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

Accredited by NAAC with A+ Grade

REGULATIONS AND SYLLABUS

of

B.Tech Civil Engineering

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

B. Tech. in Civil Engineering (w.e.f. 2020-21 admitted batch)

REGULATIONS

1. ADMISSION

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

2. ELIGIBILITY CRITERIA

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

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

3. CHOICE BASED CREDIT SYSTEM

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

- Activity based learning
- Student 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 THE PROGRAM

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 project work.

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 Practicals 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 OF INSTRUCTION

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. ATTENDANCE REQUIREMENTS

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 candidates'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 NSS/NCC/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 2nd semesters.

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 upto 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 SPECIAL EXAMINATIONS.

11.1 The odd semester supplementary examinations will be conducted on daily basis after conducting regular even semester examinationsduring 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 OF STUDY

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 ONLINE COURSES

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

14. BETTERMENT OF GRADES

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 GRADING SYSTEM

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

Table 2: Grades and Grade Points

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

16.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, subject to securing 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 POINT AVERAGE

17.1 A Grade Point Average (GPA) for the semester will be calculated according to the 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’sperformance 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 Table 3.

Table 3: CGPA required for award of Class

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

* In addition to the required CGPA of 8.0 or more, the student must have 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. DISCRETIONARY POWER

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

GITAM (Deemed to be University)

VISION

To become a global leader in higher education

MISSION

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

GITAM School of Technology

VISION

To become a global leader in holistic engineering education and research

MISSION

M1) To impart holistic, sustainable and interdisciplinary engineering education of global standards with flexible curriculum ensuring good student support and progression

M2) To build research and innovation ecosystem to advance technology and solve engineering problems of societal importance

M3) To empower active collaboration with national and international industries/universities for achieving global standards and development

M4) To create a governance and leadership where faculty and students share a passion for creating, sharing and applying technical knowledge with ethics and values to continuously impact lives in a positive way

Department of Civil Engineering

VISION

To train technical manpower of global standards in Civil Engineering with capabilities for accepting new challenges, create research environment and extend professional consultancy services.

Department of Civil Engineering

MISSION

To impart quality education in civil engineering with social relevance, train professionals, impart skills in a serene and invigorating environment and offer solutions to the technical challenges of the society.

M1 - To train students as competent professionals in Civil Engineering

M2 -To serve the society by imparting quality education and providing ethical, professional leadership quality to students to find solutions for societal problems.

M3 -To collaborate with the industry in research and allied activities for a better industry-institute interaction.

M4 - To make the department as a Centre for Excellence in the area of concrete under elevated temperatures

M5 - To impart skill development to mould as employable for a rapidly changing technological environment

Program Educational Outcomes (PEO):

The program educational objectives of the Department of Civil Engineering Program are to produce engineers whose attributes several years after graduation are marked by their ability to

PEO 1	Graduates will have strong foundation and understanding of the fundamental principles of mathematics, science, and engineering enabling graduates to pursue their careers as practicing civil engineers in civil and Allied Engineering fields.
PEO 2	Graduates will have ability to pursue Post-Graduation and research in lifelong learning in the emerging and allied areas of Civil Engineering and Business
PEO 3	Graduates will be able to practice Civil Engineering in an ethical manner and implement eco- friendly sustainable technologies for the benefit of industry and society.
PEO 4	Graduates will be able undertake consultancy services in contemporary areas to offer solutions to the technical challenges of the society.

PEO Statements	**MISSION of GITAM School of Technology**			
	M1	**M2**	**M3**	**M4**
PEO-1: Graduates will have strong foundation and understanding of the fundamental principles of mathematics, science, and engineering enabling graduates to pursue their careers as practicing civil engineers in civil and Allied Engineering fields	H	H	M	M
PEO-2: Graduates will have ability to pursue Post-Graduation and research in lifelong learning in the emerging and allied areas of Civil Engineering and Business	M	H	H	M

PEO-3: Graduates will be able to practice Civil Engineering in an ethical manner and implement eco- friendly sustainable technologies for the benefit of industry and society	M	M	H	H
PEO-4: Graduates will be able undertake consultancy services in contemporary areas to offer solutions to the technical challenges of the society	H	H	H	M

H- High Correlation, M – Medium Correlation, L- Low Correlation

PROGRAM OUTCOMES (PO) and PROGRAM SPECIFIC OUTCOMES (PSO)

Engineering Graduates will be able to:

PO 1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3	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.
PO 4	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.
PO 5	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.
PO 6	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.
PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	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.
PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

After the culmination of the course students will be able to acquire:

PSO1	Graduates shall demonstrate sound knowledge in analysis, design and execution of civil engineering infrastructure projects with appropriate consideration for cost, safety and sustainability.
PSO2	Serve the society by solving various civil engineering problems focusing on sustainable development and following professional ethics.
PSO3	Graduates will be able to provide sustainable solution for real time problems through research.

Department of Civil Engineering

B. Tech. in Civil Engineering (w.e.f. 2019-20 admitted batch)

CURRICULLUM

Semester I

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA101	Engineering Mathematics I (Calculus and Algebra)	BS	3	0	0		3	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2		3	Common to all
3.	19EPH133/ 19ECY133	Applied Physics / Chemistry of materials	BS	3	0	3		4.5	Common with MECH
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	National Service Scheme/National Cadet Corps/National Sports Organization/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,EEE & MECH
2.	19ECY133/ 19EPH133	Chemistry of materials / Applied Physics	BS	3	0	3		4.5	Common with MECH
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	3		2.5/1.5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/National Cadet Corps/National Sports Organization/YOGA	MC	0	0	2		0	Common to all
7	VDC111	Venture Discovery	PW	0	0	4		2	Common to all
8	19EHS122	Comprehensive Skill Development I	HS	0	0	0	6	1	Common to all
Total								21.5/20.5	

Semester III

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA201	Engineering Mathematics III (PDE, Complex Variables and Transform Techniques)	BS	3	0	0		3	Common with MECH
2.	19EID134/19EID132	AI Tools /Design Thinking	ES	2	0	2		3	Common to all
4.	19EME201	Engineering Mechanics	PC	3	0	0		3	
5.	19ECE233	Fluid Mechanics	PC	3	0	3		4.5	
6.	19ECE235	Surveying	PC	3	0	3		4.5	
7.	19ECE237	Civil Engineering Workshop	PC	0	0	3		1.5	Branch specific
8.	19EMC281 / 19EMC282	Constitution of India / Environmental Sciences	MC	3	0	0		0	Mandatory Course
9.	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1	Common to all
Total								20.5	

Semester IV

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA202	Engineering Mathematics- IV (Numerical Methods, Probability and Statistics)	BS	3	0	0		3	Common with MECH & EEE
2.	19EID234/19EID232	Life Sciences for Engineers/Internet of Things	BS/ES	2	0	2		3	
3.	19ECE232	Mechanics of Solids	PC	3	0	3		4.5	
4.	19ECE234	Environmental Engineering	PC	3	0	3		4.5	
5.	19ECE236	Geotechnical Engineering	PC	3	0	3		4.5	
6.	19ECE238	Construction Materials & Concrete Technology	PC	2	0	3		3.5	
7.	19EMC282 / 19EMC281	Environmental Sciences / Constitution of India	MC	3	0	0		0	Mandatory Course
8.	19ECE292	Comprehensive Skill Development III	PW	0	0	0	6	1	Common to all
Total								**24**	

Semester V

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECE301	Structural Analysis	PC	3	0	0		3	
2.	19ECE331	Highway Engineering	PC	3	0	3		4.5	
3.	19ECE303	Design of Reinforced Concrete Structures	PC	3	0	0		3	
4.	19EID232/19EID234	Internet of Things/ Life Sciences for Engineers	ES/BS	2	0	2		3	
5.	19ECE3XX	Program Elective I	PE	2	1	0		3	
6.	19EOE3XX	Open Elective I	OE	3	0	0		3	Open Elective
7.	19EYY3XX	Interdisciplinary Elective I	ID	2	1	0		3	
8	19ECE323	Survey Camp	PC	-	-	-		2	
9.	19ECE391	Comprehensive Skill Development IV	PW	0	0	0	6	1	Common to all
Total								**25.5**	

Semester VI

S.No	Course Code	Course Title	Category	L	T	P		C	Remarks
1.	19ECE302	Design of Steel Structures	PC	3	0	0		3	
2.	19ECE304	Water Resources Engineering	PC	3	0	0		3	
3.	19ECE322	Architectural planning & CAD Lab	PC	0	0	3		1.5	
4.	19ECE3XX	Program Elective II	PE	2	1	0		3	
5.	19ECE3XX	Program Elective III	PE	2	1	0		3	
6.	19EOE3XX	Open Elective II	OE	3	0	0		3	
7.	19EHS302	Engineering Economics and Management	HS	3	0	0		3	Common to all
8.	19EMC382	Engineering Ethics	MC	3	0	0		0	Mandatory Course
9.	19ECE392	Comprehensive Skill Development V	PW	0	0	0	6	1	Common to all
10	HSMCH102	Universal Human Values: Understanding Harmony	MC	2	1	0		3	
Total								**23.5**	

Semester VII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECE401	Estimation & Costing	PC	3	0	0		3	
2.	19ECE421	Computer Applications in Civil Engineering Lab	PC	0	0	3		1.5	
3.	19EYY4XX	Interdisciplinary Elective II	ID	2	1	0		3	
4.	19ECE4XX	Program Elective IV	PE	2	1	0		3	
5.	19ECE4XX	Program Elective V	PE	2	1	0		3	
6.	19EHS401	Construction Management	HS	3	0	0		3	
7.	19ECE491	Project Phase I	PW	0	0	2		1	

8.	19ECE493	Internship*	PW	-	-	-		1	
9.	19ECE495	Comprehensive Skill Development VI	PW	0	0	0	6	1	Common to all
		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	Inter Disciplinary Elective III	ID	2	1	0		3	
2.	19ECE4XX	Program Elective VI	PE	2	1	0		3	
3	GSS115	Gandhi for the 21st Century	PW					1	Online course
4	19ECE492	Project Phase II	PW	0	0	12		6	
		Total						13	

Total Credits 165

Total Number of Credits

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	**17.5/ 18.5**	**21.5/20.5**	**20.5**	**24**	**25.5**	**23.5**	**19.5**	**13**	**165**

Category and Credits

Category	Category Code	Courses	Credits GITAM	Credits proposed by AICTE
Humanities & Social Sciences	HS	Communicative English	**11**	**12**
		HS1 and HS2 (elective)		
		Comprehensive Skill Development I & II		
Basic Sciences	BS	Engineering Physics	**24**	**25**
		Engineering Chemistry		
		Mathematics (4 Courses)		
		Life Sciences for Engineers		
Engineering Sciences	ES	Problem Solving and Programming	**24**	**24**
		Basic Electrical and Electronics Engineering		
		AI Tools		
		Engineering Graphics		
		Workshop		
		Design Thinking		
		Internet of Things		
Open Electives	OE	OE1, OE2	**6**	**18**
Interdisciplinary Electives	ID	ID1, ID2, ID3	**9**	
Program Electives	PE	PE1, PE2, PE3, PE4, PE5, PE6	**18**	**18**
Program Core	PC	PC1 – PC17	**55**	**48**
Project	PW	Venture Discovery	**15**	**15**
		Internship		
		Project Phase I		
		Project Phase II		
		Comprehensive Skill Development III,IV,V,VI		
		Gandhi for 21st Century		
Mandatory	MC	Environmental Sciences, Constitution of India, Engineering Ethics	**-**	**-**

Total	162	160

Engineering Mathematics-II (Elective)

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA102	Engineering Mathematics-II	BS	3	0	0	3	
2.	19EMA104	Engineering Mathematics-II	BS	3	0	0	3	
3.	19EMA106	Mathematics for Biotechnology –II	BS	3	0	0	3	

Engineering Mathematics-III (Elective)

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA201	Engineering Mathematics-III	BS	3	0	0	3	
2.	19EMA203	Engineering Mathematics-III	BS	3	0	0	3	
3.	19EMA205	Engineering Mathematics-III	BS	3	0	0	3	
4.	19EMA207	Mathematics for Biotechnology –III	BS	3	0	0	3	

Engineering Mathematics-IV (Elective)

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA202	Engineering Mathematics-IV	BS	3	0	0	3	
2.	19EMA204	Engineering Mathematics-IV	BS	3	0	0	3	
3.	19EMA206	Engineering Mathematics-IV	BS	3	0	0	3	
4.	19EMA208	Mathematics for Biotechnology –IV	BS	3	0	0	3	

Engineering Physics (Elective)

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EPH131	Engineering Physics	BS	3	0	3	4.5	
2.	19EPH 133	Applied Physics	BS	3	0	3	4.5	
3.	19EPH 135	Physics for Biotechnology	BS	3	0	3	4.5	

Engineering Chemistry (Elective)

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19ECY131	Engineering Chemistry	BS	3	0	3	4.5	
2.	19ECY133	Chemistry of materials	BS	3	0	3	4.5	
3.	19ECY135	Chemistry for Biotechnology	BS	3	0	3	4.5	

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	Work Place Communication-Basic	OE	3	0	0	3
13	GEL347	Work Place Communication-Advanced	OE	3	0	0	3

PROGRAM ELECTIVES

Program Elective- I

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE341	Repairs, Renovation and Rehabilitation of Structures	PE	2	1	0	3
2	Geotechnical Engineering	19ECE343	Foundation Engineering	PE	2	1	0	3
3	Transportation Engineering	19ECE345	Traffic Engineering	PE	2	1	0	3
4	Water Resources Engineering	19ECE347	Hydraulic Machines	PE	2	1	0	3
5	Environmental Engineering	19ECE349	Pollution Prevention and Management	PE	2	1	0	3

Program Elective-II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE342	Advanced Structural Analysis	PE	2	1	0	3
2	Geotechnical Engineering	19ECE346	Rock Mechanics	PE	2	1	0	3

3	Transportation Engineering	19ECE352	Pavement Analysis and Design	PE	2	1	0	3
4	Water Resources Engineering	19ECE356	Hydropower Engineering	PE	2	1	0	3
5	Environmental Engineering	19ECE362	Sanitary Engineering	PE	2	1	0	3
6	Artificial Intelligence and Machine Learning	19EID331	Artificial Neural Networks	PE	2	1	0	3

Program Elective- III

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE344	Advanced Reinforced Concrete Structures	PE	2	1	0	3
2	Geotechnical Engineering	19ECE348	Advanced Foundation Engineering	PE	2	1	0	3
3	Transportation Engineering	19ECE354	Remote Sensing and Geographic Information Systems	PE	2	1	0	3
4	Water Resources Engineering	19ECE358	Open Channel Hydraulics	PE	2	1	0	3
5	Environmental Engineering	19ECE364	Air Pollution & Its Control	PE	2	1	0	3

Program Elective- IV

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE441	Advanced Design of Steel Structures	PE	2	1	0	3
2	Geotechnical Engineering	19ECE445	Soil Dynamics and Machine Foundations	PE	2	1	0	3
3	Transportation Engineering	19ECE449	Transportation Infrastructure Engineering	PE	2	1	0	3
4	Water Resources Engineering	19ECE453	Irrigation Management	PE	2	1	0	3
5	Environmental Engineering	19ECE457	Solid and Hazardous Waste Management	PE	2	1	0	3
6	Artificial Intelligence and Machine Learning	19ECS344	Introduction to Machine Learning	PE	2	1	0	3

Program Elective- V

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE443	Prestressed Concrete	PE	2	1	0	3
2	Geotechnical Engineering	19ECE447	Ground Improvement Techniques	PE	2	1	0	3
3	Transportation Engineering	19ECE451	Urban Transport Planning	PE	2	1	0	3
4	Water Resources Engineering	19ECE455	Watershed Management	PE	2	1	0	3
5	Environmental Engineering	19ECE459	Environmental Impact Assessment	PE	2	1	0	3

Program Elective- VI

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE442	Introduction to Earthquake Engineering	PE	2	1	0	3
2	Geotechnical Engineering	19ECE444	Geosynthetics	PE	2	1	0	3
3	Transportation Engineering	19ECE446	Road Safety Auditing	PE	2	1	0	3
4	Water Resources Engineering	19ECE448	Advanced Water Resources Engineering	PE	2	1	0	3
5	Environmental Engineering	19ECE452	Industrial Waste Management	PE	2	1	0	3

INTERDISCIPLINARY ELECTIVES

Interdisciplinary Elective- I

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EBT371	Bio Materials	ID	2	1	0	3
2		19AID371	Introduction to Architecture and Town Planning	ID	2	1	0	3
3	Computer Oriented Courses	19ECS371	Introduction to Database Management Systems	ID	2	1	0	3
4		19ECS375	Introduction to Programming with JAVA	ID	2	1	0	3
5	Management Courses	19EME371	Quantitative Techniques for Management	ID	2	1	0	3
6		19EME369	Computational Methods	ID	2	1	0	3

Interdisciplinary Elective- II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19AID471	Introduction to Green Buildings	ID	2	1	0	3
2		19EEE471	Renewable Energy Resources	ID	2	1	0	3
3	Computer Oriented Courses	19ECS475	Introduction to Web Technologies	ID	2	1	0	3
4		19ECS473	Introduction to software Engineering	ID	2	1	0	3
5	Management Courses	19EME456	Optimization Techniques	ID	2	1	0	3
6		19EME366	Project Management & Optimization	ID	2	1	0	3
7		19ECE371	Disaster Management	ID	2	1	0	3

Interdisciplinary Elective-III

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19AID472	Introduction to Interior Design	ID	2	1	0	3
2		19EEI479	Instrumentation and Sensor Technologies of Civil Engineering Applications	ID	2	1	0	3

3	Computer Oriented Courses	19ECS478	Introduction to Data Science	ID	2	1	0	3
4		19ECS474	Introduction to Cloud Computing	ID	2	1	0	3
5	Management Courses	19EME349	Total Quality Management	ID	2	1	0	3
6		19EME357	Supply Chain Management	ID	2	1	0	3

Semester I

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19EMA101	Engineering Mathematics I	BS	3	0	0		3

		(Calculus and Algebra)						
2.	GEL131	Communicative English	HS	2	0	2		3
3.	19EPH133/ 19ECY133	Applied Physics / Chemistry of materials	BS	3	0	3		4.5
4.	19EID131/ 19EEE131	Problem Solving and Programming / Basic Electrical and Electronics Engineering	ES	3	1	3		5.5
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES	0/1	0	3		1.5/2.5
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/National Cadet Corps/National Sports Organization/YOGA	MC	0	0	2		0
Total								**17.5/18.5**

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 programmes. The course imparts concepts of calculus and matrix algebra that are essential in applications in solving engineering problems

Course Objectives:

• To familiarize the students with the theory of matrices and quadratic forms.
• To explain the series expansions using mean value theorems.
• To teach basic concepts of partial derivatives.
• To explain the evaluation of double integrals and its applications.
• To demonstrate the evaluation and applications of triple integrals.

Unit I: Matrices **10 L**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous linear equations, eigenvalues, 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 **6 L**

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

Learning Outcomes:

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

- demonstrate the given function as series of Taylor's and Maclaurin's with remainders (L3).
- illustrate series expansions of functions using mean value theorems (L3).

Unit III: Multivariable Calculus **8 L**

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

Learning Outcomes:

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

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

Unit IV: Multiple Integrals I **8 L**

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

Learning Outcomes:

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

- apply double integrals in cartesian and polar coordinates (L4).
- calculate the areas bounded by a region using double integration techniques (L3).

Unit V: Multiple Integrals II **8 L**

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

Learning Outcomes:

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

- apply multiple integrals in cartesian, cylindrical and spherical geometries (L3).
- evaluate volumes using triple integrals (L4).

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

Course Outcomes:

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

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

GEL131: COMMUNICATIVE ENGLISH

(Common to all)

L	T	P	C
2	0	2	3

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

Course Objectives

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

UNIT I

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 learners will be able to

- Apply the requisite listening skills and comprehend at local and global level. (L4 and L2) (L5)
- Introduce themselves with accurate structure in diverse social and professional contexts. (L3)
- Apply relevant reading strategies for comprehension of any given text(L3)
- Write a paragraph using cohesive devices maintaining coherence (L3)
- Understand the Use of Articles and Prepositions, and apply appropriately for meaningful communication (L3)
- Understand the relevance of various categories in word family and apply them meaningfully in context (L3)

UNIT II

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 learners will be able to

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

UNIT III

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 learners will be able to

- Notice and understand effective listening strategies to identify discourse markers in presentations. (L1, 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 (L3, L4)
- Construct relevant sentences in active and passive voice for meaningful communication (L2, L3)
- Comprehend and apply available vocabulary items relevant to the context (L1, L2, L3)

UNIT IV

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 learners will be able to

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

UNIT V

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 learners 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 (L4, 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. (L2, L3)

Course Outcomes

By the end of the course, the learners 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.
- Write grammatically correct sentences employing appropriate vocabulary suitable to different contexts.
- Comprehend and analyze different academic texts.
- Make notes effectively and handle academic writing tasks such as Paragraph writing and Essay writing.
- Effectively handle formal correspondence like e-mail drafting and letter writing .

Reference Books:

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

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

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

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

5.Kumar S and Lata P, ***Communication Skills***: New Delhi Oxford University Press, 20

19EPH133: APPLIED PHYSICS

(AE, CE and ME)

L	T	P	C
3	0	3	4.5

This course is designed for students of Aerospace, Civil and Mechanical Engineering. It introduces fundamentals of elasticity and thermal properties – the essentials for understanding the behaviour of materials. Mechanics of solids is taught to acquaint them with the behaviour of rigid objects. An introduction to sensors will be useful for all the branches as an application of modern technology

Course Objectives

- To acquaint the basic concepts of sound waves and principles in acoustic design.
- To introduce the concepts of elasticity, strain hardening and failure in materials and impart the relation between stress and strain.
- To impart the phenomenon of heat transfer so as to understand a wide variety of practical engineering problems.
- To demonstrate the use of Newton's laws of motion for understanding the mechanics of a particle.
- To explain the working principle and construction of different types of sensor

Unit I: Mechanics **10 L**

Basic laws of vectors and scalars; Rotational frames; Conservative and non-conservative forces; F = -*grad* V; Central forces; Elliptical, parabolic and hyperbolic orbits; Noninertial frames of reference; Centripetal acceleration; Harmonic oscillator; Damped harmonic motion; Forced oscillations and resonance. Degrees of freedom.

