GITAM

(DEEMED TO BE UNIVERSITY)

(Estd. u/s 3 of the UGC Act, 1956)

VISAKHAPATNAM • HYDERABAD • BENGALURU

Accredited by NAAC with 'A+' Grade

REGULATIONS AND SYLLABUS
of
Bachelor of Technology

Electrical and Electronics Engineering (EEE)

(w.e.f 2019-20 admitted batch)

Department of Electrical, Electronics and Communication Engineering
GITAM (Deemed to be University)

VISION

To excel in higher education by imparting quality teaching and research to meet the challenges in Electrical, Electronics and Communication Engineering

MISSION

1. To impart technical skills, value-based education to students, to enable them to face the demands of the industry

2. To create innovative and instructional learning methods to hone the skills for solving problems of society

3. To carry out research through constant interaction with R & D organizations and industry

4. To motivate the students to develop expertise in multidisciplinary technologies for a sustainable growth.

B Tech (Electrical and Electronics Engineering)

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1 To impart knowledge of mathematics and science concepts as tools to device and deliver efficient solutions to problems of Electrical and Electronics Engineering

PEO 2 To inculcate analytical ability in the students to keep pace with changing technologies and to imbibe skill and research culture to meet the industrial and societal needs.

PEO 3 To provide a platform for the graduate to be successful in technical and professional careers or develop as an entrepreneur.

PEO 4 To instill teamwork, leadership, and communication skills in the student with professional, ethical and human values to be responsible citizen of the society.

PROGRAMME OUTCOMES

PO1 **ENGINEERING KNOWLEDGE:** Apply the knowledge of Mathematics, Science, Engineering Fundamentals, and an Engineering specialization to the solution of Complex Engineering problems.

PO2 **PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyze Complex Engineering problems reaching substantiated conclusions using first principles of Mathematics, Natural Sciences, and Engineering Sciences.

PO3 **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.

PO4 **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.

PO5 **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.

PO6 **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.

PO7 **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.

PO8 **ETHICS:** Apply ethical principles and commit to Professional Ethics and responsibilities and norms of the engineering practice.

PO9 **INDIVIDUAL AND TEAMWORK:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **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.

PO11 **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 multi-disciplinary environments.

PO12 **LIFELONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

Upon successful completion of BTech Electrical and Electronics Engineering Programme, student will be able to

PSO1 design and develop electrical, control and power systems for engineering applications in the fields of electrical appliances, industrial automation, power distribution and allied interdisciplinary areas.

PSO2 demonstrate the use of modern tools and techniques for solving contemporary real-world problems in electrical and electronics engineering

PSO3 research and devise appropriate technologies for implementation of the electrical and power systems as an entrepreneur/researcher with professional ethics & concern for societal wellbeing

B Tech (Electrical and Electronics Engineering)

PEO – PO/PSO MAPPING

Program Outcomes	**Program Educational Objectives**			
	PEO I	PEO 2	PEO 3	PEO 4
PO1	✓	✓		
PO2		✓	✓	
PO3		✓	✓	
PO4		✓		
PO5	✓	✓		✓
PO6				✓
PO7			✓	✓
PO8			✓	
PO9			✓	
PO10		✓		✓
PO11	✓		✓	
PO12		✓	✓	
PSO1	✓	✓		
PSO2		✓	✓	
PSO3	✓	✓		

B. Tech. in Electrical and Electronics Engineering
REGULATIONS
(w.e.f. 2019-20 admitted batches)

1. ADMISSION

1.1 Admission into B. Tech. in Biotechnology program of GITAM (Deemed to be University) is governed by GITAM admission regulations.

2. ELIGIBILITYCRITERIA

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) and the rules of reservation of statutory bodies, wherever applicable, will be followed.

3. CHOICE BASED CREDITSYSTEM

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 centered learning
- Cafeteria approach
- Students to choose courses of their choice
- 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 THEPROGRAM

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

Core Courses	Branch specific	Compulsory
Elective courses	Program Electives	*Supportive to the discipline courses with expanded scope in a chosen track of specialization or cross track courses*
	Interdisciplinary Electives	*Interdisciplinary exposure & nurture the student interests in other department courses.*
	Open Electives	*Common to all disciplines that helps general interest of a student*

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 per semester.

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

4.4 The curriculum of the eight semesters B.Tech. program is designed to have a total of 160 credits for the award of B.Tech. degree.

5. MEDIUM OFINSTRUCTION

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

6. REGISTRATION

Every student has to register himself/herself for the courses in each semester individually at the time as specified in academic calendar.

7. ATTENDANCEREQUIREMENTS

7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end - semester examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the 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 65% and 74% on genuine medical grounds and on payment of prescribed fee.

8. EVALUATION

8.1 The assessment of the candidate‘s performance in a theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end Examination (60 marks).

8.2 A candidate has to secure an aggregate of 40% in the course in the two components put together to be declared to have passed the course, subject to the condition that the candidate 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 candidate has to obtain a minimum of 40% to secure pass grade.

8.4 The courses having theory and practical combined, 70% of the weightage will be given for theory component and 30% weightage for practical component. The candidate has to acquire 40% in the semester end theory examination. However, candidate 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 candidate has to obtain a minimum of 40% to secure pass grade.

8.6 Mandatory Courses are assessed for PASS or FAIL only. No grade will be assigned to these courses. If a candidate secures more than 40 out of 100 marks, he / she will be declared PASS, else FAIL

8.7 Mandatory courses NCC/NSS/NSO/YOGA are assessed for satisfactory or not satisfactory only. No grade will be assigned. A candidate has to undergo two hours training per week in any one of the above in both 1st and 2ndsemesters.

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.	100	70% of the weightage will be given for theory component. Evaluation for theory component will be same as S. No 1 as above.
		(b)Practical component: continuous evaluation	100	30% weightage for practical components. Evaluation for practical component will be same as S. No 2 as above
		Total	200	
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 for defending the project before a panel of examiners. iii) Thirty (30) marks for final Report presentation and Viva-voce by a panel of examiners.

5	Industrial Internship (VII Semester)	Continuous Evaluation	100	i) Thirty (30) marks for Project 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	(i) Sixty (60) marks for mid semester Examinations. Three mid examinations shall be conducted for 30 marks each; performance in best two shall be taken into consideration (ii) Forty (40) marks for Quizzes, Assignments and Presentations

9. RETOTALING &REVALUATION

9.1 Retotaling of the theory answer script of the semester-end examination is permitted on request by the candidate 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 the student by paying the prescribed fee within one week after the announcement of the result.

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

9.4 A candidate 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 examination held in that course. A candidate who has secured ‗F' grade can improve continuous evaluation marks up to a maximum of 50% by attending special instruction classes held during summer.

9.6 A candidate 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 ANSWER BOOK VERIFICATION AND CHALLENGE EVALUATION

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

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

11. SUPPLEMENTARYEXAMINATIONS AND SPECIALEXAMINATIONS.

11.1 The odd semester supplementary examinations will be conducted on daily basis after conducting regular even semester examinations during April/May.

11.2 The even semester supplementary examinations will be conducted on daily basis after conducting regular odd semester examinations during October/November.

11.3 A candidate who has completed his/her period of study and still has –F grade in final semester courses is eligible to appear for Special Examination normally held during summer vacation.

12. PROMOTION TO THE NEXT YEAR OFSTUDY

12.1 A student shall be promoted to the next academic year only if he/she completes the academic requirements of 50% of the credits till the previous academic year.

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

13. MASSIVE OPEN ONLINECOURSES

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 up to 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 will be decided by the respective Board of Studies (BoS).

14. BETTERMENT OFGRADES

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

14.2 Betterment of Grades is permitted _only once‘, immediately after completion of the program of study.

15. HONORS

A student who secured 8 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 Departmental Committee (DC) to secure B. Tech (Honors). The courses will be approved by DC of respective campuses.

16 GRADINGSYSTEM

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 an average GPA of 5.0 (average of all GPAs in all semesters) at the end of the program to declare pass in the program.

17. GRADE POINTAVERAGE

17.1 A Grade Point Average (GPA) for the semester will be calculated according tothe formula:

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

where, C = number of credits for the course.
G =grade points obtained by the student in the course.

17.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student‘s performance in all the courses taken, in all the semesters up to that particular semester.

17.3 CGPA required for classification of class after the successful completion of the program is shown in Table3.

Table 3: CGPA required for award of Class

Class	CGPA Required
First Class with Distinction	≥8.0*
First Class	≥ 6.5
Second Class	≥ 5.5
Pass Class	≥ 5.0

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

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

18.1 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.

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

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

i) Registered and successfully completed all the courses and projects.

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 against him/her.

19. DISCRETIONARYPOWER

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 Electrical, Electronics and Communication Engineering
B.Tech Electrical and Electronics Engineering
(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 (Calculus and Algebra)	BS	3	0	0		**3**	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2		**3**	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics/ Engineering Chemistry	BS	3	0	3		**4.5**	
4.	19EID131/ 19EEE131	Problem Solving and Programming / Basic Electrical and Electronics Engineering	ES	3	1	3		**5.5**	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES	0/1	0	3		**1.5/ 2.5**	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NSS/NCC/NSO/ YOGA	MC	0	0	2		**0**	Common to all
Total								**17.5/18.5**	

Semester II

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA102	Engineering Mathematics II (ODE, PDE and Multivariable Calculus)	BS	3	0	0		3	Common with ECE, ME,CE and AE
2.	19ECY131 /19EPH131	Engineering Chemistry / Engineering Physics	BS	3	0	3		4.5	
3.	19EEE131/ 19EID131	Basic Electrical and Electronics Engineering / Problem Solving and Programming	ES	3	1	3		5.5	Common to all
4.	19EID132/ 19EID134	Design Thinking / AI tools	ES	2	0	2		3	Common to all
5.	19EME131 /19EME121	Engineering Graphics / **Workshop**	ES	1/0	0	3		2.5/ 1.5	Common to all
6.	19EEE122	Electrical Workshop	PC	0	0	3		1.5	
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NSS/NCC/NSO/YOGA	MC	0	0	2		0	Common to all
8.	19EHS122	Comprehensive Skill Development I	HS	0	0	0	6	1	
9	VDC111	Venture Discovery	PW	0	0	4		2	Common to all
Total								**23/22**	

Semester III

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA203	Engineering Mathematics III (Complex Variables and Transform Techniques)	BS	3	0	0		3	Common ECE with
2.	19EID134/ 19EID132	AI tools / Design thinking	ES	2	0	2		3	Common to all
3.	19EEE231	Electrical Circuit Analysis	PC	3	0	3		4.5	
4.	19EEE233	Electromagnetic Fields	PC	2	0	2		3	
5.	19EEC233	Electronic Devices and Amplifier Circuits	PC	3	0	3		4.5	Common ECE with
6.	19EEC235	Signals and Systems	PC	2	0	2		3	Common ECE with
7.	19EMC281/ 19EMC282	Constitution of India / Environ-mental Sciences	MC	3	0	0		0	Mandatory Course
8.	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	
Total								**22**	

Semester IV

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA202	Engineering Mathematics IV (Numerical methods, Probability and Statistics)	BS	3	0	0		3	Branch specific
2.	19EID232 /19EID234	Internet of Things / Life Sciences for Engineers	ES/BS	2	0	2		3	Common to All
3.	19EEE232	Electrical Machines I	PC	3	0	3		4.5	
4.	19EEE234	Power Systems I	PC	2	0	2		3	
5.	19EEC232	Digital Logic Design	PC	3	0	3		4.5	Common With ECE
6.	19EEC234	Analog Circuits	PC	3	0	3		4.5	Common With ECE
7.	19EMC282 / 19EMC281	Environmental Sciences / Constitution of India	MC	3	0	0		0	Mandatory Course
8.	19EEE292	Comprehensive Skill Development III	PW	0	0	0	6	1	
Total								**23.5**	

Semester V

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EEE333	Electrical Machines II	PC	3	0	3		4.5	
2.	19EEE331	Linear Control Systems	PC	3	0	3		4.5	
3.	19EID234 /19EID232	Life Sciences for Engineers /Internet of Things	BS/ES	2	0	2		3	
4.	19EEE34X	Program Elective-I	PE	2/3	0	2/0		3	
5.	19ZOE3XX	Open Elective I	OE	3	0	0		3	
6.	19EYY3XX	Interdisciplinary Elective I	ID	2	1	0		3	
7.	19EEE391	Comprehensive Skill Development IV	PW	0	0	0	6	1	
Total								**22**	

Semester VI

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EEC332	Microprocessors and Microcontrollers	PC	3	0	3		4.5	Common with ECE
2.	19EEE332	Power Electronics	PC	3	0	2		4	
3.	19EEE34X	Program Elective II	PE	2/3	0	2/0		3	
4.	19EEE35X	Program Elective III	PE	2/3	0	2/0		3	
5.	19ZOE3XX	Open Elective II	OE	3	0	0		3	
6.	19EHS302	Engineering Economics and Management	HS	3	0	0		3	
7.	19EMC382	Engineering Ethics	MC	3	0	0		0	Mandatory-Course
8.	19EEE392	Comprehensive Skill Development V	PW	0	0	0	6	1	
Total								**21.5**	

Semester VII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EEE431	Power Systems II	PC	3	0	3		4.5	
2.	19EYY4XX	Interdisciplinary Elective II	ID	2	1	0		3	Specialization Specific
3.	19EEE44X	Program Elective IV	PE	2/3	0	2/0		3	
4.	19EEE45X	Program Elective V	PE	2/3	0	2/0		3	
5.	19EHS403	Organizational Behavior	HS	3	0	0		3	
6.	19EEE491	Project Phase I	PW	0	0	2		1	
7.	19EEE493	Internship*	PW					1	
8.	19EEE495	Comprehensive Skill Development VI	PW	0	0	0	6	1	
Total								**19.5**	

***** Industrial Training / Research Projects in National Laboratories/Academic Institutions

Semester VIII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EYY4XX	Interdisciplinary Elective III	ID	2	1	0		3	
2.	19EEE44XX	Program Elective VI	PE	2/3	0	2/0		3	
3.	19EEE492	Project Phase II	PW	0	0	12		6	
4.	GSS115	Gandhi for 21st Century	PW					1	Online Course
5.	HSMCH102	Universal Human Values 2: Understanding Harmony	HS	2	1	0		3	
Total								**16**	

Total Number of Credits

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	**17.5/ 18.5**	**23/22**	**22**	**23.5**	**22**	**21.5**	**19.5**	**16**	**165**

Category wise credits distribution

Category	Category Code	Courses		Credits GITAM	Credits suggested by AICTE
Humanities & Social Sciences	HS	Communicative English		14	12
		HS1 and HS2 (elective) Comprehensive Skill Development II & III			
		Universal Human Values 2: Understanding Harmony			
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 and Product Innovation			
		Internet of Things			
Open Electives	OE	OE1, OE2		**6**	**18**
Inter disiplinanary	ID	ID1 – ID3		**9**	
Program Electives	PE	PE1 – PE6		**18**	**18**
Program Core	PC	PC1 – PC14		**55**	**48**
Project	PW	Venture Discovery		**15**	**15**
		Internship			
		Comprehensive Skill Development IV –VII			
		Project Phase I			
		Project Phase II			
		Gandhi for 21st Century			
Mandatory	MC	Environmental Science, Constitution of India, Engineering Ethics		-	-
Total				**165**	**160**

Mandatory Course

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMC181A	National Service Scheme	MC	0	0	2	0	Mandatory Course
2.	19EMC181B	National Cadet Corps	MC	0	0	2	0	Mandatory Course
3.	19EMC181C	National Sports Organization	MC	0	0	2	0	Mandatory Course
4.	19EMC181D	Yoga	MC	0	0	2	0	Mandatory Course

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, ME,CE and AE
2.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	3	Offered for CSE and IT
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,CE and AE
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	Offered for CSE and IT
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	Engineering Mathematics IV (Numerical Methods, Probability and Statistics)	BS	3	0	0	3	Offered for CE, ME and EEE
2.	19EMA204	Engineering Mathematics IV (Probability Theory and Random Processes)	BS	3	0	0	3	Offered for ECE
3.	19EMA206	Engineering Mathematics IV (Number Theory and Applications)	BS	3	0	0	3	Offered for CSE and IT
4.	19EMA208	Mathematics for Biotechnology IV	BS	3	0	0	3	Offered for BT

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 EEE, CSE, ECE and IT
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 EEE, CSE, ECE and IT
2.	19ECY133	Chemistry of Materials	BS	3	0	3	4.5	Offered for AE, CEand 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

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.	GEL345	Workplace Communication– Basic	OE	3	0	0	3
13.	GEL347	Workplace Communication– Advanced	OE	3	0	0	3

INTERDISCIPLINARY ELECTIVES

Interdisciplinary Elective- I

S.No	Stream	Course Code	Course Name	Category	L	T	P	C	Remarks Offered by
1	Professional courses	19EEI371	Sensors and signal conditioning	ID	2	1	0	3	EIE
2		19EPH371	Materials for Engineering Applications	ID	2	1	0	3	Physics
3	Computer Oriented Courses	19ECS476	Introduction to Big Data	ID	2	1	0	3	CSE
4		19ECS373	Object oriented Programming with C++	ID	2	1	0	3	CSE
5		19ECS375	Introduction to Programming with Java	ID	2	1	0	3	IT
6	Management Courses	19EME371	Quantitative Techniques for Management	ID	2	1	0	3	ME
7		19EME356	Enterprise Resource Planning	ID	2	1	0	3	ME

Interdisciplinary Elective- II

S.No	Stream	Course Code	Course Name	Category	L	T	P	C	Remarks Offered by
1	Professional courses	19EEC473	Fundamentals of Digital Signal Processing	ID	2	1	0	3	ECE
2		19EEI477	Industrial Automation	ID	2	1	0	3	EIE
2	Computer Oriented Courses	19ECS344	Introduction to Machine learning	ID	2	1	0	3	CSE
3		19ECS475	Introduction to Web Technologies	ID	2	1	0	3	CSE
4		19ECS471	Introduction to Operating Systems	ID	2	1	0	3	IT
5	Management Courses	19EME456	Optimization Techniques	ID	2	1	0	3	CSE
6		19EHS475	Entrepreneurship Development	ID	2	1	0	3	ME

Interdisciplinary Elective-III

S.No	Stream	Course Code	Course Name	Category	L	T	P	C	Remarks Offered by
1	Professional courses	19EEI475	Medical Instrumentation	ID	2	1	0	3	EIE
2		19EEI473	Virtual instrumentation	ID	2	1	0	3	EIE
3	Computer Oriented Courses	19ECS478	Introduction to Data Science	ID	2	1	0	3	IT
4		19ECS474	Introduction to Cloud Computing	ID	2	1	0	3	IT
5	Management Courses	19EME349	Total Quality Management	ID	2	1	0	3	ME
6		19EME357	Supply Chain Management	ID	2	1	0	3	ME

PROGRAM ELECTIVES

Electives Stream	Programme Elective I (V sem)	Programme Elective II (VI sem)	Programme Elective III (VI sem)	Programme Elective IV (VII sem)	Programme ElectiveV (VIIsem)	Programme ElectiveVI (VIIIsem)
Power Systems	Electrical Machine Design	Power System Protection	Electrical Distribution systems	High Voltage Engineering	Wind & Solar Energy Systems	Artificial Intelligence application to power systems
Power Electronics & Drives	Electrical Measurements	Electrical Drives	Industrial Electrical Systems	Power Quality & FACTS	HVDC Transmission systems	Hybrid Electric Vehicles
Control Systems	Process Control	Digital Control systems	Advanced Control systems	Modern control systems	Non -linear control systems	Robotics

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

Program Elective I

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE352	Electrical Machine Design	PE	2	0	2	3	
2	Power Electronics & Drives	19EEE343	Electrical Measurements	PE	2	0	2	3	
3	Control Systems	19EEE445	Process Control and Automation	PE	3	0	0	3	

Program Elective II

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE342	Power System Protection	PE	3	0	0	3	
2	Power Electronics & Drives	19EEE354	Electrical Drives	PE	3	0	0	3	
3	Control Systems	19EEE455	Digital Control systems	PE	2	0	2	3	

Program Elective-III

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE341	Electrical Distribution Systems	PE	3	0	0	3	
2	Power Electronics & Drives	19EEE344	Industrial Electrical Systems	PE	3	0	0	3	
3	Control Systems	19EEE457	Advanced Control systems	PE	2	0	2	3	

Program Elective IV

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE441	High Voltage Engineering	PE	3	0	0	3	
2	Power Electronics & Drives	19EEE453	Power Quality & FACTS	PE	3	0	0	3	
3	Control Systems	19EEE346	Modern control systems	PE	2	0	2	3	

Program Elective V

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE451	Wind & Solar Energy Systems	PE	3	0	0	3	
2	Power Electronics & Drives	19EEE443	HVDC Transmission systems	PE	3	0	0	3	
3	Control Systems	19EEE356	Non -linear control systems	PE	2	0	2	3	

Program Electives-VI

S.No	Stream	Course Code	Course Title	Category	L	T	P	C	Remarks
1	Power Systems	19EEE442	Artificial Intelligence application to power systems	PE	2	0	2	3	
2	Power Electronics & Drives	19EEE444	Hybrid Electric Vehicles	PE	3	0	0	3	
3	Control Systems	19EEE446	Robotics	PE	2	0	2	3	

S. No	Course Code	Course Title	Category	L	T	P	A	C	Semester	Content
1	19EHS122	Comprehensive Skill Development I	HS	0	0	0	6	1	II	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%)
2	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	III	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%)
3	19EEE292	Comprehensive Skill Development III	PW	0	0	0	6	1	IV	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%
4	19EEE391	Comprehensive Skill Development IV	PW	0	0	0	6	1	V	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) Coding (50%)
5	19EEE392	Comprehensive Skill Development V	PW	0	0	0	6	1	VI	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) **Domain Skills** (50%)
6	19EEE495	Comprehensive Skill Development VI	PW	0	0	0	6	1	VII	Verbal + Soft skills + Quantitative Aptitude and Reasoning (50%) **Domain Skills** (50%)

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 **10L**

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, diagonalisation 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: Mean Value Theorems **6L**

Rolle‟stheorem,Lagrange‟smeanvaluetheorem,Cauchy‟smeanvaluetheorem,Taylor's and Maclaurin's theorems with remainders (with out proof).

Learning Outcomes:

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

- demonstratethegivenfunctionasseriesofTaylor‟sandMaclaurin‟swithremainders(L2)
- illustrate series expansions of functions using mean value theorems(L2)

UNIT III: Multi variable Calculus **8L**

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 **8L**

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 28er form 2828 and polar coordinates(L3)
- calculate the areas bounded by a region using double integration techniques(L3)

UNIT V:MultipleIntegrals-II **8L**

Evaluation of triple integrals, change of variables(28er form2828,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 28er form2828, 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.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics,3/e,AlphaScience 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 roleplays.
- To exposelearnerstokeyReadingtechniquessuchasSkimmingandScanningforcomprehensionof 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, professional life and in an increasingly complex, interdependent world.

UNITI **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 meaning fully in context(L3)

UNITII **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)
- applyvariousnote-makingtechniqueswhilecomprehendingthereadingtexttopresentacomplete 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)

UNITIII **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

- noticeandunderstandeffectivelisteningstrategiestoidentifydiscoursemarkersinpresentations. (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)

UNITIV **10L**

Listening: Listening for labeling-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)

UNITV **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 CollegePress,2019.
2. Raymond Murphy, "English Grammar in Use A Self-Study Reference and Practice Bookfor Intermediate Learners of English, Cambridge UniversityPress,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 Black Swan, (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 & CSE)

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 their respective 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 32er form 3232 gnetic in modern communications systems.
- To impart knowledge concerning the electrical 32er form32 of dielectric materials.
- To demonstrate the properties of magnets.
- To introduce semiconductor physics and devices.

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

Electrostatic field: Coulomb's law and Gauss‟ law, derivation of Coulombs law from Gauss‟ law, applications of Gauss‟ law (line charge, 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–Savart's 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 **7L**

Introduction, advantages of optical fibers, principle and structure, acceptance angle, 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)
- analyzepropagationoflightthroughopticalfibersbasedontheconceptofmodes(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 **8L**

Introduction,originofenergyband,intrinsicandextrinsicsemiconductors,mechanismofconductionin intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors,carrierconcentrationinn-typeandp-typesemiconductors.

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)

UNIT V: Semiconductor devices **8L**

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", WileyPublications,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 along the axis of a circular coil carrying current.
2. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
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-Hcurve).
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
12. 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 photo diode, p-n junction diode and solar cell(L2).
- demonstrate the importance of dielectric material in storage of electric field energy I 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).
- determinehysteresislossesbyB-Hcurveandmeasuremagneticparametersusinghysteresisloop (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 & CSE)

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).

UNITI **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 electrode potentials.(L2)
- compare different types of cells and batteries.(L2)
- classify the ion selective electrodes.(L2)

UNITII **8L**

Battery Technology

Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zinc air, lithium cells-$LiMnO_2$cell-challenges of battery technology. Fuel cells Introduction – classification of fuel cells – 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

UNITIII **8L**

Renewable Sources of Energy Introduction- sources of renewable energy

Solar energy – Introduction – Physical and Chemical properties of Silicon- Production of Solar Grade SiliconfromQuartz-DopingofSilicon-pandntypesemiconductors-Pvcell/solarcell-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)

UNITIV **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 electro deposits, electro plating process, Electroplating of chromium, gold etc. Electro less 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)

UNITV **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

- explaintheconceptsofartificialmolecularmachinesandmolecularswitches.(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 andsons,2003.
2. B.SmurthyandP.Shankar,AtextBookofNanoScienceandNanoTechnology,UniversityPress,

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 nano clusters 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 dichromate
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-Formaldehyderesin
12. Preparation of Urea-Formaldehyderesin
13. Thin layer chromatography
14. Preparation of TiO_2/ZnO nanoparticles
15. SEM analysis of nanomaterials

Text Books

1. MendhamJ,DenneyRC,BarnesJD,ThomasMandSivasankarB,Vogel‟sQuantitativeChemical Analysis, 6/e, Pearson publishers,2000.
2. N.K Bhasinand 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

Thiscoursefocusesonproblemsolvingusingvisualprogrammingandflowcharttools.Pythonbeingsimple 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).

UNIT V: 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 with Python 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 3matrix.
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 data sets.
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 usingraptor.
2. T R Padmanabhan, Programming with python,Springer.
3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford UniversityPress.
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)

19EEE131: BASIC ELECTRICAL AND 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

- TofamiliarizethebasicDCandACnetworksusedinelectricalandelectroniccircuits.
- 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).
- ToexposebasicconceptsandapplicationsofOperationalAmplifierandconfigurations.

UNITI **10L**

Basic laws and Theorems: Ohms law, Kirchhoff'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)
- determinethecurrent,voltageandpowerinthegivenelectricalcircuit(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)
- demonstratetheperformancecharacteristicsofdifferenttypesofdcmachines (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)

UNITIV **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 witch(L2)

UNIT V **10L**

Operational Amplifiers: The Ideal Op-Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Non-inverting 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 Non-inverting configurations of Op-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 with Op-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,FundamentalsofElectricalEngineeringandElectronics,1/e,S.ChandPublishing, New Delhi,2006.
3. AdelS.SedraandKennethC.Smith,MicroelectronicCircuits,6/e,OxfordUniversityPress,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)
- demonstratetheoperationandapplicationsofvariouselectronicdevices(L2)
- construct Inverting and Non-inverting configurations of Op-Amp(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 wood working 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) Tapered tray b) Conical funnel c) Elbow pipe d)Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following 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)
- perform 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: **7L**

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:

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 representations. **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 [1] 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, NSS, 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-defense 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.

Textbook(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 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 defense organization and its duties – ndma, types of emergencies / natural disasters, fire service and firefighting, 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 rainwater harvesting, waste management, pollution control, water, air, noise and soil, energy conservation, wildlife conservation – projects in India. obstacle training, obstacle course, practical training

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

Textbook(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,** Suryanamaskaras, Tadasan, Natarajasan, Vrikshasan, Padahasthasan, Ardhachakrasan, Trikonasan, Bramari pranayama.
- **Yoga for all-round fitness,** Bhadrasan, Vajrasan, ArdhaUstrasan, Nadishuddhi pranayama, Navasan, Janusirasan, Paschimotthanasan, Shashankasan, Vakrasan, Bhujangasan, Kapalabhati..
- **Meditative Postures**: Sukhasan, Ardha Padmasan, Padmasan and Siddhasan,Meditation
- **Yoga Practice**: Makarasan, Sethubandhasan, Pavanmuktasan, Sarvangasan, Matsyasan, Halasan.

Text Book(s):

1. Swami MuktibodhandaSaraswathi 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).

19EMA102: ENGINEERING MATHEMATICS-II ODE, PDE AND MULTIVARIABLE CALCULUS

(Common with AE, CE, ECE and ME)

L T P C

3 0 0 3

This course is designed to impart knowledge on ordinary, partial differential equations and vector calculus to understand the concepts like fluid mechanics, signals and systems

etc., in engineering applications.

Course Objectives:

- To familiarize the students in the concepts of linear differential equations.
- To explain the concept of reducing linear differential equations with variable coefficients to constant coefficients and their applications.
- To demonstrate the concepts of partial differential equations.
- To explain the concepts of vector differentiation and integration.

Unit I: Linear Differential Equations of Higher Order **8 L**

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(L4).
- identify the essential characteristics of linear differential equations with constant coefficients(L3).
- solve the linear differential equations with constant coefficients by appropriate methods(L3).

Unit II: Equations Reducible to Linear Differential Equations and Applications **8 L**

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

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).

Unit III: Partial Differential Equations **8 L**

Formation of partial differential equations, solutions of first order linear partial differential equations, 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 partial differential equations(L3).
- identify the basic properties of partial differential equations(L3).

Unit IV: Multivariable Calculus (Vector Differentiation) **8 L**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

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

- illustrate the physical interpretation of gradient, divergence and curl(L3).
- apply operator del to scalar and vector point functions(L3).

Unit V: Multivariable Calculus(Vector Integration) 10 L

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Gauss divergence theorem (without proof).

Learning Outcomes:

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

- find the work done in moving a particle along the path over a force field(L3).
- construct the rate of fluid flow along and across curves(L3).
- apply Green's, Stokes and Gauss divergence theorem in evaluation of line, surface and volume integrals(L3).

Text Book(s):

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

References:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, 4/e, Jones and Bartlett Publishers,2011.
2. MichaelGreenberg,AdvancedEngineeringMathematics,2/e,Pearson,2016.
3. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas‟ Calculus, 13/e, Pearson Publishers,2014.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd.,2002.
5. Glyn James, Advanced Modern Engineering Mathematics,4/e, Pearson Publishers,2011.

Course Outcomes:

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

- solve the differential equations related to various engineering fields(L3).
- identify methods of solution for partial differential equations(L3).
- interpret the physical meaning of gradient, divergence, and curl(L4).
- determine the work done against a force field, circulation and flux using vector calculus(L4).

19EID132: DESIGN THINKING
(Common to all)

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

UNIT 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 completing 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)

UNIT 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 completing 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)

UNIT 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 completing 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)

UNIT 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 completing 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)

UNIT 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 completing 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 Book(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. http://www.algarytm.comA/it-executives-guide-to-design-thinking:e-book.
5. 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)

19EID134: AI TOOLS
(Common to all)
Effective for admitted batch 2019-20

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:

- To provide a basic foundation on different concepts of Artificial Intelligence.
- To investigate various applications of AI such as Virtual Assistants, Computer Vision, as well as other Smart Applications.
- Explore the scope, advantages as well as limitations of intelligent systems.
- Experiment with different machine learning concepts such as Deep Learning and Reinforcement Learning
- To expose students to the AI-intensive computing and information system frameworks.

UNIT I **10L**

Introduction to Artificial Intelligence: Basics of AI Applications of AI.Advanced search Constraint satisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilistic reasoning.

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

Conceptual introduction to Natural Language Processing: Natural language Understanding Sentiment Analysis, Segmentation and recognition.

Conceptual introduction to Speech Recognition & Synthesis: Speech Fundamentals, Speech Analysis, Speech Modelling, Speech Recognition, Speech Synthesis, Text-to-Speech.

Conceptual introduction to Image Processing & Computer Vision: Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Segmentation, Edge Detection, Optical Character Recognition, Feature Detection & Recognition

Learning Outcomes:

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

- Recognize various domains in which AI can be applied(L2)
- Define machine learning and forms of learning(L1)
- describenaturallanguageprocessingandconceptsforconvertingspeechtodifferentforms(L2)
- identify the concepts of image processing(L3)

UNIT II **12L**

BOT Technologies and Virtual Assistants: Catboats: Introduction to a Chabot, Architecture of a Chabot. NLP in the cloud, NL Interface, how to Build a Chabot, Transform native user experience of catboats, Designing elements of a Chabot, Best practices for Chabot development. NLP components. NLP wrapper to catboats. Audio bots and Music bots.
Virtual Assistants: Architecture of a Virtual Assistant.

Learning Outcomes:

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

- analyze the architecture of a Chabot(L4)
- illustrate how to construct a Chabot(L2)
- differentiate various catboats(L4)
- interpret the architecture of a virtual assistant(L3)

UNIT III **12L**

Image Processing &Computer Vision: Image-Definition and Tagging. Classification of images. Tagging. Image formation, Deep Learning algorithms for Object detection & Recognition. Face recognition Instance recognition, Feature detection and matching, Segmentation, Recognition Databases and test sets Applications --Feature extraction, Shape identification. Fane detection.

Applications: Automation, Agriculture [Crop and Soil Monitoring, grading farm produce, Predictive Analytics], Retail and Retail Security[Amazon Go],Autonomous vehicles.

Learning Outcomes:

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

- classify the properties of images(L3)
- interpret the concepts of image processing(L2)
- implement the methods in processing an image(L3)
- analyze and apply the concepts of image processing in automation and agriculture(L4)

UNIT IV **12L**

Reinforcement Learning: Introduction to Reinforcement Learning, Game Playing [Deep Blue in Chess, IBMWatson in Jeopardy, Google's Deep Mind in AlphaGo], Agents and Environment, Action-Value

Function, Deep Reinforced Learning

Applications: Robotics, Gaming, Diagnostic systems, Virtual Assistants.

