: Number of hours(LTP) 6 0 6

Analysing Facebook page: Facebook brand page, project planning, analysis, keywords, noun phrases, detecting trends in time series, uncovering emotions, how can brands benefit from it? Posts, Pages and User Interactions on Facebook, Mining your posts, Facebook Pages.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Learn about facebook operational process
2. Understand about interactions

Module III: Number of hours(LTP) 6 0 6

Analysing Twitter: Analyzing Twitter using sentiment analysis and entity recognition, scope and process, getting the data, sentiment analysis, customized sentiment analysis, named entity recognition, combing NER and sentiment analysis, entity analysis, text analysis, time series analysis, Mining the followers, conversation.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Analyse about twitter operations
2. Understand about NER and sentiment analysis

Module IV: Number of hours(LTP) 6 0 6

Consumer Reaction Analysis on YouTube: Campaigns and consumer reaction analytics on YouTube-Structured and Unstructured, Trends mining on GitHub, Scope and process, Getting the data, Data pull, Data processing, Data analysis.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. About Consumer reaction analysis
2. Understand YouTube structure

Module V: Number of hours(LTP) 6 0 6

Trend Mining on GitHub: Trends mining on GitHub, Scope and process, getting the Data, Data pull, Data processing, Data analysis.

Learning Outcomes:

After completion of this unit, the student will be able to:

1. Learn about trend mining on GITHUB
2. In detail analysis of data using GITHUB

Text Books(s)

1. Matthew A. Russell & Mkihail Klassen, *Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, GitHub, and More,* 3rd Edition (O'Reilly, 2019).

2. The link for above online course is Link: https://www.coursera.org/learn/social-media-data-analytics

Reference Book(s)

1. Siddhartha Chatterjee, Michal Krystvanczuk, *Python Social Media Analytics,* Packet Pub, 2017.

19EIO444: COMMUNICATION AND NETWORK TECHNOLOGIES IN IOT

L	T	P	C
2	1	0	3

This course provides the learner to assess, select and customize communication and networking technologies for IoT applications across a broad spectrum of domains. In this course, the leaner will develop a deeper understanding of the IoT applications that require data generated or acquired across geographically dispersed components to be processed collaboratively which is achieved using appropriate communication systems and networks. The learner gains insights into the characteristics of the complementary and competing technologies, analyses vulnerabilities and design network solutions.

Course objectives:

1. To introduce evolution of Internet technology and need for IoT.
2. To provide understanding of essential terms and concepts of networking.
3. To build the required skills and ability to know the layered architecture.
4. To develop the skills and analyse the working of applications at different layers.
5. To build core knowledge of protocols utilized in different IoT environments.

Module I: Number of hours(LTP) 6 3 0

Understanding IOT Communications:

M2M and IoT, Layered Architectures, System Components, Applications

Learning Outcomes:

After completion of this unit, the student shall be able to:

1. Sketch the communication architecture for Internet of Things (L2)
2. Interpret the impact and challenges posed by IoT networks leading to new architectural models (L2)
3. Compare and contrast the deployment of smart objects and the technologies used to connect them to network (L2)

Module II: Number of hours(LTP) 6 3 0

Concepts of IOT Networking: **IoT Networking**, **Types of Networks**, **Devices**: Sensors, Actuators and Controllers, Gateways; Security, Wireless Sensor Networks.

Learning Outcomes:

After completion of this unit, the student shall be able to:

1. Explain the working of various devices like sensors, actuators, and various processing paradigms for IoT (L2)
2. identify security vulnerabilities in wireless networks, IoT applications and devices, and outline the solutions (L2)
3. Compare and assess different network models and techniques of IoT systems (L2)

Module III: Number of hours(LTP) 6 3 0

IOT Protocol Layers:

Physical and Link layers: About physical and link layers, **Wireline:** Ethernet, ITU-T G.9903, IEEE1901.2, MS/TPl Wireless**:** IEEE802.11, IEEE802.15.3, IEEE802.15.4, Bluetooth Low Energy, ITU-T G.9959, DECT ULE, and NFC

Learning Outcomes:

After completion of this unit, the student shall be able to:

1. List common communication protocols of IoT (L1)
2. Experiment relevant communication protocols to design and deploy applications (L3)
3. Demonstrate the use of wireless technologies for IoT (L5)

Module IV: Number of hours(LTP) 6 3 0

Network and Transport Layers:

Why IP?IPv6, **6LowPAN:** Addresses, Header Format, Routing and Forwarding, Header Compression, Fragmentation, Security Considerations, TCP and 6LowPAN; **6Lo**,**6TiSCH**

Learning Outcomes:
After completion of this unit, the student shall be able to:
1. Compare and contrast relevant protocols (L2)
2. Describe networking technologies (L2)
3. Explain security solutions for different applications requirements (L2)

Module V: Number of hours(LTP) 6 3 0

Application Layer:

Architectures, **Request/Response:** REST Architecture, HTTP, XMPP, CoAP, SIP and RTP, OPC UA; **Publish/Subscribe:** MQTT,AMQP

Learning Outcomes:
After completion of this unit, the student shall be able to:
1. Explain the REpresentational State Transfer (REST) architecture (L2)
2. Demonstrate the application of REST APIs in IoT environment (L3)
3. Describe the working of publish/subscribe protocols (L2)

Text Books(s):
1. Rolando Herrero, Fundamentals of IoT Communication Technologies, Springer publisher, 1st edition, 2022
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017
3. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Reference Book(s)
1. Olivier Hersent, David Boswarthick and Omar Elloumi, *The Internet of Things: Key applications and Protocols*, Wiley
2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands -onApproach)”, 1 st Edition, VPT, 2014. (ISBN: 978-8173719547)

Course Outcomes:
After completion of the course, the student will be able to:
CO-1: Explain the fundamental communication architectures and networking concepts of IoT (L2)
CO-2: Identify and describe the basic concepts of networking devices (L2)
CO-3: Compare and assess different network models and techniques of IoT systems (L2)
CO-4: Describe the working of different protocols at different layers (L2)
CO-5: Demonstrate the application of REST APIs in IoT environment (L3)

List of Experiments:
1. Introduction to Arduino, ESp8266, Introduction to raspberry Pi.
2. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
3. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.
4. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.
5. Establish RFID communication.
6. Demonstration of MQTT communication.
7. Demonstration of LoRa communication.
8. Demonstrate gateway architecture.
9. Demonstrate K-Map clustering for different nodes.
10. Device control using mobile Apps or through Web pages.
11. Machine to Machine communication.