Learning outcomes

After completion of this unit the student will be able to

• explain forces and moments in mechanical systems using scalar and vector techniques (L2).
• interpret the equation of motion of a rigid rotating body (torque on a rigid body) (L3).
• apply the Newton's second law for inertial and non inertial frame of reference (L3).
• summarize harmonic motion in undamped, damped and forced oscillations (L2).

Unit II: Elasticity **8 L**

Concepts of elasticity and plasticity, stress and strain, Hooke's law, different moduli of elasticity, Poisson's ratio, strain energy, stress-strain diagram, elastic behavior of a material, factors affecting elasticity, relation between different moduli of elasticity, determination of elastic moduli.

Learning Outcomes:

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

• explain the basic concepts of elasticity (L2) .
• determine graphically a material's mechanical properties in terms of its one dimensional stress-strain curve (L2).
• derive the generalized Hooke's law by recognizing the basic stress-strain response of isotropic materials (L3).
• define several elastic constants and determine the relationship between them (L1).

Unit III Thermal Properties **10 L**

Transfer of heat energy; Thermal expansion of solids and liquids; Expansion joints -bimetallic strips; Thermal conduction, convection and radiation and their fundamental laws; Heat conductions in solids; Thermal conductivity - Forbe's and Lee's disc method: theory and experiment; Applications (qualitative only): heat exchangers, refrigerators, ovens and solar water heaters.

Learning Outcomes:

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

• explain the process of thermal expansion in solids and liquids (L3).
• distinguish fundamental laws related to conduction, convection and radiation of heat (L1).
• determine the thermal conductivity of a material by Forbes and Lee's disc method (L4).
• summarize the working of heat exchangers, refrigerators, ovens and solar water heaters (L2).

Unit IV: Acoustics **8 L**

Characteristics of sound waves; Weber-Fechner Law; Absorption coefficient, determination of absorption coefficient; Reverberation time; Sabine's formula, derivation of Sabine's formula using growth and decay method; Intensity of sound; Acoustics of buildings, Acoustic requirements of a good auditorium.

Learning Outcomes:

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

• explain the basic concepts in acoustics and describe Weber-Fechner Law (L2).
• determine absorption coefficient and reverberation time (L3).
• derive sabines formulas using growth and Decay method (L4).
• solve problems involving the intensity of a sound wave (L4).
• summarize the principles of acoustics in designing an acoustically good auditorium (L3).

Unit V: Sensors **8 L**

Sensors(qualitative description only); Different types of sensors and applications; Strain and pressure sensors- Piezoelectric, magnetostrictive sensors; Fibre optic methods of pressure sensing; Temperature sensor - bimetallic strip, pyroelectric detectors; Hall-effect sensor; Smoke and fire detectors..

Learning Outcomes:

After completion of this unit the student will be able to

- describe the principle of strain and pressure sensors (L1).
- explain the principle and working of magnetostrictive and piezoelectric sensors (L3).
- illustrate the fibre optic methods of pressure sensing (L3).
- infer the functioning of temperature sensors like bimetallic strip and pyroelectric detectors (L2).
- outline the principle and working of Hall-effect sensor, smoke and fire detectors (L2).

Text books:

1. D.Kleppner and Robert Kolenkow"An Introduction to Mechanics– II" Cambridge University Press,2015.
2. M.N. Avadhanulu & T.V.S. Arun Murthy, S Chand A Textbook of Engineering Physics, Volume-I 2018.
3. Ian R Sinclair, Sensor and Transducers 3/e,Elsevier (Newnes), 2001.

References:

1. M K Varma, "Introduction to Mechanics"-Universities Press, 2015.
2. Prithwiraj Purkait, Budhaditya Biswas and Chiranjib Koley, Chapter 11 *Sensors and Transducers,* Electrical and Electronics Measurements and Instrumentation, 1/e., McGraw Hill Education (India) Private Limited, 2013.

Course Outcomes:

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

- describe the fundamental principles of acoustics with emphasis on physical mechanisms, law and relationships (L1).
- apply the concepts of strain, internal force, stress and equilibrium to deformation of solids (L3).
- explain the fundamental theory for the analysis of heat transfer processess in solids and liquids and to apply basic principles of heat transfer in design of refrigerators and heaters (L4).
- estimate forces and moments in mechanical systems using scalar and vector techniques (L4).
- outline the basic principle and operation of different types of sensors (L2).

Applied Physics Laboratory
(AE, CE and ME)

Learning Outcomes:

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

- find

a. rigidity modulus and Poisson's ratio of a material (L1)
b. thermal conductivity of bad and good conductors (L1)

- apply resonance to

a. estimate the frequency of a tuning fork (L3).
b. examine the relation between frequency and volume of a cavity (L3).
c. an LCR circuit (L3).

• demonstrate elastic limit and stress-strain relationship using Hooke's law (L2).
• evaluate the acceptance angle and determine numerical aperture and bending loss of an optical fiber (L5).
• identify the type of semiconductor i.e., n-type or p-type using Hall effect (L3)
• determine resonant frequency of tuning fork using a sonometer (L5)
• understand damping using oscillating disc in different media (L2).

List of experiments:

1. To determine rigidity modulus of material of a wire-dynamic method (torsional pendulum).
2. To determine the thermal conductivity of a bad conductor by Lee's disc method.
3. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle.
4. To determine the Hall coefficient using Hall effect experiment.
5. To investigate Hooke's Law.
6. To determine Poisson's Ratio of Rubber experiment.
7. To determine thermal conductivity of good conductors (Forbe's Apparatus).
8. To determine the frequency of electrically maintained tuning fork by Melde's method.
9. To verify the relation between the volume of the air in the resonator and the frequency of the note.
10. To determine coefficient of damping and quality factor for damped simple harmonic motion of a simple pendulum.
11. To study resonance in a LCR circuit.
12. To determine resonance frequency using a sonometer.
13. To study damping of an oscillating disc in air and water.

References:

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

19ECY133: CHEMISTRY OF MATERIALS
(COMMON SYLLABUS for AERO, CIVIL and MECH)

L T P C
3 0 3 4.5

The course enables the students to gain knowledge on application of basic principles of chemistry to address issues relevant to engineering. This includes various aspects of water, energy sources and applications, engineering materials and polymers, corrosion of materials, applications of nano and smart materials.

COURSE OBJECTIVES

- To acquaint the students with soft and hard water types and softening methods.
- To introduce the basic concepts to develop electrochemical cells, photovoltaic cells.
- To familiarize the preparation of engineering materials, their properties and applications.
- To impart knowledge on corrosion and its significance.

- To expose to nano and smart materials

Unit- I **8L**

WATER TECHNOLOGY

Introduction –Hard and Soft water, Estimation of hardness by EDTA Method - Boiler troubles **-** scale and sludge-priming and foaming, specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, Industrial water treatment – zeolite and ion-exchange processes-desalination of brackish water, reverse osmosis (RO) and electro dialysis.

Learning outcomes:

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

- Listthe differences between temporary and permanent hardness of water. (L1)
- Explainthe principles of reverse osmosis and electrodialysis. (L2)
- Comparethequality ofdrinking water with BIS and WHO standards. (L2)
- Illustrateproblems associated with hard water. (L2)
- Demonstratethe industrial water treatment processes. (**L2)**

Unit- II **9L**

ENERGY SOURCES AND APPLICATIONS

Electrode potential, determination of single electrode potential –Nernst's equation,reference electrodes,Weston Cd Cell, hydrogen and calomel electrodes – electrochemical series and its applications – primary cell, dry or Leclanche cell – secondary cell, lead acid storage cell, nickel-cadmium cell – lithium batteries (Lithium-MnO_2) – fuel cell, hydrogen-oxygen fuel cell,Solar energy, photovoltaic cell and applications.

Learning outcomes:

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

- define electrode potential. (L-1)
- explain Nernst's equation. (L-2)
- illustrate difference between primary and secondary cells. (L-2)
- summarize the applications of solar energy. (L-2)
- construct different cells. (**L-3)**

Unit- III **8L**

CORROSION ENGINEERING

Corrosion: Definition – theories of corrosion, dry corrosion and electro chemical corrosion – factors affecting corrosion, nature of the metal and nature of the environment.

Corrosion controlling methods: Sacrificial and Impressed current cathodic protection, Metallic coatings, anodic coatings, cathodic coating, galvanizing and tinning, anodic inhibitors and cathodic inhibitors –organic coatings, paints and varnishes (constituents and their functions).

Learning outcomes:

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

- explain theories of corrosion. (L-2)
- classify different corrosion methods. (L-2)
- summarize variousfactors affecting corrosion. (L-2)
- identify different organic coatings. (L-3)

- apply the principles of corrosion control. **(L-3)**

UNIT- IV **9L**

ENGIEERING MATERIALS AND POLYMERS

Steel – Types of Steel, chemical composition – applications of alloy steels

Cement: Portland cement, constituents, Manufacture of Portland Cement, chemistry of setting and hardening of cement (hydration, hydrolysis, equations).

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

Learning outcomes:

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

- classify the types of steels. (L2)
- illustrate the chemical reactions involved in the manufacturing of cement. (L2)
- identify preparation and properties of inorganic polymers. (L3)
- distinguish between thermoplastic and thermo setting resins. (**L4)**

Unit- V

NANO AND SMART MATERIALS **8L**

Nano Materials: Introduction to Nano materials, chemical synthesis of nanomaterials: Sol-gel method, Reverse micellar method, Characterization of nanoparticles by BET method, characterization of nanomateirals by TEM(includes basic principle of TEM), Applications of nanomaterials in waste water treatment, lubricants and engines.

Smart Materials: Introduction – Types of smart materials-self healing materials
Shape memory alloys and Uses of smart materials.

Learning outcomes:

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

- **classify** nanomaterials. (**L2)**
- **explain** the synthesis andcharacterization methods of nano materials. (**L2)**
- **build**s mart materials and identify types of smart materials. (**L3)**
- **compare** the principles of BET and TEM. **(L4)**

Text Books:

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, (2014).
2. B.K. Sharma, Engineering Chemistry, Krishna Prakasham, (2014).

References:

1. Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013).
3. S.S. Dara, A Textbook of Engineering Chemistry, S.Chand & Co, (2010)
4. V.Raghavan, A Material Science and Engineering, Prentice-Hall India Ltd, (2004).
5. N.Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014).

COURSE OUTCOMES

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

- **List** the difference between temporary and permanent hardness of water. (**L1)**
- **Illustrate** the principles and applications of solar and wind energy. (**L2)**
- **Identify**different organic coatings. (**L3)**
- **Analyze** the importance of nano and smart materials**. (L4)**
- **Distinguish** the principles of BET and TEM.**(L4)**

ENGINEERING CHEMISTRY LABORATORY
(COMMON SYLLABUS for AERO, CIVIL and MECH)

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

COURSE OBJECTIVES

- To introduce the skills of basic concepts in Engineering Chemistry.
- To train the handling of different instruments.
- To familiarize the digital and instrumental methods of analysis.
- To expose the practicals to the theoretical aspects.

LIST OF EXPERIMENTS

1. Determination of sulphuric acid in lead-acid storage cell.
2. Estimation of iron as ferrous iron in an ore sample.
3. Estimation of calcium in portland cement.
4. Determination of chromium (VI) in potassium dichromate
5. Determination of copper in a copper ore.
6. Determination of viscosity of a liquid.
7. Determination of surface tension of a liquid.
8. Determination of Mohr's salt by potentiometric method.
9. Determination of strength of an acid by pH metric method.
10. Determination of Hardness of a ground water sample.
11. Estimation of active chlorine content in Bleaching powder.
12. Preparation of TiO_2/ZnO nano particles
13. Thin layer chromatography.
14. Preparation of Phenol-formaldehyde resin

TEXT BOOKS

1. Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).

2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).

COURSE OUTCOMES

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

- **Illustrate**different ores (Fe, Cr &Cu) and their usage. (**L2)**
- **Compare**the viscosities of oils. (**L2)**
- **experiment with** the physical parameters of organic compounds. (**L3)**
- **apply** the TLC technique for the identification of organic compounds.**(L3)**
- **analyze** the quality of ground water sample. (**L4)**

19EID131: PROBLEM SOLVING AND PROGRAMMING

L	T	P	C
3	1	3	5.5

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

Course Objectives:

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

Unit I: Computational Thinking and Visual Programming Concepts

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

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 38

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

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

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 39

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)

Laboratory Experiments

1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, Pentagon.
2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.
3. Design a Memory Game in Scratch which allows the user to identify positions of similar objects in a 3 x 3 matrix.
4. Construct flowcharts to
a. calculate the maximum, minimum and average of N numbers
b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
5. Construct flowcharts with separate procedures to
a. calculate simple and compound interest for various parameters specified by the user
b. calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
6. Construct flowcharts with procedures to
a. generate first N numbers in the Fibonacci series
b. generate N Prime numbers
7. Design a flowchart to perform Linear search on list of N unsorted numbers (Iterative and recursive)

8. Design a flowchart to perform Binary search on list of N sorted numbers (Iterative and recursive)

9. Design a flowchart to determine the number of characters and lines in a text file specified by the user
10. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
11. Design a Python script to determine if a given string is a Palindrome using recursion
12. Design a Python script to sort numbers specified in a text file using lists.
13. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format (0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
14. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
15. Design a Python Script to determine the time difference between two given times in HH:MM: SS format. (0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
16. Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e)* of a given number using infinite series of the function.
17. Design a Python Script to convert a given number to words
18. Design a Python Script to convert a given number to roman number.
19. Design a Python Script to generate the frequency count of words in a text file.
20. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
21. Design a Python Script to implement Gaussian Elimination method.
22. Design a Python script to generate statistical reports (Minimum, Maximum, Count, Average, Sum etc) on public datasets.
23. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.

Text Book(s):

1. Weingart, Dr. Troy, Brown, Dr. Wayne, An introduction to programming and algorithmic reasoning using raptor.
2. T R Padmanabhan, Programming with python, Springer.
3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press.
4. Wes McKinney , Python for Data Analysis, O.Reilly.

Course outcomes:

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

- create interactive visual programs using Scratch. (L3)
- 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

L	T	P	C
3	**1**	**3**	**5.5**

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

Course Objectives

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

Unit I **10L**

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

Learning Outcomes

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

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

Unit II **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

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

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

Unit III **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

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

- describe the constructional details of transformers **(L1)**
- demonstrate voltage regulation of transformer **(L3)**
- discuss about open and short- circuit tests of transformer**(L2)**
- explain the working principle of three phase induction motor**(L5)**
- describe torque and torque slip characteristics **(L1)**
- estimate losses and efficiency of three Phase Induction Motors**(L2)**

Unit IV **12L**

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

Learning Outcomes

Upon successful completion of the course, 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**(L5)**
- describe the construction and operation of *n*-channel and *p*-channel MOSFETs **(L1)**
- explain the use of MOSFET as an amplifier and bidirectional switch **(L5)**

Unit V **10L**

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

Learning Outcomes

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

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

List of Laboratory Experiments

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 Books:

1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited,2017.
2. B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1stedition, S.Chand Publishing,New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.

References:

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

Course Outcomes

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

- predict and analyze the behavior of an electrical circuit **(L3)**
- analyze the performance quantities such as losses, efficiency and identify applications of DC machines**(L4)**
- explain the use of transformers in transmission and distribution of electric power and other applications **(L2)**
- demonistratethe operation and applications of various electronic devices **(L2)**
- construct Inverting and Noninverting configurations of Op-Amp **(L5)**

19EME121: WORKSHOP

(Common to all branches)

L T P C

0 0 3 1.5

The objective of this course is to exposure students common tools in engineering. The 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 braze.
- 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)
- preform soldering and brazing operations. (L3)
- select different types of electric circuits in practical applications (L3)

19EME131: ENGINEERING GRAPHICS

L	T	P	C
1	0	3	2.5

The 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 softwares.
- Impart graphical representation of simple components.

Manual Drawing: **7 L**

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

a) Conic sections - general method only,

b) Cycloid, epicycloids and hypocycloid

c) Involutes **2L**

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

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

Sections of solids: Section 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: **6 L**

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, figures, 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. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-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 completing the course, 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)

19EMC181B – NATIONAL CADET CORPS

L T P C
0 0 2 0

Unit I **5 L**

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 L**

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 **5L**

Personality development: Introduction to personality development, factors influencing / shaping personality – physical , social, psychological and philosophical self awareness – know yourself / insight, change your mindset, interpersonal relationship and communication communication skills – group discussion / lecturettes, leadership traits, types of leadership, attitude – assertiveness and negotiation, time management, personality development, effects of leadership with historical examples, stress management skills, interview skills, conflict motives – resolution, importance of group – team work, influencing skills, body language, sociability: social skills, values / code of ethics

Disaster Management: Civil defence organization and its duties – ndma, types of emergencies / natural disasters, fire service and fire fighting, traffic control during disaster under police supervision, essential services and their maintenance, assistance during natural / other calamities / floods / cyclone / earth quake / accident, setting up of relief camp during disaster management, collection and distribution of aid material

Unit IV **5 L**

Social awareness and community development: Basics of social service, weaker sections of our society and their needs, social/ rural development projects – menrega , sgsy , nsapetc, 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 harassmentact 2012.

Unit V: **5 L**

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

Text Books

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.

19EMC181A - NATIONAL SERVICE SCHEME (NSS)

L T P C
0 0 2 0

Preamble: *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 theactivities of National Service Scheme, concept of social Service and principles of health, hygiene and sanitation.*

Unit I **2L**

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 **2L**

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

Unit III **2L**

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 **4L**

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

Unit V **10L**

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

Text Books:

1) National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi

2) NSS Diaries
3) Sanjay Bhattachaya, Social Work Interventions and Management-Deep and Deep Publications, New Delhi.

19EMC181C: National Sports Organization (Common to all)

L	T	P	C
0	**0**	**2**	**0**

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

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

Text Books:

1. Myles Schrag, The Sport Rules Book, 4/e, Human Kinetics, 2018
2. DhamaPrakashJyoti, 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 allround 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:

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

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 (L2).

Semester II

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19EMA102	Engineering Mathematics II (ODE,PDE and Multivariable Calculus)	BS	3	0	0		3
2.	19ECY133/ 19EPH133	Chemistry of materials / Applied 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
4.	19EID132/ 19EID134	Design Thinking / AI Tools	ES	2	0	2		3
5	19EME131/ 19EME121	Engineering Graphics / Workshop	ES	1	0	3		2.5/1.5
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	National Service Scheme/National Cadet Corps/National Sports Organization/YOGA	MC	0	0	2		0
7	VDC111	Venture Discovery	PW	0	0	4		2
8	19EHS122	Comprehensive Skill Development I	HS	0	0	0	6	1
Total								**21.5/20.5**

19EMA102: ENGINEERING MATHEMATICS-II

ODE, PDE AND MULTIVARIABLE CALCULUS

(Common to CIVIL, ECE, EEE & MECH)

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 student 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 8L

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

Learning Outcomes:

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

- classify the solutions of linear differential equations (L3)

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

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

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

Learning Outcomes:

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

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

Unit III: Partial Differential Equations 8 L

First order partial differential equations, solutions of first order linear PDEs, Charpit’s method, solutions to homogenous and non-homogenous linear partial differential equations.

Learning Outcomes:

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

- solve the PDE by using different techniques (L3)
- identify the basic properties of PDEs (L3)

Unit IV: Multivariable Calculus (Vector Differentiation) 8L

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:

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

- apply operator del to scalar and vector point functions (L3)
- illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

Unit V: Multivariable Calculus (Vector Integration) 10L

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

Learning Outcomes:

At the end 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 Divergence theorem in evaluation of line, surface and volume integrals (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. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
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:

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

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

19EID132: DESIGN THINKING

L	T	P	C
2	0	2	3

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

Course Objectives:

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

Unit 1

After completing this unit, the student will be able to

- identify characteristics of successful product development.
- identify opportunities for new product development.

- plan for new product development.

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

Unit 2

After completing this unit, the student will be able to

- explain the principles of Design Thinking.
- identify the benefits of Design Thinking.
- use innovations in Design Thinking.

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

Unit 3

After completing this unit, the student will be able to

- explain the techniques in idea generation.
- select ideas from ideation methods.
- identify the methods used in idea generation in some case studies.

Idea generation: Introduction, techniques, Conventional methods, Intuitive methods, Brainstorming,

Gallery method, Delphi method, Synectics etc

Select ideas from ideation methods, case studies.

Unit 4

After completing this unit, the student will be able to

- use Design Thinking in business process model.
- apply Design Thinking for Agile software development.
- use TILES toolkit.

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

Unit 5

After completing this unit, the student will be able to

- use principles of service design.
- explain the benefits of service design.
- apply principles of technology for service design.

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.

After completing this course, the student will be able to

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

Books:

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.com/it-executives-guide-to-design-thinking:e-book.
5. Marc stickdorn and Jacob Schneider, This is Service Design Thinking, Wiely, 2011

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

L T P C
2 023

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)

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 solutions 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.

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

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

Course outline and indicative content

Unit I (6 sessions)

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

Unit II (6 sessions)

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

Unit III (6 sessions)

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

Unit IV (6 sessions)

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

Unit V (6 sessions)

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

Assessment methods

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

Transferrable and Employability Skills

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

Learning and teaching activities

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

Teaching and learning resources

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

***Prescribed Modules*:**
Access to NU-IDEA online modules will be provided.

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

Personal Discovery Through Entrereneurship, 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

19EHS122: Comprehensive Skill Development I

L T P A C

0 0 0 6 1

Course Objectives:

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

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.

<u>Scheme of Evaluation</u>

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/

Semester III

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19EMA201	Engineering Mathematics III (PDE, Complex Variables and Transform Techniques)	BS	3	0	0		3
2.	19EID134/19EID132	AI Tools /Design Thinking	ES	2	0	2		3
4.	19EME201	Engineering Mechanics	PC	3	0	0		3
5.	19ECE233	Fluid Mechanics	PC	3	0	3		4.5
6.	19ECE235	Surveying	PC	3	0	3		4.5
7.	19ECE237	Civil Engineering Workshop	PC	0	0	3		1.5
8.	19EMC281 / 19EMC282	Constitution of India / Environmental Sciences	MC	3	0	0		0
9.	19EHS221	Comprehensive Skill Development II	HS	0	0	0	6	1
Total								**20.5**

19EMA201: ENGINEERING MATHEMATICS-III

APPLICATIONSOFPDE, COMPLEX VARIABLES AND TRANSFORM TECHNIQUES

(Common to CIVIL & MECH)

L	T	P	C
3	0	0	3

This course is developed on concepts in applications of partial differential equations and transform techniques to get understand the applications in engineering.