Learning Outcomes:

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

- illustrate reinforcement learning(L2)
- employ the reinforcement learning in game playing(L3)
- use reinforcement learning in agent based environment(L3)
- practice learning processsindiagnosticandvirtualassistantsystems(L3)

UNIT V **10L**

Smart Applications: Smart Manufacturing, Smart Agriculture, Smart Healthcare, Smart Education, SmartGrids, 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(L2)
- apply the artificial intelligence in various applications(L3)
- correlate the intelligence to advanced applications(L4)

Text Book(s)

1. Tom Markiewicz &Josh Zheng, Getting started with Artificial Intelligence, O'Reilly Media,2017.
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach. Prentice Hall

References

1. Aurélien Géron, Handson Machine Learning with Scikit- Learn and Tensor Flow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media, 2017.
2. BuildanAIAssistantwithWolframAlphaandWikipediainPython.https://medium.com/@salisuw y/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe
3. JosephHowse,PrateekJoshi,MichaelBeyeler-Opencv_ComputerVisionProjectswithPython- Packt Publishing(2016).
4. CuratedDatasetsonKagglehttps://www.kaggle.com/datasets.

AI TOOLS LABORATORY

List of Practical Experiments:

1. Supervisely-PerformDataLabellingforvariousimagesusingobjectrecognition
2. Lobe.ai-BuildcustommodelsusingthevisualtoolforObjectrecognitionandsentimentanalysisthatcan convert facial expressions into emoticons
3. TeachableMachine-InBrowserObjectRecognitionthroughBrain.JS
4. Liv.ai-App for Speech recognition and Synthesis through APIs
5. Building a Chabot using AWS Lex, Pandorabots
6. Configure an existing Neural Network by manipulating various parameters involved
7. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
8. Build a Convolutional Neural Network for Cat vs. Dog Image Classification

Online Resources:
Pytorch:
https://pytorch.org/https://git hub.com/pytorch
Keras:
https://keras.io/https://github
.com/keras-team
Theano:
http://deeplearning.net/software/theano/https://github.com/T heano/Theano
Cafee2:
https://caffe2.ai/https://githu b.com/caffe2
Deeplearning4j:
https://deeplearning4j.org/

Scikit-learn:
https://scikit- learn.org/stable/https://github.com/scikit
-learn/scikit-learn

DeepLearning.Ai:
https://www.deeplearning.ai/
OpenCv:
https://opencv.org/https://github.com/q qwweee/keras-yolo3
YOLO:
https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with- opencv/
nVIDIA:CUDA:
https://developer.nvidia.com/cuda-math-library

Course Outcomes

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

- Distinguish the concepts of artificial intelligence, machine learning, natural language processing, image processing. (L4)
- Illustrate the architectures of Chabot and virtual assistant(L2)
- Analyze image based applications by using image processing concepts(L4)
- Employ reinforcement learning in different applications(L3)
- Identify smart applications(L3)

19EID134: AI TOOLS
(Common to all)
Effective from admitted batch 2020-21 onwards

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.

Pre-Requisites:
Courser code: 19EID131
Course Name: Problem Solving and Programming

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 concepts
- Exposure to AI-intensive computing and information system frameworks

Unit I **6L+6P**

Introduction to Artificial Intelligence: :Basics of AI. 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 AI can be applied (L2)

Unit II **6L+6P**

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 (L1)
- identify types of machine learning(L1)

Unit III **7L+6P**

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 (L2)
- implement the methods in processing an image (L3)

Unit IV **6L+4P**

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 (L4)
- describe natural language processing and concepts for converting speech to different forms (L2)

Unit V **7L+6P**

BOT Technologies: Chatbots: Introduction to a 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. Audiobots and Musicbots.

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(L2)
- correlate Artificial Intelligence to advanced applications(L4)

Text Book(s)

1. Tom Markiewicz & Josh Zheng, Getting started with Artificial Intelligence, Published by O'Reilly Media,2017
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach.

References

1. AurélienGéron, Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
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-Packt Publishing (2016).
4. Curated Datasets on Kagglehttps://www.kaggle.com/datasets.

AI TOOLS LABORATORY

List of Practical Experiments:

1. Supervisely - Perform Data Labelling for various images using object recognition
2. Teachable Machine - In Browser Object Recognition through Brain.JS
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 OpenCV
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

Online Resources:

Pytorch: https://pytorch.org/ https://github.com/pytorch Keras:
https://keras.io/ https://github.com/keras-team Theano:
http://deeplearning.net/software/theano/ https://github.com/Theano/Theano Cafee2:
https://caffe2.ai/ https://github.com/caffe2 Deeplearning4j:
https://deeplearning4j.org/ Scikit-learn:
https://scikit-learn.org/stable/ https://github.com/scikit-learn/scikit-learn
Deep Learning.Ai:
https://www.deeplearning.ai/ OpenCv:
https://opencv.org/ https://github.com/qqwweee/keras-yolo3 YOLO:
https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/

nVIDIA:CUDA:
https://developer.nvidia.com/cuda-math-library

Course Outcomes:

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

- able to grasp the concepts of artificial intelligence, machine learning, natural language processing, image processing. (L1)
- recognize various domains in which AI can be applied.(L2)
- implement the methods in processing an image.(L3)
- implement simple of chatbots.(L4) .
- identify smart applications. (L4)

19EEE122: ELECTRICAL WORKSHOP

L	T	P	C
0	0	3	1.5

The objective of this course is to familiarize the students with commonly used components, accessories and measuring equipment in Electrical installations. The course also provides hands on experience in setting up of simple wiring circuits and electric machine wiring.

Course Objectives

- Explain different tools and symbols used in electrical wiring.
- Impart the skills to do few varieties of electric wiring.
- Demonstrate different electrical machines and their wiring arrangement.
- Train to operate various electrical machines.

List of Experiments:

1. Study of various electrical tools and symbols.
2. Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.
3. Wiring of light/fan circuit using two way/three-way control (Staircase wiring)
4. Go-down wiring / Tunnel wiring.
5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, Main switch and Energy meter.
6. Measurement of voltage, current, resistance in DC circuit.
7. Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit.
8. Wiring of backup power supply including inverter, battery and load for domestic installations.
9. Starting of DC shunt motor using three-point starter.
10. Starting of DC series motor using two-point starter.
11. Starting of single-phase induction motor.
12. Starting of three phase induction motor.

Course outcome:

After the completion of this course students will be able to

- summarize supply arrangements and their limitations, knowledge of standard voltages and their tolerances, safety aspects of electrical systems and importance of protective measures in wiring systems (L2).
- explain types of wires, cables and other accessories used in wiring. Creating awareness of energy conservation in electrical systems (L1).
- Demonstrate simple lighting circuits for domestic buildings, distinguish between light and power circuits (L3).
- derive electrical circuit parameters and current, voltage and power in a circuit (L2).

explain with backup power supply in domestic installation (L1).

19EHS122: COMPREHENSIVE SKILL DEVELOPMENT – 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

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

	Verbal and Soft Skills	
Unit	Module/ Topics	Hrs
1.	Self-Awareness and Self-Regulation	4
2.	Social Awareness & Relationship Management	4
3.	Conflict Management	3
4.	Team Work	4
	Total	15

B. Quantitative Aptitude and Reasoning

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

	Quantitative Aptitude and Reasoning	
Unit	**Module/ Topics**	**Hrs**
1.	Verbal Reasoning [Coding decoding, Blood relations, Ranking, Directions, Group Reasoning (Puzzle Test)]	6
2.	Analytical Reasoning [Cubes, Counting of Geometrical Figures)	2
3.	Logical Deductions [Venn diagrams, Syllogisms, Data Sufficiency]	4
4.	Puzzles [Puzzles from books i. Puzzles to puzzle you by Shakunthala devi ii. More puzzles by Shakunthala devi iii. Puzzles and Teasers by George Summers]	3
	Total	**15**

Part-2 **- 3 Hours per week**

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. sentation 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/

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.

COURSE OBJECTIVES

- 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

11 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 textbook 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 Outcomes	**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

19EMA203: ENGINEERING MATHEMATICS-III COMPLEX VARIABLES & TRANSFORM TECHNIQUES
(Common to EEE & ECE)

L	T	P	C
3	0	0	3

Preamble: *This course is designed to familiarize the students with complex variables, complex integration, Fourier series expansions of periodic functions and Laplace, Z-transforms to understand the applications in engineering.*

Course Objectives:

- To explain the concepts of complex analysis and their applications.
- To demonstrate the concept of Laplace and inverse Laplace transforms.
- To teach Fourier series and Fourier transforms of functions.
- To teach Z-transforms and its applications.

Unit I: Complex Variables **10 L**

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Cauchy theorem, Caufchy integral formula, Taylor's series, Laurent's series, singularities, residues, Cauchy residue theorem (All theorems without proof).

Learning Outcomes:

After completion of this unit student able to

- Identify continuous and differentiable complex functions (L3)
- apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
- Analyze the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues (L4)
- make use of the Cauchy residue theorem to evaluate certain integrals (L3)

Unit II: Laplace transforms **9L**

Definition of Laplace transform, existence conditions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, convolution theorem, periodic functions, unit step function, unit impulse function, applications to ordinary differential equations. (Without proofs)

Learning Outcomes:

After completion of this unit student able to

- examine the properties of Laplace transformation (L4)
- apply the Laplace and inverse Laplace transformations for different types of functions (L3)
- solve ordinary differential equations by using Laplace transformation technique (L3)

Unit III: Fourier series **6 L**

Fourier series, Dirichlet's conditions, functions of any period, odd and even functions - half range series.

Learning Outcomes:

After completion of this unit student able to

- build the Fourier series expansion for different periodic functions (L3)
- analyze the nature of the Fourier series that represent even and odd functions and how derivation of a Fourier series can be simplified in this way (L4)

Unit IV: Fourier transforms **8 L**

Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform, properties, convolution theorem.

Learning Outcomes:
After completion of this unit student able to

- examine the properties of Fourier transformation (L4)
- apply Fourier transformation for different functions (L3)

Unit V: Z-Transforms **9L**

Definition of Z-transform, elementary properties, linearity property, damping rule, shifting u_n to the right and left, multiplication by n, initial value theorem, final value theorem, inverse Z-transform, convolution theorem, solution of difference equations using Z-transforms.

Learning Outcomes:
After completion of this unit student able to

- summarize the properties of Z-transforms (L3)
- find Z and inverse Z-transformations for different functions (L3)
- solve difference equations by using Z-transforms (L3)

Text Books:

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. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

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

- Make use of differentiation and integration of complex functions in engineering problems (L3)
- apply the Laplace transform for solving differential equations (continuous systems) (L3)
- find the Fourier series of periodic signals (L3)
- know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- solve discrete time systems using Z transform techniques (L3)

19EEE231: ELECTRICAL CIRCUIT ANALYSIS

L	T	P	C
3	0	3	4.5

This course is aimed to introduce the basic concepts of electric circuits which are needed for the circuit analysis and has potential applications in various subjects that include design and development. This is base course for subjects like electrical machines, power systems and power electronics. The students are provided with hands on experience in verification of various network theorems and evaluation of network parameters.

Course Objectives:

- **To familiarize** various circuit elements, basic laws and theorems.
- **To appraise** the behavior of RLC networks for DC excitation.
- **To teach** the concepts of sinusoidal steady state analysis and resonance.
- **To familiarize** concepts of magnetic coupling in coupled circuits.
- **To acquire** two-port network parameters and the relations between them.
- **To solve** three phase balanced and Unbalanced circuits.

UNITI: (8L+12P)

Introduction: Ohms law, Kirchhoff's laws, series and parallel circuits, source transformations, delta–wye conversion, linearity, and superposition theorem with simple examples, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples, compensation theorem, reciprocity theorem, Milliman's theorem, mesh analysis and nodal analysis with simple examples, concepts of super node and super mesh.

Learning outcomes:

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

- **classify** various circuit elements(L2).
- **determine** node voltages and mesh currents using nodal and mesh analysis(L2).
- **solve** electric circuits involving d.c. sources using basic laws and theorems(L3).
- **simplify** electrical circuits using various reduction methods(L4).

UNITII: (6L+3P)

DC Transients: source free response of RL, RC and RLC circuits, forced response of RL, RC and RLC for DC excitation.

Learning outcomes:

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

- **calculate** the initial conditions of given RL, RC and RLC circuits(L3).
- **determine** transient response of source free RL,RC and RLC circuits(L3).
- **analyze** forced response of RL,RC and RLC circuit elements(L4).

UNITIII: (8L+6P)

Sinusoidal steady-state analysis: sinusoidal functions and complex functions, instantaneous power, average power, effective values of current and voltage, apparent power and power factor, complex power, concept of phasors, phasor relationships for RL, RC and RLC circuits and steady-state analysis of RL, RC and RLC circuits.

Learning outcomes:

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

- **solve** AC circuits for finding various quantities associated with each element(L3).
- **sketch** phasor diagram for various configurations of RLC circuits (L3).
- **examine** the real, reactive power and power factor in ac circuits(L4).

UNITIV: (8L+12P)

Coupled circuits, Resonance and Two-port Networks: magnetically coupled circuits, mutual inductance, coupling coefficient, parallel resonance, series resonance, bandwidth, quality factor, two port networks, impedance parameters, admittance parameters, hybrid parameters and transmission parameters, relationships between parameters.

Learning outcomes:

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

- **calculate** mutual inductance and coefficient of coupling in coupled circuits(L2).
- **outline** the concepts of resonance in electric circuits(L2).
- **solve** circuits involving magnetically coupled elements(L3).
- **determine** various parameters for two port networks(L5).

UNITV: (6L+3P)

Three-phase circuits: voltage, current and power in star connected and delta connected 3-phase circuits (for balanced and unbalanced loads).

Learning outcomes:

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

- **compare** star and delta connected 3-phase systems(L2).
- **determine** the line and phase voltages, line and phase currents, for various configurations of three phase circuits(L3).
- **solve** real power, reactive power and power factor in 3-phase circuits(L3).

Electrical Circuit Analysis Laboratory

List of Experiments:

1) Verification of Thevenin's and Norton's theorems.

2) Verification of superposition theorem and maximum power transfer theorem.

3) Verification of compensation theorem.

4) Verification of reciprocity, Milliman's theorems.

5) Locus diagrams of RL and RC series circuits.

6) Series and parallel resonance.

7) Determination of self, mutual inductances and coefficient of coupling.

8) Determination of Z and Y parameters.

9) Determination of transmission and hybrid parameters.

10) Measurement of reactive power for star and delta connected balanced loads.

11) Determination of time response of RL&RC network.

12) Determination of form factor of non sinusoidal waveform.

Text book(s):

1. William H. Hayt Jr., Jack E. Kemmerly, Engineering Circuit Analysis, 8/e, McGrawHill,2013
2. Van ValkenburgM.E, NetworkAnalysis, 3/e, PrenticeHallIndia, 2014

Reference book(s):

1. Sudhakar and Shyam Mohan ,Network Theory, 2/e, TMH,2012.
2. Schaum's outline series, Basic circuit analysis, McGraw-Hill Professional,2012
3. A.Chakrabarti, Circuit Theory Analysis & Synthesis, 6/e, Dhanpat Rai and Company,2014.
4. Robert L Boylestad, Introductory Circuit Analysis,12/e, Pearson Publications,2013.

Course Learning Outcomes:

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

- **solve** various electric circuits using basic laws and thermos(L3).
- **examine** the behaviour of RC and RL networks for DC excitation(L4).
- **calculate** voltage, current, real power, reactive power and power factor in electric circuits with sinusoidal excitation(L3).
- **apply** concepts of coupled circuits, resonance and two port networks(L5).
- **determine** voltages, currents and their phase relation in balanced and unbalanced 3--phase circuits (L3).

19EEE233: ELECTRO MAGNETIC FIELDS

L	T	P	C
2	0	2	3

This course provides scientific, mathematical and engineering principles that enable the students to understand forces, fields, and waves. The students need to understand the fundamental principles and laws of electromagnetism to develop and implement better analog and digital electronic system that take into account electromagnetic wave propagation and radiation effects. This course is base for other subjects like Electrical circuits, Electrical Machines and Power systems.

Course Objectives:

- **To introduce** various concepts of vector calculus and coordinate systems.
- **To expose** different concepts of electrostatic, magneto static and time varying electromagnetic systems.
- **To familiarize** the concepts of conductors, and dielectrics.
- **To impart** the concepts of Magnetic materials, magnetic forces, and inductance.
- **To expose** the students the ideas of electromagnetic waves.

UNITI: **(8L)**

Review of vector calculus:

Vector addition, subtraction, components of vectors, scalar and vector multiplications, triple products, Vector differentiation, partial differentiation, integration, vector operator- del, gradient, divergence and curl, integral theorems of vectors, three orthogonal coordinate systems (rectangular, cylindrical and spherical), conversion of a vector from one coordinate system to another.

Static electric field:

Coulomb's law, Electric field intensity, electrical field due to point charges, line, surface and volume charge distributions, electric flux, flux density, Gauss law and its applications, Absolute electric potential, potential difference, electric dipole- electric field and potential due to dipole, torque on a dipole, electrostatic energy and energy density.

Learning Outcomes:

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

- **demonstrate** electric dipole and energy density(L2).
- **apply** the concept of Gauss law for different field configurations(L3).
- **apply** the concepts of vector calculus and different types of coordinate system(L3).
- **Determine** the electric field for different configurations, potential and potential difference(L3).

UNIT II: **(8L)**

Conductors, dielectrics and capacitance: Behavior of conductors and dielectrics in an uniform electric field, current and current density, Ohm's law in point form, continuity equation, boundary conditions of perfect dielectric materials, permittivity of dielectric materials, capacitance of parallel plate and spherical capacitors, Poisson's and Laplace's equations in electric field and solution of Laplace's equation.

Learning Outcomes:

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

- **determine** current density and capacitance(L3).
- **classify** conductors and dielectrics(L2).
- **apply** Laplace and Poisson's equations for capacitance calculations(L3).
- **differentiate various** types of capacitors(L4).

UNITIII: **(8L)**

Static Magnetic Fields: Biot-Savart law, Ampere law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Magnetic Forces, Materials and Inductance: force on a moving charge, force on a differential current element, force between differential current elements, nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, self-inductance of solenoid and toroid, Neumann's formula for mutual inductance.

Learning Outcomes:

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

- **demonstrate** magnetic boundary conditions(L2).
- **apply** Biot-Savart law and Ampere law for magnetic field calculations(L3).
- **differentiate** scalar and vector magnetic potentials (L4).
- **determine** the force on different elements, self and mutual inductance(L3).

UNITIV: **(6L)**

Time Varying Fields and Maxwell's Equations: Faraday's laws of electromagnetic induction, static and motional electromotive forces, displacement current, point and integral forms of Maxwell equations, time varying fields.

Learning Outcomes:

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

- **explain** Faraday's law for electromagnetic induction(L2).
- **demonstrate** displacement current(L2).
- **explain** Maxwell's equations in integral and point forms(L2).

UNITV: **(6L)**

Electromagnetic waves: Derivation of wave equation, uniform plane waves, Maxwell's equation in phasor form, wave equation in phasor form, plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Poynting theorem.

Learning Outcomes:

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

- **explain** skin effect and Poynting theorem(L2).
- **demonstrate** wave propagation in conductors, perfect dielectrics and lossy dielectrics(L2).
- **apply** Poynting theorem to derive power equation(L3).
- **use** the wave equation in phasor form(L3).

Text Book(s):

1. A.Pramanik, Electromagnetism-Theory and Applications, PHI Learning Pvt. Ltd,2009.
2. A. Pramanik, Electromagnetism-Problems with Solution, Prentice Hall India,2012.

Reference Book(s):

1. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Publication,2014.
2. W. Hayt, Engineering Electromagnetics, McGraw Hill Education,2012.
3. Joseph Edminister , Vishnu Priye, Electromagnetics, Schaum's Outline Series,2017.

Course Learning Outcomes:

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

- **determine** the electric fields for different geometric configurations(L3).
- **calculate** capacitance using Poisson's and Laplace equations(L3).
- **determine** the magnetic fields for different geometric configurations(L3).

- **determine** and solve the Maxwell's equations(L5).
- **demonstrate** wave propagation in different media(L2).

19EEC233: ELECTRONIC DEVICES AND AMPLIFIER CIRCUITS

L	T	P	C
3	0	3	4.5

This course familiarizes the student with structure, operation, modeling and design of semiconductor devices and circuits. Laboratory experiments of this course include hardware experiments, SPICE simulations and end-to-end circuit design using EDA/PCB design software. Study of these basic circuits is helpful to train the student to design amplifier circuits, digital switches and balanced amplifiers.

Course Objectives:

- To introduce the physical construction, device operation, large signal and small signal models of bipolar junction transistors (BJTs) and metal oxide field effect transistors(MOSFETs).
- To impart the knowledge on design and simulation of current mirror circuits for a given voltage overhead, output resistance and required current sinking/sourcing capability.
- To familiarize the analysis of the input impedance, output impedance, voltage gain and bandwidth of MOSFET amplifier configurations.
- To explain the analysis and design of differential amplifiers for given gain, power dissipation, linearity, CMRR characteristics.
- To expose the student to semiconductor technology evolution, amplifier design principles and circuit analysis techniques.

Unit I: Bipolar Junction Transistors (8L + 6P)

Device structure and physical operation, current-voltage characteristics, the BJT as an amplifier and as a switch, BJT circuits at dc, biasing in BJT amplifier circuits, small-signal operation and models.

Learning Outcomes

After completion of this unit the student will be able to

- describe the device structure, physical operation and current-voltage characteristics of a BJT(L1).
- appreciate the use of BJT in an amplifier and logic gates as switch(L3).
- derive the small signal parameters of a BJT at a given operating point(L2).

Unit II: MOS Field-Effect Transistors (8L + 9P)

Device structure and physical operation, current-voltage characteristics, MOSFET circuits at dc, the MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation and models.

Learning Outcomes

After completion of this unit the student will be able to

- describe the device structure, physical operation and current-voltage characteristics of MOSFET (L1).
- appreciate the use of MOSFET as a trans conductor in an amplifier and switch in a logic gates(L3).
- derive the small signal parameters of a MOSFET at a given operating point(L3).

Unit III: (8L + 6P)

IC Design Philosophy, Comparison of the MOSFET and the BJT, IC biasing-current sources, current mirrors and current-steering circuits, current-mirror circuits with improved performance.

Learning Outcomes

After completion of this unit the student will be able to

- compareTherelativemeritsanddemeritsofMOSFETsandBJTsintermsoftransconductance,

output resistance, intrinsic gain and transition frequency(L2).
- design a MOSFET current sink/source for desired current, voltage headroom, output current and output resistance(L5).
- analyze the voltage headroom, output resistance of cascode current mirror and Wilson current mirror (L4).

Unit IV: Single Stage MOSFET Amplifiers (8L + 9P)

Basic MOSFET amplifier configurations, MOSFET internal capacitances and high frequency model, Frequency Response of the CS amplifier, Discrete circuit MOS Amplifiers.

Learning Outcomes

After completion of this unit the student will be able to

- describe the dominant pole approach, open circuit time constants method for estimating 3dB frequency of amplifiers(L1).
- derive the input impedance, output impedance and voltage gain of common source/common gate and common drain amplifiers using small signal models(L3).
- design a source follower circuit for given output impedance or required level shift(L5).
- analyze the 3dB frequency of MOSFET amplifier circuits using open circuit time constants method (L4).

Unit V : Differential Amplifiers (8L + 6P)

The MOS differential pair, small-signal operation of the MOS differential pair, other non-ideal characteristics of MOS differential amplifier, the MOS differential amplifier with activeload.

Learning Outcomes

After completion of this unit the student will be able to

- define single ended signaling and differential signaling and compare their merits/demerits(L1).
- draw the circuit diagram of a MOS differential pair and explain its basic operation w.r.t common mode voltage change and differential input change(L1).
- derive the differential mode gain, common mode gain and CMRR using small signal analysis(L3).
- explain the source of offset voltages in MOS differential pairs and their analysis(L2).

List of Experiments:

1. Current-Voltage Characteristics of BJT / Measurement of scale current & common emitter current gain.
2. Measurement of small signal parameters (g_m, r_o, r_π, r_e) of BJT at a given operating point Ic.
3. Design, Simulate and Implement BJT amplifier and Inverter logic gate Current-Voltage Characteristics of MOSFET / Measurement of threshold voltage.
4. Measurement of small signal parameters (g_m, r_o, g_{mb}) of MOSFET at a given operating point (I_d, V_{ds}).
5. Design and simulation of basic NMOS current mirror, cascode NMOS current mirror and current steering circuit.
6. Design, Simulation and Implementation of Common Source Amplifier for Gain, Power dissipation requirements.
7. Design, Simulation and Implementation of Common Drain Amplifier (Voltage Buffer) for Gain, Output Impedance, Level Shift requirements.
8. Analysis and Verification of Basic NMOS Differential Pair for Gain, Input Common Mode Range, Maximum Input differential voltage requirements.
9. Design, Simulation and Implementation of Differential Amplifier with active current mirror load for gain, power dissipation CMRR requirements.
10. Design, Simulation and PCB fabrication of BJT Astable Multivibrator Circuit.

Text Book:

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, "Microelectronic Circuits", 6/e, Oxford University Press, 2013.

References:

1. BehzadRazavi, “Fundamentals of Microelectronics”, 2/e, Wiley Student Edition,2013.
2. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuits Theory”, 10/e, Pearson Education,2009.
3. Dharma Raj Cheruku, B T Krishna, “Electronic Devices and Circuits”, 2/e, Pearson Education,2008.

Course Outcomes:

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

- describe the device structure/physical operation, analyze BJT/MOSFET circuits using their large signal and small signal models(L1).
- distinguish between discrete component circuit design and integrated circuit design and appreciate the relative merits and demerits of BJT and MOSFET devices(L2).
- design current mirror circuits given the output resistance, voltage headroom and output current requirements(L5).
- derive the low frequency and high frequency characteristics of common source, common gate, common drain amplifiers (L4).
- analyze and design differential amplifier circuits for gain and linearity requirements(L4/L6).

19EEC235: SIGNALS AND SYSTEMS

L	T	P	C
2	0	2	3

Signals contain information about the behavior or nature of some phenomenon and are functions of one or more independent variables. A system processes the signal for producing desired behavior. Signal processing plays an extremely important and continually growing role in areas of science and technology as communications, aeronautics and astronautics, acoustics, seismology, biomedical engineering and speech processing. This course introduces the basic concepts and theory required for analog and digital signal processing.

Course Objectives

- To explain the mathematical representation /classification of continuous-time and discrete-time signals and systems
- To provide understanding of characterization of linear-time invariant systems using impulse response and convolution function.
- To familiarize the application of Fourier series, Fourier transform and their properties to continuous-time and discrete time signals and systems.
- To impart the knowledge of Laplace and Z-transform and their properties to analyze continuous-time and discrete-time signals respectively.

Unit I (8L)

Signals and Systems: Continuous-time and Discrete-time signals, Transformations of the independent variable, Exponential and sinusoidal signals, The unit impulse and unit step functions, Continuous-time and Discrete-time systems, Basic System properties.

Learning Outcomes:

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

- express continuous and discrete time signals and systems in mathematical form(L1).
- perform mathematical operations on the signals. The operations should include operations on the dependent as well as independent variables(L1).
- classify continuous and discrete time signals and systems based on their properties(L3).

Unit II (7L)

Linear Time Invariant Systems: Discrete-time LTI systems: The Convolution sum, Continuous time LTI systems: The Convolution Integral, Properties of Linear Time-Invariant Systems

Learning Outcomes:

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

- represent continuous and discrete time signals in terms of impulses(L1).
- describe how to find output response of continuous time and discrete time LTI systems using convolution integral and convolution sum(L2).
- explain the property of a continuous time and discrete time system based on the impulse response of the system(L2).

Unit III (11L)

Fourier analysis of Continuous Time Signals and Systems: Fourier series representation of continuous time periodic signals, convergence of the Fourier series, Properties of continuous-time Fourier series.
Representation of Aperiodic signals**:** The Continuous-Time Fourier Transform, The Fourier transform for periodic signals. Properties of the Continuous-time Fourier transform, Systems characterized by linear constant-coefficient differential equations.

Learning Outcomes:

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

- compute the continuous time Fourier series(CTFS) and continuous Time Fourier Transform (CTFT) of a set of well-defined continuous time periodic and aperiodic signals(L2).
- apply the properties of CTFT to compute the Fourier transform of a broader class of continuous time signals(L3).
- analyze continuous time LTI systems described by linear constant coefficient differential equations using CTFT(L4).

Unit IV **(8L)**

Fourier analysis of Discrete Time Signals and Systems: Representation of Aperiodic signals: The Discrete-Time Fourier Transform, Properties of the Discrete-time Fourier transform, The Fourier transform for periodic signals, Systems characterized by linear constant-coefficient difference equations.

Learning Outcomes:

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

- compute the discrete Time Fourier Transform (DTFT) of discrete time aperiodic and periodic signals (L2).
- apply DTFT and its properties to broader class of discrete time signals(L3).
- analyse LTI systems described by linear constant coefficient difference equations using DTFT(L4).

Unit V **(8L)**

Analysis of Continuous time and Discrete time signals using Laplace Transform and Z Transform: The Laplace Transform: The Region of convergence for Laplace transforms, the Inverse Laplace transform, Properties of the Laplace Transform.

The Z-Transform: The Region of Convergence for the z-transform, The Inverse-z transform, Properties of the z-transform.

Learning Outcomes:

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

- apply Laplace Transform/ Z Transform equations and their properties to continuous time/ discrete time signals(L3).
- explain ROC of Laplace Transform/ Z Transform(L2).
- construct continuous time and discrete time signals from their transforms(L3).

Textbook:

Alan V. Oppenheim, Alan S. Wilsky with S.HamidNawab, „Signals and Systems", 2/e, Pearson Education, 1997.

References:

1. Bhagawandas P. Lathi, „Linear Signals and Systems", Oxford University Press,2009
2. Simon Haykin, Barry Van Veen, „Signals and Systems", 2/e, Wiley Student Edition.

Course Outcomes

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

- describe the mathematical model of continuous time/discrete time signals and systems and perform mathematical operations on signals(L2).
- Classify signals determine the output response of continuous time/ discrete time LTI system using convolution integral and convolution sum(L2).
- apply the mathematical tools like Fourier series/Transform and Laplace/Z transform and their properties to solve/analyze signals and systems in frequency domain(L3).
- determine the output response of LTI systems using CTFT and DTFT(L2).

19EMC281: CONSTITUTION OF INDIA (Elective)

L	T	P	C
3	0	0	0

Unit I **10L**

Introduction to Indian Constitution: Constitutional history, constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.

Unit II **8L**

Rights and Duties: Citizenship, fundamental rights and directive principles, fundamental duties.

Unit III **8L**

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

Unit IV **8 L**

State and Local Governments: 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.

Unit V **8L**

Other Constitutional and Statutory Bodies: 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 Book(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.

References

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
(COMMON SYLLABUS FOR ALL BRANCHES)

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.

Unit I: **10 L**

Introduction to environment and natural resources: 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 the 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(L1).
- explain the equitable use of natural resources for sustainable lifestyles(L2).

Unit II: **9 L**

Ecosystems and biodiversity: Structure components of ecosystem: 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 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, man-wildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ conservation of biodiversity.

Learning outcomes:

After the 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).

Unit III: 8 L

Environmental pollution and control: 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 the 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(L3).

Unit IV: 9L

Social issues and global environment problems and efforts: 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 the 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(L3).
- analyze environmental impact assessment and management plan(L4).

Unit V: 6 L

Human population and environment legislation: 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 the 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(L3).
- 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).

Textbook (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)

References:

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:

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

- 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(L3).
- analyze the role of information technology in environment and human health(L4).

Course Objectives:

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 Caselets]	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, Trie, 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/

19EMA202: ENGINEERING MATHEMATICS - IV
Numerical Methods and Probability Statistics

L	T	P	C
3	0	0	3

UNITI: Solution to algebraic equations **8hrs**

Solution of polynomial and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method, finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT II: Numerical differentiation and integration **8 hrs**

Numerical differentiation, numerical integration- trapezoidal rule, Simpson's 1/3rd and 3/8 rules, Ordinary differential equations-Taylor's series, Euler, modified Euler's and Runge-Kutta methods of fourth order for solving first order equations.

UNIT III: Probability **10hrs**

Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous)**,** probability distribution: Binomial , Poisson and normal distributions-their properties.

UNIT IV: Testing of Hypothesis **7 hrs**

Formulation of null hypothesis, critical regions, level of significance, Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means-confidence intervals.

UNIT V: Small Sample Tests **7 hrs**

Student t-distribution (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.

Textbooks:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2/e, Reprint2012.
2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson,2008.

References:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, 5/e, PHI Learning private limited, New Delhi,2012.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications,2012.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons,2011.
4. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers,2017.

19EID232: **INTERNET OF THINGS**
(For 2020-21 Odd and Even Sems and 2021-22 Odd Sem only)
(Common to all)

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)

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).

Text Book(s):

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

References

1. ArshdeepBahga, 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)

19EID232: INTERNET OF THINGS
(w.e.f. 2021-22AY Even Semester)

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 its characteristics
- Expose the student to sensors used for sensing different physical quantities
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with different application program interfaces for accessing Cloud services.
- Enable students to create simple IoT applications.

Unit I **5 Hours**

Introduction to Internet of Things (IoT): Introduction and Definition of Internet of Things, IoT Growth, Application Areas of IoT, Characteristics of IoT, Things in IoT, IoT Stack, Enabling Technologies, IoT Challenges, IoT Levels, IoT vs. Cyberphysical Systems, IoT vs WSN

Learning Outcomes:

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

- describe IoT architecture and application areas (L2)
- interpret the design principles that govern connected devices(L2)
- summarize the different IoT levels and compare with different systems (L2)

Unit II **6 Hours**

Introduction to Sensors, Microcontrollers, and Their Interfacing: Introduction to Sensor Interfacing, Types of Sensors, Controlling Sensors through Webpages, Microcontrollers

Learning Outcomes:

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

- list the different physical quantities and their sensing mechanisms (L1)
- describing the interfacing of sensors with embedded computing systems (like Arduino/Raspberry Pi and electrical signal relationships(L2)
- demonstrate the control of sensors using webpage interfaces (L4)

Unit III **6 Hours**

Protocols for IoT – Messaging and Transport Protocols: Messaging Protocols, Transport Protocols (Li-Fi, BLE), Protocols for IoT – Addressing and Identification: Internet Protocol Version 4 (IPv4), Internet Protocol Version 6 (IPv6), Uniform Resource Identifier (URI)

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 IV **5 Hours**

Cloud for IoT: IoT with Cloud – Challenges, Selection of Cloud Service Provider for IoT Applications, Introduction to Fog Computing, Cloud Computing: Security Aspects, Case Study: How to use Adafruit Cloud?