Course Objectives:

- To explain the concept of complex functions and their applications.
- To teach the concept of Laplace and inverse Laplace transforms.
- To demonstrate to express a periodic function by Fourier series and a non-periodic function by Fourier transform.
- To familiarize the students with the techniques of partial differential equations.

Unit I: Complex Variables **10 L**

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

Learning Outcomes

At the end of this unit, the student will be 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)
- evaluate the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues (L5)
- 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:

At the end of this unit, the student will be 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:

At the end of this unit, the student will be 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:

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

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

Unit V: Applications of Partial Differential Equations **9 L**

Classification of second order partial differential equations, method of separation of variables, solutions of one dimensional wave equation, one dimensional heat equation and two dimensional Laplace's equation in Cartesian coordinates.

Learning Outcomes:

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

- classify the nature of the partial differential equations (L4)
- solve the boundary value problems (related to heat diffusion, one dimensional wave equation) (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 apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- solve the boundary value problems pertaining to partial order differential equations (L3)

19EME201: ENGINEERING MECHANICS

L	T	P	C
3	0	0	3

This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. Concepts will be applied in this course from previous courses of basic mathematics and physics This course addresses the modeling and analysis of static equilibrium problems with an emphasis on real world engineering applications and problem solving..This course forms the backbone of mechanical engineering design and acts as a prerequisite to mechanics of solids, design of machines and kinematics and dynamics of machinery.

Course Objectives

- Explain the effect of force and moment and equilibrium in engineering applications.

- Compute geometric properties such as centroid and moment of inertia of various plane sections.
- Explain kinematics of particles and rigid bodies.
- Analyze the rigid bodies under dynamic conditions.
- Exposethe concepts of work-energy, conservation of energy and momentum to rigid bodies.

UNIT I **10L**

Introduction to Engineering Mechanics: Units, Significance of Engineering Mechanics, Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and non-concurrent, coplanar forces, resultant of coplanar force systems, couple, moment of a force, Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

Learning Outcomes:

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

recognize the significance of Engineering Mechanics in design. [**L-1**]

calculate the moments and resultant forces. [**L-3**]

draw free body diagrams. [**L-3**]

utilize the concept of equilibrium. [**L-3**]

UNIT II **8 L**

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

Learning Outcomes:

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

- comprehend the concept of friction. [**L-2**]
- identify different types of trusses. [**L-2**]
- analyze the plane trusses by method of joints and the method of sections. [**L-4**]

UNIT III **8 L**

Properties of Surfaces: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite areas.

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, radius of gyration.

Learning Outcomes:

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

- identify the centre of gravity of plane figures. [**L-2**]

- calculate the centre of gravity of composite plane shapes. [**L-3**]
- understand the concepts of moment of inertia and radius of gyration. [**L-2**]
- determine moment of inertia for composite plane shapes. [**L-3**]

UNIT IV **8 L**

Kinematics: Equations of motion for rigid bodies under constant and variable acceleration, rectilinear and curvilinear motion, projectile motion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis.

Learning Outcomes:

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

- develop equations of motion for particles and rigid bodies in motion. [**L-3**]
- find velocity and acceleration in rectilinear and curvilinear motions. [**L-4**]
- trace the path of projectile. [**L-3**]

UNIT V **8 L**

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear momentum, principle of momentum and impulse, impact - types of impact.

Learning Outcomes:

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

- apply Newton's 2^{nd} law and D'Alembert's principle in rectilinear translation. [**L-3**]
- utilize the principle of work and energy in dynamic systems. [**L-3**]
- make use of principle of momentum and impulse on dynamic bodies. [**L-4**]

Text Book(s):

1. N.H. Dubey, Engineering Mechanics: Statics and Dynamics, Tata McGraw Hill, 2014.

2. S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.

References:

1. Basudeb Bhattacharya, Engineering Mechanics, 2/e, Oxford University Press (India), 2015.

2. Irving Shames, G.K.M. Rao, Engineering Mechanics: Statics and Dynam-ics, 4/e, Pearson, 2009.

3. K.L. Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.

4. S.S. Bhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

Course Outcomes:

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

- obtain a basic understanding of the laws of solid mechanics. [**L-1**]
- comprehend the significance of the concepts of solid mechanics in engineering systems. [**L-2**]
- calculate the physical properties of rigid bodies required for the analysis of engineering systems. [**L-3**]
- apply the principles of statics and dynamics to solve engineering problems. [**L-3**]
- analyze various static and dynamic engineering systems and understand the underlying mechanics and drawbacks/problems. [**L-4**]

19ECE233: FLUID MECHANICS

L	T	P	C
3	0	3	4.5

This basic course helps the learner to understand the behaviour of fluids, properties of fluids, measurement of pressure, velocity and discharge of flowing liquids. This course introduces the knowledge of principles of fluid statics, kinematics and fluid dynamics and to solve various problems related to hydrostatic forces on plane surfaces, hydrodynamic force on pipe bend. The learner will familiarize with the concepts to compute losses and discharge in pipe flow. This course introduces the fundamental knowledge of hydraulic machines like pumps and turbines.

Course Objectives:

- to explain properties of fluids and pressure measurement using manometers.
- to describe the hydrostatic forces on different plane surfaces.
- to teach classification of fluid flow, continuity equation, velocity potential, stream function, flow net analysis.
- to analyze fluid dynamics using Bernoulli's equation for measurement of flow using different flow measuring devices
- to impart concepts of flow through pipes for computation of losses and discharge in pipe flow.
- to teach the fundamentals of hydraulic machines like pumps and turbines.

Unit-I: **8 L**

Introduction:

Dimensions and Units– Physical properties of fluids: Mass Density,Specific Weight, Specific gravity, Specific Volume, Dynamic and Kinematic Viscosity, Surface Tension, Capillarity, Vapour Pressure, Bulk Modulus – Ideal and Real Fluids.

Pressure at a point, Pascal's law – Atmospheric, Gauge and Vacuum pressure – Measurement of pressure – Pressure gauges, Simple and Differential Manometers.

Learning outcomes:

After completion of Unit-I, students will be able to

- explain the properties of fluids (L-1).
- find the surface tension force and shear stress of liquids (L-2)
- illustrate the measurement of pressure using manometers (L-2).
- calculate the differential pressure using manometers (L-3).

Unit-II: **9 L**

Fluid Statics: Hydrostatic forces on submerged plane surfaces, center of pressure, analysis of lock gates, buoyancy, metacentric height.

Fluid Kinematics: Description of fluid flow, Stream line, path line, streak lines and stream tubes. Classification of fluid flow: Steady and Unsteady, Uniform and Non-uniform, Laminar and Turbulent, Rotational and Irrotational flows – Equation of continuity – Definition and properties of stream function and velocity potential function, Rotation components, Flow-net.

Learning outcomes:

After completion of Unit-II, students will be able to

- classify the flow characteristics (L-2).
- explain the principles of hydrostatics, kinematics (L-2).
- solve the problems related to fluid statics and kinematics (L-3).
- distinguish the types of flows (L-4).

Unit-III: **9 L**

Fluid Dynamics: Types of forces – Bernoulli's equations for flow along a stream line and for 2-D flow, Momentum equation and its application – Forces on pipe bend.

Measurement of Flow using Venturimeter and Orificemeter, Orifice and Mouthpiece; Flow over Rectangular, Triangular Notches, Broad crested weirs.

Learning outcomes:

After completion of Unit-III, students will be able to

- explain the principles of fluid dynamics (L-2).
- compute the forces on a pipe bend (L-3).
- calculate the rate of flow using various flow measuring devices (L-3).

Unit-IV: **8 L**

Closed Conduit Flow: Reynolds experiment – Laws of Fluid friction – Darcy-Weisbach's equation, variation of friction factor with Reynolds number – Moody Chart, total energy line and hydraulic gradient line, minor losses – pipes in series – pipes in parallel - Siphon pipe –Power transmission through pipes, water hammer.

Learning outcomes:

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

- explain HGL, TEL, Laws of Fluid Friction, Water Hammer (L-1).
- describe Reynolds experiment (L-2).
- compute losses and discharge in pipe flow (L-3).
- apply Darcy-Weisbach equation (L-3).

Unit-V: **8 L**

Pumps: (Theory only) Centrifugal Pumps – Single and Multistage Pumps – Working Principles – Priming – Head, Power and Efficiency – Cavitation in Pumps - Specific Speed – Performance characteristics curves of Centrifugal Pump.

Turbines: (Theory only) Classification of Turbines – Impulse Turbines - Reaction Turbines – Various components and their functions – Draft Tubes – Radial, axial and mixed flow turbines – Impulse Turbines – Unit quantities, Specific Speed and Performance characteristics of Turbines.

Learning outcomes:

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

- explain the working operation of Centrifugal Pump (L-2).
- describe the performance characteristics of Centrifugal Pump (L-2).
- classify the Turbines (L-2).
- explain the working operation of Turbines (L-2).
- describe the performance characteristics of Turbines (L-2)

Course Outcomes:
At the end of the course, student would be able to

- Understand the principles of various properties of fluids (L-2).
- Compute pressure using manometers, forces on submerged bodies using hydrostatic law (L-3).
- Determine the possibility of flow and its characteristics using continuity equation; velocity potential and stream function (L-3).
- Compute flow velocity using Pitot tube and discharge using Venturimeter, Orificemeter, orifice, mouthpiece, notches and weirs (L-3)
- Apply Darcy-Weisbach equation to determine losses in pipes, power transmission through pipes (L-3).
- Understand the working operation of Pumps and Turbines (L-2).
- Plot the performance characteristics of Pumps and Turbines (L-2).

Fluid Mechanics & Hydraulic Machines Laboratory

Objectives

1. To explain the flow measurement in pipes and open channels.
2. To demonstrate the friction loss in pipe flow.
3. To demonstrate the Bernoulli's equation.
4. To apply the impulse-momentum equation to study impact of jets.
5. To compute the efficiencies and study the performance characteristics of turbines, pumps.

List of Experiments

1. To determine the coefficient of discharge of Venturimeter and Orificemeter.
   (IS 14615 (Part 1) : 1999 (2004), IS0 5167-1 : 1991 – Measurement of Fluid Flow by Means of Pressure Differential Devices, Part 1: Orifice Plates, Nozzles and Venturi Tubes Inserted in Circular cross-section conduits running full)

2. To determine the coefficient of discharge of mouthpiece and small orifice by constant head and falling head methods.
   (IS 14615 (Part 1) : 1999 (2004), IS0 5167-1 : 1991 – Measurement of Fluid Flow by Means of Pressure Differential Devices, Part 1: Orifice Plates, Nozzles and Venturi Tubes Inserted in Circular cross-section conduits running full)

3. To determine the coefficient of discharge of V-notch (triangular notch) & rectangular notch.
   (IS 9108 : 1979 (2003) – Liquid Flow Measurement in Open Channels using Thin Plate Weirs)
   (IS 13083 : 1991 (2003), IS0 4377 : 1990 - Liquid Flow Measurement in Open Channels - Flat-V Weirs)

4. To compute the friction factor using Darcy-Weisbach Equation for pipes of different diameters.
   (IS 2595 (Part I) : 1965 (Reaffirmed 2003) – Head loss in Straight Pipes due to frictional resistance)

5. To verify the Bernoulli's equation.

6. To find the coefficient of impact of a jet impinged on to a fixed flat circular vane & hemispherical vane.

7. To study the performance characteristics of Pelton wheel turbine.
   (IS 12800 (Part 3) : 1991 (2003) - Guidelines for Selection of Hydraulic Turbine, Preliminary Dimensioning and Layout of Surface Hydroelectric Powerhouses, Part 3 - Small, Mini And Micro Hydroelectric Power Houses)

8. To study the performance characteristics of the Francis Turbine.
   (IS 12800 (Part 3) : 1991 (2003) - Guidelines for Selection of Hydraulic Turbine, Preliminary Dimensioning and Layout of Surface Hydroelectric Powerhouses, Part 3 - Small, Mini And Micro Hydroelectric Power Houses)

9. To study the working principles of a centrifugal pump.
   (IS 9137 : 1978 (1993) – Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Pumps - Class C)
   ISO 9905 : 1994 - Technical specifications for centrifugal pumps — Class I
   https://www.iso.org/obp/ui/#iso:std:iso:9905:ed-1:v1:en

10. To study the working principles of a reciprocating pump.

Other codes: IS 9118 : 1979 (2001) – Method for Measurement of Pressure by means of Manometers

Learning Outcomes

The student will be able to:

- Calculate the coefficient of discharges of flow measuring devices (L-3).
- Calculate the friction factor (L-3).
- Compute the total head in a pipe flow by using Bernoulli's equation (L-3).
- Calculate the coefficient of impact of a jet (L-3).
- Calculate the efficiencies and draw the performance characteristic curves of turbines & pumps (L-3).
- Compute the flow through measuring devices (L-3).

Text Books

1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, Standard Book House, 2017.
2. A.K. Jain, Fluid Mechanics, Khanna publishers, 2010.

Laboratory Manuals

1. Laboratory Manuals available in FM Laboratory.
2. Sarbjit Singh, Experiments in Fluid Mechanics, Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2012.
3. V.P. Gupta J. Chadra and K.S. Gupta, Laboratory Manual of Fluid Mechanics and Machines, CBS Publishers and Distributors, New Delhi, 2006.

Reference Books

1. L. Victor, Streeter and E. Benjamin Wylie, Fluid Mechanics, Tata McGraw Hill, 1985.
2. M. Franck White, Fluid Mechanics, Tata McGraw Hill, 2017.
3. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2001.
4. K.R. Arora, Laboratory Experiments in Fluid Mechanics, 2003.
5. Fluid Mechanics virtual labs. http://eerc03-iiith.vlabs.ac.in/
6. https://vspgitcivil.gitam.edu/Infrastructure

Fluid Mechanics NPTEL Course:

https://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm
https://nptel.ac.in/courses/105105110/

19ECE235: SURVEYING

L	T	P	C
3	0	3	4.5

Surveying is the art of taking measurements which will determine the relative positions of various points on the surface of the earth. It may be represented on a plan to a convenient and suitable scale. The various natural and artificial features may be shown in their correct horizontal and vertical positions. The data collected from a survey is used in the preparation of plans, maps, profiles, charts and diagrams. In addition, process of surveying may be used for the delineation of property boundaries, computation of areas and volumes also to set out the proposed work on the ground.

Course Objectives:

1. impart knowledge on basics of surveying
2. provide exposure to different techniques of surveying and associated equipment
3. explain about tachometry, geodetic surveying, satellite surveying
4. familiarize working principles of survey instruments and types of errors encountered in field and calculations
5. demonstrate modern advanced surveying techniques involved such as remote sensing, total station, GPS, Photogrammetry etc

Unit I **8L**

Introduction, Chain and Compass Surveying: Surveying objectives, plane surveying principles and classification, linear measurements, instruments for surveying, preparation of map and plan, measurement of distance, chain surveying principles, offsets, chain surveying instruments, measurement of directions and angles, problems on obstacles of chain surveying, types of compass, meridians and bearings, local attraction, magnetic declination, traversing with a chain and compass, plotting of traverse, adjustment of closing error, problems on chain surveying.

Learning Outcomes:

After the completion of Unit, students will be able to

- **define** the objectives and classification of surveying [L1]
- **list** various surveying equipment[L1]
- **explain** principles involved in chain surveying[L2]
- **develop**knowledge on concepts of compass surveying, types and measurements[L3]

- **solve** problems related to chain and compass surveying[L3]

Unit II **8L**

Plane table Surveying, Levelling and Contouring: Principle and instruments used in plane table surveying, working operations, methods of plane table surveying, instruments for leveling, principle and classification of leveling, bench marks, readings and booking of levels, height (level) computations, field work, longitudinal and cross-sectional levelling, problems on levelling, plotting the profile, contours, characteristics of contours, contours of natural features, methods of contouring, interpolation, contour gradient, contour maps, problems on contouring.

Learning Outcomes:

After the completion of Unit, students will be able to

- **explain** the principles, working operations and methods related to plane table surveying[L2]
- **develop** knowledge on concepts and terms related to levelling [L3]
- **solve**problems related to levelling (level calculations)[L3]
- **list**different types of levelling[L1]
- **demonstrate**knowledge on contouring, process and related problems[L2]

Unit III **9L**

Theodolite Survey and Traversing, Tacheometric Surveying: Theodolite component parts, classification, theodolite observations, principle of theodolite survey and traversing, field work, traverse computations, practical problems, principle of tacheometry, methods of tacheometry, tacheometric tables, reduction diagram, tacheometry as applied to subtense measurement, field work for tacheometric surveying, errors.

Learning Outcomes:

After the completion of Unit, students will be able to

- **find** the different components of theodolite along with their functions[L1]
- **apply** knowledge of theodolite in taking observations[L3]
- **explain**principles of theodolite survey and traversing[L2]
- **develop** understanding on principles and methods of tacheometry[L3]
- **demonstrate** knowledge of tacheometric principles in field work and measurements[L2]

Unit IV **9L**

Curve Setting: Types of curves, elements of a curve, setting out a simple curve, setting out a compound curve, checks on field work, reverse curve, transition curves, super elevation, deflection angles, transition curves, characteristics of transition curves, types of vertical curves, setting out vertical curves, Construction Surveys: setting out of buildings, computation of areas, earthwork measurements: LS&CS, computation of volumes.

Learning Outcomes:

After the completion of Unit, students will be able to

- **list** different types of curves along with their elements[L1]
- **demonstrate** the process of setting out curves in the field [L2]
- **identify**difference betweensimple, compound and transition curves[L3]
- **infer** knowledge on types of vertical curves and the methods of setting of vertical curves [L2]
- **solve**forquantities of earth work (both areas and volumes) in construction[L3]

Unit V **8L**

Trigonometrical Surveying, Triangulation and Total Station: Base of the object accessible, base of an inclined object accessible, reduced level of the elevated points with inaccessible bases, instrument axes at different levels, principle of triangulation, purpose and classification of triangulation surveys, layout of triangulation, field work, triangulation stations, triangulation computations, EDM instruments, total station, global positioning system

Learning Outcomes:

After the completion of Unit, students will be able to

- **identify** different cases in trigonometrical surveying[L3]
- **develop**understanding of principle of triangulation and relative terminology[L3]
- **solve** problems in triangulation[L3]
- **demonstrate** skills of distances, angles using total station[L2]
- **develop**knowledge of global positioning system[L3]

Course Outcomes:

The student will be able to

1) Summarize about basics involved in different types of surveying like tape, compass, levelling, theodolite and tacheometer[L2]
2) demonstrate skills in measuring of distances, angles, levelling and curve setting[L2]
3) develop skill to carry out tachometry, geodetic surveying wherever situation demands.[L3]
4) select appropriate method of surveying based on the needs [L3]
5) inspect the accuracy of the recorded reading in surveying output [L4]

Text Book(s)

1. B.C. Punmia, A.K.Jain, Arun Jain, Surveying I and II, Laxmi Publications, 2005.
2. R. Subramanian, Surveying and Levellin, 2/e, Oxford University Press, 2014.
3. D.G Charles, R.W. Paul, Elementary Surveying, 14/e, Prentice Hall, 2014

References:

1. S.K. Roy, Fundamentals of Surveying, Prentice Hall of India, 2011.
2. T.P. Kanetkar, (2012), Surveying and Levelling, Part I and II, New Central Book Agency2012.

SURVEYING LABORATORY

Course Objectives:

1) impart the basics of linear and angular measurements in field using surveying equipment
2) demonstrate accurate measurements, field booking, plotting and adjustment of errors
3) familiarize students in levelling techniques and contour map development
4) explain the concepts of theodolite surveying and traversing
5) impart knowledge in principles of tacheometry

List of Experiments:

1) Survey of an area by chain survey (closed traverse) and plotting
2) Compass traversing

3) Radiation method, intersection methods by plane table survey
4) Traversing by plane table survey
5) Fly leveling (differential leveling)
6) Longitudinal and cross sectioning
7) Grid contouring and indirect contouring
8) Theodolite survey
9) Trigonometric leveling to determine heights/elevations
10) Tacheometry
11) Setting of curves
12) Demonstration of auto level and total station

Course Outcomes:

the student will be able to
1) carry out the experiments on linear and angular measurements.
2) adjust the errors and tabulate the measurements in the field book
3) acquire knowledge on concepts of levelling and contouring
4) apply the concepts of theodolite surveying and traversing.
5) Implement principles of tacheometry in the field

19ECE237: CIVIL ENGINEERINGWORKSHOP

L T P C

0 0 3 1.5

The course aims at enhancing the application skills of the civil engineering students. It is very important for a budding civil engineer to understand the basic civil engineering works by means of practicing various trades of construction. In order to efficiently carry out the tasks in the workshop, the basic theory related to the trades like masonry, plumbing etc. is taught first and then the practical exposure is provided.

Course Objectives:

- **Explain** to students about the basic construction practices, building services and specifications in the Civil Engineering profession.
- **Demonstrate** assembling of pipeline and various sanitary fittings.
- **Acquaint** the difference between English Bond and Flemish Bond.
- **Study** the application of white wash, distemper, colour wash and painting of surfaces.
- **Familiarize** the construction of models of different structures.
- **Create** knowledge on process of estimation of prices of various building materials by market survey.

INTRODUCTION TO CIVIL ENGINEERING **14 L**

To introduce construction practices such as brick masonry, plastering, painting and laying of tiles and building services such as plumbing. To acquaint the students with the specifications and market rates of different civil engineering materials by undertaking market survey.

WORKSHOP:

List of Experiments: **28 L**

1. Assemble a pipeline as per the piping layout using pipes and accessories.
2. Exercise involving sanitary fittings such as water closets, wash basins.
3. Assemble a brick wall using English bond and Flemish bond without using mortar.
4. Marking a line diagram of a building by using chain and accessories.
5. Plastering of a given brick surface.
6. Applying white wash, distemper and colour wash of given surface.
7. Painting of old and new metal surfaces.
8. Laying of tiles for floors.
9. Model making of different structures like building, bridges and different types of trusses.
10. Exercise involving construction of a recharge pit.
11. Market survey: For trade/commercial names, specifications, units of purchase and prevalent market rates for the following:
    a. Various types of Stones (Blocks and slabs)
    b. Various types of bricks, hollow blocks, etc.
    c. Tiles- Flooring tiles and clay roofing etc.
    d. Sanitary ware pipes, water closets etc
    e. Various types of cements
    f. Various types of timber available in market, timber allied products such as plywood, hard board, block board, Sun mica and various preservatives of timber available in market.
    g. Materials required for white washing, colour washing.
    h. Various types of distempers - both oil bound and water bound.
    i. Sound insulating materials available in the local market.
    j. Fire proofing material available in local market.
    k. Various types of glass available in local market.

Text Book(s)

1. Rangawala, Engineering Materials (Materials Science), Charotar Publishing house, 2017.
2. B.C. Punmia, AshokKumarJain, Arun KumarJain, **Building Construction**, 11/e, Laxmi Publications (P)Ltd, Hyderabad, 2017.

References:

1. Mimi Das Saikia, Bhargab Mohan Das, Madan Mohan Das, Elements of Civil Engineering, 1/e, PHI Learning Private Limited, 2011.
2. P.C. Varghese, A Text Book Building Materials, 2/e, Prentice Hall India Learning Private Limited, 2015
3. Ketki Rangwala Dalal, Essentials of Civil Engineering, 1/e, Charotar Publishing House, 2012.

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

- **explain** civil engineering construction practices and specifications of different civil engineering materials **(L-2)**.
- **demonstrate** the assembling ofpipeline, brick wall and various sanitary fittings **(L-2).**
- **make use of** application ofwhite wash, distemper, and paints on surfaces **(L-3)**.
- **construct** the models of buildings, bridges and trusses etc**. (L-3).**
- **outline** the salient features of laying of tiles for floors and recharge pit construction**.(L-2)**
- **summarize** the specifications and compare the rates of various construction materials.**(L-2)**

19EMC281: CONSTITUTION OF INDIA

L	T	P	C
3	0	0	0

UnitI **10 L**

Constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.

Unit II **8 L**

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

Unit III **8 L**

Union Government: President and vice president, election, removal andpowers, 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 andcouncil, 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 **8 L**

Other Constitutional and Statutory Bodies: Comptroller and auditor gen-eral, election commission, finance commission, attorney general and advocate general, union public service commission (UPSC), state public service commissions (SPSCs), tribunals, national human rights commis-sion (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: **9T**

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).

Text Book (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)

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/

Semester IV

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19EMA202	Engineering Mathematics- IV (Numerical Methods, Probability and Statistics)	BS	3	0	0		3
2.	19EID234/19EID232	Life Sciences for Engineers/Internet of Things	BS/ES	2	0	2		3
3.	19ECE232	Mechanics of Solids	PC	3	0	3		4.5
4.	19ECE234	Environmental Engineering	PC	3	0	3		4.5
5.	19ECE236	Geotechnical Engineering	PC	3	0	3		4.5
6.	19ECE238	Construction Materials & Concrete Technology	PC	2	0	3		3.5
7.	19EMC282 / 19EMC281	Environmental Sciences / Constitution of India	MC	3	0	0		0
8.	19ECE292	Comprehensive Skill Development III	PW	0	0	0	6	1
Total								**24**

19EMA202: ENGINEERING MATHEMATICS-IV

NUMERICAL METHODS, PROBABILITY AND STATISTICS

(Common to MECH, CIVIL & EEE)

L	T	P	C
3	0	0	3

This course is designed to cover basic numerical methods, probability& statistical concepts. The first two units focus on solution of algebraic equations, interpolation and numerical methods for differentiation and integration, the other three units cover the concepts of probability and statistics to lay a strong foundation in engineering applications.

Course Objectives:

- To familiarize the students with the ways of solving nonlinear equations numerically.
- To teach various topics such as interpolation, numerical differentiation, numerical integration and numerical solution of ordinary differential equations.
- To impart knowledge on the concepts in probability, random variables and several distributions in engineering applications.
- To demonstrate the concept of Testing of hypothesis for large and small samples.

Unit I: Solution to Algebraic Equations **9 L**

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

Learning Outcomes:

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

- find approximate roots of the an equation by using different numerical methods (L3)
- explain various discrete operators and find the relation among operators(L3)
- apply Newton's forward and backward formulae for equal and unequal intervals (L3)

Unit II: Numerical Differentiation and Integration **10 L**

Numerical Differentiation- Newton's forward and backward difference formulae, numerical integration- trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations- Euler, modified Euler's, Runge-Kutta method of fourth order for solving first and second order equations.

Learning Outcomes:

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

- find differentiation of a function by using different numerical methods (L3)
- find integration of a function by using different numerical methods (L3)
- solve ordinary differential equations by using different numerical schemes (L3)

Unit III: Probability **8 L**

Random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution, normal distribution and exponential distribution-their properties (mathematical expectation and variance).

Learning Outcomes:

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

- apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- interpret the properties of normal distribution, exponential distribution and their applications (L3)

Unit IV: Testing of Hypothesis **8 L**

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.

Learning Outcomes:

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

- explain the concept of estimation, interval estimation and confidence intervals (L3)
- apply the concept of hypothesis testing for large samples (L3)

Unit V: Small Sample Tests **7 L**

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.

Learning Outcomes:

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

- apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- test for the goodness of fit (L4)

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2/e, Reprint 2012.

References:

1. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Course Outcomes:

At the end of the course students will be able to

- solve approximating the roots of polynomial and transcendental equations by different algorithms (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)
- apply discrete and continuous probability distributions (L3)
- identify the components of a classical hypothesis test (L3)
- inference based on small and large sampling tests using statistical methods (L4)

19EID234: Life Sciences for Engineers

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**.**
- Introducethetechniquesused for modification of living organisms**.**
- Describethe applications of biomaterials

Unit I **10L**

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 (L3).
- compare biological organisms and manmade systems (L2).
- classify organisms (L2).

Unit II **12L**

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 **12L**

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 (L2).
- explain the mechanism of respiration and photosynthesis (L2).
- summarize the principles of information transfer and processing in humans (L2).

Unit IV **12L**

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 (L3).
- explain the medical importance of gene disorders (L2).
- identify DNA as a genetic material in the molecular basis of information transfer (L2).

Unit V **10L**

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).

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 (L2).
- apply thermodynamic principles to biological systems. (L2)
- analyze biological processes at the reductionistic level (L4).
- appreciate the potential of recombinant DNA technology (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 books:

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.

   John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012

19EID232: INTERNET OF THINGS

(For 2020-21 Odd and Even Sems and 2021-22 Odd Sem only)

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):

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
(with effect from 2021-22 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.

19ECE232: MECHANICS OF SOLIDS

L T P C
3 0 3 4.5

The response or deformation of elastic bodies subjected to different types of loading will be discussed. Various stresses developed such as bending, shear and torsion in structural elements will be estimated. The course is a prerequisite forStructural Analysis and design courses such as Design of RCC and Design of Steel structures.

Prerequisite: Engineering Mechanics.

COURSE OBJECTIVES

- To introduce the concepts of stress, strain, Hooke's law and their application.
- Todemonstratethe concept of Shear Force (SF) and Bending Moment (BM).
- To explainthe concept of transformation ofstresses andprincipal stresses.
- To facilitatethe estimate of bending and shear stresses.
- To demonstratethe variation of shear stress in circular members under torsion.

Unit I **8L**

Simple Stresses and Elastic Constants

Introduction, stress strain curve, factor of safety, lateral strain, bars of varying and tapering cross section, compound bars subjected to loads, temperature stresses in bars, Modulus of rigidity, complementary shear, Bulk Modulus, Relation between E and N.

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

- Illustrate the fundamental concepts of stress and strain(L2).
- determine the stresses in bars of varying and taperedsections(L2).
- determine the temperature stresses invbars(L2).
- relate Modulus of Rigidity and BulkModulus(L2).

Unit II **10L**

Shear Forces and Bending Moments:

Beams, Types of loads and supports, Shear Force and Bending Moments,SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads and udl, Relationship between rate of loading, shear force and bending moment.

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

- classify different types of beams (L2).
- construct shear force and bending moment diagrams for cantilever, simply supported and overhang beams(L3).
- utilize the relationship between rate of loading, shear force and bending moment(L3).

Unit III **8L**

Complexstresses

Stresses on inclined plane on block subjected to normal stress and shear stress along two planes at right angles, principal plane and principal stresses, Mohr's circle for finding principal stresses, Directions of principal planes, Volumetric strain.

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

- determine the stresses on an inclined plane at a point in a two-dimensional state ofstress (L2).
- explain principal plane and principalstress(L2).
- construct Mohr's circle of stresses(L3).
- identify the plane of maximum shearstress(L3).

Unit IV **8L**

Stresses in beams

Introduction, assumptions in the theory of bending, section Modulus, Shear Stresses in beams, Shear stress variation in rectangular sections.

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

- explain the basic assumptions in the theory of purebending(L2).
- determine Section Modulus(L2).
- determine bending stresses in beams (L2).
- determine shear stresses inbeams(L2).

Unit V **8L**

Torsional Stresses in Shafts& Springs:

Introduction, Analysis of Torsional Stresses, Power transmitted, Combined bending and Torsion, Principal Stresses.

Helical Springs: Closed coiled helical springs.

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

- find torsional stress in circularshafts(L1).
- Determine the power transmitted inshafts(L2).
- find stresses in shafts due to combined bending andtorsion(L1).
- determine deflection of closed coiled helical springs (L2).

Text Book(s):

1. V.N Vazirani and M.M Ratwani, Analysis of Structures Vol-I, Khanna Publishers,2003.
2. R.Subrahmanian, Strength of Materials, 3/e, Oxford University Press, 2016.

References:

1. Ferdinand.P.Beer&Russell.E.Johnston, Mechanics of Materials, Mc Graw Hill Education, 7/e, 2017.
2. S.S. Rattan, Strength of Materials, 2/e, Tata McGraw Hill Education,2011.
3. Gere &Timoshenko, Mechanics of Materials, 4/e, CBS Publishers& Distributors ,2004.
4. Stephen Timoshenko, Strength of Materials Part I & II, 3/e, CBSPublishers & Distributors,2002.

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

- find the stresses, strains and deformationsin axially loaded members(L1).
- determine forces in statically determinatebeams(L2).
- identify the plane of principal stresses (L3).
- interpret the flexural behavior and shear flow ofthe beams(L2).
- find the stresses in circular shafts subjected totorsion(L1).

MECHANICS OF SOLIDS LABORATORY

LIST OF EXPERIMENTS

1. Stress-strain characteristics of steel and cast iron by conducting tension test on rods.
2. Stress-strain characteristics of steel and cast iron by conducting compression test on rods.
3. Stress-Strain characteristics of steel and cast iron by conducting tension test on flats.
4. Shear strength of timber and steel by conducting
   a) direct shear test for timber b) double shear test for steel
5. Hardness of steel, aluminium, copper and brass by conducting Brinnell's, Rockwell's and Vicker's tests.
6. Impact strength of steel and aluminium by conducting Izod's and Charpy's tests.
7. Modulus of rigidity of steel wires and rods by conducting torsion test.
8. Compression strength of timber and brick by conducting compression test.
9. Failure planes of ductile and brittle materials under tension, bending and torsion.
10. Bending stress in cantilever beam by conducting bending test.
11. Shear stress in simply supported beam by conducting bending test.
12. Stiffness of helical spring under compression.

References

1. **IS-1608:(2005)**- Metallic Materials - Tensile Testing at Ambient Temperature (Third Revision)
2. **IS432-Part I (1982)-**Specification for Mild Steel and Medium Tensile Steel Bars and Hard-Drawn Steelwire For Concrete Reinforcement Part I Mild Steel and MediumTensile Steel Bars (Third Revision)
3. **IS 1500: (2005)**Method for Brinell Hardness Test For Metallic Materials(ThirdRevision)
4. **IS 1586 (Part 2) : 2012**Metallic Materials — Rockwell Hardness Test Part 2Verification and Calibration of Testing Machines (Scales A, B, C, D, E, F, G, H, K, N, T) (Fourth Revision)
5. **IS-1598 (2003)**Metallic Materials- Method for Izod Impact Test of Metals (First Revision)
6. **IS 1757:1988 (2003)**Method for Charpy Impact Test (V-Notch) on Metallic Material (Second Revision)
7. **IS 5242:1979 (2006)**Method of Test for Determining Shear Strength of Metals (First Revision)
8. sm-nitk.vlabs.ac.in.
9. https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf

LEARNING OUTCOMES

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

- Interpret the stress strain characteristics of tension and compression members (L2).
- demonstrate the properties such as hardness and impact strength(L2).
- find the shear resistance by conducting shear test (L1).
- illustrate the planes of failure for brittle and ductile materials (L3).
- determine the compressive strength of timber and brick. (L2).

19ECE234: ENVIRONMENTAL ENGINEERING

L	T	P	C
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Water and waste water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. To understand the mechanism of treatment process, this course involves the principles of science and engineering. This basic fundamental course introduces the student to estimate water demand and to calculate waste water generation. Study of physical, chemical and biological characteristics of water and waste water helps the student to assess the quality of water and degree of treatment to be given for their safe disposal.

Course Objectives:

- to study the importance of Protected water supply and quality of water as per standards
- to impart the working principal of Sedimentation , filtration and disinfection methods
- to familiarize with various water distribution systems and its installations
- to expose sewage characteristic, treatment methods and design of unit operations
- to study the functionality of basic sanitary fitting in house plumbing.

UNIT– I **8 L**

Protected water supply – Population forecasts, design period – water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards - Waterborne diseases - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

Learning Outcomes:

a. explain the importance of protected water supply –L2.
b. apply appropriate formula to estimate population forecast – L3
c. analyze and compare water quality parameters with bureau of indian standards -L4.
d. summarize various intake structures involved in pumping of surface water-L2

UNIT -II **10 L**

Sedimentation – principles of coagulation-flocculation, clarifier coagulants - Filtration – theory – working of slow and rapid gravity filters disinfection – theory of chlorination, chlorine demand, other disinfection practices- Miscellaneous treatment methods.

Learning Outcomes:

a. explain the principles involved in sedimentation, coagulation and filtration-L2
b. construct the flow chart of conventional water treatment process –L3
c. make use of design considerations to design various unit operations in water treatment process–L3
d. summarize other miscellaneous methods of water treatment –L2

UNIT -III **8 L**

Distribution systems – Gravity system – Pumping system – Dual system – Layout distribution system – Dead End – Grid Iron – Radial systems – Analysis of Pipe networks - Hardy Cross and equivalent pipe.

Learning Outcomes:

a. explain different distributive systems –L2
b. select appropriate layout distribution system –L3
c. analyze pipe networking systems -L4

UNIT -IV **10 L**

Characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. – C.O.D. equations. Introduction to primary and secondary treatment of waste water, sedimentation tanks biological treatment – trickling filters. Sludge digestion – design of Digestion tank – Sludge disposal by drying – septic tanks and Imhoff Tanks working principles and design – soak pits,. Feacal waste and septage management**,** Introduction to government policies and programs-environmental aspects.

Learning Outcomes:

a. explain the characteristics of sewage –L2.
b. illustrate the procedures for testing the quality of sewage-L2
c. analyse the equations of b.o.d &c.o.d –L3
d. make use of design considerations to design all unit operations involved in waste water treatment –L3

UNIT -V **6 L**

Sluice Valves – Pressure Relief Valves – Check walls – Meters – Sewer appurtenance - inverted siphon – catch basins — sanitary fittings-traps – one pipe and two pipe systems of plumbing. sewage pipe network

Learning Outcomes:

a. explain all types of sewer appurtenances –L2
b. analyse the working principles of all sewer appurtenances-L3
c. summarize various sanitary fittings –L2
d. differentiate between one pipe and two pipe systems of plumbing-L4

Course Outcome:
Student will be able to

1. analyse the quality for water based on Indian standards-L3
2. make use of design considerations to design water treatment units –L3
3. analyze and interpret the pipe networking systems –L4
4. calculate various design parameters of waste water treatment plant–L3
5. explain the functions of various sanitary fittings –L4

Textbooks:

1. Water supply and sanitary engineering by G.S. Birdi, Dhanpat Rai & Sons publishers,2014
2. Water Supply Engineering, Vol-I & Waste water engineering, Vol-II, P.N.MODI, STANDARD Book House, 2016

Reference books:

1. B.C. Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt. Ltd, New Delhi,
2. Elements of environmental engineering by K.N. Duggal, S. Chand Publishers.
3. https://nptel.ac.in/courses/105104102/
4. https://nptel.ac.in/courses/105105048/

Environmental Engineering Laboratory

The water required for public water supply should be potable or wholesome water. The water required for domestic consumption should possess a high degree of purity and it should be free from suspended impurities, bacteria, etc. The objective of this laboratory course is to give practical knowledge in fixing water and wastewater quality in order to identify the pollution status and arriving at the appropriate treatment techniques and control measures required to keep up their quality standards.

Course Objective

- To demonstrate Physical & chemical parameters of water and wastewater
- To study the growth of microorganism
- To expose the standards of water and waste water with BIS & WHO

List of Experiments

Cycle –I :

1. Analysis of pH ; Conductivity; Turbidity
2. Analysis of Acidity; Alkalinity
3. Analysis of Total Hardness; Calcium Hardness
4. Analysis of Available chlorine; Residual chlorine
5. Conducting Jar test for determining optimum dosage of coagulant
6. MPN –Calculation, Demo only

Cycle –II :

7. Determination of Total Solids, Total Dissolved Solids & Settelable Solids
8. Determination of Phosphates & sulphates.
9. Determination of Dissolved Oxygen
10. Determination of Biochemical Oxygen Demand (Demo only).
11. Determination of Chemical Oxygen Demand (Demo only).

Reference Books/Manual:

1. Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington: APHA.
2. Indian standard Drinking water –specifications,2nd Revision ,IS 10500:2012
3. Guidelines for water quality management –CPCB ,2008
4. Guidelines for drinking- water quality,4TH EDITION,2017
5. B. Kotaiah and Dr. N. Kumara Swamy, Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007.

Course Outcomes:

- Determine physical, chemical and biological characteristics of water and wastewater –(L5)
- Assess the quality of water and wastewater –(L5)
- Decide the degree of treatment required for water and wastewater-(L5)

19ECE236: GEOTECHNICAL ENGINEERING

L T P C
3 0 3 4.5

GTE is an essential interdisciplinary course in civil engineering. Soil has been used as a foundation supporting medium as well as an excellent material for construction of embankments, earth dams, canal levees etc. Improvement of engineering performance of soil is important for compacted engineered fills. Identification, classification and characterization is very important aspect when soil is used as a construction material. Soil behaviour under loads, compressibility, Settlement prediction and shear strength aspects play a vital role in the design of sub-structure and long term stability of structures. It could be an essential prerequisite for foundation engineering course.

Course Objectives:

- To expose the aspects of origin, formation of Soils to classify the soil as a construction material.
- To study the flow through soils and understanding the importance of effective stress in the soil behaviour and stability.
- To enable the estimation of Critical Hydraulic Gradient on permeable foundations
- To acquaint the calculation of the settlements in clayey soils.
- To demonstrate the shear strength parameters at different drainage conditions in an attempt to simulate short term and long term stability.

Unit I **9 L**

Soil Properties: Origin and formation of soils, General types of soils, residual and transported soils,three phase representationof soil mass, physical properties of soil – void ratio, porosity, degree of saturation, water content, module weights, specific gravity – their functional relationships, relative density.

Consistency Limits: Determination and various indices – plasticity index,consistency index, liquidity index – uses and applications of consistency limits in soil engineering, activity ratio.

Classification: I.S and MIT grainsize classification, Indian standard classification for fine grained and coarse grained soils for general engineering purposes.

Learning Outcome:

After completion of Unit I, students will be able to

- explain the origin of the soil formation and geological weathering cycle. - L2
- apply principles of phase model concept, volumetric, gravimetric relations for soil properties and perform basic weight-volume calculations. – L3
- relate interconnecting functional relationships from fundamental phase model concepts for solving numerical problems -L2
- explain the consistency of soil – Atterberg’s limits, uses and field behavior of Soils. -L2
- make use of IS code -1498. Indian Standard method for soil classification Procedures for General Engineering Purposes both for fine grained Soils and course Grained Soils. –L3

Unit II **8L**

Soil Hydraulics: Types of soil water, Darcy’s law and its limitations,determination of coefficient of permeability, laboratory methods-constant head and variable head permeameter tests,factors influencing coefficient of permeability, permeability of stratified soils, stress principle for saturated soils-total, neutral and effective stresses, no flow, downward flow and upward flow conditions,quick sand conditions, critical hydraulic gradient, piping failures in dams founded on permeable formations

Learning Outcomes:

After completion of Unit II, students will be able to

- explain the Sources of Soil water and theconcepts and fundamental laws governing flow through porous medium in soils.-L2
- summarize the approximate range of coefficient of permeability (K) values and rate the soils based on hydraulic conductivity values. -L2
- formulate expressions for the estimation of coefficient of permeability for Variable/ Constant headpermeameters, average K-values for Stratified Soils for solving numerical problems. –L3
- conclude significance of effective stress in controlling mechanical behavior of soils and relationship between total stress and effective stress in saturated porous medium. –L3
- formulate expressions for no flow, upward flow and downward flow of seepage flow through soils and estimation of critical hydraulic gradient. –L3

Unit III **8L**

Stress Distribution: Boussinesq's theory for the determination of verticalstresses due to point loads, assumptions and validity, extension to circular loaded areas, equivalent point load method,2 : 1 approximate method, Westergaard's theory& equation, Newmark's influence chart - construction and use, contact pressure distribution beneath rigid footings.