Learning Outcomes:

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

- describe the cloud architecture for collecting data from different sensors and analyzing them (L2)
- choose a service provider for a specific IoT application(L3)
- analyze different case studies involving Cloud IoT and discuss the security aspects (L3)

Unit V **6 Hours**

Data Analytics – Visualizing the Power of Data from IoT, Data Analysis, Machine Learning, Types of Machine Learning Models, Model Building Process, Modelling Algorithms, Model Performance.

Application Building with IoT: Smart Perishable Tracking with IoT and Sensors, Smart Healthcare – Elderly Fall Detection with IoT and Sensors, IoT–Based Application to Monitor Water Quality

Smart Warehouse Monitoring, Smart Retail

Learning Outcomes:

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

- describe the architecture of IoT involving data collection and analysis
- list the types of machine learning models used to analyze collected data (L2)
- discuss different applications of IoT illustrating the use of different data analyses and machine learning algorithms (L3)

Text Book:

1. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, Internet of Things, Wiley India, 2019

List of Experiments (2 Hours each)

1. Blinking led with Arduino using software delay, LED Control with switch
2. Temperature measurement using LM35 and display both on LCD and serial monitor
3. Control DC motor with H-bridge and as well as PWM
4. Raspberry pi installation and led control
5. DHT11 sensor interfacing to Raspberry pi and Transfer the data to Thingspeak server
6. Interfacing camera and raspberry pi
7. Accelerometer ADXL345 with i2c with raspberry pi
8. Nodemcu to control LED with thinger.io
9. With Nodemcu HTTP protocol get and post
10. With nodemcu Webserver control led
11. MQTT protocol using Nodemcu
12. Blinky app with led control

Text Book(s)

1. Simon Monk, Programming Arduino: Getting Started with Sketches, Mc Graw Hill Publications, 2011
2. Simon Monk, Programming the Raspberry Pi, Getting Started with Python, Mc Graw Hill Publications, 2015
3. Simon Monk, Hacking Electronics: Learning Electronics with Arduino and Raspberry Pi, Mc Graw Hill Publications, 2017
4. Manoj R. Thakur, NodeMCU ESP8266 Communication Methods and Protocols : Programming with Arduino IDE Amazon Media, 2018.

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).

19EEE232: ELECTRICAL MACHINES –I

L	T	P	C
3	0	3	4.5

This course is aimed to introduce the principles and applications of dc machines and transformers. Construction, working and testing of dc Machines are discussed in detail. The students are provided with hands on experience in testing the performance of various types of DC machines and transformers.

Course Objectives:

- **To familiarize** the basic concepts and analysis of magnetic circuits.
- **To teach** principles and working of dc Machines and transformers.
- **To demonstrate** the performance and control of dc machines and transformers.
- **To appraise** the testing methods of dc machines and transformers.
- **To focus** on the applications of electrical machines in industry.

UNITI: (6L+0P)

Magnetic circuits: Definition of magnetic quantities, analysis of magnetic circuits- series, parallel, leakage flux, comparison of magnetic and electric circuits, review of Ampere's Law and Biot-Savart law. B-H curve of magnetic materials, flux- linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits, energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element, torque as a partial derivative of stored energy with respect to angular position of a rotating element.

Learning outcomes:

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

- **explain** the terminology of magnetic field, magnetic flux density, magnetic flux and magnetizing force (L2).
- **calculate** various parameters in magnetic circuits(L3).
- **evaluate** various parameters in the composite magnetic circuits(L4).

UNITII: (8L+9P)

DC Generators: Basic construction of a dc machine: magnetic structure - stator yoke, stator poles, pole- faces or shoes, air gap and armature core, commutator, armature winding and - lap and wave windings, operation of dc generator, emf equation, methods of excitations - separately and self-excitations, armature reaction, compensating winding, commutation, methods of improving commutation, characteristics of dc generators, voltage build-up in a shunt generator, critical field resistance and critical speed, parallel operation

Learning outcomes:

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

- **explain** the construction and working principle of DC Generators(L2).
- **classify** DC generators(L2).
- **illustrate** the characteristics of DC generators(L2).

UNITIII: (8L+15P)

DC Motors: Operation of dc motors, back emf, torque equation, characteristics of different types of dc motors, starting methods, speed control methods, losses in dc machine, testing of dc machine – Swinburne's test, Hopkinson's test , load test, retardation test and field test.

Learning outcomes:

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

- **outline** the working principle of DC motors(L2).
- **determine** the losses and efficiency of a DC motor(L3).

- **explain** DC motor starting methods(L2).
- **demonstrate** the performance characteristics of DC machine(L4).

UNITIV: (8L+9P)

Single-Phase Transformers: Principle, construction and operation of single-phase transformers, emf equation, transformer on no load, and on load, equivalent circuit, phasor diagram, losses , efficiency and voltage regulation, all day efficiency. Testing - open circuit and short circuit tests, polarity test, back-to- back test, separation of hysteresis and eddy current losses, Parallel operation of single-phase transformers.

Learning outcomes:

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

- **explain** the working principle of single phase transformer(L2).
- **determine** the losses and efficiency of a single phase transformer(L3).
- **obtain** the characteristics of single phase transformers(L3).

UNITV: (6L+3P)

Three-Phase Transformers: construction, types of connection and their comparative features, Scott connection, tap-changing transformers - no- load and on-load tap-changing of transformers, autotransformers - construction, principle, applications and comparison with two winding transformer.

Learning outcomes:

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

- **classify** three phase transformers(L2).
- **explain** construction and working of tap changing transformers(L2).
- **outline** the working principle of autotransformers(L2).
- **compare** autotransformer with two winding transformer(L2)**.**

Electrical machines –I Laboratory

List of experiments:

1. Open circuit characteristics (OCC) and external characteristics of separately excited dc Generator.
2. Swinburne's test on a dc shunt motor.
3. OC and SC tests on single phase transformer.
4. Brake test on dc shunt motor.
5. Load test on Single phase transformer.
6. Scott connection of transformers.
7. Characteristics of dc series generator.
8. Characteristics of dc compound generator.
9. Separation of losses in dc shunt machine.
10. Speed control methods of dc shunt motor.
11. Hopkinson's test.
12. Separation of losses in single phase transformer.

Textbook(s):

1. A.E. Fitzgerald, Charles Kingsley Jr. Stephen D. Umans, Electric Machinery, 7/e, McGraw Hill., 2013
2. I.J. Nagarath and D.P. Kothari, Electric Machines, 4/e, McGraw Hill,2010.

Reference Book(s):

1. A.E. Clayton and N.N.Hancock, Performance and Design of DC Machines, Oxford,1987.
2. Chakrabarthy, Electrical Machines, 1/e, McGraw Hill,2013.

3. S.J. Chapman, Electric Machine Fundamentals, 5/e, McGraw Hill,2011.

Course Outcomes:

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

- **summarize** principles, laws, and working of dc machines(L2).
- **analyze** the characteristics and application of various types of dc generators(L4).
- **analyze** the construction, characteristics and application of various type of dc motors and testing of motors(L4).
- **explain** the working of 1- phase and 3- phase transformers(L2).
- **apply** the principles of 3 phase transformer to multi-phase transformer(L3).

19EEE234: POWER SYSTEMS-I

L	T	P	C
2	0	2	3

In this course it is aimed to introduce to the students the working principles of various power generating sources and detail analysis of faults occurrences in practical power systems. The basic concepts of solar energy, wind energy, biomass energy, geothermal energy and ocean energy are explained. Transmission line modeling parameters, fault conditions and mechanical conditions of transmission lines are analyzed.

Course Objectives:

- To Study various basic concepts of conventional power sources, power grids and microgrids.
- To Expose various basic concepts of renewable energy sources.
- To Familiarize various parameters in transmission lines
- To Interpret the effect of sag and usage of underground cables
- To Expose various AC and DC distribution systems

Unit I: Conventional Power Generation **8L**

Hydroelectric Power Generation: Plant layout, working of hydroelectric power plant and selection of site.
Thermal Power Generation: Plant layout, working of thermal power plant and selection of site.
Nuclear Power Generation: Plant layout, working of nuclear power plant and selection of site.

Learning outcomes:
After completion of this UNIT student will be able to

- **define** the concepts of power grid and micro grid(L1)
- **contrast** the difference between power grid and micro grid(L2)
- **identify** the different conventional sources for generating power(L3)
- **compare** thermal, hydro-electric and nuclear powerplant(L4)
- **justify** the use of thermal, hydro-electric and nuclear powerplant.(L5)

Unit II: Renewable Energy sources **8L**

Solar Power Generation: Physical principles of conversion of solar radiation into heat, working principle of Flat plate collectors and Photovoltaic Cell.
Wind power generation: Basic components of Wind energy conversion systems, working principle of HAWT and VAWT.
Energy from Biomass: Biomass conversion technologies, working principle of Floating drum and fixed dome plants.
Geothermal energy: Working principle of Vapour and Liquid dominated systems
Energy from Oceans: Working principle of closed cycle OTEC. Basic components of Tidal power plant

Learning outcomes:
After completion of this UNIT student will be able to

- **define** the need of renewable energy sources(L1)
- **demonstrate** the availability of solar, wind, geothermal, biomass and tidal energy sources(L2)
- **identify** the different renewable sources for generating power(L3)
- **compare** solar, wind, geothermal, biomass and tidal powerplant(L4)
- **justify** the use of solar, wind, geothermal, biomass and tidal power plant. (L5)

Unit III: Transmission line Parameters **10L**

Overhead Transmission Lines: Capacitance and Inductance calculations for single phase two wire line,

three phase lines, proximity effect, skin effect.
Sinusoidal Steady state representation of Lines: Short, medium and long lines, Characteristics of transmission lines. Surge Impedance Loading.

Learning outcomes:
After completion of this UNIT student will be able to

- **list** the various transmission line parameters(L1)
- **develop** expressions for all transmission line parameters(L3)
- **analyze** line parameters for single phase and three phase systems(L4)
- **evaluate** short, medium and long transmission lines(L5)
- **solve** various problems on transmission line parameters and modeling. (L6)

Unit IV: Mechanical design of over head lines **8L**
Sag and insulators: Line supports, insulators, voltage distribution in suspension-type insulators. Testing of insulators, String efficiency, tension and sag calculation, effects of wind and ice loading.
Underground cables: Comparison with overhead line. Types of cables, Insulation resistance, potential gradient, Capacitance of single core cables.
Corona: Formation of corona. Critical voltages, effect on line performance.

Learning outcomes:
After completion of this UNIT student will be able to

- **list** out various line supports used in transmission lines(L1)
- **demonstrate** effect of sag on transmission lines(L2)
- **categorize** various insulators used in transmission lines(L4)
- **justify** the use of Underground cables(L5)
- **estimate** the effect of corona.(L6)

Unit V: Distribution Systems **8L**
Overview of Distribution systems, Types of DC & AC Distributors: Radial, and Ring systems. Voltage drop calculation with concentrated loads and uniformly distributed loads.

Learning outcomes:
After completion of this UNIT student will be able to

- **define** various components in distribution systems(L1)
- **illustrate** various DC and AC Distributors(L2)
- **analyze** DC and AC Distributors for uniformly distributed loads(L4)
- **evaluate** DC and AC Distributors for concentrated distributed loads(L5)
- **solve** various problems on AC and DC Distributors. (L6)

Textbook(s):

1. S. N. Singh, "Electric Power Generation, Transmission and Distribution", PHI Learning,2010.
2. GD Rai, "Non-conventional Energy sources",4/e,Khannapublishers,2012
3. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education,1994.

References:

1. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education,1995.
2. Gerald B Sheble, Bruce F Wollenberg Allen J Wood, "Power Generation, Operation, and Control", 3/e, Wiley Interscience,2010.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc.,1999.
4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education,2003.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
6. C.L.Wadhwa, "Electrical Power Systems", 7/e, New Academic Science publications,2017.

Course Outcomes:

Upon completion of the course, the students would be able to

- correlate various conventional power sources, power grids and microgrids.
- identify various renewable energy sources for power generation.
- estimate the various parameters in transmission lines
- appraise the effect of sag on transmission lines
- assess various AC and DC distribution systems for concentrated and uniformly distributed loads

19EEC232: DIGITAL LOGIC DESIGN

L	T	P	C
3	0	3	4.5

Digital Logic Design is an introductory course which provides the basic concepts used in the design and analysis of digital circuits. A digital circuit is constructed using logic gates which are the basic building blocks. This course deals with the design of various combinational and sequential circuits used in the present day world. This course is a prerequisite to many other courses like Digital Communications, Computer Organization, Digital System design, Digital IC design, etc.

Course objectives:

- To introduce number systems, conversion used for representing numbers in computational structures
- To familiarize the implementation of simple logical operations using Combinational circuits
- To acquaint the student with the design of combinational and sequential logic circuits with practical design examples
- To expose different types of memories used in digital systems
- To impart the design of synchronous and asynchronous digital systems.

Unit I: **8L+6P**

Binary Systems: digital systems, binary numbers, number base conversions, octal and hexadecimal numbers, complements, signed binary numbers, binary codes, binary logic. **Boolean Algebra and Logic Gates:** basic definitions, axiomatic definition of boolean algebra, basic theorems and properties of boolean algebra, boolean functions, canonical and standard forms, digital logic gates.

Learning outcomes:

After completion of this unit the student will be able to

- identify the symbols of different logic gates and write their truth tables(L1).
- convert a number into different base representations(L2).
- construct the given Boolean function using logic gates(L3).

Unit II: **8L+3P**

Simplification of Boolean functions

the map method, four-variable map, five-variable map, product of sums simplification, don't-care conditions, NAND and NOR implementation, exclusive-OR function.

Learning outcomes:

After completion of this unit the student will be able to

- determine the simplified Boolean expression using map method(L3).
- construct digital circuits using only NAND/NOR logic gates(L3).
- design parity generator and checker circuits using exclusive-OR function(L5).

Unit III: **10L+9P**

Combinational Logic: combinational circuits, analysis procedure, design procedure, binary adder- subtractor, decoders, encoders, multiplexers. **Memories: r**andom-access memory, memory decoding, error detection and correction, read-only memory.

Learning outcomes:

After completion of this unit the student will be able to

- analyze the truth table of a given combinational logic circuit(L3).
- design combinational circuit from the given specifications(L5).
- correct the bit error in the given data word using Hamming code(L5).

Unit IV: **8L+3P**

Synchronous Sequential Logic: sequential circuits, latches, flip-flops, analysis of clocked sequential circuits, state reduction and assignment, design procedure.

Learning outcomes:

After completion of this unit the student will be able to

- explain the operation of latches and flip flops(L2).
- analyze the behavior of sequential circuits(L4).
- evaluate a clocked sequential circuit from its state diagram(L6).

Unit V: **8L+6P**

Registers and Counters: registers, shift registers, ripple counters, synchronous counters, ring counter.
Digital Integrated circuits: special characteristics, complementary MOS(CMOS), CMOS transmission gate circuits.

Learning outcomes:

After completion of this unit the student will be able to

- differentiate asynchronous and synchronous counters(L4).
- design Synchronous and Ripple counters using D, JK and T flip-flops (L5).
- construct multiplexer and D-latch using CMOS transmission gates circuits(L5).

Text Book(s):

1. Michael D. Ciletti, M. Morris Mano, Digital Design, 4/e, Pearson Education, 2007.

References:

1. Zvi Kohavi, Switching and Finite Automata Theory, 2/e, Tata McGraw-Hill,2008.
2. John F. Wakerly, Digital Design Principles and Practices, 4/e, Pearson Education,2008.
3. Frederick J. Hill and Gerald R. Peterson, Introduction to Switching Theory and Logic Design, 3/e, John Willey and Sons,1981.
4. Charles Roth, Jr., Larry Kinney, Fundamentals of Logic Design, 7/e, Cengage Learning, India,2013.

Digital Logic Design Laboratory

List of Experiments:

1. Verification of Truth Tables of Logic gates and implementation of Basic gates using Universal Gates
2. Implementation of the given Boolean functions using logic gates in both SOP and POS form.
3. Simplification of the given Boolean function using K-map and implement using logic gates.
4. Realization and verification of Full adder and Full Subtractor using logic gates.
5. Implementation of the given function using decoder and logic gates.
6. Implementation of the given function using Multiplexer and logicgates.
7. Verification of State Tables of SR, D, JK and T-Flip-Flops.
8. Verify the operation of Shift Registers using D flip-flops.
9. Design and Verify the operation of 4-bit and Mod-N Ripple Counters using JK flip-flops.
10. Mini Project.

Course Outcomes:

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

- convert any number into different base representations (L2).
- simplify logic expressions using Boolean laws and realize using basic and universal logic gates (L3).
- design combinational circuits for the given specifications (L4).
- design synchronous sequential circuits for the given specifications(L4).
- differentiate asynchronous and synchronous counters and implement Multiplexers and D flip flops using CMOS technologies (L3).

19EEC234: ANALOG CIRCUITS

L	T	P	C
3	0	3	4.5

This course equips the student with design principles of electronic system building blocks including amplifiers , oscillators, negative feedback based operational amplifiers .Laboratory experiments of this course shall include hardware experiments, SPICE simulations and end-to-end circuit design using EDA/PCB design software. Skills learnt in this course shall help the student in improving existing circuits using negative feedback, building power Amplifiers, op-amp signal processing circuits etc.

Course Objectives

- To acquaint the students with the advantages and techniques of different negative feedback circuit configurations.
- To introduce the basic principles of oscillator circuits and design/simulate discrete component and op-amp oscillator circuits.
- To impart knowledge on analysis of the linearity, power efficiency and power dissipation of different output stages/power amplifiers.
- To explain the configuration and use of operational amplifier in designing several signal processing building blocks.
- To familiarize the analysis and classification of different ADC/DAC architectures based on working principle, conversion time and resolution characteristics.

Unit I: **8L + 3P**

Feedback Amplifiers: the general feedback structure, properties of negative feedback, basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, shunt-shunt and shunt-series feedback amplifiers, determining loop gain.

Learning Outcomes:

After completion of this unit the student will be able to

- summarize the basic building blocks of negative feedback systems and list their properties(L2).
- classify the different negative feedback topologies and identify/quantify the improvement in their characteristics(L2).
- determine the input impedance, output impedance, gain and bandwidth of feedback amplifiers(L4).
- identify the kind of feedback configuration employed in a given circuit(L3).

Unit II: **8L + 9P**

Oscillators: basic principles of sinusoidal oscillators, op amp RC oscillator circuits, LC and crystal oscillators.
Power amplifiers: Classification of output stages, class A output stage, class B output stage, class AB output stage, class C output stage.

Learning Outcomes:

After completion of this unit the student will be able to

- explain Barkhausen;s criteria for sustained oscillations(L2).
- explain the operation of RC phase shift and op-amp RC oscillators(L1).
- identify the usage of RC, LC and Crystal oscillators (L3).
- classify different output stages based on linearity, power efficiency and conduction angle(L2).
- analyze the transfer function, signal waveforms and power efficiency of Class A/B/AB output stages (L4).

Unit III: **10L + 9P**

Operational Amplifiers: The ideal op-amp, the inverting and non-inverting configuration, difference and instrumentation amplifiers, summing, scaling and averaging amplifiers, integrators, differentiators,

logarithmic amplifiers, V/I and I/V converters, Comparator, regenerative comparator, Astable and

Monostable multivibrators, Triangular wave generator.

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

- list the characteristics of ideal Op-amp(L1).
- draw the op-amp inverting and non-inverting configurations and analyze them for their closed loop gain under ideal and non-ideal conditions(L2).
- describe the use of Op-amp in building analog signal processing blocks(L3).
- summarize the characteristics of comparators and analyze the Op-amp based comparators(L2).

Unit IV: **8L + 9P**

IC Timers (555): Introduction, Description of functional diagram, Monostable operation, Astable operation. **Active Filter Design:** LPF, HPF, BPF, BEF, all-pass filters. **Voltage Regulators:** Fixed voltage Regulators, Adjustable voltage Regulators.

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

- describe the architecture and list the operating modes of 555 timer(L1).
- design an active low- pass, high-pass, band-pass filter for given specifications(L5).
- describe the characteristics of voltage regulators and corresponding Op-amp based circuits(L2).

Unit V: **8L + 6P**

Data Converters: Introduction, DAC characteristics, digital to analog conversion process, voltage output DACs, multiplying DAC, 8-bit digital to analog converter DAC-08. **Analog to Digital Converters**: ADC characteristics, integrating ADC, successive approximation ADC, Flash converters: Principle of operation, conversion time.

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

- list the characteristics and operation of DACs and ADCs(L1).
- classify different DAC and ADC configurations(L2).
- explain the operation of voltage output and multiplying DACs(L1).
- describe the principle of operation of flash converters and analyze its conversion time(L1).

Analog Circuits Laboratory

List of Experiments

1. Feedback Amplifier - calculation of gain, input resistance, output resistance with and without feedback, frequency response characteristic.
2. Design and Implementation of Two stage RC Coupled amplifier.
3. Oscillators (Colpitts, RC phase-shift, Wein-bridge)
4. Class A power amplifier.
5. Class B Push - pull power amplifier.
6. Tuned voltage amplifier.
7. Analysis and simulation of RC differentiator/integrator
8. Bistable/Monostable/Astable multivibrators with 555timer
9. Operational Amplifier Circuits (Adders, Integrators, Differentiators, Filters).
10. Op-amp based AM/FM Modulator/Demodulator Circuits.

11. Data Converters
12. Active FilterDesign

Text Book(s):

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press,2013.
2. D Choudhury Roy, Shail B. Jain, Linear Integrated Circuits, New Age International,2003.
3. Ramakanth Gayakward, Op-Amps and Linear Integrated Circuits, 4/e, Pearson Education,2007.

References:

1. Behzad Razavi, Fundamentals of Microelectronics, 2/e, Wiley Student Edition,2013.
2. R.F Coughlin, F.F Driscoll, Op-Amps and Linear Integrated Circuits, 6/e, Pearson Education,2008.
3. S. Salivahanan, V.S. KanchanBhaskaran, Linear Integrated Circuits, Tata Mc- Graw Hill,2008.
4. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata Mc-Graw Hill,2002.

Course Outcomes:

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

- analyze the characteristics of different negative feedback amplifier configurations(L4).
- choose and design negative feedback circuits to improve the characteristics of given open loop amplifier(L3).
- describe the basic principle of sinusoidal oscillators and identify the usage of different oscillator circuits(L1).
- design active filters for the given design specification(L5).
- describe different DAC/ADC architectures and their design issues(L2).

19EEE292: 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.	Paragraph Jumbles	3
4.	General Usage	4
	Total	**15**

B. Quantitative Aptitude and Reasoning

Puzzles, Arithmetic, Geometry, Mensuration.

Unit	Module/ Topics	Hrs
1.	Numbers	3
2.	Arithmetic	6
3.	Data Interpretation	3
4.	Puzzles	3
	Total	15

Unit	Module/ Topics	Hrs
1.	Numerical Computation and Estimation-2. [i. Time and Work, ii. Pipes and Cisterns, iii. Time and Distance, iv. Problems on trains, Boats and Streams, v. Races and Games of skill, vi. SI & CI]	6
2.	Geometry [i. Lines and Angles ii. Triangles iii. Quadrilaterals & Polygons iv. Circles]	4
3.	Mensuration [i. 2-Dimensional Mensuration (Triangles, Quadrilaterals and Circles), ii. 3-Dimentional Mensuration (Cubes, Cuboids, Cylinder, Cone, Sphere)]	3
4.	Data Sufficiency on Quantitative Reasoning	2
	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	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/

19EEE333: ELECTRICAL MACHINES - II

L	T	P	C
3	0	3	4.5

This course is aimed to introduce to students the principles and applications of electrical alternating machines which are gaining importance in industries. Induction motors are used to meet the demand of the several industrial and commercial applications. Alternators are very widely used machine for generating bulk of electricity worldwide. Synchronous motors are used in all industrial applications where constant speed is necessary. This course is base to power electronic drives, power system stability and power system operation and control.

Course Objectives:

- **To study** principles of AC machines and how they work.
- **To familiarize** various types of induction motors, synchronous motors.
- **To acquaint** the performance and control of AC machines
- **To demonstrate** the various types of single phase and special machines
- **To expose** the significance of AC machines for industries

UNIT I **10 L**

Induction Motors: Types and constructional features of poly phase induction motors, principle of operation, three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field phasor diagram, slip, torque equation, torque characteristics, equivalent circuit, power stages, Methods of starting and speed control for induction motors.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Outline** and **explain** the working principle of Induction motors and how torque is developed (L2)
- **Classify** the Induction motors. (L 4)
- **Illustrate** the characteristics of Induction motors (L 2)
- **Identify** controlling of induction motors. (L3)

UNIT II **10 L**

Testing of Induction motors: No load and Rotor blocked tests, circle diagram. Cogging, crawling. Double cage rotor.
Single phase induction motors: Double revolving field theory, starting methods -Split phase type, capacitor start and capacitor run, shaded pole types, equivalent circuit based on double revolving field theory, universal motor, stepper motor, reluctance motor.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Test for** performance of induction motor.(L4)
- **Explain** double field revolving theory in single phase induction motor.(L2)
- **Classify** the single phase Induction motors.(L4)
- **Utilize** the equations to solve problems in Induction motors.(L3)

UNIT III **10 L**

Alternators: Types and constructional features. Air-gap MMF distribution with fixed current through winding-concentrated and distributed. emf Equation, distribution factor, pitch factor. Effect of harmonics on EMF equation. Regulation of alternators on load. Parallel operation of alternators.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Outline** and **explain** the working principle of AC Generators and Derive the EMF equation. (L2)
- **Classify** the AC generators.(L4)
- **Demonstrate** the various factors influencing the performance of AC generators. (L2)
- **Make use of** the equations to solve problems in DC generators.(L3)

UNIT IV **10 L**

Determination of regulation characteristics: Synchronous impedance method, MMF method, Zero power factor method (ZPF Method).
Salient Pole Alternators: Basic ideas of two reaction theory. Direct and quadrature axis reactance and their determination. Phasor diagram and regulation of salient pole alternators. Expression for power developed as a function of torque angle.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Illustrate** the characteristics of Ac generators(L2)
- **Determine** the characteristics by implementing various methods.(L5)
- **Explain** the derivation of power developed in alternators. (L2)

UNIT V **8 L**

Synchronous Motors: Constructional features and working of synchronous motors, synchronous machines on infinite bus bars. Phasor diagram. Starting methods. Synchronization, V and inverted V curves. Current and Power circle diagrams. Hunting and its suppression. Synchronous condenser.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Explain** the working principle and construction of synchronous motors.(L2)
- **Outline** phasor diagrams of synchronous motors. (L2)
- **Examine** the characteristics of synchronous motors.(L4)
- **Demonstrate** synchronous condenser.(L2)

ELECTRICAL MACHINES – II LABORATORY

List of experiments:

1. No load and blocked rotor test on three phase Slip ring induction motor.
2. No load and blocked rotor test on three phase Squirrel cage induction motor.
3. No load and blocked rotor test on Single phase induction motor.
4. Regulation of alternator by Synchronous impedance method.
5. V and inverted V curves of Synchronous motor.
6. Load test on three phase Slip ring induction motor.
7. Load test on three phase Squirrel cage induction motor.
8. Load test on single phase induction motor.

9. Regulation of alternator by Zero power factor load (Z.P.F.) method.
10. Speed control of three phase Squirrel cage induction motor by frequency control (V/f) method.
11. Speed control of three phase slip ring induction motor by rotor resistance control method.
12. Slip test on 3, Phase synchronous machine.

Text Book(s):

1. M.G.Say, "Performance and design of AC Machines", 3/e, ELBS, 2002.
2. I.J.Nagarath and D.P.Kothari, "Electrical Machines", 4/e, McGraw Hill, 2010.

References

1. Atkins; Chapman, "General Theory of Electrical Machines", 8/e, McGraw Hill, 1979.
2. Fitzgerald A.E. & Kingsley, "Electrical Machinery", 7/e, McGraw Hill, 2013.
3. George McPherson, Robert D. Laramore, "An Introduction to Electrical Machines and Transformers", 2/e, Wiley, 2014

Course Outcomes:

Upon successful completion of the course the students will be able to

- **Interpret** the knowledge on fundamental of AC rotating machine.(L2)
- **Explain** the constructional details, principle of operation of induction motor, 3 phase alternator and synchronous motor, single phase induction motor and special machines. (L3)
- **Select** ac electrical machines for various applications. (L3)
- **Analyze** the performance of ac machines.(L4)

19EEE331: LINEAR CONTROL SYSTEMS

L	T	P	C
3	0	3	4.5

This course is aimed to introduce linear mathematical modeling of different systems and their representation as open loop and closed loop systems. Output Response of developed mathematical models for different single input systems for standard test signals will be studied. Stability of system is assessed in with time-domain and frequency domain plots. Modern state space approach for modeling and analysis of multi-input and multi-output systems are introduced.

Course Objectives:

- **To explain** various concepts of block diagrams reduction techniques.
- **To develop** mathematical modeling of the system.
- **To obtain** response of single input systems for various test signals.
- **To analyze** stability of the system in time and frequency domains.
- **To apply** state variable analysis to multi-input and multi-output systems.

UNIT I **10L**

Introduction: Concepts of control systems. Different examples of control systems, Open loop and closed loop control systems and their differences. Block diagram representation of systems considering electrical systems as examples. Block diagram algebra. Representation by Signal flow graph, reduction using Mason's gain formula, feedback Characteristics, Effects of feedback.

Learning outcomes:

After completion of this UNIT student will be able to

- **explain** concepts of control systems (L2).
- **differentiate** open loop and closed loop systems (L2).
- **apply** the different block diagram reduction techniques to a given system (L3).
- **determine** transfer functions using Masons gain formula(L3).
- **analyze** effect of feedback on performance of a system (L4).

UNIT II **10 L**

Introduction to mathematical modeling of physical systems, impulse response and transfer functions, equations of electrical networks, modeling of translational and rotational mechanical systems, time response of first and second order systems with standard input signals, Time domain specifications, steady state error and error constants.

Learning outcomes:

After completion of this UNIT student will be able to

- **model** different components of a system using Laplace transform method (L3).
- **explain** the impulse response and transfer functions (L2).
- **Model** different components of electrical and mechanical system using Laplace transform method (L3).
- **analyze** the time response of second order system for different signals (L4).
- **develop** equations of different time domain specifications (L2).
- **categorize** steady state error and error constants based on input (L4).

UNIT III **10L**

Concept of stability, Routh-Hurwitz criterion, construction of Root locus, correlation between time and frequency responses, determination of frequency domain specifications, effects of P, PI, PD and PID Controllers.

Learning outcomes:

After completion of this UNIT student will be able to

- **explain** the concept of stability (L2).
- **apply** Routh Hurwitz criterion for checking the stability of a system based on characteristic equation (L3).
- **construct** root locus of given system and check its stability (L5)**.**
- **relate** time and frequency responses specifications (L2).
- **develop** equations of different frequency domain specifications (L3).
- **analyze** effect of PID controllers on performance of system (L4).

UNIT IV: 10L

Stability of control systems from Bode plots, Polar plots and Nyquist plots, all pass and minimum phase systems, numerical examples.

Learning outcomes:

After completion of this UNIT student will be able to

- **Construct** Bode plots of given system and check its stability (L3)**.**
- **Construct** Polar plots of given system and check its stability (L3)**.**
- **Construct** Nyquist plots of given system and check its stability (L3)**.**
- **Explain** All pass and minimum phase systems (L2).

UNIT V: 12L

State variable analysis: State, State variables, State variable representation. Transfer function form to State variable form (Diagonal form), State variable form to transfer function form, transfer function form to canonical form.

Learning outcomes:

After completion of this UNIT student will be able to

- **Explain** the concept of state and state variables (L2).
- **Model** different components of a mechanical and electrical system in state variable form (L3).
- **Translate** Transfer function form to State variable form (L2).
- **Develop** an equation in State variable form to transfer function form (L3).
- **Translate** an equation in transfer function form to canonical form (L2).

Linear Control Systems Laboratory

List of experiments

1. Characteristics of series, parallel magnetic amplifier.
2. Design of PID controller for second order systems.
3. Time response of first and second order systems.
4. Frequency response for a lag compensating network.
5. Characteristics and transfer function of DC servo motor.
6. Characteristics and transfer function of AC servo motor.
7. Stepper motor control.
8. Frequency response for a lead compensating network.
9. Characteristics of self-saturated magnetic amplifier.
10. D.C Position control system.
11. Design of lag-lead compensator.
12. Step response and frequency response of a given plant.

Textbook(s):

1. Benjamin C.Kuo, Automatic Control Systems ,7/e , Prentice Hall of India, 1997.
2. M.Gopal, Control Systems Engineering , 3/e , Wiley Eastern Ltd., TMH ,2008

Reference books:

1. Ogata, Modern Control Engineering , 2/e, Prentice Hall of India.,2011

2. R.C. Sukla, Control Systems, 3/e, Dhanpatrai and Sons,1998

Course Outcomes:

Upon successful completion of the course the students will be able to

- Solve numerical on block diagrams reduction techniques(L3)
- Build the mathematical model of a given system(L3)
- Analyze the response of different order systems for various step inputs(L4)
- Analyze the stability of the system(L4)
- Able to comprehend solution of state equation(L5)

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).

19EEE352: ELECTRICAL MACHINE DESIGN (Elective)

L	T	P	C
2	0	2	3

This course is aimed to introduce the students the principles and design concepts of machines. The concepts to design the main dimensions and the operating characteristics of dc machine, transformer, induction motor and synchronous machines are highlighted. Transformers and synchronous machines designs are used during substations and power plants erection worldwide. This course is base to power electronic drives, power system stability.

Course Objectives:

- **To expose** the students towards the major consideration in the design of electrical machines.
- **To enable** overall designing of transformers and learning the operating characteristics
- **To demonstrate** the students the designing of induction motor stator and rotor along with performance analysis.
- **To train** the size and design of synchronous machine.
- **To demonstrate** the limitations of traditional designs and emphasizing the concepts of modern machines

UNIT I: **8 L**

General aspects: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, temperature rise, rating of machines.
DC Machine: Main dimensions, output equation.

Learning outcomes:
After completion of this UNIT student will be able to

- **Recall** the basics of electrical machines.(L1)
- **Demonstrate** the terminology of machine design. (L2)
- **Illustrate** the electric and magnetic loading .(L3)
- **Analyze** the thermal constraints(L4)

UNIT II **10 L**

Transformers: Main dimensions**,** KVA Output for single phase and three phase transformers, window space factor, over all dimensions, temperature rise in transformers, and method of cooling.

Learning outcomes:
After completion of this UNIT student will be able to

- **Recall** the basics of transformers.(L1)
- **Demonstrate** the terminology of machine design. (L2)
- **Illustrate** methods of cooling .(L2)
- **Design** of Transformers(L6)

UNIT III **12 L**

Induction machines: Main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations ,magnetizing current, short circuit current.

Learning outcomes:

After completion of this UNIT student will be able to

- **Recall** the basics of Induction machines.(L1)
- **Demonstrate** the terminology of machine design. (L2)
- **Explain** the design of various components of Induction machines .(L3)
- **Design** of Induction machines(L6)

UNIT IV **10 L**

Synchronous Machines: Main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of turbo alternators, rotor design.

Learning outcomes:

After completion of this UNIT student will be able to

- **Recall** the basics of Synchronous machines.(L1)
- **Demonstrate** the terminology of machine design. (L2)
- **Explain** the design of various components of Synchronous machines .(L3)
- **Design** of Synchronous machines(L6)

UNIT V **8 L**

Computer aided Design (CAD): Limitations (assumptions) of traditional designs need for CAD analysis. Introduction to FEM based machine design. Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM.

Learning outcomes:

After completion of this UNIT student will be able to

- **Explain** the basics of Computer aided Design (CAD). (L2)
- **Outline** the structures of modern machines .(L2)
- **Discuss** drawbacks of traditional designs.(L6)
- **Apply** the FEM designs. (L3)

Text Book(s)

1. Clayton and Hancock, “Performance and Design Of DC Machines”, 3/e, CBS, 2001.
2. M. G Say, “Performance and Design of AC Machines, Pitman”, 3/e, ELBS. 1983.

References

1. A.K .Sawhney, “A course of Electrical Machine Design”, Dhanpat Rai and Sons, 1970.
2. K. M. V. Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- **understand** the basic concepts of machine design parameters.(L2)
- **identify** the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines(L3)
- **understand** the design dimensions and characteristics of Transformers.(L2)
- **choose** the design procedures to find the main dimensions of Induction Motor and learns the operating characteristic of Induction machines.(L4)
- **designing** of salient pole machine, turbo generator. (L6)
- **Understand** the structures of PMSMs, BLDCs, SRM. (L2)

19EEE343: ELECTRICAL MEASUREMENTS(Elective)

L	T	P	C
2	0	2	3

This subject deals with analog and digital measuring instruments. It signifies measurement of resistance, inductance and capacitance by using bridge circuits and calibration of meters. It acts as a base course for Electrical machines, Electrical power systems and power electronics etc...

Course Objectives:

- Introduce students to various secondary instruments.
- Train students about various bridges.
- Acquaint various meters and its construction.
- Classify instrument transformers and its testing.
- Apply knowledge to design and create novel products.

Unit I **10 L**

Indicating instruments: Principle, different types of control and damping arrangements in indicating instruments, Permanent Magnet Moving Coil (PMMC), Moving Iron (MI), electrostatic and dynamometer type meters, errors in indicating instruments, extension of instrument range for ammeters and voltmeters.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Choose** different types of damping arrangements. (L1)
- **Explain** different types of dynamometer and indicating instruments. (L2)
- **Analyzing** calculation of extension of ranges for ammeters and wattmeter's. (L4)
- **Build** knowledge about usage of voltmeter and ammeter in laboratory. (L6)

Unit II **8 L**

Measuring instruments: Dynamometer type wattmeter, errors and compensation, 3-phase power measurement by two wattmeter method, single phase energy meters, single phase induction type energy meter, errors and compensation. Calibration of wattmeter and energy meter. Frequency meters: Mechanical and electrical resonance type. Power factor meters: Dynamometer type, Moving Iron (MI) type.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Relate** types of errors and compensation of dynamometer type wattmeter's. (L1)
- **Demonstrate** working principle of energy meters and frequency meter. (L2)
- **List** out calibration of power factor meters. (L4)
- **Create** knowledge about usage of meters in laboratory. (L6)

.

Unit III **8L** **Bridges:**

Measurement of resistance using Wheatstone bridge, Kelvin double bridge and megger. LCR meter Measurement of inductance using Maxwell's bridge, Hay's bridge and Anderson's bridge. Measurement of capacitance using Schering bridge.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Select** different types of DC and AC bridges. (L1)
- **Classify** different ranges of bridges. (L2)
- **Compare** calibration of quality factor of bridges. (L5)

- **Estimate** usage of bridges in laboratory. (L6)

Unit IV **8L**

Potentiometers: General principle, Vernier dial, principle of standardization. AC potentiometers coordinate type and polar type, application of DC and AC potentiometers. Display devices: CRT display, DSO, Digital multimeter.

Learning outcomes:

After completion of this UNIT student will be able to

- **Define** standardization of potentiometer. (L1)
- **Illustrate** different types of potentiometers. (L2)
- **Distinguish** types of CRT displays. (L4)
- **Formulate** usage of potentiometer in laboratory. (L6)

Unit V **8 L**

Instrument transformers: Components and working of Current Transformer (C.T.), phasor diagram, ratio error and phase angle error, testing. Components and working of Potential Transformer (P.T.), phasor diagram, ratio error and phase angle error, testing.

Learning outcomes:

After completion of this UNIT student will be able to

- **List** out instrument transformers. (L1)
- **Explain** working of instrument transformers. (L2)
- **Construct** phasor diagram of CT and PT. (L3)
- **Mark** phase angle and ratio errors. (L5)
- **Predict** applications of instrument transformers. (L6)

ELECTRICAL MEASUREMENTS LABORATORY:

List of experiments (Minimum of Ten Experiments should be conducted)

1. Measurement of very low resistance using Kelvin's double bridge.
2. Measurement of medium resistance using Wheatstone's bridge.
3. Measurement of self inductance using Maxwell's bridge.
4. Measurement of self inductance in terms of capacitance using Anderson's bridge.
5. Measurement of capacitance power factor using Schering Bridge.
6. Measurement of capacitance using Wien's bridge.
7. Calibration of Energy meter by Phantom loading
8. Calibration of Wattmeter
9. Finding parameters of Choke Coil
10. Measurement of mutual inductance
11. Measurement of 3-phase power using 2-Wattmeter method
12. Measurement of 3-Phase power using three voltmeter and three Ammeter method.

Text Book (s)

1. A.K. Sawhney, "A Course in Electrical and Electronic Measurement and Instrumentation", 19/e, Dhanpat Rai and Sons,2011.
2. E.W. Golding and F.C. Widdis, "Electrical Measurements and Measuring Instruments" ,5/e, Wheeler Publications,1991

Reference Books:

1. Rajendra Prasad., "Electronic Measurements and Instrumentation", 4/e, Khanna Publishers, 2012.
2. Harris F.K., "Electrical Measurements", John Wiley Publishers, 1974.
3. U.A. Bakshi, A.V. Bakshi,"Electrical measurements and instrumentation, Technical publications, 2009.

Course Outcomes:

At the end of the course students will be able to

- **Estimate** indicating instruments like voltmeter, ammeter, wattmeter etc . (L5)
- **Determine** dynamo meter type measuring instruments. (L5)
- **Analyze** to balance Bridges to find unknown values. (L4)
- **Determine** use the potentiometer and skills for electrical projects. (L5)
- **Solve** and CT and PT ratios. (L6)
- **Simplify** measurement of R, L, C ,Voltage, Current, Power factor , Power, Energy . (L4)

19EEE445: PROCESS CONTROL AND AUTOMATION (Elective)

L	T	P	C
2	0	2	3

Proper application of process control improves the safety and profitability of a process, while maintaining consistently the desired product quality. The automation of selected functions have relieved plant personnel of tedious, routine tasks, providing them with time and data to monitor and supervise operations in real-time. This course aims to provide in-depth understanding of designing and implementing practical control strategies in process industries.

Course Objectives:

The purpose of the course is to

1. Familiarize the basic principles & importance of process control in industrial process plants;
2. Study the required instrumentation and final elements to ensure that well-tuned control is achieved.
3. Train the use of block diagrams & the mathematical basis for the design of control systems.
4. Create and tune process (PID) controllers.
5. Impart software tools for the modeling of plant dynamics and the design of well-tuned control loops.
6. Expose the importance and application of good instrumentation for the efficient design of process control loops for process engineering plants.
7. Demonstrate the experimental implementation of advanced process control schemes and the methods for process monitoring and diagnosis.

Unit I **10 L**

Fundamentals of process control: Definition of industrial processes and control. Hierarchies in process control systems block diagram representation of process control system. Control system instrumentation, codes and standards, preparation of P& I diagrams.

Learning outcomes:

After completion of UNIT I, students will be able to

- Define control loop. (L1)
- Define the three tasks necessary for process control to occur. (L1)
  Define Correcting element/final control element. (Level I)

Unit II **8 L**

Strategies for computer aided process control: Open loop control systems, closed loop (feed back) control system, feed forward control system, cascade control system, ratio control. Controller design, controller tuning, tuning of P, PI and PID controllers, Ziegler Nichols tuning method, selection of controllers, predictive control, model based predictive control, multivariable control system.

Learning outcomes:

After completion of UNIT II, students will be able to

- Distinguish between discrete, multistep, and continuous controllers. (L4)
- Define the general goal of controller tuning. (L1)
- Define the basic mechanism, advantages and disadvantages of the following mode of controller action. (L1)
- Identify the basic implementation of P, PI and PID control in the following types of loops. (L3)

- Find rapid response to major disturbances with derivative control. (L1)
- Explain the basic implementation process, including a description of equipment requirements and considerations, for each of the following types of control. (L2)

Unit III **8 L**

Programmable logic controllers (PLCs): Introduction, principles of operation, architecture of programmable logic controllers. Programming the programmable controllers, software, configurations, applications.

Learning outcomes:

After completion of UNIT III, students will be able to

- Explain the basic parts of a PLC, how a PLC is used to control a process, and the different kinds of PLCs and their applications. (L2)
- Classify the various subparts of a PLC as well as general connection paths. (L2)
- Explain the hardware of the input/output section, including the difference between the discrete and analog types of modules. (L2)
- Explain how ladder diagram language, Boolean language, and function chart programming language are used to communicate information to the PLC. (L2)
- Explain PLC timer instruction and differentiate between a non-retentive and retentive timer.(L2)

Unit IV **8 L**

Distributed control systems: Introduction, functional requirements of distributed control system, system architecture, distributed control systems configuration and applications of distributed control systems.

Learning outcomes:

After completion of UNIT IV, students will be able to

- Explain the historical background of DCS. (L2)
- Illustrate the local control unit architecture. (L2)
- Identify the basic elements of a Microprocessor-Based Controller. (L3)
- Demonstrate the local control unit languages. (L2)

Unit V **8 hours**

Industrial control applications: Automation of thermal power plant, automation strategy, distributed system structure, automatic boiler controller, diagnostic function and protection, digital electro, hydraulic governor, automatic startup system, thermal stress control, man, machine interface, software system, communication system, variable pressure control, combined plant control.

Learning outcomes:

After completion of UNIT V, students will be able to

- Define Automation and Control and explain the differences in the sense of the terms. (L1)
- Explain the relation between Automation and Information Technology. (L2)
- Outline the basic objectives of a manufacturing industry and explain how automation and control technologies relate to these. (L2)
- Explain the concept of a Product Life Cycle and explain how Automation and Control technologies relate to the various phases of the cycle.(L2)

Text Book(s)

1. Krishna Kant, “Computer based Industrial Control”, 2/e, Prentice,Hall India, 2010.
2. S.K.Singh, “Computer Aided Process Control”, 3/e, Prentice,Hall India, 2005.

References

1. D.E Seborg, T.F. Edgar, and D.A. Mellichamp . “Process Dynamics and Control”3/e, John Wiley, 2010.
2. Johnson D Curtis, “Instrumentation Technology” ,8/e , Prentice,Hall India, 2008.

19EOE301: JAPANESE FOR BEGINNERS
(Elective)

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
(Elective)

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
(Elective)

L	T	P	C
3	0	0	3

Unit-I

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

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

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

Drugs and Designer Bodies, Personal Genomics, Biotechnology and Race, Bioprospecting and Bio colonialism

Unit-V

Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Use of biofertilizers and biopesticides 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
(Elective)

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

Unit I **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 of socialist 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, discover natural 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 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.

19LOE301: FUNDAMENTALS OF CYBER LAW
(OPEN ELECTIVE FOR ENGINEERING PROGRAMMES)

L T P C
3 0 0 3

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 Perspectives of 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:

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.

19MOE303: INTRODUCTION TO INTERNATIONAL BUSINESS

L T P C
3 0 0 3

UNIT I: Globalization and International Business Environment

Introduction and Overview: Definition and Scope of International Business-Globalization: Boon or Bane, Globalization – New Dimensions: Mercantilism- Adam Smith: "Theory of Absolute Cost Advantage"- David Ricardo: "Theory of Comparative Cost Advantage". World Trade Organization: Important Provisions and Agreements: Agreement on Agriculture(AOA), Agreement on Textiles and Clothing (ATC), General Agreement on Trade in Services (GATS), Agreement on Rules of Origin, Agreement on Trade Related Investment Measures

(TRIMS), Agreement on Anti-Dumping, WTO: Intellectual Property Right and Industrial Sector, WTO: Dispute Settlement Body

UNIT II: India and International Trade

Exports, Imports and Industrial Production-Trends, Reforms for the Growth of Foreign Trade. Impediments to Growth of India's International Trade, Agreements, Challenges and Opportunities. India's Trade Policy-Past, Present and Future: Trade policy, EXIM Policy: Special Economic Zone and Foreign Trade.

UNIT III: Foreign Direct Investment and International Economic Environment

Foreign Direct Investment (FDI) and Developing Countries. Trends in FDI, Benefits and Determinants: China and Other East Asian Countries: Chinese Imports and Impact on Indian Industries. Case Study- Bicycle Industry. Special Economic Zones and Foreign Trade. Problems in Establishing and Managing International Marketing Channels, Major Players in the International Market, Major players in the International Marketing.

UNIT IV: Exchange Rates, Risk Management and FEMA

Exchange Rate Depreciation and Impact on Exports and Imports: Foreign Exchange Risk, Risk Management, Forecasting of Foreign Exchange, Reforms in Foreign Exchange Marketin India: Exchange Rates- Euro Vs. US Dollar, Exchange Rate Movements and Implications: Currency Crisis: The South -East Asian Crisis, The Currency Crisis in Argentina. Case Study: Case for Euro Invoicing, Dollar as Incumbent.

UNIT V: Regional Trading Blocks

Types of Regional Grouping, North American Free Trade Agreement, The Andean Community, Caribbean Community and Common Market (CARICOM), South Asian Association for Regional Cooperation (SAARC), Association of South-East Asian Nations (ASEAN), European Union (EU).

Prescribed Textbook:

International Business. Justin Paul. 2004, Prentice Hall of India Pvt Limited. New Delhi(ISBN-81-203-2426-9).

Suggested Readings:

1. S.N. Chary- "Elements of International Business"- Wiley India- I Edition- 2006
2. Francis Cherunilam- "International Business- Text and Cases"- Prentice Hall- 3rdEdition- 2004.
3. Margaret Woods- "International Business an Introduction"- Palgrave Publications- 1stEdition- 2003.
4. Aswathappa- "International Business"- TATA McGraw Hill- 1st Edition- 2003.
5. Mike W. Reng- "International Business"- Cengage Learning- 1st Edition- 2007.
6. Vyuptakesh Sharan- "International Business Concept- Environment- &Strategy"-Pearson Education- 1st Edition- 2006.

19EOE319: INTRODUCTION TO MUSIC

L T P C
3 0 0 3

Unit I **8 hours**

Introduction to Indian Classical Music: Heritage-Contribution of various 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 transmitter 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 (Elective)

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, pho-to synthesis, components of ecosystem, carbon and oxygen cycles, nitro-gen, 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, tsunami, 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 climatic change, consequences of climate change in India. Biodiversity and Legislation: 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 (Elective)

L	T	P	C
3	0	0	3

Unit I **10 Hours**

Ancient Indian History and Culture (Earliest Times to 700 AD): Indus valley civilization, 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 administration under Mauryas, Guptas, social and economic conditions in ancient 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 companies, their struggle for supremacy, the battle of Plassey and its significance, consolidation of British rule in India.

Unit IV **8 Hours**

Impact of British Colonial Rule: Economic: Commercialization of agriculture, dislocation of traditional trade and commerce, de-industrialization, 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, introduction of western education in India, the rise of print media, literature and public opinion, the rise of modern vernacular literature, progress of science, 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 moderates and extremists, 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.

A. R. Desai, Social Background of Indian Nationalism, 6/e, Popular Prakashan, 2005

19EOE327: PROFESSIONAL COMMUNICATION
(Elective)

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

(A Preparatory Course for Language Proficiency Tests)

L	T	P	C
3	0	0	3

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

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

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

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

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 arguments and 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

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

Seely, John.*Oxford Guide to Effective Writing and Speaking.*Oxford University Press, (India), 2013

Rizvi, M Ashraf. *Effective Technical Communication*.Tata McGraw Hill. 2005.

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

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 anyway.

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 Objective:

1. To understand the basic fundamentals of sensors and their characteristics.
2. To implement the principles of Resistive sensors and its signal conditioning circuit
3. To apply the concepts of Reactance variation and Electromagnetic sensors
4. To realize the Self-Generating sensors and its signal conditioning circuits
5. To interpret the concepts of Intelligent Sensors & other sensing methods

Unit 1: **8 hours**

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: The students 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: **8 hours**

Resistive Sensors: Potentiometers, Strain Gauges, Resistive Temperature Detectors (RTDs), Thermistors, Magneto resistors, 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: The students 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: **8hours**

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: The students 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: **8hours**

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: The students 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: **8hours**

Digital and Intelligent Sensors: Position Encoders, Resonant Sensors, Variable Oscillators, Conversion to 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: The students 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 the completion of the course the student will be able to

1. Classify different types of sensors and their characteristics (L2)
2. Build the signal conditioning circuits for different resistive sensors (L3)
3. Develop the signal conditioning for reactance variation and electromagnetic sensors (L4)
4. Implement the signal conditioning for self-generating sensors (L2)
5. Identify the differences between conventional sensors and Intelligent sensors (L1)

19EPH371: MATERIALS FOR ENGINEERING APPLICATIONS
(Physics elective)

L	T	P	C
2	1	0	3

This course is designed to train students to engage in advanced education and to become effective researchers for the development in materials engineering, including materials discovery and/or processing. The student will engage effectively with the scientific community that benefit to address technical challenges and to provide the solutions in materials engineering.

Course objectives:

- To provide a basic conceptual understanding of crystal structure of materials and imperfections in materials.
- To familiarize students with different classification of materials with its physical properties.
- To develop the skills and methodologies necessary to apply for the processing of thin film materials.
- To know the tailoring of properties of materials towards specific engineering applications.
- To allow the students to become familiar with the fundamental principles of smart materials.

UNIT I: Introduction to materials **8 L**

Introduction, Classification and properties of materials, Materials used in Electrical and Electronic Industries, Bbonding in solids, Crystal structures, Imperfections in solids, Concept of amorphous, single and polycrystalline structures with their properties.

Learning outcomes:

The student will able to

- To classify the different types of materials
- Know the physical properties of materials
- Understand the bonding in solids
- Know the classification of crystal structures and the defects in the materials
- Distinguish the crystalline and amorphous materials

UNIT II: Semiconducting and Optical materials **10 L**

Electronic band structure of metals and semiconductors- Direct and indirect bandgap semiconductors, Degenerate and non-degenerate semiconductors, Determination of dopant levels- Electronic structure of interfaces: metal-semiconductor, insulator-semiconductor, semiconductor heterostructures, electron-hole recombination, bandgap engineering -Optical properties of materials- Applications –Liquid crystals - LED and related materials.

Learning outcomes:

The student will able to

- Know the bands structure of metals and semiconductors
- Understand the electronic structure of interfaces between different types of materials
- Learn about the tuning of band gap of materials with dopants in the material
- Know about the interaction of light with materials and its optical properties
- Explain the conduction mechanism in semiconducting and optical devices.

UNIT III: Ceramic materials **8 L**

Definition of ceramics, Classification of ceramic materials – structure and properties of ceramics, Powder processing,

Fundamentals of sintering mechanisms, Electro ceramics, Applications –superconductors, capacitor dielectrics, ceramic varistors.

Learning outcomes:

The student will able to

- Learn the basic concepts of ceramics and its properties
- Know the different types of ceramic materials
- Describe and distinguish the structure of ceramic materials
- Understand the materials processing by sintering mechanisms
- Know the materials selection for the design and fabrication of electrical devices

UNIT IV: Thin-Film Materials **10 L**

Basics of vacuum pumps -Rotary, Diffusion pump, Turbomolecular pumps - Preparation of thin films -Physical methods (Thermal and e-beam evaporation, Sputtering) – Chemical methods (CVD, Sol-gel process).

Electrical properties: Conduction in metal films, Electrical Transport in Insulating films, Metal - Semiconductor contacts, Applications – Thin film diodes, transistors, sensors and solar cells.

Learning outcomes:

The student will able to

- Learn about the fundamental concepts of vacuum
- Know the preparation of thin films by physical and chemical methods
- Understand the conduction mechanism in metallic thin films
- Understand the electrical transport phenomenon in insulating materials
- Learn the design of the thin films structures for device applications

UNIT V: Functional Materials **8 L**

Smart materials- Piezoelectric- Electro strictive – Magneto strictive materials –Thermoelectric materials, Shape memory alloys- Chromogenic materials-Applications-Transducers, Sensors and actuators-Thermoelectric generators.

Learning outcomes:

The student will able to

- Understand the basic principles of piezoelectric, electro strictive and magneto strictive methods.
- Learn about the thermoelectric materials for energy storage applications
- Know how the materials (chromogenic) change color and transparency reacting to temperature, voltage, pressure or light.
- Understand the fundamental principles involved in
- Know how the shape memory alloys can be used in a wide range of engineering, medical and dental applications.

Text Books:

1. Raghavan V, Materials Science and Engineering: A first course, 5th edition, PHI Learning, 2004.
2. M. Ohring, Materials Science of Thin Films, 2nd ed., Academic Press, San Diego, 2002.
3. Paolo Gaudenzi, Smart Structures: Physical Behaviour, Mathematical Modelling and Applications, 2009 Wiley.

Reference Books:

1. W. D. Callister Jr, Materials science and engineering. An introduction 2nd eds, John Wiley & Sons, New York, 1991.
2. *W. D. Kingery*, H. K. Bowen and D. R. Uhlmann, "*Introduction to Ceramics*" 2nd eds, *John Wiley* and Sons, New York, 1976.
3. A. Roth, Vacuum Technology, A. Roth, 3rd eds, 1990Elsevier Science, North-Holland,.

Course outcomes:

On successful completion of this course students will be able to

- Understand the basic properties of materials, types of bonds in solids and defects in solids.
- Classify the different types of materials and selection of materials for device applications.
- Learn the basic aspects of semiconducting materials and devices with their physical properties.
- Know the fabrication of thin films by physical and chemical methods.
- Understand the necessity of smart materials and its applications in various fields.

19ECS476: INTRODUCTION TO BIG DATA

L	T	P	C
2	1	0	3

The course is designed which largely involves collecting data from different sources, manage it in a way that it becomes available to be consumed by analysts and finally deliver data products useful to the organization business. The process of converting large amounts of unstructured raw data, retrieved from different sources to a data product useful for organizations by creating different applications using suitable Data Analytics for solving for different problems.

Course Objectives:

- Optimize business decisions and create competitive advantage with Big Data analytics.
- Introducing Java concepts required for developing map reduce programs.
- Derive business benefit from unstructured data.
- Analyzing Business Solution to take decisions.
- Identifying social networks issues and relations.

Unit I: **8 L**

Objective: Learn how to collect data, data sampling and preprocessing.

Data Collection, Sampling, and Preprocessing: Types of Data Sources, Sampling, Type of Data Elements, Visual Data Exploration and Exploratory Statistical Analysis, Missing Values, Outlier Detection and Treatment, Standardizing Data, Categorization.

Learning outcomes:

After completion of this unit, student will be able to

- demonstrate Big Data Concepts (L1).
- identifying Statistical Exploration (L3).

- understanding Various Statistical Methods for Preprocessing (L5).

Unit II: **8 L**

Objective: Understanding different types of data analytics like descriptive & predictive analytics.
Predictive Analytics: Target Definition, Liner Regression, Logistic Regression, Decision Trees, Neural Networks, Support Vector Machines, Ensemble Methods, Multiclass Classification Techniques, Evaluating predictive Models.

Learning outcomes:

After completion of this unit, student will be able to

- applying descriptive Analytics to analyze the data for getting useful information (L1).
- applying Predictive Analytics for Data Analysis (L2).
- understanding Business Decisions (L3).

Unit III: **10 L**

Objective: Understanding how survival analysis supports to take decisions.
Survival Analysis: Survival Analysis Measurements, Kaplan Meier Analysis, Parametric Survival Analysis, Proportional Hazards Regression, Extensions of Survival Analysis Models, Evaluating Survival Analysis Models.

Learning outcomes:

After completion of this unit, student will be able to

- demonstrating survival analysis (L2).
- analyzing survival analysis to take decisions (L1).
- building Survival Analysis Models (L3).

Unit IV: **8 L**

Objective: Analyzing Social Network and Relations.
Social Network Analytics: Social Network Definitions, Social Network Metrics, Social Network Learning, Relational Neighbor Classifiers, Probabilistic Relational Neighbor Classifier.

Learning outcomes:

After completion of this unit, student will be able to

- evaluating social network and its relations: (L4)
- understanding Graph Structures of Social Networks: (L2)
- analyzing and Configuring Social Network Models: (L2)

Unit V: **10 L**

Objective: Understand how data analytics applied in different applications.
Analytics: Putting it all to Work- Back testing Analytical Models, Benchmarking, Data Quality, Software, Privacy, Model Design and Documentation, Corporate Governance.
Example Applications: Credit Risk Modeling, Fraud Detection, Recommender Systems, Web Analytics, Social

Media Analytics, Business Process Analytics.

Learning outcomes:

After completion of this unit, student will be able to

- creating different applications by using suitable data analytics for solving different Problems (L1).
- illustrating Big Data Models for Business Processing (L3).
- understanding corporate governance (L5).

Text Book(s):

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications by Bart Baesens. 2014, SAS Institute Inc.

References:

1. Data Analytics Models and Algorithms for Intelligent Data Analysis By Thomas A. Runkler Springer Vieweg 2012
2. Data Analytics Made Accessible -2018 by Anil K. Maheshwari.

Course Outcomes:

After completing this Course, the student should be able to

- demonstrate the big data concepts for real world data analysis (L1).
- understanding Survival Analysis and its models (L2).
- analyze and understanding Business models (L3).
- illustrate Social Network Models and its Properties (L4).
- building a complete business data analytic solution (L5).

19ECS373: OBJECT ORIENTED PROGRAMMING WITH C++

L	T	P	C
2	1	0	3

C++ is one of the most popular languages, contains object-orientation, a new programming concept, is used to create an object, in code, that has certain properties and methods or Units, the implementation of the Units helps to see the whole world in the form of objects. This course also helps in developing high quality software like system application software, drivers, client-server applications and embedded firmware.

Course Objectives:

- To introduce the difference between procedure oriented programming and object oriented programming.
- To familiarize the basic concept, applications of OOPS and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;
- To identify and practice the object-oriented programming concepts and techniques, practice the use of C++ classes and class libraries, modify existing C++ classes, develop C++ classes for simple applications
- To explain the implementation of features of object oriented programming to solve real world problems using Inheritance, data abstraction, encapsulation and Polymorphism.
- To provide an understanding the concept of file and handling function to perform file operations like accessing the data from file and store the data into file.

Unit I: **10 L**

Introduction to OOP: Procedure oriented programming, object oriented programming, basic concepts of OOP, simple C++ program, namespace scope, structure of C++ Program, creating, compiling and linking a file.
Tokens: Keywords, identifiers, constants, basic data types, user defined data types, derived data types, dynamic initialization of variables, reference variables, operators in C++, scope resolution operator, member dereferencing operators, memory management operators.

Learning Outcomes::

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

- list the difference between procedure and object oriented programming, applications of OOP (L1).
- explain basic concepts of object oriented programming (L2).
- choose appropriate data type and operators in programs (L3).
- extend the concepts of C++ in developing efficient programs (L2).
- create, compile and run the C++ programs (L6).

Unit II: **8 L**

Control Structures:
Classes and Objects: Specifying a class, defining member functions, C++program with class, private member functions, arrays within class, memory allocation for objects, static data members, static member functions, arrays of objects.
Functions in C++: Main function, function prototyping, inline functions, default arguments.

Learning Outcomes:

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

- compare and contrast parameter passing techniques of C and C++ (L2).
- illustrate the concept of classes and objects (L3).
- develop real world applications by using appropriate concepts(L6).
- apply static members in programming (L3).
- compare and contrast inline functions with macros (L2).

Unit III: **8 L**

More about Functions: Function overloading, friendly functions: friend function, objects as function arguments.
Constructors & Destructors: Constructors, parameterized constructors, multiple constructors in a class, copy constructors, dynamic constructors, destructors.

Learning Outcomes:

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

- apply function overloading concept whenever required (L2).
- explain the need of friend function (L2).
- extend the concept of parameter passing techniques with objects (L2).
- define the different types of Constructors (L1).
- apply constructor and destructor in programming (L2).

Unit IV: **10 L**

Inheritance: Introduction to inheritance, single inheritance, making a private member inheritable (protected member),

multi-level inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance.
Operator Overloading: Rules for overloading operators, overloading unary operators, overloading binary operators.
Pointers: Introduction to pointers, declaring and initializing pointers, pointers with arrays, arrays of pointers, 'this' pointer.

Learning Outcomes:

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

- explain the need of reusability concept with inheritance (L2).
- summarize different types of inheritance (L2).
- extend the overloading concept on operators (L2).
- recall the basics of pointers from C language and extend to objects (L1).
- describethe need of this pointer (L2).

Unit V: **8 L**

Polymorphism and Virtual Functions: Compile-time polymorphism, run-time polymorphism, virtual functions.
Templates: Introduction, function templates, class templates.
Exception Handling: Introduction, exception handling mechanism, throwing mechanism, catching mechanism.

Learning Outcomes:

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

- compare and contrast compile time and run time polymorphism (L2).
- apply of virtual functions (L3).
- classify the various input and output operators into formatted and unformatted (L2).
- apply the concept of templates for generic programming (L3).
- show the handling of run time errors (L2).

Text Book(s):

1. E. Balagurusamy, Object Oriented Programming with C++, 6/e, McGraw Hill, 2013.

References:

1. SouravSahay, Object Oriented Programming with C++, 2/e, Oxford University Press, 2012.
2. Behrouz A. Forouzan and Richard F. Gilberg, Computer Science : A Structured Approach Using C++, 2/e, Cengage Learning, 2003.
3. Ashok N. Kamthane, Object Oriented Programming with ANSI and Turbo C++, 1/e, Pearson Education, 2006.

Course Outcomes:

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

- differentiate between procedure-oriented programming and object-oriented programming with emphasis on special features of C++ language (L2).
- differentiate the fundamental concepts of C and C++ (L2).
- identify the differences in C and C++ operators and their usage in C++ applications (L2).
- examine the working of Control structures in C++ programs (L3).
- define, declare and implement classes and objects (L1).
- develop applications with the help of functions, constructors and destructors (L6).
- interpret various Inheritance mechanisms, operator overloading, polymorphism and apply in applications (L3).
    - determine the concepts of Polymorphism, Virtual functions and Exception handling and be able to develop applications with them (L3).
    - construct applications using generic programming concepts (templates) (L6).

19ECS375: INTRODUCTION TO PROGRAMMING WITH JAVA

L	T	P	C
2	1	0	3

Java's unique architecture enables programmers to develop a single application that can run across multiple platforms seamlessly and reliably. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and GUI applications and store and retrieve data from relational databases.

Course objectives

- To make it understand the difference between programming languages C, C++ and Java.
- Learn various types of Inheritance mechanisms.
- Give exposure over various software packages applicability and usage of multithreading concepts.
- Applet creation and its graphical effects.
- Learn different components required for forms designing in AWT.

Unit I: **10L**

Java Evolution and Overview of java Language: Fundamentals of OOP, Java evolution, overview of java language, java history, features of java, how java differs from C and C++, java and World Wide Web, web browser. Java Environment: Java Development kit (JDK), Application Programming Interface (API), java programming structure, java tokens, constants, variables, expressions, decision making statements and looping, java statements, overview of arrays and strings, machine neutral, Java Virtual Machine (JVM), Command Line Arguments. Arrays and Strings :One-dimensional arrays, creating an array, declaration of arrays, initialization of arrays, two-dimensional arrays, string arrays, string methods, string buffer class, vectors, wrapper classes. Basic I/O Streams: Scanner, buffered reader.

Learning Outcomes:

After completion of the unit, student will be able to

- identify the difference between c++ and Java (L2)
- identify the Environment that allows to write platform independent programs(L2)
- apply the methods of Strings to solve the string oriented problems.(L3)
- analyze the uses of wrapper classes in the design of solutions.(L4)
- contrast the difference between the usage of I/O Streams(L4)

Unit II: **11L**

Classes, Objects and Methods: Introduction, defining a class, creating objects, accessing class members, constructors, methods overloading, static members. Inheritance: Defining a sub class, sub class constructor, multilevel variables, final classes, and finalize methods, abstract methods and classes, visibility control. Managing Errors and Exceptions: Introduction, types of errors: compile time and run time errors, exceptions, types of exceptions, syntax of exception handling code, multiple catch statements, using finally statement, throwing our own exceptions.