Learning Outcomes:

After completion of Unit III, students will be able to

- explain the concepts of elastic stress distribution theories, various assumptions made in order to derive expressions. (J.V.Boussinesq's and Wetergaard's theories only)–L2
- estimate the vertical compressive stresses and shear stresses induced in soils due to loading on to the soil, how stresses are transferred through soils. –L3
- determine both geostatic and induced stresses due to point loads, line and extended to area loads. –L3
- estimate the stresses due to loading analytical methods also by simple graphical methods –L3
- determine the Stresses induced due to loading on horizontal, vertical planes and plotting isobar diagrams for computation of significantdepth below foundation. –L3

Unit IV **9L**

Consolidation: Oedometer Tests, e-p and e-log p curves – compressionindex, coefficient of compressibility and coefficient of volume change, Terzaghi's assumptions for one dimensional consolidation, equation and application, coefficient of consolidation, degree of consolidation vs time, initial compression, primary compression and secondary compression, normally consolidated, over consolidated and under consolidated clayey deposits,

Compaction: Mechanism of compaction, factors affecting compaction,effect of compaction on engineering properties of soils, field compaction equipment and quality control.

Learning Outcomes:

After completion of Unit IV, students will be able to

- compare the differentiate betweenthe processes of Soil Compaction & Consolidation. –L2
- predict the long term consolidation Settlements experienced by structures. –L3
- estimate the consolidation time period and Rate of Settlements-L2
- construct compaction control curve to determine a) MDD b) OMC c) ZAV Curve-L3
- adapt Quality Control of EarthStructures and for Road Works with Specifications-L3

Unit V **8 L**

Shear Strength of Soils: Stress at a point, Mohr circle of stress, Mohr-coulomb's failure theory, shear tests – direct shear box, unconfined compression, tri-axial compression, and field vane shear tests, shear parameters, types of shear tests in the laboratory based on drainage conditions, shear strength of sands, critical void ratio, thixotrophy and dilatancy of sands.

Learning Outcomes:

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

- explain the Shear Parameters of Soil, different drainage conditions to simulate field conditions and factors influencing shear parameters of soil. -L2
- solve numerical problems with different types of Shear Tests used are Direct Shear, Tri-axial and Unconfined compression for different soil types. –L4
- estimation of Shear Parameters of Soil by analytical methods, -L3
- construct Mohr's circles, and other graphical methods for Shear Parameters of Soil –L3
- analyze the shear strength problems with pore water pressure measurements so as to determine Total Stress and Effective Stress Parameters. –L4

Course Outcomes:
The student will be able to

- explain Soil behaviour, Gravimetric, Volumetric, Functional interconnecting relationships & phase model concepts. Identify, Classify and characterise the soil as a construction material. –L2
- illustrate the problems in flow through the soils and acquire knowledge in the importance of Effective Stress Concepts.-L2
- analyze Stress distribution in Soils, based on elastic theories, analytical and graphical methods.-L3
- solve Compaction & Consolidation problems and compute the probable long term settlement of structures.-L3
- determine shear strength parameters by analytical and graphical methods-L2

Text Book(s):

1. B.C. Punmia, Soil Mechanics and Foundations, (SI Modules), 16/e Laxmi Publications, Sixteenth edition (2017).
2. Gopala Ranjan and A.S.R, Rao, Basic and Applied Soil Mechanics, 2/e, New Age International Publishers, Third edition 2016.

References:

1. C. Venkataramaiah, Geotechnical Engineering, New Age International, 2006..
2. M. Braja Das, Principles of Geotechnical Engineering,Cengage Learning, 2013.

NPTEL Links:

Unit-1: https://nptel.ac.in/courses/105103097/1
Unit-2:https://nptel.ac.in/courses/105103097/25
Unit-3:https://nptel.ac.in/courses/105103097/20
Unit-4:https://nptel.ac.in/courses/105103097/37
Unit-5:https://nptel.ac.in/courses/105103097/43

GEOTECHNICAL ENGINEERING LABORATORY

Course Objectives:

- To demonstrateIndex and Engineering Properties of Soils
- To study the Permeability properties of soil
- To impart the knowledge on Compaction Characteristics.
- To enable the estimation of Shear Parameters of various soils
- To demonstrate the Long term Settlement characteristics of Soils

LIST OF EXPERIMENTS:

1. Determination of water content by Oven drying and Calcium carbide method (rapid).
2. Determination of specific gravity of soil grains by pycnometer and density bottle
3. Determination of grain size analysis by sieve analysis
4. Determination of Atterberg's limits (LL / PL /SL).
5. Determination of field density by core cutter method / sand replacement method.
6. Determination of permeability of soil by falling head /variable head permeameter method.
7. Determination of optimum moisture content and max density by IS light compaction test.
8. Determination of relative density of soils.
9. Determination of shear strength by direct shear test.
10. Determination of shear strength by unconfined compression test for cohesive soils.
11. Determination of shear strength by tri-axial compression test.
12. Differential Free swell Index Test

Demonstration:

1. Determination of co-efficient of consolidation and compressibility of soils by consolidation test.
2. Determination of swell pressure of soil by swell pressure test**.**

List of IS Codes:

S.NO	**NAME OF THE EXPERIMENT**	**IS CODE**
1	Specific Gravity By Pycnometer Method	IS: 2720 Part 3 – 1980
	Specific Gravity By Density Bottle Method	
2	Field Density Test - Core Cutter Method	IS:2720 Part 29 -1975
	Insitu Density – Sand Replacement Method	IS :2720 Part 28- 1974
3	Determination Of Density Index (Relative Density) Of Cohesion less Soil	IS:2720 Part 14 – 1983
4	Liquid Limit Test	IS:2720 Part 5 – 1985
	Plastic Limit Test	IS:2720 Part 5 – 1985
	Shrinkage Limit Test	IS :2720 Part 6 – 1972
5	Field Identification And Classification of Soils	IS: 1498 -1970 Any Standard Text Book
6	Grain Size Distribution By Sieve Analysis	IS : 2720 Part 4-1985
7	Permeability Test- Variable Head Method	IS:2720 Part 17 -1986
8	IS Light Weight Compaction Test	IS:2720 Part 7 – 1980
9	Consolidation Test	IS:2720 Part 15 – 1986
10	Swell Pressure Test	IS: 2720 Part 41 – 1977
11	Direct Shear Test	IS :2720 Part 13 – 1986
12	Unconfined Compressive Strength Test	IS:2720 Part 10 - 1991
13	Triaxial Shear Test	IS:2720 Part 11 – 1971

Learning outcomes: The student will be able to

- demonstrate the water content by Oven drying and Calcium carbide method.-L2
- demonstrate the specific gravity of soil grains by pycnometer and density bottle-L2
- construct the grain size distribution curve of a soil-L4
- determine the Atterberg's limits or consistency limits-L3
- demonstrate the field density by core cutter and sand replacement method-L2
- estimate the permeability of soil by falling head permeameter method-L3
- determine compaction characteristics of a soil by IS Light Weight Compaction test-L3
- demonstrate the relative density of soils-L2
- estimate the shear strength Parameters of a soil by Ddirect Shear test- L3
- estimate the shear strength Parameters by unconfined compression test for cohesive soils L3
- estimate the shear strength Parameters of a soil by tri-axial compression test L3
- demonstrate the Free swell Index test of soils.- L2

Course Outcomes: Student shall be able to

- determine index properties of soils like moisture content, consistency limits, Specific gravity of soil grains, and density of soil stratum and voids ratio, Gradation of soil and coefficient of permeability of soils. –L2
- estimate the Shear Strength parameters of soils using Direct shear/ Tri-axial/UCS-L3
- determine the settlement characteristics using Consolidation test.-L2

Text Books:

1. S.Mittal&J.P.Shukla, Soil testing for Engineers, Khanna Publications-2012.
2. K.V.S.AppaRao,V.C.S Rao, Soil Testing-Laboratory Testing and Question Bank, University of science Press-2016.

Virtual Labs:

- 1.http://smfeiiith.vlabs.ac.in/exp1/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
- 2.http://smfeiiith.vlabs.ac.in/exp3/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
- 3.http://smfeiiith.vlabs.ac.in/exp4/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
- 4.http://smfeiiith.vlabs.ac.in/exp2/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
- 5.http://smfeiiith.vlabs.ac.in/exp6/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab

- 6.http://smfeiiith.vlabs.ac.in/exp7/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab

- 7.http://smfeiiith.vlabs.ac.in/exp9/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab
- 8.http://smfeiiith.vlabs.ac.in/exp10/Introduction.html?domain=Civil%20Engineering&lab=Soil%20Mechanics%20Lab

19ECE238: CONSTRUCTION MATERIALS & CONCRETE TECHNOLOGY

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This course deals with different kinds of construction materials used in Civil Engineering. It also discusses about the properties of concrete which is a widely used as a Construction material. This course is a pre requisite for design courses such as Design of Reinforced Concrete Structures and Advanced Design of Reinforced Concrete Structures. This course gives confidence for the learners in judicious selection of materials used in the construction industry.

Prerequisite: Chemistry and Civil Engineering Workshop.

COURSE OBJECTIVEs

- To familiarize with the basic construction materials.
- To help in deciding the suitability of the materials in construction.
- To demonstrate the gradation of aggregates as construction materials.
- To enable the conduct of workability tests of concrete.
- To train on mix design for concrete.

Unit I - Construction Materials: 5L

Stones and Bricks -Properties of building stones, classification of stones, stone quarrying, various types of bricks and blocks used for construction, tests on bricks and blocks

Wood: Classification of various types of woods used in buildings, Timber – Market forms – Industrial timber– **Plywood** – Veneer –panels of laminates.

Learning Outcomes

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

- illustrate the properties of stones and bricks suitable for construction (L2).
- demonstrate tests on bricks(L2).
- explain the suitability of wood (L2).

Unit II- Construction Practices: 5L

Structural system-load bearing structure- framed structure- load transfer mechanism

Foundations – Deep and Shallow foundations

Masonry -Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry.

Wall: Load bearing wall, partition wall, shear wall

Finishings- Damp Proofing and water proofing materials and uses, Plastering Pointing, white washing and distempering.

Learning Outcomes

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

- illustrate the difference between load bearing walls and partition walls. (L2).
- summarize the uses of damp proofing and water proofing materials (L2).
- define plastering and pointing (L1).

Unit III **6L**

Cement: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Types and different grades of cement.

Aggregates: Classification of aggregate Particle shape & texture –, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Soundness of aggregate –Sieve analysis – Fineness modulus Grading curves – Grading of fine & coarse Aggregates

Learning Outcomes

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

- illustrate the structure of hydrated cement(L2).
- classify the cements(L2).
- classify the aggregates (L2).

Unit IV **6L**

Fresh Concrete: Process of manufacture of concrete, quality of mixing water, properties of fresh concrete, workability, factors affecting workability, measurement of workability.

Admixtures: Benefits of admixtures, types of admixtures, accelerating admixtures, retarding admixtures, water-reducing admixtures, super plasticizer.

Learning Outcomes

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

- illustrate the process of manufacture of concrete (L2).
- Demonstrate the workability of concrete (L2).
- outline about admixtures, types and benefits (L2).

Unit V **6L**

Strength of Concrete: Water/cement ratio, effect of age and specimen size on strength of concrete, **Mix proportions**:-Factors in the choice of mix proportions – Proportioning of concrete mixes by– IS 10262- 2009 and IS 456.

Learning outcomes

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

- explain the effect of water-cement ratio on strength of concrete (L2).
- Identify factors in the choice of mix proportioning (L3).
- Design concrete mix as per codal provisions (L3).

Text Book(s)

1. S.C. Rangwala, Engineering Materials, 4/e, Charotar Publishing House, 2014.
2. M.S. Shetty, Concrete Technology,7/e, S.Chand and Company Ltd, 2015.

References

1.P.C. Varghese, A Text Book Building Materials, 1/e, Prentice-Hall, Publication, 2005.
2. A.M. Neville and J.J. Brooks, Concrete Technology,2/e,Prentice Hall, 2010.
3. P.K.Mehta, Concrete: Microstructure, Properties and Materials, 4/e, McGraw-Hill Education, 2014.
4. A.R.Santha Kumar, Concrete Technology, 2/e, Oxford University Press India, 2018.
5. http://textofvideo.nptel.ac.in/105102012/lec41.pdf
6. https://nptel.ac.in/courses/105102088/

COURSE OUTCOMES

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

- list the construction materials in Civil Engineering (L1).
- summarize types of foundations and walls(L2).
- list different types of cement(L1).
- Explain the behaviourof fresh concrete (L2).
- designconcrete mixes as per codal provisions (L3)

CONSTRUCTION MATERIALS &CONCRETE TECHNOLOGY LABORATORY

MATERIAL TESTS

1. Compression test on Stones, Solid and Hollow Blocks.
2. Determination of fineness of two types of cements by sieving and Blain's apparatus.
3. Determination of consistency of cement and setting time of two types ofcement. IS 4031(Part 5)
4. Determination of specific gravity of two types of cement(IS:4031-PART 11)
5. Determination of compressive strength of two types of cements.IS 4031(Part 6) & IS 4031(Part 7)
6. Grading of fine and coarse aggregate by conducting sieve analysis.
7. Determination of specific gravity and bulking characteristics of fine aggregate.
8. Determination of workability of design mix concrete of specific grade by slump cone test.IS: 1199
9. Designing a concrete mix of a particular grade for a target slump using superplasticizers.
10. Determination of workability of design mix concrete of specific grade by compaction factor apparatus.IS: 1199
11. Determination of workability design mix concrete of specific gradeby Vee Bee Consistometer. IS: 1199
12. Determination of unit weight, water absorption and compressive strength of design mix concrete of specific grade. IS 516.
13. Determination of split tensile strength (IS 516) and modulus of rupture of plain concrete beam (IS 5816).

Text Book(s) :

1.B.S Raghuwanshi, A course in WorkshopTechnology,DhanpatRai&Co,2015.

2. Anurag A. Kandya, Elements of Civil Engineering, Charotar Publishing house,2011.

References:

1. Satheesh Gopi, Basic Civil Engineering, Pearson Publishers,2009.
2. Rangwala, Essentials of Civil Engineering, Charotar Publishing House,2012.
3. **IS1121(part-I):1974(2008)**Methods of Test for Determination of Strength Properties of Natural Building Stones Part I Compressive Strength (First Revision)
4. **IS 1077:1992 (2007)** -Common Burnt Clay Building Bricks – Specification(Fifth Revision)
5. **IS :4031 (Part 4)- 1988 (1995)**Methods of Physicaltestsfor Hydraulic Cement Part 4 Determination Of Consistency Of Standard Cement Paste (First Revision)
6. **IS 4031(Part-I):1996 (2005**)Method of Physical Tests for Hydraulic Cement-Part 1 - Determination of Fineness by Dry Sieving (Second Revision)

7. **IS : 4031 (Part 5) – 1988 (2005**) Methods of Physical Tests for Hydraulic Cement - Part 5 Determination of Initial and Final Setting Times (First Revision)
8. **IS : 4031 (Part 6) – 1988(2005)**Methods of Physical Tests for Hydraulic Cement - Part 6 Determination of Compressive Strength of Hydraulic Cement other than Masonry Cement.
9. **IS 1383:1970 (2002)**Specification for Coarse and Fine Aggregates from Natural Sources for Concrete (Second Revision)
10. **IS: 2386 (Part III) – 1963 (2002)**Methods Of Test For Aggregates For Concrete Part Ill Specific Gravity, Density, Voids, Absorption and Bulking
11. IS 10262: 2009 –Concrete Mix Proportioning Guidelines
12. **IS : 1199 -1959 (2004)**Methods of Sampling and Analysis of Concrete (Eleventh Reprint November 1991)
13. **IS : 516 – 1959 (2004)**Methods of Tests for Strength of Concrete (Eighteenth Reprint June 2006)
14. **IS 5816: 1999 (2004**) Splitting Tensile Strength of Concrete - Method of Test (First Revision)

Learning Outcomes:

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

- summarize various physical properties of cement (L3).
- choose aggregates by performing specific gravity and fineness modulus test (L3).
- estimate the materials required for a particular grade of concrete (L3).
- make use of various testing methods for deciding the workability of concrete(L3).
- Evaluate the compressive strength, split tensile and modulus of rupture of concrete(L3).

19ECE292: 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/

Semester V

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19ECE301	Structural Analysis	PC	3	0	0		3
2.	19ECE331	Highway Engineering	PC	3	0	3		4.5
3.	19ECE303	Design of Reinforced Concrete Structures	PC	3	0	0		3
4.	19EID232/ 19EID234	Internet of Things/ Life Sciences for Engineers	ES/BS	2	0	2		3
5.	19ECE3XX	Program Elective I	PE	2	1	0		3
6.	19EOE3XX	Open Elective I	OE	3	0	0		3
7.	19EYY3XX	Interdisciplinary Elective I	ID	2	1	0		3
8	19ECE323	Survey Camp	PC	-	-	-		2
9.	19ECE391	Comprehensive Skill Development IV	PW	0	0	0	6	1
Total								**25.5**

Program Elective- I :

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE341	Repairs, Renovation and Rehabilitation of Structures	PE	2	1	0	3
2	Geotechnical Engineering	19ECE343	Foundation Engineering	PE	2	1	0	3
3	Transportation Engineering	19ECE345	Traffic Engineering	PE	2	1	0	3
4	Water Resources Engineering	19ECE347	Hydraulic Machines	PE	2	1	0	3
5	Environmental Engineering	19ECE349	Pollution Prevention and Management	PE	2	1	0	3

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

Interdisciplinary Elective I:

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EBT371	Bio Materials	ID	2	1	0	3
2		19AID371	Introduction to Architecture and Town Planning	ID	2	1	0	3
3	Computer Oriented Courses	19ECS371	Introduction to Database Management Systems	ID	2	1	0	3
4		19ECS375	Introduction to Programming with JAVA	ID	2	1	0	3
5	Management Courses	19EME371	Quantitative Techniques for Management	ID	2	1	0	3
6		19EME369	Computational Methods	ID	2	1	0	3

19ECE301: STRUCTURAL ANALYSIS

L TP C
3 0 0 3

The student will be able to analyze statically determinate members such as columns, cylinders and indeterminate structural members such as fixed beams and continuous beams. Various methods for computing deflections in beams and trusses are covered in this course. Design of Reinforced Concrete Structures and Design of Steel Structures require this course as a prerequisite.

Prerequisite: Mechanics of Solids

COURSE OBJECTIVES

- To demonstrate calculation of displacements in statically determinate beams andtrusses.
- To familiarize with the analysis of indeterminate beams.
- To familiarize with the analysis of continuous beams using various methods.
- To explain the behavior of long columns.
- To facilitate the analysis of cylinders.

Unit I **8L**

Deflection of Statically Determinate Structures- Introduction, Relation between curvature, slope and deflection, Deflection curves, Maculay's Method, Moment area method, Slopes and deflection for cantilevers and simply supported beams

Deflection of Trusses: Deflection of trusses by Unit load method(having 5 members or less)

Learning Outcomes

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

- relate between curvature, slope and deflection(L1).
- determine the slopes and deflections of statically determinate beams using Maculay'smethod(L3).
- determine the slopes and deflections of staticallydeterminate beamsusing Moment areamethod(L3).
- determine the deflection of trusses using Unit loadmethod(L3).

Unit II **8L**

Analysis of Indeterminate Beams

Fixed beams: Shearforce and bending moment diagrams for Fixed beams subjected to UDL and point loads

Two span continuous beams: Shear force and bending moment diagrams for two span continuous beams using Slope deflection method

Learning Outcomes

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

- analyze fixed beams(L4).
- construct shear force and bending moment diagrams for fixedbeams (L3).
- construct shear force and bending moment diagram for two span continuousbeams using Slope deflectionmethod(L3).

Unit III **10L**

Analysis of two span continuous beams

Moment distribution method: Shear force(S.F) and bending moment (B.M) diagrams for two span continuous beams using Moment Distribution Method

Kani's method: Shear force and bending moment diagrams for two span continuous beams using Kani's Method

Learning Outcomes

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

- analyze two span continuous beams (L4).
- construct shear force and bending moment diagram for two span continuous beams using Moment DistributionMethod (L3).
- construct shear force and bending moment diagram for two span continuous beams using Kani'sMethod (L3).

Unit IV **8L**

Columns and Struts: Introduction, Column with one end free and other fixed, Column with both ends hinged, column with both ends fixed, column with one end fixed and the other hinged, Limitation of Euler's formula, column carrying eccentric load, Rankine-Gordon formula, Perry's formula.

Combined bending and direct stresses–Introduction, Limit of eccentricity for no tension in the section.

Learning Outcomes

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

- make use of Euler's theory for analysis of long columns(L3).
- make use of Rankine Gordon's formulas for columns (L3).
- solve eccentrically loadedcolumns (L3).

Unit V **8L**

Thin Cylinders - Introduction, Stresses and strains in thin cylinders, volumetric change in cylinder.

Thick cylinders: Thick cylinders subjected to internal pressure and external pressure, compound cylinders.

Learning outcomes

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

- classify thin and thick cylinders (L2).
- analyze stresses in cylinders(L4).
- determine the stresses in compound cylinders (L5).

Text Book(s)

1. V.N Vazirani and M.M Ratwani, Analysis of Structures Vol-II, Khanna Publishers,2012.
2. T.S. Thandavamoorthy, Structural Analysis, 2/e, Oxford University press, 2011.

References

1.C.K.Wang, Statically Indeterminate Structures,TataMcGrawHill,2010.
2. R.C. Hibbeler, Structural Analysis, 6/e, Pearson, 2011.
3. https://nptel.ac.in/downloads/105101085/.

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

- calculate the deflections in statically determinate beams andtrusses (L2).
- construct SFD and BMD for fixed and two span continuousbeams using Slope Deflection Method (L3).
- construct SFD and BMD for fixed and two span continuous beams usingMoment Distribution method and Kanismethod (L3).
- solve bucklingload oncolumns (L3).
- evaluate the stresses incylinders(L5).

19EID232: INTERNET OF THINGS
(w.e.f. 2020-21AB)

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:

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

List of Experiments (2 Hours each)

13. Blinking led with Arduino using software delay, LED Control with switch
14. Temperature measurement using LM35 and display both on LCD and serial monitor
15. Control DC motor with H-bridge and as well as PWM
16. Raspberry pi installation and led control
17. DHT11 sensor interfacing to Raspberry pi and Transfer the data to Thingspeak server
18. Interfacing camera and raspberry pi
19. Accelerometer ADXL345 with i2c with raspberry pi
20. Nodemcu to control LED with thinger.io
21. With Nodemcu HTTP protocol get and post
22. With nodemcu Webserver control led
23. MQTT protocol using Nodemcu
24. Blinky app with led control

Text Book(s)

5. Simon Monk, Programming Arduino: Getting Started with Sketches, Mc Graw Hill Publications, 2011
6. Simon Monk, Programming the Raspberry Pi, Getting Started with Python, Mc Graw Hill Publications, 2015

19ECE331: HIGHWAY ENGINEERING

L	T	P	C
3	0	3	4.5

Highway engineering is a very diverse and multidisciplinary field, which deals with the planning, design, operation and maintenance of transportation systems. The course aims to make thestudents learn the principles of highways, their components anddesign of flexible and rigid pavements. Further, students will getacquainted with treatment for failures and remedial measures during maintenance of pavements.