Learning Outcomes:

After completion of the unit, student will be able to

- define the user defined classes of the given problem to be solved.(L1)
- explain the behavior of each object in its scope.(L2)
- apply the concepts finalize, abstract and final over the methods and classes.(L3)
- analyze the exception handling mechanisms.(L4)
- develop a code with try and catch blocks.(L3)

Unit III: **9L**

Interfaces, Package & Multithreaded Programming: Introduction, defining interfaces, extending interfaces, implementing interfaces. Package: Creation, importing a package and user defined package. Threads: Introduction to threads, creating threads, extending the thread class, implementing the 'runnable' interface, life cycle of a thread, priority of a thread, synchronization, and deadlock.

Learning Outcomes:

After completion of the unit, student will be able to

- review the concepts of Inheritance for implementing new classes.(L2)
- extends the new classes from one or more classes.(L2)
- define the interfaces and packages.(L1)
- develop new packages for solving complex problems.(L3)
- analyze the flow of execution by decomposing into two or more.(L4)

Unit IV: **9L**

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 the unit, the student will be able to

- define the new concept applet on internet programming.(L1)
- compare applet with application programs(L2)
- apply applet life cycle to the real problem to solve.(L3)
- test the parameterized applet.(L3)
- examine the behavior of applet using HTML code (L4)

Unit V: **8L**

Graphics Programming: Introduction, abstract window toolkit class hierarchy, frames, event-driven programming, layout managers, panels, canvases, drawing geometric figures. Introduction to Swings: Introduction to swings, overview of swing components-J button, J Check Box, J Radio Button, J Label, J Text Field, J Text Area, J List. Introduction to Networking: I net Address class, socket class, URL class.

Learning Outcomes:

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

- choose awt to create GUI(L3)
- classify the various layouts (L3)
- develop the very user friendly GUIs(L3)
- contrast the between applet and Swings(L2)
- construct an Internet based application using networking concepts in java(L3)

Textbook(s):

1. Herbert Scheldt, The Java complete References, 9/e, TMH Publications,2014.

References:

1. Balagurusamy, Programming with JAVA, 2/e, TMH Publications,2014.
2. Y.DanielLiang, An Introduction to JAVA Programming, TMH Publications, 2009.
3. Kathy Sierra, Head First Java, 2/e, Shroff Publishers, 2012..

Course Outcomes:

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

- differentiate Java and C,C++ and basic environment required for implementing Java program.(L4)
- explain the concept of class and object and Ability to apply inheritance concepts(L2)
- illustrate concept of user defined exceptions(L4)
- demonstrate usage of a package and thread implementation in application development(L3)
- develop applets with various graphical aspects and Develop GUI forms using different AWT components(L3)

19EME371: QUANTITATIVE TECHNIQUES FOR MANAGEMENT

L	T	P	C
2	1	0	3

Course Objectives:

- Provide methodical survey of statistical data analysis and models used in decision making.
- Understand the characteristics of different types of decision making environments and the appropriate decision making approaches and tools to be used in each type.
- Develop skills of formulation of decision problems into appropriate models.
- Understand the scope of implementation and limitation of each type of models used.
- Apply optimization and heuristic methods to solve business problems, and make effective decisions.
- Understanding the relationship among key variables, and establish functional capability by using decision techniques.
- Understand time and project management concepts.

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

- Apply the most widely used quantitative techniques in decision making. (L3)
- Grasps the wide applicability of quantitative techniques. (L1)
- Apply various statistical techniques and the calculation of probabilities to a range of management problems(L3)

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

- Demonstrate their competence and confidence in using descriptive statistics(L2)
- Demonstrate their competence and confidence in using inferential statistics in general and to the use of significance testing in particular(L2)

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

- Apply mathematics to technical problems in business management.(L3)
- Apply mathematical techniques in engineering decision making(L3)

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

- Realize the Importance of certain mathematical techniques in getting the best possible solution to a problem involving limited resources.(L2)
- Apply optimization and heuristic methods to solve business problems, and make effective decisions.(L3)

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

- Evaluate and plan projects, using graphical linear programming, and network analysis(L5)
- Apply linear programming methods to solve business problems, and make effective decisions(L3)

Text Books:

1. Anderson, Sweeney, Williams, 2005, An introduction to management science Thomson South Western
2. Barry Render, Ralph MStairJr, 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
- Use appropriate mathematical techniques in engineering decision making.
- Use Operations Research Techniques/ Models like Linear Programming, Transportation Model, Project management, for optimal allocation of resources.
- Understand and apply the characteristics of different types of decisions making capabilities.
- Identify real-life problems and choose appropriate tool/technique to model them, being aware of the assumptions underlying the tools.

19EME356: ENTERPRISE RESOURCE PLANNING

L	T	P	C
2	1	0	3

Course Objectives:

- To provide awareness about the ERP concepts and the technologies.
- To Understand ERP Implementation Procedure.
- To know the process of Post Implementation of ERP.
- To provide knowledge of ERP for various Units.
- To help in understanding how companies have implemented ERP successfully.

Unit I: **8 L**

Introduction: Concept of Enterprise, ERP Overview, Integrated information system, The role of Enterprise, Business

Modeling, Myths about ERP, Basic ERP Concepts, Intangible benefits of ERP, Justifying ERP investment, Risks of ERP, Benefits of ERP.

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

- understand the concept of enterprise resource planning(L1)
- apply and interpret basic summary and modelling techniques of business modelling in ERP(L4)
- Get equipped with the myths, risks and benefits of ERP(L3)
- Enhance wide knowledge in the areas where ERP has significance. (L2)

Unit II: 9 L

Implementation: Life Cycle, Methodologies, Strategy, Business Case and Return on Investment Analysis for ERP, Selecting Consulting Partner, ERP Package Selection, ERP Project Team and Project Organization Structure,ERP Project Management, Managing Requirements, Business Process Re-engineering, Business Process Modeling and Business Modeling.

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

- understand the concept of life cycle and strategies involved in ERP(L1)
- apply the ideas of any project team and develop modelling techniques in the structure of ERP(L4)
- get equipped with the process of selecting consulting partner and package selection.(L3)
- Enhance wide knowledge in business process re engineering. (L2)

Unit III: 8 L

Post ERP Implementation: Post-Implementation Review of ERP Systems, Post-Implementation Support, Maintenance and Security of ERP, Gaps Identification and Strategies to Bridge the Gap, Configuring and Testing of the Solution, Data Migration, Cutover Planning and Go Live Preparation, Training, Change Management, Success or Failure of ERP Implementation.

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

- Identify the gaps in the maintenance and security of ERP systems.(L1)
- configure and test the solutions in data migration (L2)
- get equipped with the process of cutover planning, preparation and training (L3)
- enhance wide knowledge in the success and failure of ERP(L2)

Unit IV: 9 L

ERP Functional Units: Human Capital Management, Financial Management Procurement, Inventory Management through ERP, Supplier Relationship Management, Production Planning, Execution, Supply Chain Planning, Sales and Service, Logistics Execution, Warehouse and Transport Management, Customer Relationship Management, Quality Management, Maintenance Management, Enterprise Asset Management, Product Lifecycle Management.

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

- Understand the concept and distinguish the features between capital management, financial management and inventory management.(L1)
- Recognize the execution of logistics, ware house and transport management.(L1)
- Get equipped with the basic knowledge of customer relationship management, quality management and enterprise management.(L3)
- Identify the features of product life cycle management.(L1)

Unit V : 8 L

ERP Applications: Portal, Content Management, Knowledge Management, Data Warehousing, Data Mining, Business Intelligence and Analytics, ERP and Enterprise Applications, Emerging Trends, ERP for Industries- ERPs for Different Manufacturing Industries, ERPs for Different Service Industries, Case Studies.

Learning outcomes:

After completing this unit, the student will be able to

- Identify the gaps in the maintenance and security of ERP systems.(L1)
- configure and test the solutions in data migration (L2)
- get equipped with the process of cutover planning, preparation and training (L3)
- enhance wide knowledge in the success and failure of ERP(L2)

Textbooks:

1. Rajesh Ray, Enterprise Resource Planning, 1st Edition, McGraw Hill Education, 2010.
2. Robert D.Hisrich, Michael P.Peters, Mathew J. Manimala and Dean A. Shepherd, Entrepreneurship, 9th Edition, McGraw Hill Education, 2010.

References:

1. D. P. Goyal, Enterprise Resource Planning A Managerial Perspective, 1st Edition, McGraw Hill Education, 2011.
2. L.Wagner, Concepts in Enterprise Resource Planning, 4th Edition, engage Learning India Pvt. Ltd, 2014.
3. A. leon, Enterprise Resource Planning, 3rd Edition, McGraw Hill Education, 2014.
4. P. C. Reddy,Enterprise Resource Planning, 1st Edition, S. K. Katarina& Sons, 201

Course Outcomes:

- The student will be able to understand the concept of ERP.
- The student will be able to know ERP Implementation Procedure.
- The student will be able to learn Various ERP Units.
- The student will be able to know various software's using for ERP
- The student will be able to compare ERP Units for Industries and Service org.

19EEE391: COMPREHENSIVE SKILL DEVELOPMENT IV

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:

Unit	Module/ Topics	Hrs
1.	Grammar and Error Detection Exercises	6
2.	Structure and Sentence Correction/ Improvement Exercises	6
3.	Error Detection & Sentence Correction–FAQs with Solutions	2
4.	Fill-in-blanks and Cloze Passages	3
	Total	**15**

Unit	Module/ Topics	Hrs
1.	Arithmetic	9
2.	Geometry	2
3.	Mensuration	2
4.	Puzzles	2
	Total	15

B. Quantitative Aptitude and Reasoning

Unit	Module/ Topics	Hrs
1.	Combinatorics [i. Permutations & Combinations, ii. Probability]	3
2.	Cryptarithmetic & Modular Arithmetic [i. Cryptarithmetic, ii. Application of base system (7, 24) Clocks (Base 24) Calendars (Base 7)]	3
3.	Mental Ability [i. Number series ii. Letter series & Alpha numeric series iii. Analogies (Numbers, letters) iv. Classifications]	4
4.	Algebra [i. Exponents, ii. Logarithms, iii. Problems related to Equations, iv. Special Equations, v. Statistics]	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	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/

19EEC332: MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	3	4.5

The use of microcontrollers in various fields such as automobile, aeronautics, space, robotics, electronics, defense application, mobile communications, rail transport, industrial processing, and medical applications is rapidly increasing. This course is intended to cover hardware and software aspects of 8086 microprocessor, 8051 microcontroller and brief introduction of ARM processors. Study of programming trains the student to design and implement real time applications.

Course Objectives

- To familiarize the concepts and architecture of 16-bit microprocessor 8086.
- To explain assembly language programming of 8086 microprocessor.
- To demonstrate the architecture, instruction set and programming of8051 microcontroller.
- To impart C programming to interface various peripherals like data converters, timers, serial pot etc.,
- To create microcontroller based embedded system.

Unit I **17L**

The Processor 8086: Register organization of 8086, architecture of 8086, signal description of 8086, physical memory organization, I/O addressing capability.

Learning Outcomes

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

- demonstrate the architecture of 8086(L4).
- summarize how memory of 8086 is addressed using segmentation (L4).
- explain physical memory organization of 8086(L5).

Unit II **18L**

Instruction Set and Interrupts: Addressing modes of 8086, instruction set of 8086, assembly language programs (example programs), interrupts and interrupt service routines, interrupt cycle of 8086, non-maskable interrupt, maskable interrupt (INTR).

Learning Outcomes

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

- analyze the addressing modes of 8086 (L4).
- construct various assembly language programs of 8086 (L3).
- illustrate the interrupt cycle of 8086 (L1).

Unit III **15L**

An Introduction to microcontroller 8051: Intel family of 8 bit microcontrollers, architecture, signal description, register set of 8051, important operational features of 8051- program status word (PSW).

Learning Outcomes

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

- distinguish microprocessor and microcontroller (L4).
- demonstrate the architecture of 8051(L4).
- illustrate the register set and operational features of 8051(L3).

Unit IV **14L**

Programming 8051 Timers and Serial port: Basic registers of timer, modes of operation, programming timers in C(examples), Basics of serial communication, baud rate in 8051, SBUF, SCON, serial port programming in C(examples).

Learning Outcomes

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

- describe various modes of operations of 8051 timers (L2).
- develop programs of 8051 timers in C to generate time delays (L3).
- develop techniques to program 8051 serial port in C (L3).

Unit V **14L**

Interfacing of Peripherals to 8051:ADC 0808/0809 chip with 8 analog channels, programming ADC 0808/0809 in C, DAC interfacing DAC0808, programming DAC in C.
Introduction to ARM processor: The ARM Family History, ARM family variations.

Learning Outcomes

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

- assess how to interface ADC and DAC to 8051 (L6).
- develop programs to interface ADC and DAC of 8051 in C (L3).
- distinguish between microcontroller and ARM processor (L4).

Microprocessors and Microcontrollers Laboratory

Experiments with microprocessor 8086 using Assembler:

1. Arithmetic operations on 8 bit and 16 bit operands.
2. Transfer block of data from one memory location to another memory location.
3. Programs using monitor routines.
4. Compute maximum, minimum and sorting (ascending and descending)
5. Generate Fibonacci series, average of N numbers, factorial of N.

Experiments for microcontroller 8051 using Keil-C51:

6. Arithmetic operations on 8051.
7. Transfer given string serially with suitable baud rate.

8. Generation of waveforms using timers of 8051.
9. Interface DAC with 8051 to generate waveforms.
10. Interface ADC with 8051 to read analog data and display read data.

Real Time Applications:

11. Interface traffic lights using microcontroller 8051.

12. Interface stepper motor using microcontroller 8051.

Text Book(s):

1. AK Ray, KM Bhurchandi, Advanced Microprocessors and Peripherals, 2/e,Tata McGraw Hill Publications, 2009.

2. Muhammad Ali Mazidi, Janice Gillispie, Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems using Assembly and C, Second Edition, Person Education, 2002.

3. Muhammad Ali Mazidi, SarmadNaimi, SepehrNaimi, Janice Mazidi, ARM Assembly Language Programming & Architecture(ARM books) (Volume 1)

References:

1. Barry B. Brey, The Intel Microprocessors: Architecture, Programming andInterfacing, 8/e, Pearson Education, 2008.

2. Kenneth J. Ayala, 8086 Micro Processor: Programming and Interfacing the PC, 1/e, Delmar Cengage Learning, 2007.

3. Douglas V Hall, Microprocessors and Interfacing: Programming and Hardware,2/e, Tata McGraw Hill, 2006.

Course Outcomes

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

- summarize the concepts of architecture, instruction set and addressing modes of 8086 microprocessor (L2).
- develop programs of 8086 microprocessor to perform various tasks and verify the programs with 8086 kits (L3).
- differentiate between microprocessor and microcontroller and understand the basics of 8051 microcontroller and perform experiments with microcontroller 8051 using Keil-C51 (L4).
- interpret the interfacing of microcontroller with different peripheral devices such as timers, serial port, ADC and DAC etc. and verifying it practically using trainer kits (L3).
- identify the architectural highlights of ARM processors (L4).

19EEE332: POWER ELECTRONICS

L	T	P	C
3	0	2	4

Power Electronics deals with power conversion from mW to MW using Semiconductor devices (Diode, Thyristor, MOSFET, IGBT etc.). Power Electronics can be used in various fields such as Aerospace, Automotive electrical and electronic systems, industrial, residential, telecommunication, transportation, utility systems, etc. this is base course like Advanced power electronics and Electrical Drives and Control.

Course Objectives:

- **To impart** knowledge about various power semiconductor devices
- **To introduce** knowledge on the basic theory of power semiconductor devices and their practical applications in power electronics.
- **To familiarize** students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
- **To expose** strong foundation for further study of power electronic circuits and systems.
- **To train** the students to analyze and design different power converter circuits.

UNIT I: Power semiconductor switches and SCR 9 L

Power diodes, power transistors, power MOSFET, IGBT,GTO, SCR, Thyristor family, two transistor model of SCR, static and dynamic characteristics, turn-on and turn-off methods, Gate characteristics, series and parallel operation of thyristors, Gate triggering circuits, Thyristor ratings, Protection circuits of SCR.

Learning outcomes:

After completion of this UNIT student will be able to

- **Name** the various power electronic devices (L1)
- **Explain** i-v characteristics of power electronic devices (L2)
- **Examine** two transistor model and series/parallel of SCR (L3)
- **Inspect** gate triggering circuits, thyristor ratings and protection of SCR's (L4)

UNIT II: Phase controlled rectifiers 8 L

Single phase and three phases – half wave, semi converter, full wave controlled rectifiers, dual converters, effect of load and source inductances. Natural commutation, forced commutation circuits- Self, impulse, resonant pulse, complimentary and external pulse commutation.

Learning outcomes:

After completion of this UNIT student will be able to

- **Define** controlled rectifiers (L 1)
- **Classify** the controlled rectifiers and explain the operation of each (L 2)
- **Develop** commutation circuits of SCR (L3)
- **Analyze** dual converter circuits (L4)

UNIT III: Choppers 8 L

Principle of operation, step down choppers, step up choppers, Analysis of first quadrant chopper- Derivation of average load voltage, load current for continuous/discontinuous current operation, Morgan, Jones and Oscillation choppers.

Learning outcomes:

After completion of this UNIT student will be able to

- **Spell** the operation of SCR chopper (L1)
- **Compare** the operation of step down and step up chopper (L2)

- **Apply** Morgan, Jones and Oscillation choppers for DC motor (L3)
- **Examine** the analysis of quadrant I chopper (L4)

UNIT IV: Inverters **9 L**

Series and parallel inverters, 1-phase and 3- phase inverters, McMurray inverter, McMurray Bedford inverter, Voltage control in inverters, Methods of harmonic reduction, Current source inverters.

Learning outcomes:

After completion of this UNIT student will be able to

- **Define** the operation Inverter (L 1)
- **Classify** the types of Inverters and explain the operation of each type (L2)
- **Develop** McMurray/Bedford inverter (L3)
- **Analyze** voltage control in inverters (L4)
- **Appraise** harmonic reduction methods (L5)

UNIT V: AC to AC Converters **9 L**

Principle of operation of cycloconverter, 1-phase to 1-phase cycloconverter, 3-phase to 1-phase cycloconverter, 3-phase to 3-phase cycloconverter, 1- phase and 3- phase voltage controllers using thyristors and triacs, AC choppers.

Learning outcomes:

After completion of this UNIT student will be able to

- **Relate** cycloconverter and AC voltage controller (L 1)
- **Explain** the operation of circuits of cycloconverter and ac voltage controllers (L2)
- **Identify** the use of Triacs for AC voltage controllers (L3)
- **Discover** the operation of AC choppers (L4)
- **Conclude** the various applications ac-ac converters(L5)

Power Electronics Laboratory

List of Experiments

1. Static or V-I characteristics of SCR. Find I_L and I_H
2. UJT Relaxation Oscillator
3. 1-phase half controlled rectifier with R and R_L Load
4. MOSFET based step up/ step down chopper
5. 1-phase AC voltage controller using TRIAC
6. Voltage commutation
7. 3-phase Fully controlled Rectifier
8. 1-phase Dual converter
9. 3-phase IGBT based PWM Inverter
10. 3-phase VVVF PWM Inverter
11. 1-phase Cyclo-converter
12. Complementary Commutation

Text Books:

1. R.Ramshaw, “Power Electronics”, 1/e, John Wiley, 1973.
2. Muhammad H Rashid, “Power Electronics”, 2/e, Pearson Education, 2003.

Reference Books:

1. M D Singh, K B Khanchandani, “Power Electronics”, 3/e, Tata MC Graw Hill, 2008.
2. P.S. Bhimbra, “Power Electronics”, 3/e, Khanna Publishers, 1999.

Course Outcomes:

After the completion of the course the students will be able to

- **Describe** basic operation and **compare** performance of power semiconductor devices (L1)
- **Design** and **Analyze** power converter circuits and learn to **select** suitable power electronic devices by **assessing** the requirements of application fields (L2)
- **Identify** the critical areas in application levels and **derive** typical alternative solutions, **select** suitable power converters to control Electrical Motors and industry grade apparatus (L 3)
- **Recognize** the role power electronics play in the improvement of energy usage efficiency and the **applications** of power electronics in emerging areas (L 4)
- **Analyze** various single phase and three phase power converter circuits and understand their applications (L5)
- **Develop** skills to build, and troubleshoot power electronics circuits(L6)
- **Understand** the use of power converters in commercial and industrial applications (L 7)

19EEE342: POWER SYSTEM PROTECTION(Elective)

L	T	P	C
3	0	0	3

This course is aimed to introduce the students the principle of protection and describes the protection of electrical power system components from faults through the disconnection of faulted parts from the rest of the electrical network. Protection scheme is to keep the power system stable by isolating only the components that are under fault. Thus, protection schemes are applicable for very pragmatic and pessimistic approach to clearing the system faults. This is a basic course for power system stability, power system operation and control and Advanced power system protection courses.

Course Objectives:

- To expose basic concepts of circuit breakers and different circuit breakers.
- To impart basic idea of protective relay and different types of relays.
- To acquaint various static relays used in protection
- To enable the various Computer-aided protection schemes.
- To accustom different system protection schemes.

Unit I: **Circuit breakers** **10 L**

Methods of arc interruption, Expression for RRRV. Resistance switching. Single frequency transients. Current chopping, interruption of capacitive currents. Classification of circuit breakers, principle of operation and constructional features of oil, air, air-blast, SF_6 and vacuum circuit breakers. Ratings of circuit breakers. Testing of circuit breakers. Auto reclosing.

Learning outcomes:

After completion of this UNIT student will be able to

- **What** is the need for power system protection(L1)
- **Explain** operation and constructional features of various circuit breakers.(L2)
- **Identify** the ratings of circuit breakers(L3)
- **Test for** circuit breakers(L4)

Unit II: Faults and Over-Current Protection **8 L**

Protective relays, basic idea, essential qualities of protection,

Electromagnetic relays:

Types of electromagnetic relays**,** application, characteristics and general equation of over current. Earth fault. Differential and distance relays. Directional relays. Protection: Feeder protection, protection of transformers, generators, motors.

Learning outcomes:

After completion of this UNIT student will be able to

- **List** the Types of electromagnetic relays(L1)
- **Explain** characteristics various over current relays(L2)
- **Distinguish** the Differential, distance and Directional relays(L3)
- **Analyze** protection of feeders, transmission lines, generators and motors. (L4)

Unit III: **Static Relays:** **8 L**

Advantages of static relays. Comparators, amplitude and phase comparators. Duality. Classification of static relays: over current, distance, differential protection relays.

Learning outcomes:

After completion of this UNIT student will be able to

- **List** the Advantages of static relays (L1)
- **Explain** role of amplitude and phase comparators in static relays(L2)
- **Classify** the various static relays (L4)
- **Compare** distance and differential protection relays.(L5)

Unit 4: **Digital Protection** **8 L**

Computer-aided protection, Fourier analysis for phasor estimation, Discrete Fourier Transform and application to current and voltage phasor estimation. DFT issues like Sampling, aliasing.

Learning outcomes:

After completion of this UNIT student will be able to

- **What** is the need of Computer-aided protection(L1)
- **Explain** sampling theorem (L2)
- **Apply** Fourier analysis for phasor estimation (L3)
- **Estimate** the current and voltage phasors using DFT (L6)

Module 5: **System Protection** **8 L**

Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Learning outcomes:

After completion of this UNIT student will be able to

- **What** is the Effect of Power Swings on Distance Relaying (L1)
- **Demonstrate** the under-voltage and df/dt relays(L2)
- **contrast** phasor measurement units (L4)
- **Adapt** WAMS for improving protection systems(L6)

Texts Book(s):

1. Badriramand D.N. Viswakarma, "Power System Protection and Switchgear", 2/e, Tata McGrawHill, 2011.
2. A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.

Reference(s):

1. J.B. Gupta , "Switchgear and protection", S.K.Kataria & sons,2009
2. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, Newyork, 1987.
3. Y. G.Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall,India, 2010.
4. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.
5. D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.

Course Outcomes:

At the end of the course students will be able to

- Explain the field of power system protection and discuss about basic operation of C.B's.(L1)
- Demonstrate the working mechanism of circuit breakers and their selection for each of protection scheme design. (L2)
- Compare the concept of different types of relays, including differential relay, distance relay, etc. and their selection for each protection scheme design. (L2)
- Compare the types of static relays. (L4)
- Develop the Digital Protection algorithms. (L6)
- Estimate the Effect of Power Swings on Distance Relaying. (L5)

19EEE354: ELECTRIC DRIVES(Elective**)**

L	T	P	C
3	0	0	3

In this course it is aimed to enable the students on introduction to the operation of electric drives controlled from a power electronic converters and also provides the design concepts of controller. To familiarize students with applications of electric motor drives in industries. This can be a base course for Advanced AC and DC Electrical drives.

Course Objectives:

- **To introduce** main principles of drives
- **To familiarize** with basic requirements placed by mechanical systems on electric drives.
- **To study** the basic concept of electric braking.
- **To enable** with phase controlled DC motor drives.
- **To expose** to power electronic controlled AC drives.

UNIT-I: Fundamentals of Electric Drive: 8 L

Electric Drives and its parts, advantages of electric drives, Classification of electric drives, multi-quadrant operations, Constant torque and constant power operation, Types of load torque: components, nature and classification

Learning outcomes:

After completion of this UNIT student will be able to

- **What** is electric drives(L1)
- **Illustrate** the operation of electric drive (L2)
- **Identify** the different types of load torques (L3)

UNIT-II: Dynamics of Electric Drive: 9 L

Dynamics of motor-load combination Steady state stability of Electric Drive, Transient stability of electric Drive, Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty; Load equalization

Learning outcomes:

After completion of this UNIT student will be able to

- **Define** the dynamics in the motor -load combinations. (L1)
- **Explains** the steady state and transient stability operation electric drives (L2)
- **Identify** the suitable motor for suitable applications. (L3)

UNIT-III: Electric Braking: 8 L

Purpose and types of electric braking, braking of DC, three phase induction and synchronous motors, Calculation of acceleration time and energy loss during starting of DC shunt and three phase induction motors, Energy relations during braking

Learning outcomes:

After completion of this UNIT student will be able to

- **What** is electric braking (L1)
- **Classify** the types of electric braking (Level2)
- **Develop** a suitable braking system to a suitable electric drive (L3)

UNIT- IV: Power Electronic Control of DC Drives: 9 L

1- phase and 3- phase controlled converter fed separately excited DC motor drives (continuous conduction only), dual converter fed separately excited DC motor drive, rectifier control of DC series motor, Chopper control of separately excited DC motor and DC series motor.

Learning outcomes:

After completion of this UNIT student will be able to

- **Find** type of power electronic converters to control the DC motor drives (L1)
- **Illustrate** the operations of different electric DC- Motor drives (L3)
- **Motivated** to identify the problems in DC drives(L4)

UNIT-V: Power Electronic Control of AC Drives: 9 L

3-Phase induction Motor Drive- Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based), static rotor resistance and slip power recovery control schemes. 3-Phase Synchronous motor-staring using SCR's, Self controlled and true synchronous scheme.

Learning outcomes:

After completion of this UNIT student will be able to

- **Find** type of power electronic converters to control AC- Motor drives(L1)
- **Illustrates** theoperations of different electric motor AC drives (L2)
- **Motivated** to identify the problems in DC drives(L4)

Text Book(s):

1. G.K. Dubey, "Fundamentals of Electric Drives", Narosa publishing House.
2. S.K. Pillai, "A First Course on Electric Drives", New Age International.
3. B.N. Sarkar, "Fundamental of Industrial Drives", Prentice Hall of India Ltd.

Reference Books:

1 M. Chilkin, "Electric Drives",Mir Publishers, Moscow.
2 Mohammed A. El-Sharkawi, "Fundamentals of Electric Drives", Thomson Asia, Pvt. Ltd. Singapore.
3 N.K. De and Prashant K. Sen, "Electric Drives", Prentice Hall of India Ltd.

19EEE455: DIGITAL CONTROL SYSTEMS(Elective)

L	T	P	C
2	0	2	3

Digital control is a branch of control theory that makes use of digital systems for acting as controllers in a system. Digital Control systems are an integral part of everyday life in today's society. They control appliances, entertainment centers, office environments, industrial processes and our transportation systems. Almost all of these applications use digital controllers implemented with computers, microprocessors, or digital electronics. Every electrical engineering student should therefore be familiar with the basic theory of digital controllers as it lays the foundation for advanced control systems.

Course Objectives:

The purpose of the course is to

- **Expose** digital representation of continuous systems
- **Analyze** a discrete time system with mathematical tools like Z transforms
- **Analyze** stability of discrete time system
- **Interpret** state variable analysis
- **Design** a digital control system

UNIT I: **8 L**

Discrete Representation of Continuous Systems: Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

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Learning outcomes:

After completion of UNIT I, students will be able to

- **outline** concepts of digital control systems(L2)
- **demonstrate** the Discrete representation of continuous systems (L2)
- **develop** the mathematical modeling of Sample and hold circuit (L3)
- **dissect** the effects of sampling and quantization (L4)
- **assess** the choice of sampling frequency, ZOH equivalent (L4)

UNIT II: **10 L**

Discrete System Analysis Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.

Learning outcomes:

After completion of UNIT II, students will be able to

- **explain** transfer function of closed loop systems (L2)
- **apply** the Z-Transform and Inverse Z Transform for analyzing discrete time systems. (L3)
- **build a** mapping from s-plane to z plane. (L3)
- **determine** the time response of discrete time system. (L4)
- **develop** solution of discrete time systems. (L6)

UNIT III: **8 L**

Stability of Discrete Time System Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

Learning outcomes:

After completion of UNIT III, students will be able to

- **apply** Jury test for checking the stability of a system . (L3)
- **analyze** the stability using bilinear transformations. (L4)
- **design** digital control system with dead beat response. (L6)
- **discuss** the practical issues with dead beat response design**.** (L6)

UNIT IV: **10 L**

State Space Approach for discrete time systems State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Re-constructability and observability analysis. Effect of pole zero cancellation on the controllability & observability.

Learning outcomes:

After completion of UNIT IV, students will be able to

- **explain** State space models of discrete systems (L1)
- **analyze** Lyapunov Stability of the discrete system**.** (L4)
- **examine** Controllability, reach-ability, Re-constructability and observability of the discrete system (L4)
- **examine** the influence of pole zero cancellation on the controllability & observability. (L4)

UNIT V: **10 L**

Design of Digital Control System: Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator. Design of discrete output feedback control

Learning outcomes:

After completion of UNIT V, students will be able to

- **build** a Discrete PID Controller (L6)
- **model** a discrete state feedback controller. (L6)
- **develop a** Discrete Observer for LTI System. (L6)
- **design** a Discrete compensator. (L6)
- **design** of discrete output feedback control. (L6)

Textbook(s):

3. K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.
4. M.Gopal, "Control Systems Engineering" , 3/e , Wiley Eastern Ltd., TMH ,2008

Reference book(s):

1. G. F. Franklin, J. D. Powell and M. L. Workman, "Digital Control of Dynamic Systems", Addison-Wesley,1998.
2. B.C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980.

Course Outcomes:

Upon successful completion of the course the students will be able to

- **represent** continuous systems in discrete domain. (L2)
- **analyze** a discrete time system using Z transforms . (L3)
- **determine** the time response of discrete time system(L4)
- **evaluate** the stability of discrete system . (L5)
- **construct** state space models of discrete systems and performing their stability analysis(L5)
- **design** a digital control system for different applications(L6)

19EEE341: ELECTRICAL DISTRI BUTION SYSTEMS (Elective)

L	T	P	C
3	0	0	3

The structure and load patterns of a power distribution system are significantly different than transmission system. This course gives insight into various aspects of distribution system such as basic components and factors, distribution feeders, system analysis, compensation, design, operation and coordination. In addition, distribution systems are transitioning from passive to active with the adoption of distributed generation, storage, and smart-grid technologies. Therefore, this course acts as base course for analysis of distribution systems with distributed generation.

Course objectives:

- **To interpret** load modeling and analyze the characteristics of loads.
- **To identify** the design concepts of primary and secondary systems.
- **To explain** substation bus schemes and know the difference between them.
- **To demonstrate** the coordination procedure of various protective devices.
- **To determine** the optimum capacitor location and can understand the applications of capacitors in distribution systems .
- **To explain** the importance of voltage control and list the equipment used for it.

UNITI: **10L**

Introduction to distribution systems: Overview of distribution systems. Load modeling and characteristics. Coincidence factor, contribution factor loss factor. Relationship between the load factor and loss factor.Classificationofloads(residential,commercial,agriculturalandindustrial) and their characteristics.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Recall** the concepts of electrical distribution systems. (L1)
- **Summarize** load modeling and characteristics. (L2)
- **Determine** the relation between load factor and loss factor(L5)
- **Explain** the classification of loads and their characteristics. (L2)

UNITII: **8L**

Design considerations of distribution feeder: Basic design practice of the secondary distribution system. Location of Substations: Rating of distribution substation, service area within primary feeders. Benefits derived through optimal location of substations.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Explain** the basic design practice of secondary distribution system.(L2)
- **List** the factors effecting the location of substation.(L2)
- **Estimate** the rating of distribution substation.(L5)
- **Elaborate** the benefits derived through optimal location of substations.(L5)

UNITIII: **8L**

System analysis: Voltage drop and power loss calculations: derivation for voltage drop and power loss in line, distribution automation. Energy management, load management. Limitations of distribution systems. Improvement of existing distribution system, fault locations, future orientation of rural system.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Determine** the voltage drop and power loss. (L5)
- **Explain** the concepts of distribution automation, energy and load management. (L2)
- **List** the limitations of distribution systems.(L1)
- **Identify** the location of fault in a distribution system. (L3)

UNITIV: 8L

Capacitive compensation for power factor control: Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors, effect of series capacitors. Power factor correction, capacitor allocation. Economic justification. Procedure to determine the best capacitor location.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Contrast** the types of power capacitors.(L2)
- **Analyze** the effect of series and shunt capacitors. (L4)
- **Determine** the capacitance value for power factor correction.(L5)
- **Identify** the optimal location of capacitor.(L3)

UNITV: 8L

Design, operation and coordination: Load variation, voltage fluctuations, Motor starting, simultaneous operation. Continuous varying loads, measure to reduce flickering. Coordination of protective devices: general coordination procedure.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Demonstrate** the effects of load variation , voltage fluctuations and motor starting.(L2)
- **Explain** the measures to reduce flickering. (L2)
- **Interpret** the need for coordination of protective devices. (L2)
- **Illustrate** the general coordination procedure.(L2)

Text Book(s)

1.TuranGonen, Electric Power Distribution System, Engineering, 4/e, McGrawHill ,1985.
2. A.S.Pabla,ElectricPowerDistribution,4/e,TataMcGrawHill,1997.

References

1. S.Sivanagaraju, V.Sankar, Electrical Power Distribution and Automation, DhanpatRai and Co,2006.
2. V.Kamaraju, Electrical Power Distribution systems, 3/e, Right publishers, 2009.

Course outcomes:

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

- **Summarize** load modeling and their characteristics.(L2)
- **Compare** the design concepts of primary and secondary systems.(L4)
- **Classify** substation bus schemes and explain difference between them.(L4)
- **Explain** the coordination procedure of various protective devices.(L5)
- **Decide** the optimum capacitor location and can understand the applications of capacitors in distribution systems. (L5)
- **Summarize** the importance of voltage control.(L2)

19EEE344: INDUSTRIAL ELECTRICAL SYSTEMS (Elective)

L	T	P	C
3	0	0	3

This course is designed around industrial maintenance personnel, to help them diagnose and repair electrical faults. The significance of this course is to equip learners with the skills and knowledge necessary to successfully carryout basic service and maintenance. This course is basic for utilization of electrical energy.

Course Objectives:

- To introduce students to LT system wiring components.
- To train students about residential and commercial wiring systems.
- To import students about various illumination systems.
- To acquaint students about various substation equipment and DG systems.
- To demonstrate the students role industrial electrical system automation using PLC's and SCADA.

Unit I: **8 L**

Electrical system components

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Choose** LT system wiring components. (L1)
- **Explain** importance of protection components. (L2)
- **Analyze** electrical safety practices. (L4)
- **Build** knowledge of single line diagram of a wiring system. (L6)

Unit II: Residential and Commercial Electrical Systems **8 L**

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Relate** types of residential and commercial wiring system. (L1)
- **Demonstrate** general rules and guidelines for installation. (L2)
- **List** out rating of main switch, distribution board. (L4)
- **Create** knowledge about selection and sizing of components. (L6)

Unit III: Illumination Systems **6 L**

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premise, flood lighting.

Learning Outcomes:

After completion of this UNIT student will be able to

- **Define** various terms regarding illumination. (L1).
- **Classify** various illumination schemes. (L2)
- **Compare** incandescent lamps and modern luminaries like CFL, LED. (L5)
- **Estimate** lighting scheme for a residential and commercial premise. (L6)

UNIT IV: Industrial Electrical Systems **10L**

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels, Specifications of LT Breakers, MCB and other LT panel components. DG Systems, UPS System, Selection of UPS and Battery Banks.

Learning Outcomes:
After completion of this UNIT student will be able to

- **Tell** various industrial electrical systems. (L1)
- **Explain** earthing design. (L2)
- **Distinguish** types of compensation devices.(L4)
- **Formulate** selection of UPS and battery banks.(L6)

UNIT V: Industrial Electrical System Automation 6 L

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Learning Outcomes:
After completion of this UNIT student will be able to

- **List** advantages of process automation. (L1)
- **Outline** SCADA system for distribution automation. (L1)
- **Design** PLC bases control systems. (L3)
- **Explain** the role of automation. (L5)

Text Book(s):

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating &Costing", Khanna publishers, 2008.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Reference Book(s):

1. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
2. S. Singh and R. D. Singh, "Electrical estimating and costing", DhanpatRai and Co., 1997.Web site for IS Standards.

Course Outcomes:
After completion of this UNIT student will be able to

- Explain the importance of protection components.
- Demonstrate residential and commercial wiring systems.
- Estimate lighting schemes for residential and commercial premises.
- Distinguish different types of compensation devices.
- Determine the role of automation.

19EEE457: ADVANCED CONTROL SYSTEMS (Elective)

L	T	P	C
2	0	2	3

Course Objectives:

The purpose State space analysis is

1. to conceptualize state variable systems.
2. to enlist common types of non linear characteristics, linearization.
3. to exemplify basic concepts describing function.
4. to familiarize pole placement technique by state feedback for linear siso time invariant system.
5. to theorize optimal control, adaptive control, robust control and intelligent control methods. introduction to distributed control systems.

Unit I: **10L**

State space analysis .State variable systems. Controllability and observability .State variable feedback and its effect on controllability and observability. Elements of observer theory.

Unit II: **8 L**

Common types of non linear characteristics, linearization. Singular points. Phase plane methods, construction of phase trajectories. Isocline Method. Pell's method. Delta method. Stability analysis using phase trajectories.

Unit III: **8 L**

Basic concepts of describing function, derivation of describing functions of Common types of non linear characteristics. Stability of non linear systems by describing function method, Lyapunov's method of stability studies , Popov's criterion.

Unit IV: **8 L**

Pole placement technique by state feedback for linear SISO time invariant system. Design of state observations and servo system.

Unit V: **8 L**

Optimal control, adaptive control, robust control and intelligent control methods. Introduction to distributed control systems.

Text Books:

1. Nagarath and Gopal, "Control System Engineering", 2/e, Wiley Eastern, 2001.
2. Stanley M.Shiners, "Modern Control System theory and Design", 2/e, John Wiley and Sons, Singapore, 1992.

Reference Book:

1. Ogata. K, "Modern Control Engineering" ,4/e, PHI,2002.

Course Outcomes:

Students will be able

1. to understand state variable systems.
2. to infer common types of non linear characteristics, linearization.
3. to learn basic concepts describing function.
4. to comprehend pole placement technique by state feedback for linear siso time invariant system.
5. to apply optimal control, adaptive control, robust control and intelligent control methods. introduction to distributed control systems.

19EOE302: GERMAN FOR BEGINNERS
(Elective)

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 (Elective)

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 sentence. 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 (Elective)

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 specific task 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 unbiased in assessing a claim, taking a stand and justifying it, writing a response.

Unit IV **9 hours**

Writing an Argumentative Essay on a Topic of Contemporary Interest: Planning, writing and revising, clear, concise and defined thesis statement that occurs in the introduction, clear and logical transitions. Body Paragraphs that include Evidential Support (factual, logical, statistical or 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 from the 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 New York, 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 (Elective)

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 (Elective)

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 minister, council of ministers, cabinet, central and state secretariats, boards and commissions, governor, chief minister and council of ministers, central- 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.

19EOE312: ENVIRONMENTAL MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives:

1. To familiarize with basic with basic concepts of green buildings
2. To acquire an insight on characteristics, collection transportation and disposal of different types of biomedical wastes
3. To acquaint the basic principles of EIA.
4. To impart about e-waste management.
5. 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-Labelling 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 activities 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

3. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000

4. Industrial Wastewater Management, Treatment and Disposal, WEF Manual of practice No. FD-3, 3rd Ed., WEF Press and McGrawHill, 2008

19EOE327: PROFESSIONAL COMMUNICATION
(Elective)

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 (Elective)

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.

Recommended Textbook:

1. Shashi K. Gupta & R.K. Sharma, "Financial Management –theory and practices" 8th revised edition, 2014, Kalyani Publishers.

REFERENCES (All Latest Editions)

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

GITAM Journal of Management, GITAM Institute of Management, GITAM University, Visakhapatnam

19LOE301: FUNDAMENTALS OF CYBER LAW(Elective)

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

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

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:

3. Yatindra Singh : Cyber Laws
4. Vakul Sharma, Handbook of Cyber Laws

References:

4. Linda Brennan and Victoria Johnson: Social, ethical and policy implication of Information Technology.
5. Kamath Nandan : Law relating to Computer, Internet and E-Commerce.
6. Mike Godwin: Cyber Rights Defencing free speech in the Digital Age.

19EOE313: PERSONALITY DEVELOPMENT (Elective)

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, 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 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 (Elective)

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).

TEXT BOOK

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 practice 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; recognizing functions such as complaining, greeting, apologizing; recognizing 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
- recognize different language functions such as greeting, apologizing, 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:

Whitby, N. (2014). *Business Benchmark: Upper Intermediate.* Cambridge English: CUP.
Seely, John. *Oxford Guide to Effective Writing and Speaking.* Oxford University Press, (India), 2013
Rizvi, M Ashraf. *Effective Technical Communication*. Tata McGraw Hill. 2005.
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 to identify 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, summarising, recommending a course of action, and persuading the reader; writing letters for specific purposes; planning and organising 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 verb + ing; 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
Whitby, N. (2014). *Business Benchmark: Advanced.* Cambridge English: CUP.
Seely, John. *Oxford Guide to Effective Writing and Speaking.* Oxford University Press, (India), 2013
Rizvi, M Ashraf. *Effective Technical Communication*. Tata McGraw Hill. 2005.
Olsen, Leslie & Huckin, Thomas. *Technical Writing and Professional Communication for Non- native Speakers.* McGraw-Hill. 1991

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

Module 1 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 of demand, simple problems.

Learning outcomes :

Student will be able to

1. Define utility and value of goods.
2. Distinguish between necessities, comforts and luxuries.
3. Classify demand
4. Analyze the elasticity of demand for various economic goods.

Module 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

1. List types of costs
2. Apply cost analysis in finding profit
3. Classify accounts
4. Compose & Interpret balance sheet for a given enterprise

Module III 6 hours

Break-Even Analysis: Assumptions, break-even charts, simple problems.
Depreciation: Depreciation methods - Simple problems.

Learning outcomes:

Student will be able to

1. Apply break even analysis in business organization
2. Examine the impact of fixed and variable costs on profits
3. List depreciation methods

4. Compute the depreciation of assets.

Module 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
1. Categorize forms of business organization
2. Distinguish types of organization
3. Illustrate advantages and disadvantages of each form of organization
4. Evaluate the effect of span of management on decision making

Module 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

1. Summarize the function of management
2. Assess the role of manager
3. Compare and contrast between Leader and Manager
4. 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 preparing effective profit and loss statements
• Discover the optimal production strategies.
• Examine and analyze break even evaluation concepts for identification of minimum production volume for survival and to gain profits.
• Adapt and build good manager skills by employing the concepts of various skills like good leadership qualities, utilizing motivation capabilities and incorporating communications skills.

19EMC382: ENGINEERING ETHICS (Mandatory Course)

L	T	P	C
3	0	0	0

Engineering Ethics is the set of rules and guidelines that engineers adhere to as a moral obligation to their profession and to the world. This course is aimed to introduce students about developing moral reasoning and increasing ethical awareness within engineering profession. It is important in preventing grave consequences of faulty ethical reasoning and in giving meaning to engineers' endeavors. Study of ethics helps engineering students to develop a moral autonomy and ability to think critically and independently about moral issues.

Course Objectives

The purpose of this course is to

- **Create** awareness among engineering students by providing basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues.
- **Develop** basic familiarity about Engineers as responsible citizens and professionals and their role of production and preservation for future use.
- **Illustrate** knowledge and exposure on technology and globalization, corporate social responsibility, issues of compliance and governance.
- **Improve** awareness on integrity, character, accountability and attitude
- **Build** adequate knowledge in reorganizing living conditions through harmony, responsibility, reappraising economic sectors and ethical consumerism.

Unit I: **8 L**

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.

Learning Outcomes

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

- Define Morals and ethical values (L1)
- Demonstrate Personal and Professional ethics (L2)
- **Elaborate** Social and Constitutional ethics (L6)

Unit II: **8L**

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.

Learning Outcomes

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

- **Illustrate** various Rights of citizens and professionals (Level II)
- **Value** various Concepts of justice and fairness (Level V)
- **Analyze** social responsibility and individual rights (Level IV)

Unit III: **9 L**

Global Issues in Ethics: Technology and globalization, business ethics, corporate social responsibility, environmental ethics, media ethics, protecting the common good while respecting the values and beliefs of nations/ ethnic groups, issues of compliance and governance, equal opportunities.

Learning Outcomes

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

- **Relate** ethics in Technology and globalization (Level I)
- **Explain** Business and environmental ethics (Level II)
- **Identify** various issues of compliance and governance (Level III)

Unit IV: **8L**

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.

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

- **Identify** wholeness and consistency of character (Level III)
- **Classify** Methods and principles of ethical integrity (Level II)
- **Analyze** Attitude formation and attitude change (Level IV)

Unit V : **9 L**

Ethical Living: Needs of life, materialistic and non-materialistic, qualitative and quantitative, harmony in living, self (physical and mental well being), 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.

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

- **Formulate** various needs of ethical living (Level VI)
- **Build** sense of security, society, peace and diversity (Level III)
- **Understand** environmental sustainability (Level II)

Text Book(s):

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.

Reference Books:

1.Swami Tathagatananda, Healthy Values of Living, Advaita Ashrama, Kolkata, 2010.
2.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

19EEE392: COMPREHENSIVE SKILL DEVELOPMENT V

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:

Unit	Module/ Topics	Hrs
1.	Resume Writing & Acing Job Interviews	4
2.	Corporate Readiness 1	3
3.	Mock Tests with Solutions 1	5
4.	Company-Specific Tests with Solutions 1	3
	Total	**15**

B. Quantitative Aptitude and Reasoning

Unit	Module/ Topics	Hrs
1.	Combinatorics	4
2.	Crypt arithmetic & Modular Arithmetic	5
3.	Analogy & Classification of Numbers	3
4.	Puzzles	3
	Total	15

Unit	Module/ Topics	Hrs
1.	GRE-Oriented Advanced Concepts Discussion	4
2.	CAT-Oriented Advanced Concepts	4
3.	TCS, Infosys-Oriented Advanced Concepts	4
4.	Successful Test Cracking Techniques	3
	Total	15

Part-2 Domain Skills **- 3 Hours per week**

1. High voltage DC test source for HVDC measurement
2. Open circuit and short circuit and load test on three phase alternators
3. Introduction to programmable logic controller (PLC)
4. To measure the dielectric Strength of transformer oil.
5. GPS Based Train/Bus Station Indication System with display on LCD.
6. Bidirectional Visitor Counter using 8051 Microcontroller.
7. Line follower robot using Arduino,
8. Solar tracking system using Arduino,
9. **Develop smart home automation using Arduino.**

References:

1. High voltage engineering by M.S. Naidu and Kamaraju (Tata Mcgrawhill)
2. High voltage engineering by E. Kuffel and M. Abdullah (Pergamon Press)
3. https://electrical-engineering-portal.com
4. https://www.vlab.co.in/broad-area-electrical-engineering
5. www.engineersgarage.com
6. www.electronicshub.org
7. https://microcontrollerslab.com
8. https://rees52.com/en
9. https://microcontrollerslab.com
10. https://www.arduino.cc

19EEE431: POWER SYSTEMS-II

L	T	P	C
3	0	3	4.5

After completing this course the student will be acquainted with problems faced in power system like fault analysis, load flows, stability etc., and solution methods that are traditionally used to solve power system problems. The course equips the student with the control methods of frequency and voltage in power systems. Also the course introduces the advanced topics like SCADA, basic pricing principle of electricity market and demand side management.

Course Objectives:

The purpose of the course is

- To introduce various short circuit faults that occur in power systems .
- To acquaint the power system network using load flows and symmetric faults.
- To study the mathematical solution methods to power system problems.
- To familiarize the concepts of control of frequency and voltage.
- To impart monitoring and economic management methods.

Unit I: Fault Analysis **10 L**

Symmetrical faults: Three phase short circuit of unloaded alternator. Sub-transient, transient and steady state reactance of alternator. Symmetrical short circuit currents.

Unsymmetrical Faults: symmetrical components theory. Line to ground, line to line and line to line to ground faults. Problem solving. Fault calculations using Z-bus matrix.

Learning outcomes:

After completion of Unit I, students will be able to

- **Identify** Types of short circuit faults that occur in power system (L1)
- **Analyze** symmetrical and unsymmetrical faults on alternator. (L2)
- **Solve** various problems on short circuit faults (L3)

Unit II: Power Flow solution **8 L**

Bus admittance matrix. Load flow studies, Gauss-Seidel Newton-Raphson, Decoupled and Fast decoupled methods of load flow analysis. Comparison of load flow methods.

Learning outcomes:

After the completion of Unit II student will be able to

- **Understand** the importance of admittance matrix in load flow studies. (L2)
- **Formulate** admittance matrix for any given system(L4)
- **Make use of** knowledge of numerical methods to load flows.(L3)
- **Solve** power flow problem(L4)
- **Compare** different solution methods of solution. (L6)

Unit III: Stability of synchronous grids: **10 L**

Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three-phase fault. Analysis using Equal Area Criterion and numerical methods (Euler and Runge-Kutta 4^{th} order).Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

Learning outcomes:

After the completion of Unit III student will be able to

- **Understand** the dynamics of synchronous machine. (L1)
- **Examine** the loss of synchronism using EAC. (L3)
- **Solve** Swing equation using numerical methods given in UNIT-1.(L6)
- **Conclude** the effects of series compensation on stability.(L5)

Unit IV: Control of frequency and voltage: 8L

Turbines and Speed-Governors. Frequency dependence of loads. Droop Control and Power Sharing. Automatic Generation Control.Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulator. Shunt Compensators, Static VAR compensators and STATCOM. Tap-Changing Transformer.

Learning outcomes:

After the completion of Unit IV student will be able to

- **Define** the necessity of frequency and voltage control. (L1)
- **Explain** droop and AGC control. (L3)
- **Understand the** operation of voltage regulators.(L2)
- **Conclude** the effects of series compensation on stability.(L5)

Unit V: Monitoring, Economics and Managements: 8 L

Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.

Learning outcomes:

After the completion of Unit V student will be able to

- **Understand** the advantages of SCADA system and PMUs. (L2)
- **Outline** the basic principles of electricity market operation. (L2)
- **Distinguish** between deregulation and demand side management.(L4)
- **Examine** the regulatory framework.(L5)

POWER SYSTEMS LABORATORY

List of Experiments:

1. Study of different types of insulators.
2. Study of different types of relays.
3. Time-current characteristics of fuse.
4. Static over voltage relay.
5. Static under voltage relay.
6. Time-current characteristics of over current relay.
7. Operating characteristics of biased differential relay.
8. Earth resistance measurement.
9. Transmission line parameters.
10. Ferranti effect of transmission line.
11. Transmission line efficiency for different loads.
12. Power flow in a both end fed transmission line
    a) No load with phase shift in injected voltage
    b) Mid tapped load
13. Transmission line voltage regulation for different loads.
14. Transmission line reactive power compensation with no load.
15. Enhancing the power flow of transmission line series compensation.

Text Books:

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
2. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.

References:

1. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.
2. A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc., 1999.
3. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education.

Course outcomes:

After completion of the course the student will have achieved the following

1. Acquired the knowledge of various short circuit faults in power systems.
2. Enabled to do load flow studies using different numerical methods.
3. Familiar with swing equation and its solution methods.
4. Operate and Control techniques and compensation required in power system.
5. Create awareness of automation and deregulation of power systems.

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)

19EEI477: INDUSTRIAL AUTOMATION

L	T	P	C
2	1	0	3

To provide students with required knowledge in the field of automation and to introduce the advanced automation techniques like PLC, SCADA and DCS systems and Instrument protocols which are presently used in different Industries for Automation.

Course Objectives:

- To familiarize the role of automation in industries
- To explain the architecture and applications of PLC, SCADA and DCS
- To provide an understanding of instrumentation standard protocols
- To describe the concept and applications of DCS.
- To explore the importance and applications of automation in various modern industries.

UNIT I **8L**

Control Systems and Automation Principles: Evolution of instrumentation and control, role of automation in industries, benefits of automation, introduction to automation tools PLC, DCS, SCADA, hybrid DCS/PLC, automation strategy evolution, control system audit, performance criteria and safety systems.

Learning Outcomes:

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

- summarize the importance of instrumentation and control in industry (L2).
- describe various automation tools (L4).
- analyze the performance criteria of the system (L4).

UNIT II **9L**

Programmable logic Controllers (PLC): Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, PLC design, advanced applications of PLC and SCADA**:** PLC programming methods, PLC applications for batch process using SFC, analog control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Mod bus ASCII/RTU).

Learning Outcomes:

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

- explain the architecture of PLC and assemble it with SCADA/DCS (L2).
- distinguish between PLC & PC and PLC & DCS (L2).
- construct the ladder diagrams of PLC(L3).
- identify the advanced applications of PLC and SCADA(L1).
- list out PLC programming methods (L1).

UNIT III **8L**

Instrumentation Protocols: HART protocol introduction, frame structure, programming, implementation examples, benefits, advantages and limitations. Foundation field bus H1 introduction, structure, programming, FDS configuration, implementation examples, benefits, advantages and limitations, comparison with other field bus standards including device net, Profibus, control net, CAN, industrial Ethernet etc.

Learning Outcomes:

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

- explain the hart protocol and its programming (L2).
- list the advantages and limitations of HART protocol (L3).
- demonstrate the foundation field bus H1and its programming (L3).

- compare foundation field bus H1 with other field bus standards (L4).

UNIT IV **9L**

Distributed Digital Control Systems: DCS introduction, functions, advantages and limitations, DCS as an automation tool to support enterprise resources planning, DCS architecture of different makes, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. enhanced functions viz. advance process control, batch application, historical data management, OPC support, security and access control etc.

Learning Outcomes:

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

- describe distributed control system (L2).
- list the advantages and limitations of DCS (L3).
- formulate DCS as an automation tool for various functions (L5).
- illustrate DCS architecture of different makes (L3).

UNIT- V **8L**

Industrial Applications for Automation: Power, water treatment, food and beverages, dairy, cement, steel, pharmaceuticals, automobile and building automation.

Learning Outcomes:

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

- analyze power plant industry (L4).
- develop water treatment and food &beverages plant using various automated tools (L3).
- explain the process of cement and steel plant automation (L3).
- adapt automated tools for automobile and building automation (L5).

Textbooks:

1. Popovik, Bhatkar, Distributed Computer Control for Industrial Automation, Marcel Dekkar Publications, 1990.
2. Webb and Reis, Programmable Logic Controllers: Principles and Applications, PHI, 5th Edition.
3. S.K.Singh, Computer Aided Process Control, PHI, 2004.

References:

1. Gary Dunning, Introduction to Programmable Logic Controllers, Thomson Learning, 3rd Edition.
2. N.E.Battikha, The Management of Control System: Justification and Technical Auditing, ISA, 1992.
3. Krishna Kant, Computer Based Process Control, PHI, 2nd Edition.

Course Outcomes:

After completion of this course, the students will able to

- explain importance of automation in industries (L2).
- design and develop control systems for various real time industrial applications using PLC, SCADA and DCS (L5).
- apply different instrumentation protocols for industrial applications (L3).
- use DCS as an automation tool for various functions (L3).
- design and develop advanced Instrumentation systems in Industrial & Automation field (L3).

19ECS344: INTRODUCTION TO MACHINE LEARNING

L	T	P	C
2	1	0	3

Machine Learning addresses the question how to enable computers to learn from past experiences. It introduces the field of machine learning describing a variety of learning paradigms, algorithms, theoretical results and applications. Upon successful completion of the course, students will have an understanding the working of various machine learning algorithms which can be implemented through projects they undertake.

Course Objectives

This Course imparts knowledge on how

- To design a learning system and what are concept learning tasks
- To apply decision tree learning in classification tasks
- To develop neural networks algorithms in machine learning
- To illustrate bayesian learning and instance based learning
- To examine the concepts of genetic algorithms and reinforcement learning

Unit I: **10 L**

Introduction: Well-Posed Learning Problems, Designing a Learning System, Perspectives and Issues in Machine Learning.

Concept Learning and the General-to-Specific Ordering: Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis.

Learning outcomes:

After completion of this unit, student will be able to

- define a well-posed learning problem (L1).
- illustrate the designing of a learning system (L1).
- explain a concept learning task (L2).

Unit II: **10 L**

Concept Learning and the General-to-Specific Ordering: Version Spaces and the Candidate-Elimination Algorithm, Remarks on Version Spaces and Candidate-Elimination.

Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning.

Learning outcomes:

After completion of this unit, student will be able to

- name what are version spaces (L1).
- define a decision tree (L1).
- illustrate the decision tree learning algorithm (L2).

Unit III: **10 L**

Decision Tree Learning: Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning; **Artificial Neural Networks:** Introduction, Neural Network Representations, Appropriate Problems for Neural Network Learning,

Learning outcomes:

After completion of this unit, student will be able to

- list various issues in decision tree learning (L1).
- define what is a neural network and associated fundamentals (L1).

Unit IV: **8 L**

Bayesian Learning: Introduction, Bayes Theorem, Bayes Theorem and Concept Learning.

Instance-Based Learning: Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression.

Learning outcomes:

After completion of this unit, student will be able to

- define bayes theorem (L1).

- summarize the importance of Bayesian methods in machine learning (L2).
- show how bayes theorem and concept learning are related (L2).
- contrast instance-based learning with other methods of learning (L4).

Unit V: **8 L**

Genetic Algorithms: Motivation, Genetic Algorithms, An Illustrative Example, Hypothesis Space Search, Genetic Programming;

Learning outcomes:

After completion of this unit, student will be able to

- model genetic learning method by an analogy to biological evolution (L3).
- experiment with hypothesis space search in genetic learning (L3).
- apply the concepts of genetic programming (L3).

Textbook(s):

1. Tom M. Mitchell, *Machine Learning*, McGraw Hill Education (India) Private Limited, 2013.

References:

1. Vinod Chandra S.S. and Anand Hareendran S., *Artificial Intelligence and Machine Learning*, PHI.
2. Shai Shalev-Shwartz and Shai Ben-David, *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press, 2014.

Course Outcomes:

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

- illustrate the designing of a learning system and concept learning task(L3)
- describe version spaces and explain the concepts of decision tree learning(L2)
- determine the working of single-layer and multilayer neural networks(L5)
- interpret the importance of Bayesian methods in machine learning and how instance-based learning methods are different(L5)
- illustrate genetic algorithms and reinforcement learning(L3)

19ECS475: INTRODUCTION TO WEB TECHNOLOGIES

L	T	P	C
2	1	0	3

This course enables the students to associate with developing websites for hosting via intranet or internet. The web development process includes web design, web content development, client-side scripting, server-side scripting. Web development is the coding or programming that enables website functionality as per the owner's requirements. It mainly deals with the non-design aspect of building websites, which includes coding and writing markup.

Course objectives

- On completion of this course, a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and project- based experience needed for entry into web application and development careers.
- Employ fundamental computer theory to basic programming techniques.
- Use fundamental skills to maintain web server services required to host a website.
- Select and apply markup languages for processing, identifying, and presenting of information in web pages.
- Use scripting languages and web services to transfer data and add interactive components to web pages.

UNIT I **10 L**

HTML Programming: HTML elements, working with images, working with lists, Introduction to forms, working with frames, Introduction to cascading style sheets: inline, External, Internal, Style classes, multiple styles.

JavaScript Programming: Introducing JavaScript, Client-side Benefits of using JS over VB script, Embedding JavaScript in an HTML page, Handling Events, Using variables in JavaScript, Creating Objects in JavaScript, Using

array in JavaScript, Using Operators, Working with control flow Statements, Working with Functions.

Learning Outcomes

After completion of this unit, student will be able to

- Analyze the uses of CSS in developing web technologies.(L4)
- determine the uses of HTML and its basic tags and their uses.(L3)
- Understand the way CSS helps us develop full-fledged graphic web pages.(L2)
- Illustrate how java script is used in our day to day life.(L4)
- determine the basics of Elements in java script(L3).

UNIT II **10 L**

PHP Programming: Introducing PHP: Creating and Running a PHP script, working with Variables and constants, Exploring data Types in PHP, Exploring operators in PHP, controlling program flow: Conditional statements, Looping statements, Break, continue and Exit statements**.**

Forms: Working with the <form> Tag and its elements, Text box, radio button, checkbox, Drop down box, processing a Web Form, Validating a form.

Learning Outcomes

After completion of this unit, student will be able to

- describe initial concepts of PHP.(L2)
- write conditional and looping statements to develop full-fledged PHP programmes.(L6)
- Understand Forms in PHP.(L2)
- explain Arrays in PHP.(L3)
- write functions and Iterators to create programs in PHP. (L6)

UNIT III **8 L**

Working with functions and arrays in PHP: User-defined functions, Built- in functions, recursive, variable and call back functions, Arrays and Types of Arrays, Traversing Arrays Using Loops and Array Iterators, Built In Array functions.

Introduction to XML: Describing DTD, Xml Schemas, Document Object Model(DOM), Extensible Style sheet Language Transformation(XSLT), Simple API for XML(SAX).

Learning Outcomes

After completion of this unit, student will be able to

- Analyze the syntaxes of XML.(L4)
- review the different XML schemas used to develop web technologies(L2)
- Understand other XML technologies like X Link, XPointer and XQuery.(L2)
- Connecting to a database using PHP and MySQL.(L4)
- Applying the concept of tables in Databases using PHP and MySQL.(L3)

UNIT IV **8 L**

Introduction to Servlets: java servlet, servlet api, Servlet object, Lifecycle of a servlet, Deploying first Servlet App, Initialization parameters, handling http request& responses, using cookies, session tracking and security issues.

Learning Outcomes

After completion of this unit, student will be able to

- explain servlets in JAVA and how servlets can be used to develop web pages.(L2)
- Review the Lifecycle of a Servlet.(L2)
- Understand the concept of cookies and session tracking(L2)

UNIT V **8 L**

Introduction to JSP: Understanding JSP: advantage over servlets, tag based Approach, JSP Lifecycle: Page translation stage, compilation stage, Loading and Initialization stage, Request handling stage, Destroying Stage, Creating simple JSP pages.

Learning Outcomes

After completion of this unit, student will be able to

- determine the uses of JSP in creating web applications.(L3)
- Understand the different stages of JSP Lifecycle.(L2)
- describe the concepts used in Programming Using JDBC.(L2)
- review the javax.sql.* package and how it is useful in JSP.(L2)
- Analyze the components of JSP and how it helps us to connect to a database.(L4)

Text book(s)

1. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Black Book bykogent leanrning solutions, published by dreamtech.
2. Jason Hunter, William Crawford, Java Servlet Programming, 2/e, O'Reilly,2003

References

1. XML: The Complete Reference –(by Williamson Heather published by Osborne publications 1/e)(UNIT 3)
2. Robert W.Sebesta, Programming the World Wide Web, 4/e, PearsonEducation,2007.

Course Outcomes:

After completion of the course the student will be able to (L6)

- develop a dynamic webpage by the use of java script and DHTML.
- write a well formed / valid XML document.(L6)
- connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.(L4)
- write a server side java application called Servlet to catch form data sent from client, process it and store it on database.(L6)
- write a server side java application called JSP to catch form data sent from client and store it on database.(L6)

19ECS471: INTRODUCTION TO OPERATING SYSTEMS

L	T	P	C
2	1	0	3

Operating systems are essential part of any computer system and equally important for computer science education. This course provides a clear description of the concepts that underlie operating systems.

Course Objectives

This course imparts knowledge on

- 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.

Unit I: **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

Learning Outcomes:

After completion of this unit, student will be able to

- describe the basic organization of the computer systems.(L1)
- interpret the major components of operating systems.(L2)
- give an overview of the many types of computing environments.(L2)

Unit II: **8 L**

Operating system Structures: operating system services, User and operating system Interface, system calls, Types

of System calls, system programs, operating system structure, system boot.
Process Management: Process concepts, process scheduling, Operations on processes, inter-process communication.
Learning Outcomes:
After completion of this unit, student will be able to

- describe the services an operating system provides to user's, processes, and other systems.(L1)
- explain the various ways of structuring an operating system.(L2)
- interpret the notion of a process- a program in execution and describe the various features of processes, including scheduling, creation and termination.(L3)
- analyze inter process communication using shared memory and message passing.(L4)

Unit III: 10 L

CPU Scheduling: Scheduling-criteria, scheduling algorithms, Thread scheduling, Multiple processor scheduling, algorithm evaluation.
Process Synchronization: Critical section problem, Peterson's solution, synchronization hardware, Mutex locks, semaphores, classic problems of synchronization, monitors.
Learning Outcomes:
After completion of this unit, student will be able to

- identify CPU-scheduling and describe various CPU-scheduling algorithms.(L2)
- estimate evaluation criteria for selecting a CPU-scheduling algorithm for a particular system.(L2)
- identify critical section problem. (L2)
- find both hardware and software solutions to the critical section problem.(L1)
- classify several classical process synchronization problems.(L3)

Unit IV: 10 L

Deadlock: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock.
Memory Management: Swapping, contiguous memory allocation, paging, segmentation, structure of page the table.
Learning Outcomes:
After completion of this unit, student will be able to

- develop description of deadlocks.(L3)
- show a number of different methods for preventing or avoiding deadlocks.(L3)
- reproduce detailed description of various ways of organizing memory hardware.(L2)
- review various techniques of allocating memory to processes.(L2)

Unit V: 8 L

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, student will be able to

- illustrate how paging works in contemporary computer systems.(L3)
- explain the concept of demand paging, page replacement algorithms, allocation of page frames.(L2)
- summarize briefly about file concepts.(L2)

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

References:
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, PHI Learning,1/e, 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:
At the end of the course, the student will be able to
- illustrate the basic and overall view of operating system(L3)
- describe the structure of operating systems, applications, and services provided by operating systems(L2)
- analyze the concept of a process, process life cycle, process states and state transitions.(L4)
- implement various CPU scheduling strategies and process synchronization techniques.(L3)
- verify & resolve deadlock handling situation(L4)
- explain the importance of file structures in the data storage and manipulation.(L2)
- implement and practice various memory-management schemes.(L3)

19EME456: OPTIMIZATION TECHNIQUES

L	T	P	C
2	1	0	3

The main aim of this course is to introduce the concepts of optimization techniques and their importance in engineering applications. The students will be familiarized to use these applications in various applications.

Course Objectives:
- Introduction to optimization theory and methods, with applications in systems, control, and communication
- This is a course on nonlinear optimization problems, both unconstrained and constrained. We will study optimality conditions and the basic numerical optimization methods with their convergence analysis.
- The numerical methods include: basic descent methods, conjugate direction methods, quasi Newton algorithms, reduced gradient method, gradient projection method, penalty and barrier methods, duality, and Lagrange methods
- Introduction to Integer programming, with emphasis on Integer linear Programming (ILP), its relation with linear programming and the various types of integer programming,. Among the various techniques for solving ILP, a well known method *Gomory's cutting plane method* is explained.
- Principles of search heuristics and branch and bound and outer linearization methods for mixed integer problems.