Course Objectives:

The purpose of this course is to

- Impart knowledge on the history and current trends in highway development
- explain concepts of geometric design related to roads along with their applications
- familiarize about different materials used for the highway construction along with their properties
- instruct the types of pavements along with their design procedures, construction and maintenance
- train traffic related information on highways

Unit I **8L**

Highway Development and History of Roads: History of development of roads, highway development in India, classification of roads, planning surveys, highway alignment, engineering surveys for highway alignment.

Learning Outcomes:

After the completion of Unit, students will be able to

- **gain** knowledge about the history of roads [L2]
- **summarize** the road development in India[L2]
- **classify** different types of roads[L2]
- **explain** the basic requirements of highway alignment[L2]
- **list** various surveys required for road development[L1]

Unit II **9L**

Highway Geometric Design: Highway cross-sectional elements, stopping sight distance, overtaking sight distance, intermediate sight distance, camber, super elevation, extra widening, setback distance at horizontal curves, design of horizontal curves, transition curves, vertical curves.

Learning Outcomes:

After the completion of Unit, students will be able to

- **list** outvarious highway cross-sectional elements[L1]
- **analyze** different sight distances concepts[L3]
- **determine**super elevation, extra widening and set backs at horizontal curves[L5]
- **design** vertical curves for different conditions[L3]
- **explain**theimportance of design of transition curves[L2]

Unit III **9L**

Pavement Materials and Design: Highway materials: aggregate properties and tests: crushing, abrasion and impact test, bitumen properties and tests, - penetration, ductility, viscosity, binder content and softening point design of pavements: design of flexible pavement by C B R method as per IRC 37-2012 and theory of empirical mechanistic method, stresses in rigid pavement by Westergaards and IRC methods, design of overlay by Benkelman beam method.

Learning Outcomes:
After the completion of Unit, students will be able to
- **identify** different materials used inhighway construction[L3]
- **explain** the different properties of aggregate and bitumen[L3]
- **design** of flexible pavement as per IRC Codes[L4]
- **categorize**various stresses in rigid pavement[L4]
- **estimate** theoverlay thickness using Benkelman Beam Method[L5]

Unit IV **8L**

Highway Construction and Maintenance: highway construction: earthen roads, WBM roads, bituminous roads and cement concrete roads, highway maintenance: failure of flexible and rigid pavements and their maintenance, highway drainage: surface and sub surface drainage system.

Learning Outcomes:
After the completion of Unit, students will be able to
- **compare** highway construction techniques by various materials[L2]
- **interpret**existing conditions of road[L3]
- **identify** the failures in flexible and rigid pavements[L3]
- **explain**differentmaintenance activities on flexible and rigid pavements[L2]
- **demonstrate** importance of highway drainage[L2]

Unit V **8L**

Traffic Engineering: Traffic characteristics: road user characteristics and vehicle characteristics, traffic studies: traffic volume study, speed studies and origin and destination studies, traffic control devices: signs, signals and markings and traffic islands, intersection: introduction to un-channelized and channelized intersections and rotary intersections.

Learning Outcomes:
After the completion of Unit, students will be able to
- **identify**different types of traffic characteristics[L3]
- **illustrate**types of traffic studies along with their procedures[L2]
- **explain** types of traffic control devices[L2]
- **distinguish** between channelized and un-channelized intersections[L4]
- **explain**the concepts of rotary intersections[L2]

Course Outcomes:
The student will be able to
1) explain highway development and classify roads and highway alignment.[L2]
2) categorize highway geometrics for different conditions[L4]
3) evaluate a flexible and rigid pavement[L5]

4) apply the principles of highway construction, maintenance and drainage systems[L3]
5) acquire knowledge on traffic characteristics, traffic studies, traffic control devices and intersections[L3]

Text Book(s):

1. Khanna, S.K.,Justo, C.E.G., Veeraragavan. A. Highway Engineering, Nemchandand Bros,Roorkee, 2015
2. Fred L. Mannering , Scott S. Washburn Principles of Highway Engineering and Traffic Analysis, 6th Edition

References:

1. W.R. McShane and R.P. Roess, Traffic Engineering, Prentice Hall India, 2010.
2. C. JotinKhisty and B. KentLal, Introduction to Highway Engineering, 3/e, Prentice Hall India, 2002.
3. Highway Material Testing & Quality Control, by G. Venkatappa Rao (Author), K. Ramachandra Rao (Author), Kausik Pahari (Author), D.V. Bhavanna Rao.

HIGHWAY ENGINEERING LABORATORY

Course Objectives:

The purpose of this course is to

1. Develop knowledge on different pavement materials currently in use
2. Identify properties of pavements materials and their corresponding quality control tests
3. Gain knowledge on traffic flow characteristics be performing different studies
4. Familiarize with the concept of intersection design (signalized and un-signalized)

List of Experiments

1. Determination of specific gravity and water absorption of aggregates.
2. Gradation test on aggregates.
3. Shape test of aggregates.
4. Determination of impact and compressive strength value of aggregates.
5. Determination of abrasion value of aggregates.
6. Determination of penetration, viscosity and stripping value test on bitumen.
7. Determination of ductility test of bitumen.
8. Determination softening point, flash and fire point test of bitumen.
9. Determination of optimum binder content(Marshall mix design).
10. Traffic volume studies.
11. Spot speed studies.
12. Parking studies.

Note: All laboratory tests are as per IS, ASTM, AASHTO, TRL, IRC, BS procedures specifications and guidelines.

Course Outcomes:

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

1. characterise the pavement materials
2. perform quality control tests on pavements and pavement materials
3. tabulate traffic studies for estimating traffic flow characteristics
4. design at-grade intersections

References:

- Khanna, S.K.,Justo, C.E.G., Veeraragavan. A, Highway Material Testing, 4/e, Nem Chand, Roorkee

- Highway Material Testing & Quality Control, by G. Venkatappa Rao (Author), K. Ramachandra Rao (Author), Kausik Pahari (Author), D.V. Bhavanna Rao.
- W. R. Mc Shane, and R.P. Roess, Traffic Engineering, Prentice Hall, 2010
- L.J. Pignataro, Traffic Engineering Theory and Practice; Prentice Hall, 1973

19ECE303: DESIGN OF REINFORCED CONCRETESTRUCTURES

L T P C

3 0 0 3

The student will be able to analyze and design various reinforced concrete members subjected to different types of loads using Indian Standard codal provisions. The course is a prerequisite for Advanced Design Reinforced Concrete Structures and Prestressed Concrete.

Prerequisite: Structural Analysis, Construction Materials and Concrete Technology.

Course Objectives

- To impart the concept of working stress method.
- To train on limit state method of design for flexure.
- To train on limit state method of design for shear, torsion.
- To enable the design of one-way and two-way slabs.
- To instill the design of columns.

Unit I **8L**

Loading standards as per IS 875, grades of steel and concrete, Introductionto working stress, ultimate load and limit state methods.Working stress method:Assumptions, flexure of RCC beams ofrectangular section, under reinforced, balanced and over-reinforced sections, analysis and design of singly reinforced beams of rectangular sections using working stress method.

Learning Outcomes

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

- list different Loading standards as per IS code (L1).
- outline the assumptions used in working stress method and limit state method (L2).
- classifythe RCC beams sections (L2).
- design of singly reinforced beams using working stress method (L3).

Unit II **8L**

Limit State Method:RCC beams of rectangular sections under flexure,under reinforced, balanced and over-reinforced sections, analysis anddesign of singly and doubly reinforced beams of rectangular sections;

Design of T beams: effective flange width, analysis and design of T-beams.

Learning Outcomes

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

- apply the principles of Limit State in design of rectangular Reinforced Beams (L3).
- design of singly reinforced RCC beams (L3).
- design of doubly reinforced RCC beams (L3).
- analyze a given T-beam section (L2).

Unit III **8L**

Shear and Torsion: Limit state of collapse in shear, types of shearfailures, truss analogy, shear, span/depth ratio, calculation of shear stress,types of shear reinforcement, design for shear in beams, analysis fortorsional moment in a member, torsion shear stress in rectangular sections,reinforcement for torsion in RCC beams.

Learning Outcomes

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

- list different types of shear failure based on span/depth ratio (L1).
- identify the effect of Torsion in RCC beams (L3).
- design of RCC beams for shear (L3).
- design of RCC Beams for torsion (L3).

Unit IV **8L**

Design of one-way and two-way slabs (using IS 456),method of analysis,classification of slabs, design of one way simply supported slab, behaviour of twoway slab, types of two way slabs, analysis of two way slabs, designof two way slabs with different edge conditions.

Learning Outcomes

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

- distinguish between the structural action of One Way and Two Way Slabs (L2).
- design of One way slabs (L3).
- design of Two way slabs for different edge conditions (L3).

Unit V **10L**

Columns: Short columns, minimum eccentricity, column under axialcompression, analysis and design of short columns subjected to uniaxialmoment, analysis and design of short columns subjected to bi-axialmoments.

Footings: Design of isolated footings for a column subjected to axial loading.

Learning Outcomes

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

- distinguish between the structural action of Short and long columns (L2).
- design of short columns subjected to axial loading (L3).
- design ofshort columns subjected to uni& bi-axial moment (L3).
- design ofisolated footings (L3).

Text Book(s)

1. Pillai and Menon, Reinforced Concrete Design, 3/e, Tata McGraw Hill, 2017.
2. A.K. Jain, Reinforced Concrete – Limit State Design, 7/e, Standard book house,2012.

References

1. P.C. Varghese, Limit State Design of Reinforced Concrete, 2/e, Prentice Hallof India,2013.
2. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University, 2014.
3. https://nptel.ac.in/courses/105105105/1
4. https://nptel.ac.in/downloads/105105104/

Course Outcomes

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

- design of RCC beams using working stressmethod (L3).
- design of RCC beams using Limit State Method (L3).
- design of RCC beams for shear & Torsion (L3).
- designof one-way and two-way slabs (L3).
- design of short columns & isolated footings (L3).

(Program Elective-I)

19ECE341: REPAIRS, RENOVATION AND REHABILITATION OF STRUCTURES

L T P C

2 1 0 3

The prerequisite for this course would be Construction Materials and Concrete Technology. The study of this course helps student in identifying the causes for failure of a structure and adopting a suitable repair or rehabilitation technique. The knowledge gained by the students on repair materials and methods learnt helps in finding solution to problems related to maintenance and repair of existing structures.

Course objectives

- Identify and define all the terms and concepts associated with deterioration of concrete structures.
- To examine various distress and damages to concrete structures.
- To assess the damage to structures using various field tests.
- To illustrate various types and properties of repair materials.
- To list various repair techniques of damaged and corroded structures.
- Demonstrate the principles of rehabilitation and retrofit techniques.

Unit I

Durability and Deterioration of Concrete: 8L

Physical causes:

Durability of concrete, causes of distress in concrete structures, Shrinkage in concrete, honeycombing in concrete, creep of concrete, Temperature changes – Internally generated temperature differences, Externally generated temperature differences, Fire on concrete, Thermal movement in concrete,

Corrosion:

Corrosion process, Damages due to corrosion

Learning Outcomes:

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

- list the factors affecting the durability of concrete(L1).
- identify the physical parameters affecting durability of concrete due to shrinkage, creep, temperature and fire(L3).
- assess the extent of damage due to corrosion(L5).
- examine the causes for deterioration of concrete(L4).

Unit II **8L**

Damage Assessment

Investigation of Damage- Observation, Assessment Procedure

Non-Destructive Testing Methods: Introduction, Non-Destructive Testing Methods, Surface Hardness Test, Ultrasonic Pulse velocity test,

Semi-Destructive Testing Systems: Core Sampling and Testing, Half -Cell potential survey

Learning Outcomes:

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

- apply different assessment procedures for evaluation of distressed structures.(L3).
- Illustrate non-destructive testing in evaluation of concrete structures(L2).
- evaluate the strength/extent of damage to existing buildings through field investigations.(L5).

Unit III **8L**

Repair Materials

Polymeric repair materials, Polymeric coatings, Polymer concrete/mortar composites, Fibre reinforced concrete, Glass fiber reinforced concrete, Polyprolene fibre, Carbon fibres, Fiber reinforced polymer composites, Concrete made with industrial wastes, Bacterial concrete.

Learning Outcomes:

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

- explain the importance of polymer concrete as repair material(L2).
- make use of industrial wastes in making of concrete(L3).
- extend the use of bacterial concrete in repair of cracks(L2).

Unit IV **8L**

Evaluation and Repair of Cracks:

Symptoms and Diagonsis of Distress, Evaluation of cracks, Selection of Repair Procedure, Repair of cracks-Preparation of Surface, Repair Techniques, Common types of repairs:Sealing of cracks, Flexible sealing, Providing additional steel, Stitching of cracks, Repair by jacketing, Autogenous Healing.

Learning Outcomes:

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

- identify the causes for evaluation of cracks in buildings(L3).
- select repair and protection techniques for existing concrete structures(L5).
- classify different repair methods available for buildings(L2).
- decide and suggest suitable method for repair of cracks in structures(L5).

Unit V **10L**

Rehabilitation and Strengthening Techniques

Rehabilitation Techniques:

Replacement Mortar- Epoxy bonded epoxy mortar, Replacement Concrete- Epoxy-bonded Replacement concrete, Application, Shotcrete or Gunite, Grouting- Portland Cement Grouts, Polymer Grouts, Epoxy Grouting, Resin injection, Sprayed concrete, Slab jacking technique, Cathodic Protection

Strengthening methods:

Introduction-Need for strengthening, Structural Concrete Strengthening, Column Strengthening, Strengthening with external reinforcement, External Post-tensioning, Section Enlargement, Guidelines for Seismic rehabilitation of existing buildings.

Learning Outcomes:

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

- summarize available techniques and their application for strengthening or upgrading existing structural systems(L2).
- identify the service life of buildings (L3).
- develop various maintenance and repair strategies (L6).
- adapt different retrofitting techniques for existing structures(L6).

Text Book(s):

1. B.Vidivelli, Rehabilitation of Concrete Structures, 1/e, Standard Publishers Distributors, 2018.
2. M.L.Gambhir, Concrete Technology: Theory and Practice, 4/e, Tata McGraw Hill Education Private Limited, 2013.

References:

1. Peter.H.Emmons and Gajanan.M.Sabnis, Concrete Repair and Maintainence, 2/e, Galgotia Publications Pvt Ltd, 1992.
2. S.Mahaboob Basha, A textbook of Concrete Technology, 1/e, Anuradha Publications, 2011.
3. J.Bhattacharjee, Concrete Structures Repair Rehabilitation and Retrofitting, 1/e, CBS, 2017.
4. P.C.Varghese, Maintenance Repair and Rehabilitation and Minor works of Buildings, 1/e, Prentice Hall India Learning Private Limited, 2014.

Course Outcomes

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

- explain the mechanisms of degradation of concrete structures affecting durability(L2).
- develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques(L6).

- select appropriate repair technique and repair material(L5).
- decide the appropriate rehabilitation/retrofitting technique for damaged structural members(L5).

Laboratory experiments

1) Assessment of compressive strength of concrete by Rebound Hammer test.
2) To conduct Ultrasonic Pulse Velocity test on concrete.
3) Measurement of corrosion of reinforcement by Half cell Potentiometer.
4) Measurement of cover and bar diameter by Profometer.
5) Evaluation of Permeability of concrete.
6) Drying shrinkage of concrete.
7) Creep test on concrete.
8) To conduct Rapid Chloride Permeability test on concrete.
9) To assess the residual strength of concrete subjected to high temperature.
10) Core sampling and testing of concrete.
11) Repair technique on damaged concrete-Wire brush/Sand blasting technique

19ECE343: FOUNDATION ENGINEERING

L T P C
2 1 0 3

Preamble: A foundation is a integral part of the structure which transfer the load of the superstructure to the soil and classified in to shallow and deep foundations. For every structure foundation is essential. There are two major requirements to be satisfied in the design of foundations, i.e Provision of an adequate factor of safety against shear failure and Adequate provision against damage to the structure by total or differential settlements. To satisfy these requirements detail investigation of the properties of soil by means of laboratory or field testing. Based on the investigation report type and depth of foundation is suggested, earth pressure calculated, Stability of slope analyzed and bearing capacity also determined

Course Objectives:

1. To acquaint the need of Soil Investigation and characterisation for structural stability.
2. To study the estimation of bearing capacity of soils for shallow foundations and design considerations.
3. To study the estimation of Load Carrying Capacity of Piles and well foundations.
4. To introduce the determination of earth pressure behind retaining walls. Understand Ground Improvement Methods. Analysis of Slope Stability aspects. (This course does not cover the structural design of foundations.)

Unit I **8 hours**

Subsoil Exploration: Importance, Methods of subsoil exploration, direct, indirectmethods, soundings by standard, dynamic cone and static cone penetration tests, correlations of shear parameters from N values, types of boring, types of samples, criteria for undisturbed samples, bore-logs-preparation, report writing.

Learning Outcomes: After completion of Unit-I Students will be able to:

- **Summarize** the importance of Soil Investigation and various methods of sub-soil exploration -**L2**
- **Apply** direct and indirect methods of Soil Investigation Consistent with Site Conditions/ Strata Conditions.–**L3**
- **Identify** Suitable Samplers for UD-Soil Sample Collection during Investigations-**L3**
- **Adap**t the suitable Geo-Physical, Soil exploration to supplement direct methods soil Investigation data with Electrical Resistivity, Reflection and Refraction Surveys.–**L6**
- **Propose** the conservative, appropriate, economical foundation type, depth of foundation for the soil profile.–**L6**

Unit II **9 hours**

Shallow Foundations: Safe bearing capacity and allowable bearingpressure, Terzaghi's bearing capacity equations its modifications for square, rectangular and circular foundation, types of bearing capacity failures : general, local and punching shear conditions, factors affecting bearing capacity of soil, allowable bearing pressure based on n-values, bearing capacity from plate load tests, causes of settlement, computation of elastic or immediate settlement, allowable settlement, related applications.

Learning Outcomes: After completion of Unit-II Students will be able to:

- **Classify** the types of different foundation systems - L2
- **Illustrate** the necessary theoretical, practical aspects for design considerations and construction of foundation systems.-**L2**
- **Identify** with various theoretical, semi-theoretical methods of determination of bearing capacity on a construction site, for shallow foundations.**–L3**
- **Estimate** Load carrying capacity for shallow foundations with different shapes **-L5**
- **Evaluate** the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.**–L5**
- **Apply** the codal provisions in order to estimate safe bearing capacity based on permissible settlements as settlements to arrive at safe soil pressure.**–L3**
- **Determine** the immediate elastic settlements and long term consolidation settlements very often governs the design of footings-**L5**

Unit III **8 hours**

Pile Foundations: Classification, use and installation, load carrying capacity of single pile, dynamic formula, static formula, pile load, load capacity of pile groups, average efficiency of pile groups, settlement of pile groups in clays, negative skin friction on plies. **Caissons**: Introduction, various forces acting and types of caissons.

Learning Outcomes: After completion of Unit-III Students will be able to:

- **Classify** pile foundations based on functionality, material –composition, method of installation (construction) and displacement of sub-soil.-**L2**
- **Identify** the methods to estimate pile load capacity (Single Pile/ Group of Piles) – **L3**
- **Identify** measures to estimate reduction of load capacity due to Negative Skin friction.**–L3**
- **Determine** the settlements of Pile groups in Sand, Granular Soils and in Clayey Sub-Soils.**–L5**
- **Analyze** the various forces acting on well foundation–**L4**
- **Estimate**load capacity of well foundations due to end bearing at the base of well and skin friction on staining. **–L4**
- **Identify** the various types of well foundations – L3

Unit IV **9 hours**

Earth Pressure: Types of earth pressures, Rankine’s active and passiveearth pressures, smooth vertical wall with horizontal backfill, extension to Coloumb’s wedge theory, Rebhann’s graphical method for active earth pressure.

Learning Outcomes: After completion of Unit-IV Students will be able to:

- **Illustrate**Lateral Earth Pressure concept and classical theories Rankine's, Coulombs theory of active and passive earth pressures with and without sloping backfill -**L2**
- **Analyze** lateral earth pressures under at-rest, active and passive conditions – **L4**
- **Identify** design considerations of Rigid Retaining walls, flexible retaining walls for overall stability**–L3**
- **Apply** theory to granular soils as an ideal backfill and extension to clayey soil backfills.**–L3**
- **Solve** earth pressure problems of Coulombs trial wedge theory, Rebhaan’sgraphical method. **–L6**

- **Classify** the flexible retaining walls (Bulkheads) - **L2**

Unit V **8 hours**

Stability Analysis of Slopes: Introduction, types of slope failures, finiteslopes, Swedish slip circle – ø = 0 analysis, c-ø analysis, friction circle methods of stability analysis, Taylors stability number, factors influencing slope stability

Learning Outcomes: After completion of Unit-V Students will be able to:

- **Identify** various types of failure of finite slopes and method of analysis for slope stability.–**L3**
- **Explain**the various factors influencing slope stability.-**L2**
- **Determine** the FoS against slope failures and interpret the results.–**L5**
- **Analyse** those remedial measures to be adopted for stability of existing slopes.–**L4**
- **Solve** problems related to stability of slope using analytical and graphical methods-**L6**

LIST OF EXPERIMENTS:

1. Classification of soil using Hydrometric Analysis
2. Determination of Group Index of soil
3. Determination of Optimum Moisture Content and Maximum Dry Density of soil using Modified Proctor test
4. Determination of shear strength of soil using Vane Shear test
5. Determination of California Bearing Ratio of soil
6. Determination of Swell pressure of an expansive soil
7. Demonstration on Standard Penetration Test
8. Demonstration on cone Penetration Test
9. Demonstration on plate load test
10. Demonstration on pile load test

Text Book(s):

Gopala Ranjan and A.S.R. Rao, Basic and Applied Soil Mechanics, New age Publishers, 2000.