Unit I: **8 L**

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, optimization techniques.

Optimization techniques: Introduction, single variable optimization, multi variable optimization with no constraints, multi variable optimization with equality and inequality constraints-Kuhn-tucker conditions, constraint qualification.

Learning outcomes:
After completing this unit, the student will be able to
- Describe the need and origin of the optimization methods (L1)
- Classify design constraints, constraint surface, objective functions, optimization problems and techniques (L2)
- Familiarize optimization problems to suitably choose the method needed to solve the particular type of problem (L2)
- Solve the Optimization of multivariable function with and without equality Constraints using analytical methods (L3)

Unit II: **10 L**

Non-linear programming I: One Dimensional Minimization Methods: Introduction, unimodal function, elimination methods- unrestricted search, exhaustive search, interval halving method, Fibonacci method, golden section method, interpolation method, cubic interpolation method, direct root method-Newton method, secant method.

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

- Understand Optimization techniques with elimination process for solving 1-dimensional objectives (L1)
- Solve 1-dimensional numerical methods like basic descent methods, conjugate direction methods, quasi Newton algorithms, reduced gradient method, gradient projection method, penalty and barrier methods, duality, and Lagrange methods particular type of problems (L2)
- Expose students to utilize gradient of problems for solving problems. (L3)
- Apply numerical methods to solve multi variable unconstrained Non-Linear programming problems (L3)

Unit III: **8 L**

Non-linear programming II: Introduction, classification of unconstrained minimization methods, random search methods, univariate method, Hooke and Jeeves method, Powell's method, indirect search methods- steepest descent method (Cauchy's method)

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

- Acquaint with classification of unconstrained minimization methods (L2)
- Introduce optimization techniques like Hooke and Jeeves method, Powell's method as random search methods. (L2)
- Solve NLP with indirect search methods like Cauchy's method. (L3)
- Solve un-constrained Non-Linear programming problems (L3)

Unit IV: **8 L**

Dynamic Programming: Multistage decision processes, Concepts of sub optimization, computational procedure in dynamic programming calculus method and tabular methods, Linear programming as a case of D.P and Continuous D.P.

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

- Introduce calculus method like dynamic programming for optimization solving. (L1)
- Comprehend multistage decision processes.(L2)
- Apply dynamic programming method towards optimization of linear programming problems. (L3)
- Apply different approaches in dynamic programming problems(L3)

Unit V: **8 L**

Integer Programming: Introduction, Graphical Representation, Gomory's cutting plane method, Balas algorithm for zero-one programming, Branch-and- bound method, Penalty Function method; Basic approaches of Interior and Exterior penalty function methods

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

- Introduce Integer programming concepts (L1)
- Formulate Integer linear Programming (ILP) with its relation with linear programming and the various types of integer programming. (L2)
- Familiarize with the need of a well known method *Gomory's cutting plane method*.(L3)
- Apply optimization concepts like Balas algorithm for zero-one programming, Branch-and- bound method,

Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. (L3)

Text books:

1. S.S.Rao, Engineering optimization theory and practice,3rd Edition, New age international,2007.

Reference

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.
3.

Course outcomes:

- Understand the need and origin of the optimization methods
- Classify optimization problems to suitably choose the method needed to solve the particular type of problem
- Optimization of multivariable function with and without equality Constraints
- Formulate Integer Linear Programming (ILP) models.
- Use computer software efficiently for modelling and solving the ILP problems.
- describe the logic underlining the idea in the Branch and Bound method and use that method to solve ILPs
- Describe the logic underlining the idea in the Cutting Plane algorithm and use that method to solve ILPs
- Use computer software efficiently for modelling and solving the Non-Linear programming problems.
- solve single variable unconstrained Non-Linear programming problems
- solve single variable constrained Non-Linear programming problems

19EHS475: ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
2	1	0	3

This course aims to provide entrepreneurial abilities because business conditions have changed significantly since the advent of new technologies and business started demanding from both CEOs and managers entrepreneurial abilities which are in line with latest and contemporary business models in the era of globalization and disruption. This course includes a description of various concepts like process of entrepreneurship, opportunity identification, business plan preparation, registration process of business enterprise, funds requirement for business and evaluation of business enterprise.

Course Objectives:

- To identify the concept and process of Entrepreneurship and its role in the society.
- To recognize opportunity identification, different business model and business plan preparation.
- To explain the entrepreneurship development programmes (EDP) and Central government policy initiatives for entrepreneurship development
- To identify registration process of business enterprise.
- To assess funds requirement and evaluation of business enterprise.

Unit I: **8L**

Introduction: Entrepreneur and Entrepreneurship; Description of an Entrepreneur; Traits of an Entrepreneur; evolution of Entrepreneurship; functions of an Entrepreneur; Entrepreneurial mindset; Entrepreneurial Motivation; entrepreneurial process; entrepreneurial competencies; types of entrepreneurship; role of entrepreneurship in the economic development.

Learning Outcomes:

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

- identify the traits and functions of entrepreneur(L2).
- recognize entrepreneurial process and entrepreneurial competencies(L3).
- demonstrate the role of entrepreneurship in the economic development(L4).

Unit II: **8L**

Business Idea Generation and Business Opportunity Identification: Scanning the environment; finding the gaps for new business and new ways of business, Startup Culture and Incubation; Boot Camps; Mentoring the ideation process, validation of different ideas, Proto type Development; Business Model Development; need and importance of Business Plan preparation- process of Business Plan.

Learning Outcomes:

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

- list the gaps for new business and new ways of business(L1).
- identify startup culture and incubation and boot Camps(L2).
- recognize mentoring the ideation process, validation of different ideas(L2).
- apply proto type development and business model development(L3).
- demonstrate the need and importance of business plan preparation- process of Business Plan(L3).

Unit III: 8L

Entrepreneurship Development Programmes and Government Support to Entrepreneurs: Evolution of Entrepreneurship Development Programmes (EDP)-Phases of EDPs-Course content and curriculum of EDPs– Educational Institutions and Entrepreneurship Development Programmes; Definition of Micro, Small and Medium Enterprises (MSME),growth and development of MSME's in India; Central Government Policy initiatives; District Industrial Centers and Industrial Estates.

Learning Outcomes:

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

- identify the phases of EDPs and curriculum of EDPs(L2).
- recognize growth and development of MSME's in India(L2).
- to explain central government policy initiatives and district industrial centers(L2).

Unit IV: 8L

Registration of Business Enterprises: Business Name registration; Trade Mark registration; Patent registration and legal formalities; Sole Proprietorship, Partnership, Limited Liability Partnership (LLP), Private Limited Company and Public Limited Company Registration process; benefits of registration of enterprises; process of obtaining licenses and permissions including export and import license; Income Tax and Goods and Service Tax (GST) registration process.

Learning Outcomes:

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

- interpret registration of business enterprises (L3).
- evaluate sole Proprietorship, Partnership, Limited Liability Partnership (LLP) (L6).
- Identify process of obtaining licenses and permissions including export and import license (L2).

Unit V: 8L

Funds Requirement and Evaluation of Business Enterprise: Own Capital v/s Loan Capital (equity and debt); Cost of the project; evaluation of different sources of funds - Projected Income and Turnover statements; Seed Capital, Angel Investment and Venture Capital; Institutional Financing to Entrepreneurs; Working Capital; Short term-Medium term and Long term financing to entrepreneurs by financial institutions and commercial banks.

Learning Outcomes:

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

- interpret the cost of the project, projected income and turn over statements (L3).
- evaluate different sources of funds (L6).
- recognize institutional Financing to Entrepreneurs financial institutions and commercial banks (L2).
- Identify process of obtaining licenses and permissions including export and import license (L2).

Case Analysis (not exceeding 200 words):

Any Software Company Business Plan- Any Automobile Company Business Plan- Any Ecommerce Business plan.

Course Outcomes:

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

- interpret the concept and process of Entrepreneurship and its role in the society (L3).
- differentiate different business model and analyse business plan preparation (L4).

- appraise entrepreneurship development programmes (EDP) and Central government policy initiatives for entrepreneurship development (L4).
- conclude registration process of business enterprise (L6).
- estimate funds requirement and interpret short term, medium term and long term financing to entrepreneurs by financial institutions and commercial banks (L6).

Teaching and learning resources:

1. Donald F. Kuratko, Entrepreneurship: Theory, Process, Practice, Cengage Learning, New Delhi, Latest Edition.
2. Robert Hisrich, M.J.Manimala, M.P.Peters and D. A.Shepherd "Entrepreneurship" MC Graw Hill Education, Latest Edition.
3. Bruce R Barringer, Preparing effective Business Plan-an Entrepreneurial Approach, New Delhi: Pearson Publication, Latest Edition.
4. Jeffrey A Timmons, New Venture Creation, New Delhi: Irwin publishers, Latest Edition.
5. Dr. S. S. Khanka "Entrepreneurship Development", S. Chand and Company Limited, New Delhi, Latest Edition.
6. PoornimaM.Charantimath,"EntrepreneurshipDevelopment-SmallBusiness Enterprises", Pearson, New Delhi, Latest Edition.
7. AryaKumar, "Entrepreneurship: Creating and Leading an Entrepreneurial Organization" Pearson, New Delhi,Latest Edition.
8. Vasant Desai, Dynamics of Entrepreneurial Development and Management New Delhi: Himalaya Publishing House, Latest Edition.

Journals

1. Harvard Business Review
2. International Journal of Entrepreneurial Behaviour And Research
3. International Journal of Small Business Management
4. International Journal of Entrepreneurship And Innovation Management

Daily English News Papers

1. The Mint
2. The Economic Times
3. Business Standard
4. Business Line

19EEE441: HIGH VOLTAGE ENGINEERING(Elective)

L	T	P	C
2	0	2	3

In this course it is aimed to introduce the principles of high voltage engineering to the students. Principle causes of over voltages and currents, types and protection against these over voltages and currents are discussed. Mechanism of breakdown in solids, liquids and gases, generation, measurement and testing of the high voltages and currents are enlightened in this subject.

Course Objectives:

The purpose of the course is to

1. Study the principles of power system protection
2. Familiarize the phenomenon of generation of over voltages and their protection.
3. Expose the mechanisms of electrical breakdown in gases, liquids and solids.
4. Study the methods of generation of high voltages and currents.
5. Impart the methodologies involved in measurement of high voltages and currents.
6. Train the high-voltage testing of equipment including insulators, bushings, isolators, circuit breakers, cables transformers and surge diverters.

UNIT I **10 L**

Over Voltages in Electrical Power Systems: Causes of over voltages and their effects on power system , lightning, switching and temporary over voltages, Protection against over voltages , insulation coordination.

Learning outcomes:

After completion of UNIT I, students will be able to

- **Outline** causes of over voltages and currents in a power system (L1)
- **Contrast** the difference between lightning and switching over voltage (L1)
- **Explain** the over voltage protection schemes (L2)
- **Illustrate** principles of insulation coordination (L2)

UNIT II **8 L**

Electrical breakdown in gases, solids and liquids: Gaseous breakdown in uniform and non-uniform fields , corona discharges. Vacuum breakdown. Conduction and breakdown in pure and commercial liquid. Breakdown mechanisms in solid and composite dielectrics.

After completion of UNITII, students will be able to

- **Outline** causes of breakdown of insulation (L1)
- **Interpret** the causes and the mechanism of breakdown in gases (L2)
- **Analyze** the mechanism of breakdown in liquid and solid dielectrics (L4)

UNIT III **8L** **Generation of high voltage and currents:** Generation of high DC voltages, multiplier circuits. Van de Graff generator. High alternating voltage generation using cascade transformers. Production of high frequency AC high voltages. Standard impulse wave shapes. Marx circuit ,generation of switching surges.

After completion of UNIT III, students will be able to

- **Explain** the methods of generation of high voltages and currents (L2)
- **Outline** the limitations of various circuits (L2)
- **Analyze** the construction and operation of various circuits. (L4)
- **Examine** the characteristics of various voltage and current waveforms generated.(L4)

UNIT IV **8 L**

Measurement of high voltages and currents: HVDC measurement techniques. Measurement of power frequency A.C voltages. Sphere gap measurement technique, Potential divider for impulse voltage measurements. Measurement of high DC and AC impulse currents.

After completion of UNITIV, students will be able to

- **Explain** the methods of measurement of high voltages and currents (L2)
- **Analyze** the construction and operation of measuring circuits. (L4)
- **Analyze** the operation of measuring circuits. (L4)
- **Examine** the limitations of the measuring circuits.(L4)

UNIT V **8 L**

High voltage testing: Various standards for HV Testing of electrical apparatus .Tests on insulators. Testing of bushings, Testing of isolators and circuit breakers. Cable testing, testing of transformers. Surge diverter testing. Use of I.S for testing. Testing facility requirements, safety precautions in H. V. Labs.

After completion of UNIT V, students will be able to

- **Define** various testing standards (L1)
- **Explain** the testing of insulators, bushings, cables and transformers. (L2)
- **Explain** the testing of isolators, circuit breakers, surge diverters (L2)
- **Outline** the testing facility requirements and safety precautions.(L2)

Text Book(s)

1.M.S Naidu., and Kamaraju, "High Voltage Engineering", 4/e, Tata McGraw Hill, 2009.
2. E Kuffel and M.Abdullah., "High Voltage Engineering", 2/e,Pergamon Press, 2000.

Reference Book(s)

1.C.LWadhwa., "High Voltage Engineering", 2/e,Wiley Eastern, 2007.
2. Dieter Kind, "An Introduction to High Voltage ExperimentalTechnique", 1/e,WileyEastern, 1978.
3. RavindraArora, Wolfgang Mosh, "High Voltage and Electrical Insulation Engineering", 1/e,Wiley-VCH Publishers, 2011.

Course Outcomes:

The students will be able to

- Explain the principle causes of over voltages and currents, over voltage and over current protection, insulation coordination.
- Interpret the methods of generation of high voltages and currents.
- Analyze the methods of measurement of various high voltages and currents.
- Explain the mechanism of breakdown in solids, liquids and gases explain the high voltage testing of electrical devises.
- Summarize the testing methods of various power system components.

19EEE453: POWER QUALITY AND FACTS(Elective)

L	T	P	C
3	0	0	3

This course is aimed to introduce the students working principles of various FACTS devices and power quality issues in practical power systems. The basic concepts of reactive power compensation and power quality conditions are explained. Different configurations and control strategies of various FACTS devices are analyzed. FACTS are used to increase transmission capacity, voltage control, and power flow control.

Course Objectives:

The purpose of the course is to

- **Expose** basic concepts of reactive power compensation.
- **Study** various series and shunt compensating FACTS
- **Analyze** the working of VSC, STATCOM, SSSC and UPFC
- **Expose** the various power quality problems.
- **Interpret** the working of DSTATCOM, DVR and UPQC

UNIT 1

Transmission Lines and Series/Shunt Reactive Power Compensation 8 L

Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

Learning outcomes:

After completion of UNIT I, students will be able to

- **define** the concepts of AC Transmission(L1)
- **illustrate** the concepts of Reactive power compensation (L2)
- **identify** the different shunt and series compensation (L3)
- **analyze** uncompensated AC transmission lines (L4)

UNIT II

Thyristor-based Flexible AC Transmission Controllers (FACTS) 8 L

Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Learning outcomes:

After completion of UNIT II, students will be able to

- **demonstrate** the working of SVC, TCSC, TCBR and SPST(L2)
- **model** SVC, TCSC, TCBR and SPST (L3)
- **contrast** SVC, TCSC, TCBR and SPST (L4)
- **develop** control strategies for reducing harmonics in power system. (L6)

UNIT III

Voltage Source Converter based (FACTS) controllers 10 L

Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control.

Learning outcomes:

After completion of UNIT III, students will be able to

- **demonstrate** working of Multi-pulse and Multi-level VSC(L2)
- **analyze** the working of STATCOM, SSSC and UPFC (L4)
- **contrast** STATCOM,SSSC and UPFC (L4)
- **develop** control strategies for STATCOM, SSSC and UPFC. (L6)

UNIT IV

Power Quality Problems in Distribution Systems **8 L**

Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Sources of PQ problems, Remedies to improve PQ, power quality monitoring.

Learning outcomes:

After completion of UNIT IV, students will be able to

- **define** various power quality problem, voltage swell and sag. (L1)
- **illustrate** various surges and harmonics in power systems (L2)
- **analyze** the source for power quality problems (L4)
- **assess** various methods to improve power quality in system. (L5)

UNIT V

DSTATCOM, DVR, UPQC: **8 L**

Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM. Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle Capabilities and Control Strategies.

Learning outcomes:

After completion of UNIT V, students will be able to

- **list** out various power quality filters(L1)
- **demonstrate** working of DSTATCOM and shunt active filters(L2)
- **contrast** DSTATCOM,DVR and UPQC (L4)
- **develop** control strategies for DSTATCOM, DVR and UPQC. (L6)

Text books:

1. N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
2. K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.
3. T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.

References:

1. R. C. Dugan, "Electrical Power Systems Quality", McGraw Hill Education, 2012.

2. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991

Course Outcomes:

Upon completion of the course, the students would be able to

- **compare** various reactive power compensation techniques. (L2)
- **identify** various series and shunt compensating devices in FACTS (L3)
- **estimate** the location of VSC, STATCOM, SSSC and UPFC (L6)
- **evaluate** various power quality problems. (L4)
- **appraise** the working of DSTATCOM, DVR and UPQC (L5)

19EEE346: MODERN CONTROL SYSTEMS (Elective)

L	T	P	C
2	0	2	3

The role of control systems in engineering will continue to expand as the global issues facing us require ever increasing levels of automation and precision. Control engineering is an exciting and a challenging field. By its very nature, control engineering is a multidisciplinary subject. The ultimate significance is to implement controllers in real feedback control systems. Development of control engineering methodology is based on mathematical fundamentals, stresses physical system modeling and practical control system designs with realistic system specifications. This can be base course for Advance control systems.

Course Objectives:

- **Discuss** of various controllers for closed loop feedback system to obtain desired performance.
- **Develop** the compensators for the open-loop plant so that it can safely be used with feedback control in frequency domain.
- **Demonstrate** stability of the system using state space analysis.
- **Design** of state feedback controllers and compensators based on pole placement technique.
- **Illustrate and Analyze** the physical systems in discrete time using mathematical tools like z-transform method.

UNITI: **10L**

Controllers: Introduction to Block diagram of on-off control, proportional control, integral control, derivative control, PI, PD and PID control. Control objective, feedback control systems characteristics, proportional mode of feedback control, integral mode of feedback control, derivative mode of feedback control.

Learning outcomes:

After completion of this UNIT student will be able to

- **Outline** concepts of modern control systems(L2)
- **Demonstrate** the design of P,PI,PID controllers for continuous systems (L2)
- **Develop** the mathematical equations to control objectives (L3)
- **Dissect** the effects of integral and derivative feedback control (L4)

UNITII: **8L**

Cascade Compensation: Cascade lead compensation, cascade lag compensation, cascade lag-lead compensation. Cascade lead compensation using Root locus. Cascade lag compensation using Root locus. Cascade Lag-Lead Compensation using Root locus. Reshaping the Bode plot, cascade lead compensation using Bode Plot. Cascade lag compensation using Bode Plot. Cascade Lag-Lead Compensation using Bode Plot.

Learning outcomes:

After completion of this UNIT student will be able to

- **Explain the** concepts of Root locus and Bode plot in frequency domain.(L2)
- **Dissect** the effects of Cascade lead and lag compensation to feedback control (L4)
- **Demonstrate** the design of Lead, Lag and lead-lag compensator for continuous systems using Root Locus (L2)
- **Demonstrate** the design of Lead, Lag and lead-lag compensator for continuous systems using Bode plot (L2)

UNITIII: **8L**

State Space Analysis of Continuous time Control Systems: State diagram, state transition matrix, conversion of state variable models to transfer function. Conversion of transfer functions to canonical state variable models. Solution of state variable models, state transmission matrix, solution of state equations.

Learning outcomes:
After completion of this UNIT student will be able to

- **Explain** State space models of Continuous time systems (L1)
- **Develop** methods to convert transfer functions to canonical form(L3)
- **Solve** state equitation and transition matrix.(L3)

UNITIV: **8L**
Design of state feedback controller: Introduction, controller design by pole placement, definition of observability and controllability.

Learning outcomes:
After completion of this UNIT student will be able to

- **Examine** Controllability and Observability of continues systems(L4)
- **Design** of controllers and compensators based on pole placement techniques. (L6)

UNITV: **8 L**
Discrete time systems: Introduction to discrete time systems, analog and digital controllers, the z transformation, basic definition of z-transform, derivation of z -transform of standard functions. Difference equation and its solution by the z-transform method. Initial value and Final value theorems. Inverse z-transform by expanding X(z) into (i) an infinite power series and (ii) partial fractions. Pulse transfer functions, pulse transfer function of closed loop system using signal flow graph technique. Stability analysis in z-plane.

Learning outcomes:
After completion of this UNIT student will be able to

- **Explain** transfer function of closed loop systems in discrete time domain (L2)
- **Apply** the Z-Transform and Inverse Z Transform for analyzing discrete time systems. (L3)
- **Develop** solution by using z-transformation method.(L3)
- **Determine** the inverse z-transformation using power series and partial fractions. (L5)
- **Examine** the stability of discrete time systems in z-plane(L4)

Text Book(s):
1.M.Gopal,ControlSystems:PrinciplesandDesign,2/e,McGrawHill,2002.

References:
1. Katsuhiko Ogata, Modern Control Engineering, 5/e, Prentice Hall of India,2010.
2. M. Gopal, Digital Control and State Variable Methods, 4/e, McGrawHill, 2012.

Course Outcomes:
Upon successful completion of the course the students will be able to

- **Design** P,PI,PID controllers for closed loop system.
- **Develop** compensators in frequency domain for closed loop system.
- **Evaluate** the system stability using state space analysis.
- **Develop the** pole placement technique for controllers and compensators.
- **Analyze** a discrete time system using z-transform.

19EEE451: WIND AND SOLAR ENERGYSYSTEMS

L	T	P	C
3	0	0	3

By undergoing this course, the student will acquire the knowledge of renewable energy system particularly wind and solar PV like their historical development, control etc.

Course outcomes:

The purpose of this course is to

- **Understand** the history and operating principles of PV and Wind energy conversion.
- **Evaluate** the control methods used in PV and Wind energy systems.
- **List** the different grid integrating issues like power quality etc.

UNIT I: Overview of Wind Energy Conversion Systems: **10 L**

Installed Capacity and Growth Rate, Small and Large Wind Turbines, Stand-Alone and Grid- Connected Applications, On-Land and Offshore Applications, Costs of Wind Energy Conversion Systems. Fundamentals of WECS Control: Wind Turbine Components. Wind Turbine Aerodynamics: Power Characteristic of Wind Turbines, Aerodynamic Power Control: Passive Stall, Active Stall, and Pitch Control, Tip Speed Ratio. Maximum Power Point Tracking Control: MPPT with Turbine Power Profile, with Optimal Tip Speed Ratio and with Optimal Torque Control.

Learning Outcomes:
After completing Module-I the student will be able to

- **Understand** history growth and fundamentals of wind energy conversion(L2)
- **Identify** the control methods used with wind energy system. (L3)
- **Analyze** the maximum power point tracking methods used in wind energy systems (L4)

UNIT II: Wind Turbine Technology: 8L

Horizontal- and Vertical-Axis Wind Turbines, Fixed-and Variable-Speed Turbines, Stall and Pitch Aerodynamic Power Controls. Fixed-Speed WECS without Power Converter Interface, Variable-Speed Systems with Reduced-Capacity Converters, Variable-Speed Systems with Full-Capacity Power Converters.

Learning Outcomes:
After completing Module-I the student will be able to

- **Understand** the construction and study the main parts of wind turbine(L2)
- **Define** Stall and aerodynamic control of wind turbine. (L1)
- **Examine** the different converters used in aiding wind energy conversion (L4)

UNIT III: The Solar Resource **8L**

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Solar thermal power generation:

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Learning Outcomes:
After completing Module-I the student will be able to

- **List** different solar receivers(L1)
- **Contrast** different solar receivers. (L3)
- **Analyze** the Solar ponds. (L4)

UNIT IV: Solar photovoltaic **8L**

Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT)algorithm.

Learning Outcomes:
After completing Module-I the student will be able to

- **Understand** history growth and fundamentals of PV cell manufacturing(L2)
- **Identify** the Power Electronic Converters used with PV system. (L3)
- **Analyze** the maximum power point tracking methods used in PV (L4)

UNIT V: Network Integration Issues: 8 L

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Learning Outcomes:
After completing Module-I the student will be able to

- **Understand** grid code requirements for PV and wind energy conversion(Level II)
- **Classify** the issues while integrating PV and Wind systems to grid. (Level III)
- **Analyze** the Hybrid and isolated operation of PV and Wind systems (Level IV)

Text Books:

1. Bin_Wu,_Yongqiang_Lang,_Navid_Zargari,_Samir_Kour,"Power Conversion and Control of Wind Energy Systems", IEEE Press Series on Power Engineering, John Wiley and SonsLtd.,2011.
2. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.

References:

1. G. M. Masters, "Renewable and Efficient Electric Power Systems**",** John Wiley and Sons, 2004.
2. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd.,2005.
3. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd.,2006.
4. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications,2004.
   J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons,1991

19EEE443 : HVDC TRANSMISSION SYSTEMS

L	T	P	C
3	0	0	3

In this course it is aimed to introduce to the students the principles, operation and control of HVDC transmission systems. The historical aspects of HVDC systems, types of HVDC, Converter configurations, control of converters, faults in HVDC, harmonics and elimination of harmonics are discussed in this subject.

Course Objectives:
The purpose of the course is to

1. Study operational concerns of existing HVDC
2. Demonstrate Next generation HVDC Technologies
3. Expose HVDC Converter operation & control.
4. Train with the protection of HVDC system.
5. Study of Harmonic generation and Filtering.

UNIT I **10 L**

General aspects and converter circuits: Historical developments, HVAC and HVDC links comparison, Economic technical performance, reliability, limitation. Modern Trends in HVDC Technology, Application of DC Transmission, Properties of thyristor converter circuits, assumptions, choice of best circuit for HVDC converters, Components of a HVDC system.

Learning outcomes:
After completion of UNIT I, students will be able to

- **Outline** historical concepts of HVDC transmission systems (L1)
- **Contrast** the difference between AC and DC transmission systems (L1)
- **Classify** the kinds of DC Links (L2)
- **Build** different six pulse converter configurations (L3)
- **Analyze** the economic and technical aspects of HVDC systems(L4)
- **Estimate** Volt ampere rating of various components of converters(L5)

UNIT II **8 L**

Bridge converters analysis: Assumptions, Analysis with gate control bus no overlap, Analysis with gate control and overlap less than 60 degrees. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Equivalent circuit for rectifier, Operation of inverter, Equivalent and modified equivalent circuit of HVDC link.

Learning outcomes:
After completion of UNITII, students will be able to

- **Analyze** the operation of bridge converter with grid control and no overlap. (L4)
- **Describe** the effect of source inductance on the operation of converters (L2)
- **Develop** the expressions of voltages and currents in rectifiers and inverters (L3)
- **Build** equivalent circuit of rectifier and inverter (L3)
- **Develop** equivalent circuit of the entire HVDC Line. (L6)

UNIT III **8 L**

Bridge converters control: Basic means of control, power reversal, desired features of control, actual control characteristics, Basic characteristics, modification of control characteristics, System control hierarchy, firing angle control schemes.

Learning outcomes:
After completion of UNITIII, students will be able to

- **Explain** the desired features of control (L2)
- **Analyze** basic means of control and actual control characteristics. (L4)
- **Explain** the modification of control characteristics (L2)
- **Explain** the hierarchical control structure (L2)
- **Classify** the firing angle control schemes (L4)

UNIT IV **8 L**

Mis-operation of Converters and Protection: Converter disturbance, bypass action in bridges, Commutation failure, basics of protection, DC reactors, DC circuit breakers, over voltage protection.

After completion of UNIT IV, students will be able to

- **Define** the converter disturbances (L1)
- **Explain** bypass action in bridges and its effects (L2)
- **Identify** the causes of commutation failures (L3)
- **Determine** the value of DC reactor for prevention of commutation failures (L5)
- **Explain** the over voltage protection schemes employed. (L2)

UNIT V **8 L**

Harmonics and Multi Terminal DC (MTDC) systems: Characteristic and uncharacteristic harmonics, Troubles due to harmonics, harmonic filters, single tuned and double tuned filters, Multi-Terminal Systems: Series and Parallel MTDC systems operation.

After completion of UNIT V, students will be able to

- **Define** harmonica and types of harmonics (L1)
- **Explain** troubles due to harmonics (L2)
- **Design** the filters for elimination of harmonics (L5)
- Explain the operation of MTDC systems (L2)

Text Book(s)

1.E.W. Kimbark, "HVDC Transmission" , John Wiley publishers.
2.K.R.Padiyar , "HVDC Transmission", 3/e, New age Publishers, 2013.

Reference Book(s)

1. A.Chakraborthy, M.L.Soni, P.V.Gupta,"A Text Book on Power System Engineering" , 1/e, Dhanpatrai and Sons, 2008.

Course Outcomes:

Upon successful completion of the course the students will be able to

- Explain the historical developments, advantages and drawbacks, applications, types and economic factors of a.c. and d.c transmission systems.
- Analyze various converter configurations.
- Develop equivalent circuit of HVDC system.
- Conclude various faults and protection schemes employed in HVDC.
- Develop the circuits for elimination of harmonics in HVDC systems.

19EEE356: NONLINEAR CONTROL SYSTEMS

L	T	P	C
2	0	2	3

This course is aimed to introduce concepts of Non-linear systems, and characteristics of Non-linear systems. Equilibrium points in the non-linear systems, and their classification are studied. Different methods for analysis of nonlinear systems are studied. Stability assessment methods for nonlinear systems are investigated.

Course Objectives:

- **To introduce** the need and concept of nonlinear system.
- **To impart** knowledge about different strategies adopted in the analysis of nonlinear systems.
- **To familiarize** with the design of different types of nonlinear controllers.

UNIT I **10L**

Introduction - Characteristics of nonlinear systems – Phase plane method- Classification of equilibrium points- analysis of systems with piecewise constant inputs using phase plane analysis.
Describing function Method.

Learning outcomes:
After completion of this UNIT student will be able to

- **explain** various concepts of nonlinear control systems (L2).
- **explain** characteristics of nonlinear systems (L2).
- **construct** Phase plots for any given nonlinear function (L3)**.**
- **develop** describing functions for different nonlinearities (L3).
- **classify** different equilibrium points(L4).

UNIT II

10 L

Stability of Nonlinear Systems - Lyapunov stability - local stability - local linearization and stability in the small- Direct method of Lyapunov - generation of Lyapunov function for linear and nonlinear systems – variable gradient method.

Learning outcomes:
After completion of this UNIT student will be able to

- **explain** concept of stability of Nonlinear Systems (L2).
- **analyze** the stability using Lyapunov stability theorem(L4)
- **apply** Variable gradient method for determining stability(L3)
- **explain** local linearization and stability (L2).

UNIT III **8L**

Centre manifold theorem - region of attraction - Feedback Control and Feedback Stabilization-Analysis of feedback systems- Circle Criterion – Popov Criterion.

Learning outcomes:
After completion of this UNIT student will be able to

- **explain** the Centre manifold theorem (L2).
- **apply** Circle Criterion for analysis of feedback systems(L3).
- **analyze** feedback systems using Popov Criterion. (L4).
- **explain** the Feedback stabilization (L2).

UNIT IV: **7L**

Feedback linearization- Design via linearization- stabilization - regulation via integral control- gain scheduling

Learning outcomes:

After completion of this UNIT student will be able to

- **explain** the feedback linearization (L2).
- **design** systems via linearization (L3).
- **apply** concept of regulation via integral control(L4).
- **explain** the concept of gain scheduling (L2).

UNIT V: **7 L**

Exact Feedback Linearization - Input state linearization - input output linearization - state feedback control - stabilization - tracking - integral control

Learning outcomes:

After completion of this UNIT student will be able to

- **explain** the exact feedback linearization (L2).
- **design** systems with input output linearization (L3).
- **Model** state feedback control (L4).
- **design** systems using concept of tracking (L3).

Textbook(s):

5. Hassan K Khalil, Nonlinear Systems, Prentice - Hall International (UK), 2002.
6. Jean-Jacques E. Slotine and Weiping Li, "Applied Nonlinear Control", Prentice-Hall, NJ, 1991.

Reference books:

3. M Vidyasagar, "Nonlinear systems Analysis", 2nd Edition, Prentice Hall, 1993.
4. Alberto Isidori, "Nonlinear Control System", Vol I and II, Springer, 1999

Course Outcomes:

Upon successful completion of the course the students will be able to

- construct the phase plane trajectory of a given nonlinear system (L3)
- explain describing function for various nonlinearities (L2)
- identify the stability of the given linear and nonlinear system using Lyapunov stability theory (L4)
- analyze the stability of the nonlinear system(L4).
- design systems using concept of tracking (L3).

19EHS403: ORGANIZATIONAL BEHAVIOR

L	T	P	C
3	0	0	3

Unit I

Introduction; Definition of Organization Behavior and Historical development, Environmental Context (Information Technology and Globalization), Diversity and Ethics, Design and Cultural, Reward Systems.

The Individual: Foundation of individual behavior, Ability

Unit II

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.

Unit III

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.

Unit IV

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.

Unit V

Leadership: Definition, Behavioral theories – Blake and Mounton managerial grid, Contingency theories – hersey - 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:

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.

References:

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.

19EEE491: PROJECT PHASE I

L T P C
0 0 2 1

Mini project is a short project intended to train students to identify a problem of practical significance related to

i. Design of components/circuit/system development for a problem.
ii. Various tools used in industry.
iii. Modelling and analyzing a design problem.

Study of literature related to any of the above and work for a solution and submit a report.

The mini project can be individual or maximum of four persons.

19EEE493: INTERNSHIP

L T P C
0 0 0 1

Summer internship is planned to expose students to industrial practices. Students have to correlate the theory learnt in class room to the procedures adopted in industry. Students have to maintain a dairy on the work carried out in industry and submit a detail report of her/his experience at the industry.

19EEE495: COMPREHENSIVE SKILL DEVELOPMENT VI

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:

Unit	Module/ Topics	Hrs
1.	Corporate Readiness 2	4
2.	Topic-Wise Discussion of Question Papers	4
3.	Mock Tests with Solutions 2	4
4.	Company-Specific Tests with Solutions 2	3
	Total	**15**

B. Placement and Career Guidance

Unit	Module/ Topics	Hrs
1.	GRE-Oriented Tests and Discussions	4
2.	CAT-Oriented Tests and Discussions	4
3.	TCS, Infosys-Oriented Tests and Discussions	4
4.	Other Company-Specific Tests & Discussions	3
	Total	15

Part-2 Domain Skills **- 3 Hours per week**

1. Open circuit and short circuit on single phase transformer for finding the efficiency and regulation at different load conditions.
2. To determine the direct axis reactance (Xd) and quadrature axis reactance (Xq) of synchronous machine
3. To build and test a wind turbine.
4. Construction and Development of an Automated Greenhouse System using Arduino Uno.
5. Smart Water tank Level monitoring system **Arduino or any Microcontroller**
6. High power device control with **Arduino or any Microcontroller**

7. **Distance Measurement Using Infrared Sensor with ADC0804 & 8051 Microcontroller (AT89C51)**
8. Control of led using Raspberry Pi Azure IoT Online Simulator
9. Read DHT11 using Raspberry Pi Azure IoT Online Simulator and upload data to cloud.

References:

1. https://rpowerlabs.shinyapps.io/RLFC_AGC/
2. https://www.vlab.co.in/broad-area-electrical-engineering
3. https://studentenergy.org/
4. https://www.youngscientistlab.com/sites/default/files/interactives/wind-energy/
5. https://www.alternative-energy-tutorials.com/wind-energy/wind-turbine-design.html
6. https://rees52.com/en
7. https://microcontrollerslab.com
8. https://www.tinkercad.com

19EEI475: MEDICAL INSTRUMENTATION

L	T	P	C
2	1	0	3

This course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance. The fundamental principles of equipment that are actually in use at the present day are introduced.

Course Objectives:

- To understand the physical foundations of biological systems
- To learn various sensors and the various electrodes used in medical field.
- To introduce the student, the various sensing and measurement devices of electrical origin and also have a detailed understanding about the various electro physiological measurements in the human body.
- To understand the basic concepts of various medical imaging techniques and their applications.
- To bring out the important and modern methods of imaging techniques.

Unit I: **8L**

Physiological systems and Bio-signals: Physiological systems of the human body, Functional structure of the cell, electrical activity of cells: resting and action potentials, functioning of the heart, physiological signal amplifiers.

Learning Outcomes:

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

- list out the physiological systems of the human body (L1).
- illustrate the functional structure of cell (L1).
- distinguish between resting and action potentials (L2).
- summarize the function of heart (L2).
- design physiological signal amplifier (L5).

Unit II: **9L**

Electrodes, Sensors, and Transducers: Introduction to Electrodes, Half-cell potential, Electrode paste, electrode material, Various types of Electrodes: surface electrodes, micro electrodes, needle electrodes depth electrodes, inductive, capacitive, Resistive and temperature transducers.

Learning Outcomes:

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

- state the role of an electrode (L1).
- estimate the half cell potential (L2).
- describe various electrode materials used in electrodes (L3).
- differentiate various types of electrodes (L4).
- illustrate the function of various transducers (L3).

Unit III: **8L**

Measurement of Physiological parameters: Measurement of blood pressure, blood flow and cardiac output – Plethysmography, respiration rate, temperature, ECG, EEG, EMG, Safety measures Medical Instrumentation.

Learning Outcomes:

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

- explain the process involved in BP measurement (L2).
- summarize the cardiac output measurement (L2).
- discuss the respiration rate measurement (L2).
- analyze ECG, EEG, EMG signals (L4).
- interpret safety measures taken in medical instrumentation (L6).

Unit IV: **8L**

Patient Monitoring Systems and Medical assist devices: Intensive cardiac care units and Central monitoring systems, Patient monitoring through biotelemetry. Pacemakers, Defibrillators.

Learning Outcomes:
After completion of this unit, the student will be able to
- list out the components and their functioning in ICCU (L1).
- discuss the role of central monitoring systems (L2).
- integrate patient monitoring through biotelemetry (L5).
- illustrate the function of pacemakers (L3).
- describe the role of defibrillators (L2).

Unit V: **9L**

Medical Imaging Systems: X-ray machines, Principles of computer tomography (CT), CT number scale Scanning Systems, Detector arrays. Principles of Nuclear Magnetic Resonance (NMR) and MR Imaging, T1 and T2 based imaging, Basic MRI system.

Learning Outcomes:
After completion of this unit, the student will be able to
- summarize about X-RAY machines (L3).
- discuss the principles of CT (L2).
- analyze the CT number scale scanning systems (L4).
- describe the principles of NMR (L2).
- discriminate between NMR and MRI systems (L4).

Text Book(s):

1. Biomedical Instrumentation and Measurements, Leslie Cromwell, Fred J Weibell, and Erich A Pfeiffer, PHI/Pearson Education, 2003.
2. Hand Book of Biomedical Instrumentation, RS Khandpur, TMH, 2003.

References:

1. Principles of Medical Imaging, K.KirkShung, Benjamin Tsui and Michael. B. Smith, Academic Press Inc., New York.
2. Introduction to Biomedical Equipment Technology, Joseph J Carr, John M.Brown, 4th Edition, Pearson Education, Singapore, 2001.
3. Bio-Medical Instrumentation, M.Arumugam Anuradha Agencies, 2003.

Course Outcomes:
After successful completion of the course, the student will be able to
- understand the functioning of various physiological systems of human body (L1).
- identify various electrodes and transducers used in different physiological measurements (L4).
- summarize the process involved in measurement of various physiological parameters (L3).
- interpret safety measures taken in medical instrumentation (L6).
- illustrate functional units in patient monitoring systems and medical assisting devices used in patient monitoring (L3).
- distinguish different medical imaging systems(L4).

19EEI473: Virtual Instrumentation

L	T	P	C
2	1	0	3

The evolution and pervasiveness of PCs as cost-effective computing platforms, recently joined by workstations with more powerful software tools, has resulted in a virtual explosion in data acquisition, signal processing and control systems from laboratory to industry including field applications. The emphasis of this course is to discuss a number of new technologies and challenges of virtual instrumentation systems in terms of applications in the areas including control systems, power systems, networking, robotics, communication, and artificial intelligence.

Course Objectives:

1. To understand the basics of Virtual Instrumentation (VI) and Data Acquisition Systems
2. To learn and implement the basic LabVIEW programming concepts
3. To interface the data acquisition systems to VI environment
4. To build the relation between the communication networking devices and VI
5. To apply the concepts and build models of VI in various engineering fields

Unit-I **6 hours**

Introduction: Virtual Instrumentation – Definition, flexibility, Block diagram and Architecture of Virtual Instruments, Virtual Instruments versus Traditional Instruments Data flow techniques, graphical programming in dataflow, Review of Popular software's in virtual Instrumentation.

Learning Outcome: student will be able to

- Understand the basics of Virtual Instrumentation.
- Differentiate between VI & TI
- Review popular software related to VI
- Outline the concepts related to data flow techniques & graphical programming.
- Explain the basic block diagram and architecture of VI

Unit-II **10 hours**

VI Programming Techniques: VI, sub-VI, Loops, structures, charts, arrays, clusters, graphs, formula node, math-script, local and global variable, strings, file I/O-execution control, Instrument drivers.

Learning Outcome: student will be able to

- Investigate the concepts related to VI programming techniques.
- Formulate the different variables and strings in VI
- Outline the concept related to Instrument drivers
- Memorize the file I/O execution control
- Examine the strings related to VI

Unit-III **8 hours**

Data Acquisition in VI: Introduction to data acquisition, signal conditioning, classes of signal conditioning, field wiring and signal measurement, ground loops, A/D, D/A converters, plug-in DAQ boards, Analog input/output cards, Digital Input/output card, counter and timer I/O boards, Isolation techniques, Opto-isolation, Data acquisition modules with serial communication.

Learning Outcome: student will be able to

- Understand the concepts of Introduction to data acquisition system
- Appraise the different signal conditioning & classes of VI
- Investigate the cards of Analog & digital inputs in VI
- Demonstrate the counter & timer I/O boards and Isolation techniques
- Develop the data acquisition modules with serial communication system.

Unit-IV **8 hours**

Communication networked modules: Introduction to PC Buses, Local bus: ISA, PCI, RS232, RS422, RS485, Interface Bus – USB, PCMCIA, VXI, SCXI, PXI. Instrumentation buses: Modbus – GPIB - Networked bus – ISO/OSI Reference model, Ethernet, and VISA

Learning Outcome: student will be able to

- Examine the basics of PC buses
- Discuss the various local Buses of VI

- Recognize the concepts of Instrumentation Buses
- Interface the various types of buses related to communication networking modules
- Memorize the various Reference models of communication modules

Unit-V **8 hours**

LabVIEW tools and Applications: Signal Processing and analysis, Control design and simulation tools, digital filter design tools, sound and vibration tools, spectral measurements, System Identification tools, Embedded Module, Biomedical startup kit

Learning Outcome: student will be able to

- State the concepts of signal processing analysis in VI
- Design and simulate the LAB view tools.
- Examine the performance of digital filter tools in VI
- Sketch the various Embedded module for its Applications
- Familiarize the basic Biomedical startup kit

Text Books:

1. LabVIEW based advanced Instrumentation System, S Sumathi, P Surekha, Springer Science Elsevier 2007.
2. Virtual Instrumentation using LabVIEW, Jovitha Jerome, PHI 2010.

References:

1. LabVIEW Graphical programming, Gary Jhonson, Mc Graw Hill, Newyork, 1997.
2. LabVIEW for everyone, Lisa K.Wells and Jeffrey Travis, Prentice Hall, NewJersey, 1997.
3. Practical Data Acquisition for Instrumentation and Control Systems, John Park and Steve Mackay, Elsevier Publications.

Course Outcomes:

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

1. Explain the difference between virtual instrument and conventional instruments
2. Apply the concepts of LabVIEW programming
3. Interface the DAQ to LabVIEW environment
4. Use the Communication networking devices in Virtual Instrumentation
5. Implement the VI models for different applications

19ECS478: INTRODUCTION TO DATA SCIENCE

L	T	P	C
2	1	0	3

Data Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better, and in many contexts enable us to make better decisions. While this is the broad and grand objective, the last 20 years has seen steeply decreasing costs to gather, store, and process data, creating an even stronger motivation for the use of empirical approaches to problem solving.

Course Objectives

- To an understanding of how the nature of the data collection, the data itself, and the analysis processes relate to the kinds of inferences that can be drawn
- To understand the limitations of data sets based on their contents and provenance
- To provide knowledge of data organization, management, preservation, and reuse
- To familiarize general linear models and cluster analysis methods for statistical analysis
- To describe the Data Science Process and how its components interact.
- To reason around ethical and privacy issues in data science conduct and apply ethical practices.

Unit I: **9L**

Understanding Big Data: Concepts and Terminology, Datasets, Data Analysis, Data Analytics

Business Intelligence, Key Performance Indicators, Big Data Characteristics, Different Types of Data, Metadata, Case Study

Business Motivations and Drivers for Big Data Adoption: Marketplace Dynamics, Business Architecture, Business Process Management, Information and Communications Technology, Data Analytics and Data Science, Digitization, Affordable Technology and Commodity Hardware, Social Media, Hyper-Connected Communities and Devices, Cloud Computing, Internet of Everything

Learning Outcomes:

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

- understand the terminology of Big data (L2).
- list Big Data characteristics (L1).
- identify different types of data (L2).
- analyze Big data with business perspective (L4).

Unit II: 10L

Big Data Adoption and Planning Considerations : Organization Prerequisites , Data Procurement, Privacy, Security, Provenance , Organization Prerequisites , Data Identification , Data Acquisition and Filtering, Data Extraction, Data Validation and Cleansing, Data Aggregation and Representation, Data Analysis , Data Visualization, Utilization of Analysis Results.

Enterprise Technologies and Big Data Business Intelligence: Online Transaction Processing (OLTP), Online Analytical Processing (OLAP), Extract Transform Load (ETL), Data Warehouses, Data Marts, Traditional BI, Ad-hoc Reports, Dashboards, Big Data BI, Traditional Data Visualization, Data Visualization for Big Data, Enterprise Technology, Big Data Business Intelligence.

Learning Outcomes:

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

- illustrate how to handle data and its preprocessing (L3).
- appraise the usage of OLTP Vs. OLAP and ETL (L4).
- identify what is a data warehouse (L2).
- analyze how Big Data plays a role in BI (L4).

Unit III: 8L

Big Data Storage Concepts: Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Master-Slave, Peer-to-Peer, Sharding and Replication, Combining Sharding and Master-Slave Replication, Combining Sharding and Peer-to-Peer Replication, CAP Theorem, ACID.

Big Data Processing Concepts: Parallel Data Processing, Distributed Data Processing, Hadoop, Processing workloads, Batch Processing with MapReduce, Map and Reduce Tasks, A Simple MapReduce Example, Understanding MapReduce Algorithms, Processing in RealTime Mode, Speed Consistency Volume (SCV), Event Stream Processing, Complex Event Processing, Realtime Big Data Processing and SCV, Realtime Big Data Processing and MapReduce

Learning Outcomes:

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

- analyze file system and distributed file system (L4).
- explain Sharding and replication (L2).
- understand Big data processing concepts (L2).
- Explain Map Reduce Algorithms (L2).
- appraise complex event processing (L4).

Unit IV: **10L**

Big Data Storage Technology: On-Disk Storage Devices, Distributed File Systems, RDBMS, Databases, NoSQL Databases, NewSQL Databases, In-Memory Storage Devices, In-Memory Data Grids, In-Memory Databases.

Big Data Analysis Techniques: Quantitative Analysis, Qualitative Analysis, Data Mining, Statistical Analysis, A/B Testing, Correlation, Regression, Machine Learning, Classification (Supervised Machine Learning), Clustering (Unsupervised Machine Learning), Outlier Detection, Filtering, Semantic Analysis, Natural Language Processing, Text Analytics , Sentiment Analysis, Visual Analysis, Heat Maps, Time Series Plots, Network Graphs, Spatial Data Mapping.

Learning Outcomes:

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

- explain big data storage technology(L2).
- analyze various big data analysis techniques(L4).
- illustrate natural language processing(L3).
- appraise text analytics and sentiment analysis(L4).

Unit V: **8L**

Information Management: The Big data foundation, Big data Computing Platforms, Big data computation, More on Big Data Storage, Big data computational limitations, Big data emerging technologies

Data Privacy and Ethics: The Privacy Landscape, The Great Data Grab isn't new, Preferences, Personalization, and Relationships, rights and responsibility, playing in a global sandbox. Conscientious and Conscious responsibility, privacy may be the wrong focus, can data be anonymized? Balancing for Counterintelligence.

Learning Outcomes:

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

- understand the overview of big data (L2).
- cite big data computational limitations (L2).
- explain big data emerging technologies (L2).
- appraise data privacy and ethics (L4).

Text Book(s):

1. Thomas Erl, WajidKhattak and Paul Buhler, Big Data Fundamentals, Prentice Hall 2015.
2. Michael Minelli, Michele Chambers, AmbigaDhiraj, Big Data Big Analytics, Wiley Publishing company, 2014

References:

1. Davy Cielen, Arno D.B.Meysman, Mohamed Ali, Introducing Data Science, Dreamtech Publishers,2018

Course Outcomes:

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

- understand the terminology of Big data, its characteristics and various types of data (L2).
- analyze a data warehouse, OLTP Vs. OLAP Vs. ETL (L4).
- appraise Big Data storage and processing concepts (L4).
- examine Big Data storage technology and analysis techniques (L3).
- explain Big Data computational limitations, emerging technologies, privacy and ethics (L3).

19ECS474: INTRODUCTION TO CLOUD COMPUTING

L	T	P	C
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 impart fundamental concepts in the area of cloud computing.
- To impart knowledge in applications of cloud computing.
- To provide sound foundation of the cloud computing.
- To explore some important cloud computing driven commercial systems and other businesses cloud applications.
- Solution for the various issues in cloud computing.

UNIT I **10 L**

Introduction**:** Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud

Learning Outcomes:

After completion of this unit, student will be able to

- apply the concept of Cloud Computing(L3)
- identify parallel computing(L1)
- describe cloud characteristics(L2)
- construct cloud(L6)
- evaluate distributed computing(L4)

UNIT II **10 L**

Cloud Enabling Technologies: Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices

Learning Outcomes:

After completion of this unit, student will be able to

- examine SOA(L1)
- state REST. (L!)
- identify Virtualization(L1)
- formulate Types of virtualization(L6)

UNIT III **8 L**

Cloud Architecture, Services And Storage Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

Learning Outcomes:

After completion of this unit, student will be able to

- describe Cloud architecture.(L2)
- apply Iaas, Paas(L3)
- compare Cloud Services((L2)
- choose Cloud storage(L3)
- evaluate Cloud Storage providers(L4)

UNIT IV **8 L**

Resource Management And Security In Cloud Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – es – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security Security Standards.

Learning Outcomes:

After completion of this unit, student will be able to

- apply Resource Management(L3)
- interpret Resource Provisioning(L2)
- evaluate Security Overview(L4)
- determine VMS(L3)
- determine Security Standards(L3)
- explain Security Governance(L2)

UNIT V **8 L**

Cloud Technologies And Advancements: Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications.

Learning Outcomes:

After completion of this unit, student will be able to

- understand Hadoop(L2)
- describe Google App Engine(L2)
- describe OpenStack(L2)
- explain Federation in cloud(L2)

Text book(s)

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

References

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009

Course Outcomes

After completing this course student will be able to

- explain the main concepts, key technologies, strengths and limitations of cloud computing.(L2)
- apply the key and enabling technologies that help in the development of cloud.(L3)
- explain use the architecture of compute and storage cloud, service and delivery models.(L2)
- explain the core issues of cloud computing such as resource management and security.(L2)
- evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.(L4)

19EME349: Total Quality Management

L	T	P	C
2	1	0	3

This Course is to introduce the applications to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management. The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable them to identify the parameters that are improving/depriving the quality. By knowing about the quality ISO systems, the student will maintain processes/documentation properly so that the quality maintained by the organization gets recognized.

Course objectives:

1. The overall purpose of the course is to provide an understanding of the process of managing quality and managing services.
2. The principles of Quality, Quality Assurance, and Total Quality Management will provide an insight into the concepts of Excellence and Best Value and the contribution of quality to strategic management
3. Understand the usage of several techniques and quality management tools.
4. Identify the elements that are part of the quality measuring process in the industry.
5. Learn various Customer satisfaction measurement techniques

Module I: **Quality, Strategic Planning and Competitive Advantage** Number of hours(LTP) 9 0 0

Brief history, definitions of quality. Quality in manufacturing and service systems. Quality and price, quality and market share, quality and cost, quality & competitive advantages. ISO 9000, 14000.

Module II: **Managing and Organization for Quality** Number of hours(LTP) 9 0 0

Quality policy, quality objectives, leadership for quality, quality and organization culture, cross-functional teams, supplier/customers partnerships.

Module III: **Quality Control and Improvement Tools** Number of hours(LTP) 9 0 0

Cheek sheet, histogram, pareto chart, cause and effect diagram, scatter diagram, control chart, graph, affinity diagram, tree diagram, matrix diagram, process decision program chart, arrow diagram, acceptance sampling, process capability studies, zero defect program (POKA-YOKE)

Module IV: **Quality Circles** Number of hours(LTP) 9 0 0

Concept and total quality through bench marking, Japanese 5-S, quality management systems QS 9000, ISO 14000. Statistical process control: Control chart - X bar R, P, np and C Charts, benefits of control charts and applications (10 %)

Module V: **Customer Focus and Six sigma principles** Number of hours(LTP) 9 0 0

Customer satisfaction measurement techniques, customer relationship management techniques, Concept of Six Sigma, Six Sigma for manufacturing, Six Sigma for service, Understanding Six Sigma organization.

Text Books(s)

1. J.M. Juran, & F.M. Gryna, Quality Planning and Analysis, McGraw-Hill, 1993
2. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc.2003. (Indian reprint 2004).

3. Evans. J. R. & Lindsay. W, M “The Management and Control of Quality”, (5thEdition),SouthWestern (Thomson Learning), 2002
4. Geoff Tennant, Six Sigma: SPC and TQM in Manufacturing and Services, 1/e, Gower Publishing Ltd., 2001.

Reference Book(s)

1. J.Bank, Essences of Total Quality Management, Prentice Hall, 2007
2. Joel E. Ross - Text & Cases, Total Quality Management, St. Lucie Press, 1995
3. D.L. Goetsch & S. Davis, Introduction to Total Quality, Prentice- Hall, 2002.
4. R. Cavanagh, R. Neuman, P. Pande, what is Design for Six Sigma, 1/e, Tata McGraw- Hill, 2005.

Course Outcomes:

1. Understand the fundamental principles of Total Quality Management
2. Choose appropriate statistical techniques for managing and improving processes in Organisations
3. Develop skills on Quality control and improvement tools
4. Understand benefits of control charts and their applications
5. Analyse Customer relationship management techniques

19EME357: Supply Chain Management

L	T	P	C
2	1	0	3

The course under Operations and supply chain management has been designed to cover the basic concepts of operations management and supply chain management. The students will understand the role of logistics, drivers and metrics in supply chain and how to design the network. The students will understand the globalization and its risks and forecasting in supply chan. The students will understand collaborative planning and replenishment strategies and how to manage uncertainties in inventory. The students shall also be able to understand the role of information technology in inventory management and transportation in supply chain.

Course objectives:

1. To introduce operations management, role and responsibilities of operations manager.
2. To explain the importance of logistics and supply chain management and the relevant drivers and metrics.
3. To demonstrate the technique of forecasting to reduce uncertainty by identifying the risks in a global supply chain setting
4. To impart knowledge of collaborative planning, forecasting and replenishment methodologies to achieve better coordination in a supply chain.
5. To summarize the importance of technology in operations, logistics and supply chain management.

Module I: **Introduction to Operations Management** Number of hours(LTP) 9 0 0

History of operations management, types of manufacturing systems, roles and responsibilities of operations manager, Product operations and service operations, Current Trends in Operations Management

Module II: **Understanding the Logistics and Supply Chain** Number of hours(LTP) 9 0 0

Introduction to supply chain, supply chain links, role of logistics in supply chain, drivers and metrics in supply chain, designing the supply chain network, online sales and distribution network, factors influencing the network design.

Module III: **Impact of Uncertainty in Network** Number of hours(LTP) 9 0 0

Globalization and supply chain, risk management in global supply chain, demand forecasting in supply chain role of information technology in forecasting.

Module IV: **Coordination in Supply Chain** Number of hours(LTP) 9 0 0

Collaborative planning and replenishment strategies, CPFR, managing uncertainties in inventory.

Module V: **Impact of Replenishment Policies in Safety Inventory** Number of hours(LTP) 9 0 0

Role of information technology in inventory management, transportation in supply chain.

Text Books(s)

1. Sunil Chopra, Supply Chain Management, Pearson Publications, 2012.

Reference Book(s)

1. Sridhara Bhatt, Logistics and Supply Chain Management, Himalaya Publishers, 2011
2. D.K Agarwal, Logistics and Supply Chain Management, Macmillan Publishers, 2013.

Course Outcomes:

1. Understand the fundamental principles of Total Quality Management
2. Choose appropriate statistical techniques for managing and improving processes in Organisations
3. Develop skills on Quality control and improvement tools
4. Understand benefits of control charts and their applications
5. Analyse Customer relationship management techniques

19EEE442: ARTIFICIAL INTELLIGENCE APPLICATIONS TO POWERSYSTEMS

L	T	P	C
2	0	2	3

In this course it is aimed to introduce the major characteristics of expert system, rule-based expert system, Fuzzy logic systems, Artificial neural networks, Genetic algorithm and Hybrid intelligence techniques to the students. Also application of these artificial intelligence techniques to power systems are enlightened in this subject.

Course Objectives:

The purpose of the course is to

1. Study the importance of artificial intelligence techniques.
2. Familiarize major characteristics of expert systems and rule-based expert systems.
3. Understand the characteristics of Artificial neural networks
4. Understand the characteristics of Genetic algorithm
5. Understand the characteristics of Hybrid intelligence techniques
6. Apply the above artificial intelligence techniques to power systems

UNITI: **10L**

Expert systems: Major characteristics of expert systems, rule-based expert systems, application to power systems.

After completion of UNIT I, students will be able to

- **Explain** the importance of artificial intelligence techniques. (L2)
- **Contrast** the difference between classical and artificial intelligence techniques (L1)
- **Explain** major characteristics of expert systems and rule-based expert systems (L2)
- **Apply** rule-based expert systems to power systems (L3)

UNIT II: **8L**

Fuzzy Logic: Characteristics of fuzzy logic systems, fuzzy logic in power systems.

After completion of UNIT II, students will be able to

- **Explain** the importance of fuzzy logic systems. (L2)
- **Explain** major characteristics of fuzzy logic systems (L2)
- **Apply** fuzzy logic system to power systems (L3)

UNIT III: **8 L**

Artificial neural networks: Artificial neural networks, neural network types, neural networks in power systems.

After completion of UNIT III, students will be able to

- **Explain** the importance of Artificial neural networks. (L2)
- **Explain** major characteristics of Artificial neural networks (L2)
- **Define** the types of neural network systems(L1)
- **Apply** neural networks to power systems (L3)

UNITIV: **8L**

Genetic algorithm: Characteristics of genetic algorithm, genetic algorithms in power systems.

After completion of UNIT IV, students will be able to

- **Explain** the importance of Genetic algorithm. (L2)
- **Define** the operators in genetic algorithm (L1)
- **Apply** genetic algorithms to power systems (L3)

UNIT V: **8L**

Hybrid systems: Hybrid intelligence techniques, application in power systems.

After completion of UNIT V, students will be able to

- **Explain** the importance of Hybrid intelligence techniques. (L2)
- **Explain** major characteristics of hybrid intelligence techniques.(L2)
- **Apply** hybrid intelligence techniques to power systems (L3)

Text Book(s)

1.D.W.Patterson, Introduction to Artificial Intelligence and Expert systems, 2/e, PHI,2009.

References

1. Yong-Hua Song, Allan Johns, Raj Aggarwal, Computational Intelligence Applications to Power Systems, Science Press, 1/e, Kluwer Academic Publishers, 1997.

Course Outcomes:

The students will be able to

1. Explain the importance of artificial intelligence techniques
2. Understand major characteristics of rule-based expert systems, ANN, GA and Hybrid intelligence techniques
3. Differentiate types of neural network systems
4. Understand the operators in genetic algorithm
5. Apply artificial intelligence techniques to any power system problems.

19EEE444: HYBRID ELECTRIC VEHICLES

L	T	P	C
2	0	2	3

This course introduces the fundamental concepts, principles, analysis and design of hybrid and electric vehicles. The course will be useful for post-graduate students, teachers, practitioners and final year undergraduate students. This course goes deeper into the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used, energy storage devices, etc. Each topic will be developed in logical progression with up-to-date information.

Course Objectives:

The purpose of the course is to

- Study various basic concepts of hybrid and electric vehicles.
- Expose various basic conventional vehicle performance and various hybrid drive-train topologies.
- Familiarize various electric components used in hybrid and electric vehicles
- Expose various energy storage requirements in hybrid and electric Vehicles
- Interpret the energy management strategies used in hybrid and electric vehicles.

UNIT I: **8 L**

Basic concepts of Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Learning outcomes:

After completion of UNIT I, students will be able to

- **Define** the concepts of hybrid and electric vehicles (L1)
- **Contrast** the difference between hybrid and electric vehicles (L2)
- **Identify** the environmental importance of hybrid and electric vehicles (L3)
- **Justify** the use of modern drive-trains. (L5)

UNIT II: **10 L**

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Learning outcomes:

After completion of UNIT II, students will be able to

- **Define** the basic conventional vehicle performance (L1)
- **Demonstrate** the transmission characteristics and mathematical models of conventional vehicles (L2)
- **Identify** the different hybrid drive-train topologies (L3)
- **Compare** various power flow control in various hybrid drive-train topologies (L4)

UNIT III: **8 L**

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Learning outcomes:

After completion of UNIT III, students will be able to

- **List** the various electric components used in hybrid and electric vehicles (L1)
- **Develop** a configuration and control of DC Motor drives (L3)

- **Analyze** the various control schemes of Induction Motor drives (L4)
- **Justify** the control of Permanent Magnet Motor drives (L5)

UNIT IV: **8 L**

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Learning outcomes:

After completion of UNIT IV, students will be able to

- **Demonstrate** the energy storage requirements in hybrid and electric vehicles (L2)
- **Analyze** the fuel cell based energy storage(L3)
- **Evaluate** the expression for super capacitor based energy storage (L5)
- **Solve** various problems in hybridization of different energy storage devices. (L6)

UNIT V: **8 L**

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Learning outcomes:

After completion of UNIT V, students will be able to

- **List** out various energy management strategies used in hybrid and electric vehicles (L1)
- **Classify** various energy management strategies (L2)
- **Apply** energy management strategies to electric vehicles (L4)
- **Justify** the use of Underground cables (L5)
- **Predict** various issues of energy management strategies. (L6)

Text Books:

1. Chrismi, M. AbulMasrur and David WenzhangGao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Wiley, 2011.
2. Yang Sheng Xu, HuihuanQian, Jingyu Yan and Tin Cun Lam, Hybrid Electric Vehicle Design and Control: Intelligent Omnidirectional Hybrids, IET, 2014.

Reference Books:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
2. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.

Course Outcomes:

Upon completion of the course, the students would be able to

- **Compare** the difference between hybrid and electric vehicles (L2)
- **Identify** different hybrid drive-train topologies. (L3)
- **Estimate** the various electric components used in hybrid and electric vehicles (L5)
- **Assess** various problems in hybridization of different energy storage devices. (L5)
- **Predict** various issues of energy management strategies. (L6)

19EEE446: ROBOTICS

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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, 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's 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 Intelligence & Programming the Robots: AI and Robotics, Expert Systems, Interpreting Sensory Inputs, Intelligent Tutoring Systems. Robot Languages, Robot Operating System, Robot Application Programming, Teaching Robots

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).
- classify types of sensors used in robot development (L2).
- 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. SatyaRanjan, 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

- get acquainted with history of robotics, technological advances and many types of End Effectors (L2).
- gain 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)

19EEE492: PROJECT PHASE II

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0 0 12 6

A graduate is expected to contribute to the industry in design, development, testing maintenance and managing the employees as soon as joining the industry. Hence it is essential to have training in any of the above areas by taking up a project work. The project work can be an extension of mini project or can be an independent

GSS115: GANDHI FOR THE 21ST CENTURY

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.

Objectives

The major Objectives of the Course are;

- To provide the basic knowledge of Gandhi's life, thought and works
- To analyse the political contributions of Gandhi towards India's independence
- To examine the significance of Gandhian principles in the contemporary scenario
- To educate the students about the necessity of world peace and sustainable development
- To provide understanding about the life of eminent world leaders who were influenced by Gandhi

Learning Outcomes

After finishing the course, the students will be able to

- Understand the life and works of Gandhi
- Understand and appreciate the political contributions of Gandhi
- Analyse the contemporary issues and connect it with Gandhian solutions
- Analyse the issues related to world peace and to think about possible alternatives
- Understand and appreciate the role of eminent world leaders towards non-violent social and political transformation.

Unit-I: Introduction to the course: Gandhi's Early Childhood-Beginning of Satyagraha in South Africa-Entry to Indian Politics-Major Movements

Unit-II: Gandhi's Political Philosophy: Eleven Vows and their significance, Gandhi's Constructive Programmes and their significance, *Sarvodaya* and *Satyagraha*

Unit-III: Gandhian Way of Management: Management lessons from Gandhi, his views on education and its significance, Gandhian Economics and Sustainability

Unit-IV: Gandhi and his contemporaries-Gandhi and Tagore, Ambedkar, Subhash Chandra Bose, Muhammed Ali Jinnah, Gandhi Mandela, and Martin Luther King Jr.

Unit V: Gandhi and Ecology: Ideas from Hind Swaraj-Environmental movements and Gandhian environmentalism-World Peace and Gandhi-Conflict resolution and Gandhian principles.

Reference Books

Allen, Douglas. (2019). *Gandhi after 9/11: Creative Non-violence and Sustainability*. New Delhi: Oxford University Press.

Chandra, B. (2009). *History of Modern India*. New Delhi: Orient Blackswan.

Gandhi, M K. (1941). *Constructive Programme*. Ahmadabad: Navjivan Publishing House

Gandhi, M. K. (1948). *The Story of My Experiments with Truth*. Ahmadabad: Navjivan Publishing House.

Gandhi, M K. (1968). *Satyagraha in South Africa*. Ahmadabad: Navjivan Publishing House.

Hardiman, David. (2004). *Gandhi in His Times and Ours: The Global Legacy of His Ideas.* New York: Columbia University Press.

Journals

Gandhimarg, Gandhi Peace Foundation, New Delhi.
GITAM Journal of Gandhian Studies, GITAM University, Visakhapatnam.

HSMCH102 - UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

L T P C
2 1 0 3

Human Values Courses: During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

OBJECTIVE: The objective of the course is four fold:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSE TOPICS: The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential 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 fulfilment 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 fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. 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, 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 tome. Identifying from one's own life.

Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of 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 family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment 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 being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize the 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 above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
    a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    b. At the level of society: as mutually enriching institutions and organizations
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

READINGS: Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, 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 - PanditSunderlal
9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self- observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations.

Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials)would also provide support to a student in performing actions commensurate to his/her beliefs. It is
intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty.

Teacher preparation with a minimum exposure to at least one 8- day FDP on Universal Human Values is deemed essential.

ASSESSMENT:
This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:
Assessment by faculty mentor: 10 marks
Self-assessment: 10 marks
Assessment by peers: 10 marks
Socially relevant project/Group Activities/Assignments: 20 marks Semester End Examination: 50 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

OUTCOME OF THE COURSE: By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to- day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundational input. It would be desirable to follow it up by

a) faculty-student or mentor-mentee programs throughout their time with the institution
b) Higher level courses on human values in every aspect of living. E.g. as a professional