- C. Venkataramaiah, Geotechnical Engineering, New Age Publishers, 2006.
- Dr. K. R Aurora, Soil Mechanics and Foundation Engineering, Standard Publisher Dist, 2009.

References:

1. V.N.S. Murthy, Soil Mechanics, Foundation Engineering, UBS Publishers, 2011.
2. J.E. Bowles, Foundation Analysis and Design, McGraw Hill, Publishers, 2001.
3. M.D. Braja, Principles of Geotechnical Engineering, 7/e, Cengage Learning: 2013.
4. P.C. Donald, Geotechnical Engineering, Prentice-Hall India, 2010.
5. Rodrigo Salgado, The Engineering of Foundations, McgrawHill, 2006.

Course Outcomes:

Student shall be able to

1. **Explain** direct and indirect soil Investigation methods to be adopted prior to construction of structures – **L2**
2. **Determine** bearing capacity of soils for shallow foundations and settlement – **L4**
3. **Estimate** Load Capacities of Pile Foundations and well foundations- **L5**
4. **Estimate** earth pressure behind Retaining Structures, Ground Improvement Techniques – **L5**
5. **Perceive** the Stability analysis of Soil Slopes and arrival of FOS for the natural and manmade slopes – **L5**

NPTEL LINKS

1. **Soil Exploration** **http://nptel.ac.in/courses/105105039/2**
2. **Shallow foundations** **http://nptel.ac.in/courses/105107120/**
3. **Pile foundations** **http://nptel.ac.in/courses/105107120/13**
4. **Earth pressures** **http://nptel.ac.in/courses/105107120/8**
5. **Stability analysis of soils** **http://nptel.ac.in/courses/105101084/55**

19ECE345: TRAFFIC ENGINEERING

L	T	P	C
2	1	0	3

Students will acquire comprehensive knowledge of traffic surveys and studies such as volume count, Speed and delay, origin and destination, Parking, pedestrian and accident surveys. They will achieve knowledge on design of at-grade and grade separated intersections. Students will become familiar with various traffic control and traffic management measures

Course Objectives:

- Provide an insight on traffic and its components, factors affecting road traffic and the design of intersection.
- Explain sampling of data, analysis and interpretation of data in conducting various surveys.
- Demonstrate traffic movements, types of intersections, islands, crossings and their design.
- Enable design of signals and explain the redesigning of existing signals.
- Impart knowledge on traffic regulations, pollution caused by traffic and the method of controlling pollution.

Unit I **8 L**

Introduction: Objectives and scope of traffic engineering. Components of road traffic - vehicle, driver and road. Road user characteristics; human and vehicle characteristics, factors affecting road traffic

Learning Outcomes:

After the completion of Unit, students will be able to

- Definecomponents of road traffic[L1]
- explain different road user characteristics[L2]
- outline various human characteristics[L2]
- list various vehicle characteristics[L1]
- develop knowledge on factors affecting road traffic**[L3]**

Unit II **8 L**

Traffic Engineering: Concepts of passenger car units for mixed traffic flow. Traffic Manoeuvres. Traffic Stream Characteristics- RelationshipbetweenSpeed,FlowandDensity, capacity, level of service concept

Learning Outcomes:

After the completion of Unit, students will be able to

- definepassenger car unit and related concepts[L1]
- explaindifferent traffic maneuvers[L2]
- identifytraffic stream characteristics[L3]
- build relationshipbetween speed, flow and density[L3]
- illustrateknowledgeon capacity and level of service**[L2]**

Unit III **10 L**

Traffic Engineering Studies and Analysis: Sampling in traffic studies; adequacy of sample size; application of sampling methods for traffic studies, objectives, methods of traffic study, equipment, data collection, analysis and interpretation (including case studies) of (i) Spot speed (ii) Speed and delay (iii) Volume (iv) Origin - destination (v) Parking

Learning Outcomes:

After the completion of Unit, students will be able to

- list terminology related to sampling in traffic studies[L1]
- applydifferent methods of sampling for traffic studies[L3]
- plantraffic studies using identified methods and equipment [L3]

- utilizedata from traffic studies**[L4]**
- **explain** different traffic study methods such as spot speeds, speed and delay, volume, origin-destination and parking studies**[L2]**

Unit IV **8 L**

Traffic Regulations and Control: flow; Other regulations and control. traffic and method of control. General regulations; Regulations on Vehicles, drivers and Traffic management; noise and air pollution due to road

Learning Outcomes:

After the completion of Unit, students will be able to

- showthe necessity of regulations and control for traffic flow[L2]
- explainmethods of traffic control[L2]
- listregulations on vehicles and drivers[L1]
- developknowledge ontraffic management[L3]
- identifynoise and air pollution aspects because of traffic**[L3]**

Unit V **8 L**

Traffic Control Devices: Principlesof Signal Design, Webster'smethod of Signal Design,Redesign of Existing Signals including Case Studies; Signal SystemandCoordination.Evaluation and design of road lighting

Learning Outcomes:

After the completion of Unit, students will be able to

- develop knowledge on signal design[L3]
- summarizeWebster's method of signal design[L2]
- demonstrate knowledge of signal design by redesigning an existing signal[L2]
- explain the concept of signal coordination[L2]
- findout the evaluation and design procedures for road lighting**[L1]**

List of Experiments:

1. Volume Studies – MidBlock and Intersections
2. Speed Studies - Spot Speed Studies by Stop Watch, and Radar Speed Meter
3. Journey Time and Delay Studies - Floating Car Method
4. Parking Surveys
5. Study of Gaps and Lags – Critical Gaps and Lags at Intersections
6. Delay Measurement at Signalised
7. Delay Measurement at Unsignalised Intersections

Course Outcomes:

After the completion of the course students should be able to

- demonstrate components of road traffic, their characteristics and factors affecting road traffic in intersection design **[L2]**
- apply the knowledge of sampling data in conducting various surveys and analysis **[L3]**
- interpret traffic movements and designing islands, intersections and road lightings **[L2]**
- explain design new signals and redesign existing signals **[L2]**
- summarize traffic regulations, impact of noise pollution, air pollution and the method of controlling them **[L2]**

Text Book(s):

- Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018
- Drew, D.R. Traffic Flow Theory and Control, McGraw Hill Book Co, 1968.
- Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, 9/e, Nemchand and Bros, Roorkee, 2017

References:

- Papacostas, C.A., Fundamentals of Transportation Engineering, 3/e, Prentice-Hall of IndiaPrivate Limited, New Delhi.2001
- McShane W.R. and Roess R.P., Traffic Engineering, 5/e, Prentice Hall India, 2018
- Indian Highway Capacity Manual - Indo-HCM 2017
- NPTEL Web course on Traffic Engineering and Management: https://nptel.ac.in/courses/105101008/

19ECE347: HYDRAULIC MACHINES

L	T	P	C
2	1	0	**3**

The prerequisite for this course would be fluid mechanics. This course introduces the knowledge of application of impulse momentum equation to compute the force exerted by fluid jet on stationary and moving vanes, torque exerted on a wheel with radial curved vanes. This course gives the comprehensive knowledge of hydraulic machines to illustrate the working principles of pumps and hydraulic turbines. The learner will gain the knowledge of unit quantities, specific speed and performance characteristics of pumps and turbines.

Course Objectives:

- to explain the application of impulse momentum equation to compute the force exerted by fluid jet on stationary and moving vanes
- to explain the velocity triangles resulting from impact of jet of an unsymmetrical curved moving vane.
- to impart the concepts to compute the work-done of pumps and turbines.
- to explain the performance characteristics of turbines and pumps.
- to summarize the functionality of various hydraulic machines.

Unit-I: **9 L**

Impact of free jets on vanes: Impulse Momentum Equation – Force exerted by fluid jet on stationary and moving vanes, torque exerted on a wheel with radial curved vanes, velocity triangles.

Learning outcomes:

After completion of Unit-I, students will be able to

- explain Impulse – Momentum Principle (L-2).
- compute impact of free jet on vanes (L-3).
- draw velocity triangles (L-3).
- compute the work-done of wheel with radial curved vanes (L-3).

Unit-II: **9 L**

Hydraulic Turbines: Elements of hydropower plants, classification of turbines – Impulse Turbines (Pelton wheel), Reaction Turbines (Francis, Kaplan) –components, functioning, work done and efficiencies (theory only); applications of draft tube, surge tank.

Learning outcomes:

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

- list the components of turbines (L-1).
- describe the functionality of the turbines (L-2).
- explain the significance of draft tube, surge tank (L-2).
- compute the work-done of turbines (L-3).

Unit-III: **8 L**

Performance of Turbines: Performance under unit head and specific conditions, expressions for specific speeds (no derivations), performance characteristic curves, cavitation in turbines, selection of turbines.

Learning outcomes:
After completion of Unit-III, the student will be able to

- define unit quantities and specific quantities of turbines (L-1).
- explain the selection of turbines (L-2).
- solve problems related to performance of turbines (L-3).
- draw performance characteristic curves for impulse and reaction turbines (L-3).

Unit-IV: 8 L
Pumps: Rotodynamic Pumps (Centrifugal Pumps) – components, working, types, work done, efficiencies, specific speed (theory only), advantages of centrifugal pumps, pumps in series and parallel.

Learning outcomes:
After completion of Unit-IV, the student will be able to

- state the components of pumps (L-1).
- describe the functionality of the pumps (L-2).
- compute work done by and efficiencies of pumps (L-3).
- draw performance characteristic curves for pumps (L-3).

Unit-V: 8 L
Functionality and working principles of Mono-block pump, submersible pump, jet pump, Tubular turbine, bulb turbine, lawn sprinkler.

Case Studies related to various Hydraulic Machines *(for internal assessment only)*

Learning outcomes:
After completion of Unit-V, the student will be able to

- explain the functionality of various hydraulic machines (L-2).
- illustrate the working principles of various hydraulic machines (L-2).
- present case studies of various hydraulic machines (L-3).

Course Outcomes:
At the end of the course, student would be able to

- Draw the velocity triangles resulting from the jet impinged onto a moving unsymmetrical curved vane (L-3).
- Describe the functioning of impulse and reaction turbines, rotodynamic and positive displacement pumps (L-2).
- Draw the performance characteristic curves of turbines (L-3).
- Compute efficiencies of hydraulic pumps (L-3).
- Select appropriate turbine based on head available and other parameters (L-5).
- Describe the significance and working of various hydraulic machines (L-2).

Hydraulic Machines Laboratory

List of Experiments

1.To find the coefficient of impact of a jet impinged on to a hemispherical vane.

2.To de monstrate the working principles of a centrifugal pump using model

3.To demonstrate the working principles of a submersible pump using model

4.To demonstrate the working principles of a Jet pump using model

5.To study the performance characteristics of Pelton wheel turbine.
(IS 12800 (Part 3) : 1991 (2003) - Guidelines for Selection of Hydraulic Turbine, Preliminary Dimensioning and Layout of Surface Hydroelectric Powerhouses, Part 3 - Small, Mini And Micro Hydroelectric Power Houses)

6.To study the performance characteristics of the Francis Turbine.
(IS 12800 (Part 3) : 1991 (2003) - Guidelines for Selection of Hydraulic Turbine, Preliminary Dimensioning and Layout of Surface Hydroelectric Powerhouses, Part 3 - Small, Mini And Micro Hydroelectric Power Houses)

7.To study the performance characteristics of a centrifugal pump.
(IS 9137 : 1978 (1993) – Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Pumps - Class C)
ISO 9905 : 1994 - Technical specifications for centrifugal pumps — Class I
https://www.iso.org/obp/ui/#iso:std:iso:9905:ed-1:v1:en

8. **To study the performance characteristics of a reciprocating pump.**

Learning Outcomes

The student will be able to:

1. Calculate the coefficient of discharges of flow measuring devices (L-3).
2. Calculate the friction factor (L-3).
3. Compute the total head in a pipe flow by using Bernoulli's equation (L-3).
4. Calculate the coefficient of impact of a jet (L-3).
5. Calculate the efficiencies and draw the performance characteristic curves of turbines & pumps (L-3).
6. Compute the flow through measuring devices (L-3).

Text Books

3. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, 20/e, Standard Book House, 2015.
4. A.K. Jain, Fluid Mechanics, 12/e, Khanna publishers, 2014.

Reference Books

1. K. Subramanya, Hydraulic Machines, Tata McGraw Hill, 2017.
2. L. Victor, Streeter and E. Benjamin Wylie, Fluid Mechanics, 9/e, Tata McGraw Hill,2013.
3. M. Franck White, Fluid Mechanics, Tata McGraw Hill, 2014.

19ECE349: POLLUTION PREVENTION AND MANAGEMENT

L	T	P	C
2	1	0	3

Clean drinking water, hygiene, and sanitation play an important part in maintaining health. Because the health of patients is ***important*** *to hospitals, they are tasked with proper* ***disposal*** *of* ***biomedical waste****. It transports the* ***waste*** *to its treatment facility and then properly treats the* ***waste*** *prior to disposing of it. Bioremediation is a waste management technique that involves the use of organisms to remove or neutralize pollutants from a contaminated site and saves natural resources. Recycling recovers valuable materials from old electronics that can be used to make new products. Globally, 50 million tons of e-waste is generated annually and has all 'potential' to grow at much faster rate than any other waste streams. It is very interesting to note that even after the due use, this particular 'waste' is of great significance & value.*

Course objectives:

- to introduce about waste disposal methods in rural sanitation
- to study the concepts of biomedical waste management
- to impart about hazardous waste management
- to acquaint with e-waste management rules
- to expose to various bioremediation techniques

Unit – I: Rural Sanitation 8 L

Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems- Effluent disposal.

Learning outcomes:

1. explain various methods of waste water collection systems –L2
2. outline the treatment methods of waste water –L2
3. illustrate various effluent disposal methods –L2

Unit – II : Biomedical Waste Management 8 L

Definition-Sources-Classification of biomedical waste – Objectives of Biomedical waste management- segregation-containers for biomedical waste-Labeling Collection-Transport-Disposal methods.

Learning outcomes:

1. classify the biomedical waste –L2
2. explain the principles involved in biomedical waste management –L2
3. summarize the disposal methods –L2

Unit –III: Industrial And Hazardous Waste Management 8 L

Industrial waste types, characteristics of industrial wastes, pollution from major industries, effects of industrial effluents, cleaner production, treatment technologies; Hazardous wastes definition, sources of hazardous waste, transportation, treatment and disposal methods and processes

Learning outcomes:

1. classify various industrial and hazardous waste –L2

2. identify the effects of industrial effluents – L3
3. summarize the disposal methods of hazardous waste - L2

Unit – IV - E-Waste management 8 L

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.

Learning outcomes:

1. compare various types of e-waste –L2
2. explain the impact of e-waste on air, water and soil-L2
3. make use of e-waste management rules for its safe disposal –L3

Unit –V: Bioremediation for soil environment 10 L

Soil-water-environment interaction, Soil Organic Matter and Characteristics -Biotechnologies for Ex-Situ Remediation of Soil - Biotechnologies for in-Situ Remediation of Soil - Emerging Environmental Biotechnologies- Phytoremediation -Sequestering Carbon Dioxide -Biomonitoring -Application of Microbial Enzymes -Biomembrane Reactors

Learning outcomes:

1. interpret the soil –water relationship –L2
2. distinguish in-site and ex-situ remediation methods –L3
3. summarize various emerging technologies in bioremediation –L4

Course outcomes:

1. summarize the disposal techniques of rural sanitation –L2
2. analyze best disposal techniques in biomedical waste management –L4
3. explain various treatment methods of Industrial And Hazardous Waste –L2
4. estimate the e-waste generated –L5
5. assess the role of microorganism in bioremediation techniques –L4

Text Books

1. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007.
2. Rittmann, B.E., and McCarty, P.L., Environmental Biotechnology: Principles and Applications, McGraw Hill, 2001.

Reference Books

1. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000
2. Industrial Wastewater Management, Treatment and Disposal, WEF Manual of practice No. FD-3, 3rd Ed., WEF Press and McGrawHill, 2008

19EOE301: JAPANESE FOR BEGINNERS
(Open Elective-I)

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
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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 Biocolonialism

Unit-V

Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Use of biofertilisers 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**
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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

L	T	P	C
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Objectives: The objective of this course is to make students familiar with the developments that are taking place in different areas of study with the help of Computer and Information Technology. The students will acquire knowledge in national and international legal order on the Fundamentals of Cyber Laws. The abuse of computers has also given birth to a gamut of new age crimes that are addressed by the Information Technology Act, 2008 (as amended). The chief aim of this course is to encourage inter-disciplinary studies.

UNIT-I

Conceptual and theoretical perspectives of Cyber Law - Computer and Web Technology –Evolution of Cyber Law – National &International Perspectivesof Cyber Law - Legal Issues &Challenges in India, USA and EU - Data Protection - Cyber Security, etc.

UNIT-II

International Perspectives - Budapest Convention on Cybercrimes - ICANN’s core principles and the domain names disputes - Net neutrality - EU electronic communications regulatory framework - Web Content Accessibility Guidelines (WCAG).

UNIT-III

Information Technology Act, 2008 as amended - Overview of the Act - Jurisdiction -Electronic Governance - Electronic Evidence (Relevant portions of Indian Evidence Act) - Digital Signature Certificates (DSCs) - Duties of Subscribers of DSCs - Role of DSC Certifying Authorities - The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability – Powers of Police - Impact of the Act on other Laws - Social Networking Sites vis-à-vis Human Rights.

UNIT-IV

Cyber Laws vis-à-vis IPRs - Copyright in Information Technology - Software - Copyrights Vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Patents - European Position on Computer related Patents - Legal position of U.S and India on Computer related Patents - Trademarks in Internet - Domain name registration - Domain Name Disputes & World Intellectual Property Organization (WIPO) - Databases in Information Technology - Protection of database in USA, EU &India.

UNIT-V

Mobile Technology- SIM (Subscriber Identity Module) cloning–Mobile frauds - Usage of mobile software - Special reference to the relevant provisions of IT ACT 2008, India Penal Code and Evidence Act.

Textbooks:

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

LT P C
3 0 0 3

Objectives:

The objectives of the course are to understand, analyze, and examine the following:

- The factors that determine trade between countries: labour productivity, labour intensity, technology, skills, etc; protectionism and new trade policies of developed and developing countries;
- Impact of global trade patterns on developing countries including
- Impact of exchange rate regime and global financial crisis on trade;
- The new world trading system, Global Logistics, International markets, and its implications on the developing world.

UNIT I:

Introduction and Overview: Definition and Scope of International Business- Mercantilism- The process of Internationalization- International Business and India. Environment: Economic Environment-Country Risk, Political Risk, Socio-Cultural Risk Factors, PESTEL Analysis - Brief historic overview of Protectionism- Regional Economic Arrangements - NAFTA, and ASEAN- Evolution of International Monetary System- International Money and Capital Markets-instruments, players and markets- Foreign Exchange Markets.

UNIT II:

Theoretical & Institutional Framework- Institutions: WTO Functions- basic principles - anti dumping duty - countervailing duties, safeguards – GATS – TRIPS – IMF - World Bank - Asian Development Bank – UNCTAD - GATT- Case Studies: ADD on Shrimps, Patents and Indian Pharma Sector. International Trade: Why do nations Trade- Brief Overview of International Trade Theories- Gains from International Trade- Export Orientation and Economic Development- Trade as an engine of growth-Balance Of Payments - International Trade in Goods and Services- Case Studies: East Asian Miracle, Flying Geese Effect

UNIT III:

Managing International Business – I: International Marketing: Internationalization- global orientations toward market place- evolution of global marketing- global marketing environment- modes of entry into foreign markets- global marketing mix- global marketing research. International Financial Management: Multinational Finance Function - Sources of Debt and Equity Finance, International Trade Finance, Exchange Rate Arithmetic, Foreign Exchange Risk & Exposure and its Management, International CAPEX Decisions, FDI, and FII.

UNIT IV:

Managing International Business – II: EXIM Operations: Export and Import Documentation- Designing EXIM Strategies- The role of third party agents and intermediaries in international trade- INCO Terms, International Packaging Issues, Foreign Trade Zones. Global Logistics & Supply Chain Management: Shipping and Multi-Modal Transport- Global Supply Chain perspective – Global Sourcing and Vendor Network- IT enabled Logistics

UNIT V:

Managing International Business – III: International Human Resource Management: Managing global corporations- International HRM - Managing diverse workforce – Cross Cultural issues – Ethical Issues in International Business. Trends in International Business: Outsourcing- IT enabled Service enterprises- Collaborative Business- Extended Enterprises- Tax Havens- Multi-Country Production facilities- Global Assembly Lines- Trans National Corporations- Reverse Innovation- Non-conventional regional grouping.

Textbook:

Charles W.L. Hill- Arun K. Jain- "International Business: Competing in Global Market Place"- McGraw Hill- 6th Edition- 2009.

Suggested Readings:

1. John D. Daniels- Lee H. Radebaugh- Daniel P. Sullivan- "International Business-Environment and Operations"- Pearson Education- 10th Edition- 2004
2. Michael R. Czinkota- Llkka A. Ronkainen- Michael H. Moffett- "International Business" – Cengage Learning- 7th Edition- 2005
3. Justin Paul- "International Business"- Prentice Hall- 3rd Edition- 2007.
4. Ball- McCulloch- Geringer- Minor- Mcnett- "International Business: The challenge of Global Competition"- McGraw Hill- 11 Edition- 2009.
5. S.N. Chary- "Elements of International Business"- Wiley India- 1 Edition- 2006.
6. Francis Cherunilam- "International Business- Text and Cases"- Prentice Hall- 3rd Edition- 2004.
7. Margaret Woods- "International Business an Introduction"- Palgrave Publications- 1st Edition- 2003.
8. Aswathappa- "International Business"- TATA McGraw Hill- 1st Edition- 2003.
9. Mike W. Reng- "International Business"- Cengage Learning- 1st Edition- 2007.
10. Vyuptakesh Sharan- "International Business Concept- Environment- & Strategy"- Pearson Education- 1st Edition- 2006.

19MOE319: INTRODUCTION TO MUSIC

LT P C
3 0 0 3

Unit I **8 hours**

Introduction to Indian Classical Music: Heritage-Contribution of vari-ous races and tribes to the evolution of music in India, technical aspects of Indian classical music, influences Persian music especially on hindustani music, significance of music in bringing about social change.

Unit II **9 hours**

History of Indian Music: Origin-Vedas, scriptures and bharata'snatyasastra, traditions- hindustani and carnatic, basic elements, shruthi, swara, raaga and taala, similarities and variations in hindustani, carnatic and western classical music, octave, semitones, introduction to shruthi, swara, raaga and taala, fundamental ragas, importance of taala in indian music, introduction to pallavi, anupallavi and charana.

Unit III **8 hours**

Hindustani Music: Brief history of hindustani music, concepts of raagaand taala, introduction to various gharanas, classification of music (folk, semi-classical, bhajans, light), appreciation of music.

Unit IV **8 hours**

Carnatic Music: History of carnatic music, traditions, the musical trinity,Syama Sastri, Thyagaraja, Muthuswami Dikshitar, introduction to tech-nical terms in carnatic music, compositional forms/strategies.

Unit V **9 hours**

Connections-Music, Art and Culture: Musical oral tradition as a trans-mitter of culture, music as an expression of societal change, music as a means of communication across cultures.

References

1. Rangaramanuja Iyengar R., History of South Indian Carnatic Music: From Vedic Times To The Present, Wilco Publishing House, 1972.
2. Beni Madhab Barua, Swami Prajnanananda, The Historical Development of Indian Music: A Critical Study, Buddh Gaya, India, 1973.
3. G.H. Ranade, Hindustani Music, Popular Prakashan, 1971.

19EOE321: ENVIRONMENT AND ECOLOGY (Elective)

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Unit I **8 hours**

Basic Concepts: Environment types, features of environment, structureof atmosphere, earth's four spheres, ecology, ecological principles, pho-tosynthesis, 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 andglobal warming, acidification, world distribution of acid rain, impact of acid of precipitation, ozone depletion, Antarctic ozone hole, some basic facts about ozone depletion, salinisation, desertification or desertisation, soil erosion, types of soil erosion, soil conservation, deforestation, waste disposal, sustainable development.

Unit IV **8 hours**

Natural Hazards and Disaster Management: Disaster, natural hazards,earthquakes in India, seismic zones of India, earthquake prediction, tsu-nami, landslides, types of landslides, avalanches, cyclones, thunderstorms, tornadoes, surge, sea-surge or storm surge. Floods: floods in India, flood disaster management. Drought hazards: causes of droughts, consequences of droughts, biological hazards and disasters, famines, wildfire (forest fire), forest fires in India.

Unit V **8 hours**

Climate Change: Evidence of global warming, consequences of climaticchange, consequences of climate change in India. Biodiversity and Leg-islation: Earth summit, the five earth summit agreements, the Montréal protocol, Kyoto protocol on climatic change.

Text Book(s)

1. Majid Husain, Environment and Ecology, 2/e, Access Publishing, New Delhi, 2014.

References

1. S. V. S. Rana, Essentials of Ecology and Environmental Science, Prentice Hall India, New Delhi, 2011.

19EOE323: INDIAN HISTORY (Elective)

L	T	P	C
3	0	0	3

Unit I **10 Hours**

Ancient Indian History and Culture (Earliest Times to 700 AD): Indusvalley civilisation, origin, significance. art and architecture, aryans and vedic period, expansions of Aryans in India, significance of the vedic age, evolution of monarchy and varna system, political conditions and admin-istration under Mauryas, Guptas, social and economic conditions in an-cient India, philosophy and religions in ancient India.

Unit II **8 Hours**

Medieval Indian History and Culture: Delhi sultanate, great mughals,bahumanis, rise of south supremacy and conflicts, Pallava, Chalukya, Chola and Rasthrakutas.

Unit III **8 Hours**

Modern Indian History and Culture: European penetration into India,the Portuguese and the Dutch, the English and the French east India com-panies, their struggle for supremacy, the battle of Plassey and its signifi-cance, consolidation of British rule in India.

Unit IV **8 Hours**

Impact of British Colonial Rule: Economic: Commercialization of ag-riculture, dislocation of traditional trade and commerce, de-industrialisation, decline of traditional crafts, drain of wealth, famine and poverty in the rural interior. Social and Cultural Developments: The state of indigenous education and its dislocation, orientalist, anglicist controversy, introduc-tion of western education in India, the rise of print media, literature and public opinion, the rise of modern vernacular literature, progress of sci-ence, rail and road connectivity.

Unit V **8 Hours**

The Rise of Indian National Movement: Indian response to British rule,the great revolt of 1857, the peasant movements of the 1920s and 1930s, the foundation of the Indian national congress, the moderates and extrem-ists, the partition of Bengal (1905), the swadeshi movement in Bengal, the economic and political aspects of swadeshi movement. Gandhian nationalism: Gandhi's popular appeal, Rowlett Act, satyagraha, the Khilafat movement, the non-cooperation movement, civil disobedience movement, Simon commission, the peasant and working class movements, Cripps mission, the quit India movement, declaration of independence.

Text Book(s)

1. Romila Thapar, A History of India, Vol. I, Penguin Books, 2013.
2. R.C. Majumdar, The History and Culture of the Indian People: Volume 1, The Vedic Age, Bharatiya Vidya Bhavan, 2010.
3. B. L. Grover, Modern Indian History: From 1707 to the Modern Times, S. Chand, 1998.
4. R.C. Majumdar, History of the Freedom Movement in India, South Asia Books, 1988.

References

1. D. N. Jha, Ancient India in Historical Outline, Manohar Publishers and Distributors, 2001.
2. G. S. Chabra, Advanced Study in the History of Modern India, Lotus Press, 2007.
3. M.K. Gandhi, Hind Swaraj: Indian Home Rule, Sarva Seva Sangh Prakashan, Varanasi, 2014.
4. W. W. Hunter, History of British India, Read Books Design, India, 2010.
5. A. R. Desai, Social Background of Indian Nationalism, 6/e, Popular Prakashan, 2005.

19EOE327: PROFESSIONAL COMMUNICATION
(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

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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 VIRUTUAL REALITY

L	T	P	C
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Summary

Virtual Reality extends the boundaries of the physical environment by providing a never ending real estate on which an infinite number of worlds can be built to learn, explore and visualise. In order to empower interested students by providing them with an opportunity to learn a cutting-edge technology like VR and getting skilled for industry while in university, Facebook School of Innovation powered by SV.CO, has provided a VR skill pathway offering VR 201 (Beginner), VR 301 (Intermediate) and VR 401 (Advanced) level course.

Course Objectives

The objective of this course is to introduce the students to learn about Virtual Reality and the skills required to become a Unity VR developer.

Course Outcomes

By the end of the course, the student should be:

- well versed with the concepts of VR,
- able enough to understand, articulate and criticize VR experiences/applications in sufficient detail
- able to execute the concepts into demonstrable examples,
- able to understand the requirements and the skillset to be a VR developer in the current economy.

Skills required

None (But a basic understanding of VR, Unity, and C# will be helpful)

Skills acquired

- Basic VR Developer (Oculus Platform)
- Basic Unity Developer (Wireframing/Storyboarding, Level Designing, C# Programming)

Project

Build a basic Virtual Reality application that allows the student to exercise all the fundamental knowledge gained in the course

Course Syllabus

Level 1 : Introduction to VR and Unity3D

M1: Keep it Virtual (Introduction to VR)
M2: Platforms and Paradigms
M3: Unity, Diversity (Introduction to Unity 3D)
M4: Ready Player One (Getting Started in Unity)
M5: Oh Hello World (Deploying your First App to Oculus Quest or Go)

Level 2 : Components of Unity

M1: Materials and Meshes
M2: Lights, Camera, VR
M3: I like to Move it (Animation in Unity)

Level 3 : Scripting in Unity #1

M1: Basics of C# in Unity #1
M2: Basics of C# in Unity #2

Level 4 : Scripting in Unity #2

M1: Let's Code #1
M2: Let's Code #2

Level 5 : Oculus Quest (Go) and its basics

M1: Oculus Inputs and UI Fundamentals
M2: Events and Buttons
M3: Buttons and the Joystick

Level 6 : Fundamentals of Unity Physics and Visual Effects

M1: Action, but Reaction? (Physics, Colliders, Raycast)
M2: More Controller Interactions
M3: Visual Effects

Level 7 : Design and Debug

M1: Debug.Log("This is where it breaks")
M2: VR Design
M3: Documentation and Unity Collab

Level 8 : Performance in Unity and Easter Eggs (Optional Level)

M1: Device Performance
M2: Easter egg #1
M3: Easter egg #2

Capstone Project Targets

P1: Level Design and UI
P2: Mechanics, Navigation and Deploy

Continuous Evaluation Plan (100 marks)

Milestones Based Evaluation (50 marks):

- Each level has a graded target where the students demonstrate their understanding of the content and get feedback.
- Each target is evaluated for 5 marks.
- These targets from Level 1 to 8 will contribute to the internal marks. Level 8 is optional.
- Marks received out of 35 / 40 (if Level 8 is attempted) are scaled up to 50.

Project Evaluation (50 marks):

This will have two components:

1. Capstone Project linked Targets:
    a. Students will complete extra targets from which will contribute to a mini project /capstone work.

2. Viva Q&A
    a. Students are given a small task on the spot to complete based on the course, and/or asked a few questions to check their understanding of the course by an industry expert.

Annexure (Optional)

Checklist for students in VR201 to be eligible for the startup-aligned project

1. Interest was shown to build a startup in the pre-course interest form. (Likely teamed up)
2. The 4 highest scorers of the students (team of 2) that also show continuing interest in building a startup at the end of the 6 weeks in the program get to choose the problem statements (discussed and worked with coaches/TAs to structure into outcomes) that they get to work on.
3. In case the students choose not to go with their self-described problem statement then the next in the list in terms of scores top-down gets a chance. And if nobody later during the program wishes to go with their self-described problem statement, they'll go with the problem statement given out in the program anyway.

(Interdisciplinary Elective-I)

19EBT371: BIOMATERIALS

L	T	P	C
2	**1**	**0**	**3**

Biomaterials are a highly diverse group of materials. Some biomaterials possess unique properties such as self-assembly and self-repair. Other materials are useful for targeted and controlled drug delivery. Knowledge of the structure-function studies of biomaterials can be used to guide the design of smart materials, sensors and devices. Knowledge of interaction of implant materials with human body is required for design of human implants.

Course Objectives

- Describe the properties of biomaterials
- Describe the properties of biological-nonbiological interfaces
- Describe the principles and applications of self-assembled and smart biomaterials
- Describe the principles and applications of drug delivery vehicles
- Describethe materials used in implants

UNIT I 10L

Unique Properties of Biological Materials: Adaptation, Self repair and Self assembly. Structure and properties of Cytoskeleton, Gels, Adhesives, Biofibres, Bioceramics and Composites illustrated with following examples: Collagen, Agarose, Hair, Silk, Shells of molluscs, exoskeleton of crustaceans and arthropods, bone, cartilage, teeth and wood.

Learning Outcomes:

After completing this unit, the student will be able to

- understand the properties of biomaterials. (L2)
- understand the relationship between the structure and function of biomaterials. (L2)
- describe the methods for measurement of mechanical properties of biomolecules. (L2)

UNIT II 8L

Biomaterial semiconductor interface Biomaterial electrode interface Biomaterial nanoparticle hybrids Materials for Cochlear prosthesis.

Learning Outcomes:

After completing this unit, the student will be able to

- describe the methods for interfacing biological and semiconductor materials. (L2)
- describe the methods for interfacing biological materials with electrodes. (L2)
- describe the methods for interfacing biological materials with nanoparticles. (L2)
- describe the materials used for cochlear prosthesis. (L2)

UNIT III **8L**

Self assembly: Self assembled monolayers. Viral capsid assembly. Formation of double stranded DNA. DNA origami. Smart biomaterials. Materials for wearable bioelectronics.

Learning Outcomes:

After completing this unit, the student will be able to

- list the biological systems that are formed from self-assembly. (L1)
- describe the principles of self assembly of biological systems. (L2)
- describe the properties of smart biomaterials. (L2)
- discuss the potential applications of smart biomaterials (L2)

UNIT IV **8L**

Response of human body to foreign materials. Drug delivery vehicles. Liposomes, Micelles, Dendrimers, nanodots and viral capsids. Targeted drug delivery. Controlled drug delivery.

Learning Outcomes:

After completing this unit, the student will be able to

- describe the required properties of drug delivery vehicles. (L2)
- list the drug delivery vechicles that are currently in use. (L1)
- discuss the potential of targeted and controlled drug delivery vehicles. (L2)

UNIT V **8L**

Biocompatibility and Biodegradability of materials for implants: polymers, metals and ceramics. Materials for cardiovascular medical devices: heart valves, stents and grafts. Materials for Dental implants, Opthalmology and Orthopedics. Tissue engineering scaffolds

Learning Outcomes:

After completing this unit, the student will be able to

- describe the required properties of implants. (L2)
- list types of materials used in implants. (L1)
- discuss the biological responses to implants (L2)

Text books

1. Biomaterials Science: An introduction to Materials in Medicine, Third Edition. Edited by Ratner, Hoffman, Schoen and Lemons, Elsevier, 2012. **ISBN:** 9780123746269
2. R.S.Lakes and J.B.Park. Biomaterials: An introduction. 2nd Ed. Springer. 2012

References Books:

1. https://nptel.ac.in/courses/113104009/

Course Outcomes

After the completion of the course the student should be able to

- describe the unique properties of biomaterials. (L2)
- understand the materials for cochlear prosthesis. (L2)
- apply smart biomaterials. (L3)
- discuss the body response to various foreign materials. (L2)
- use various materials for biological applications. (L2)

19AID371: INTRODUCTION TO ARCHITECTURE AND TOWN PLANNING

L T P C
2 1 0 3

Preamble: This course gives a basic introduction to the Architecture and Town Planning. It covers the basic principles of design, building design approach and its components. This course provides an understanding on the role and importance of Town planning in the Urban Forms in the Historical and Modern Indian Context. Building codes and planning standards are also included in the course.

Course Objectives:

- *To familiarize the fundamental concepts of architectural design and Town Planning.*
- *To acquaint the various building typologies and their design approach.*
- *To study the historical Indian town planning system.*
- *To introduce the Indian building design codes and planning standards.*

Unit 1: Introduction to Architectural Design:

- Definition of Architecture, Role of Architect in Built Environment
- Elements of design: point, line, plane, volume, colour, texture, light and shade
- Principles of design: rhythm, harmony, contrast, symmetry, balance, emphasis and their application in architectural design.

Learning Outcomes:

After Completion of Unit, student would be able to

- Demonstrate the basic fundamentals of architecture and built environment. (L2)
- Identify the principles of design. (L3)
- Explain the application of elements of design. (L5)

Unit 2: Functional Planning of Buildings:

- Introduction to buildings and Functional classification of buildings such as residential, institutional, public, commercial and industrial buildings etc.
- Site selection, Climatic aspects, Activity zoning, Anthropometry, Ergonomics, Circulation, Services, landscaping, Materials and construction.

Learning Outcomes:

After Completion of Unit, student would be able to

- Classify the types of buildings as per Function (L2)
- Analyze the building design approach on various design parameters(L4)

Unit 3: Introduction to Town Planning:

- Definitions of town planning, Goals and Objectives of Planning. Role of Urban Planner in Built Environment.
- Levels of planning in India – Perspective Plan, Regional Plan, Development Plan, Local Area Plan.
- Components & Steps for preparation of a development plan.

Learning Outcomes:

After Completion of Unit, student would be able to

- Define the town planning and its objectives (L1)
- Classify the various levels of planning existing in India (L2)
- Outline the steps for preparation of development plan (L2)

Unit 4: History of Town Planning in India:

- Ancient system of town planning in India, Indus valley civilization - Mohenjodaro, Harappa, Manasara's Vastushastra.
- Medieval town planning – Jaipur, Shahjahanabad.
- Modern Town Planning – Chandigarh, Luteyen's Delhi

Learning Outcomes:

After Completion of Unit, student would be able to

- Explain the ancient Indian town planning system with examples(L2)
- Outline the planning of towns in Medieval and Modern India (L2)

Unit 5: Development Control & Building Regulations

- Planning Standards, Zoning Regulations
- Building codes & Byelaws
- Floor Area Ratio (FAR), Ground Coverage, Height Restriction, Setbacks, Density

Learning Outcomes:

After Completion of Unit, student would be able to

- Define various terminologies related to Building codes (L1)
- Interpret the content of various regulations related to building development (L5)

Course Outcomes:

Students will be able to:

- Define architecture and explain its design fundamentals.
- Analyze the factors influencing the design of the buildings.
- Understand the town planning objectives and its planning process including Indian historical context.
- Define various terminologies related to Building codes and standards.

References:

Recommended Books:

1. Rangwala, Town Planning, Charotar publishing house
2. James C.Snyder and Anthony Y. Catanese, Introduction to Architecture, New York: McGraw Hill.
3. National Building Code 2016
4. URDPFI Guidelines 2014
5. AP Building Byelaws

19ECS371 : Introduction to Database Management Systems

L T P C
2 1 0 3

This course provides fundamental and practical knowledge on database concepts by means of organizing the information, storing and retrieve the information in an efficient and a flexible way when data is stored in a well-structured relational model. This course ensures that every student will gain experience in creating data models and database design.

COURSE OBJECTIVES

- Relate the role of a database management system in an organization.
- Demonstrate basic database concepts, including the structure and operation of the relational data model.
- Construct simple and moderately advanced database queries using Structured Query Language (SQL).
- Explain and successfully apply logical database design principles, including E-R diagrams and database normalization.
- Demonstrate the concept of a database transaction and related database facilities, including concurrency control, and data object locking and protocols.

UNIT-I **12 hours**

Introduction to DBMS: Overview, File system vs DBMS, advantages of DBMS, storage data, queries, transaction management, DBMS structure, people who work with Databases.

Data base Design: data models, the importance of data models.

E-R model: Entities, attributes and entity sets, relationship and relationship sets, mapping cardinalities, keys, features of ER model, conceptual database design with ER model

Learning outcomes

Students will be able to

- **interpret** the basic terminology of DBMS like data, database, database management systems**(L2)**
- **compare** DBMS over File Systems. **(L2)**
- **define** levels of abstraction with three tier architecture. **(L1)**
- **define** the role of DBA and other users of DBMS. **(L1)**
- **model** a given application using ER diagram. **(L3)**

UNIT-II **10 hours**

Relational model: Integrity constraints over relations and enforcement, querying relation data, logical database design, views, destroying/altering tables and views.

Relational Algebra and Relational Calculus

Learning outcomes

Students will be able to

- **match** the integrity constraints from ER model to relational model. **(L1)**
- **translate** an ER Model to Relational Model and vice versa. **(L2)**
- **compare** the difference between views and physical tables and working with views**. (L2)**
- **construct** the given Query in Relational Algebra and Relational Calculus. **(L3)**

UNIT-III **12 hours**

Structured Query Language (SQL): Introduction to SQL, Basic SQL Queries: DML, DDL, DCL, TCL, Select Commands, Union, Intersection, Except, Nested Queries, Aggregate Operators, Null values, Relational set operators, SQL join operators

Learning outcomes

Students will be able to

- **create** and modify database using SQL query.**(L5)**
- **illustrate** different types of query forms (simple queries, nested queries, and aggregated queries) in SQL.**(L2)**

UNIT-IV **8 hours**

Schema Refinement and Normal Forms: Schema Refinement, Functional Dependencies, Reasoning about Functional Dependencies. Introduction to Normal Forms.

Learning outcomes

Students will be able to

- **make use of** about schema refinement process.**(L3)**
- **illustrate** knowledge about different types of normal forms and the importance of normalization. **(L2)**

UNIT-V **10 hours**

Transaction Management and Concurrency Control: Introduction to Transaction Management, ACID properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency control without locking,

Learning outcomes

Students will be able to

- **interpret** the overview of transaction management in DBMS. **(L2)**
- **explain** the importance of concurrency and concurrency control mechanisms.**(L2)**
- **develop** knowledge about concurrency control with and without locks.**(L3)**
- **identify** knowledge about different types of crashes in DBMS.**(L3)**
- **apply** crash recovery techniques to recover from DBMS crashes. **(L3)**

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- build a data base for a system Using E-R data model and Relational Data model(L3)
- construct logical database with all integrity constraints over relations.(L3)
- construct all types of SQL, relational algebra, relational calculus queries over relations and he/she can be able to create views on the existing relations.(l3)
- extend the characteristics of database transactions and how they affect database integrity and consistency.(L2)
- demonstrate the concurrency control mechanisms and crash recovery algorithms.(L2)

Text Books:

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill, 3rd Edition, 2014

Reference Books:

1. Database System Concepts, H.F.Korth and A.silberschatz McGraw-Hill, 6e, 2011

2. Fundamentals of Database Systems, RamezElmasri, Shamkant B. Navathe, Pearson Education, 7e, 2016

3. Fundamentals of Database Systems, Elmasri, Navathe, Somayajulu, Gupta, Pearson Education, 6e, 2010

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 packagesapplicability 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 Unit I, Student will be able to

1. Identify the difference between c++ and Java
2. Identify the Environment that allows to write platform independent programs
3. Apply the methods of Strings to solve the string oriented problems.
4. Analyze the uses of wrapper classes in the design of solutios.
5. Contrast the difference between the usage of I/O Streams

Unit II **11 L**

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

1. Define the user defined classes of the given problem to be solved.
2. Explain the behavior of each object in its scope.
3. Apply the concepts finalize, abstract and final over the methods and classes.
4. Analyze the exception handling mechanisms.
5. Develop a code with try and catch blocks.

Unit III **9 L**

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

1. Recall the concepts of Inheritance for implementing new classes.
2. Extends the new classes from one or more classes.
3. Define the interfaces and packages.
4. Develop new packages for solving complex problems.
5. Survey the flow of execution by decomposing into two or more.

Unit IV **9 L**

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

1. Defining the new concept applet on internet programming.
2. Compare applet with application programs
3. Apply applet life cycle to the real problem to solve.
4. Examine the behavior of applet using HTML code
5. Test the parameterized applet.

Unit V **8 L**

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 swingcomponents-Jbutton, JCheckBox, JRadioButton, JLabel, JTextField, JTextArea, JList.Introduction to Networking: InetAddress class, socket class, URL class.

Learning Outcomes

1. Choose awt to create GUI
2. Classify the various layouts
3. Develop the very user friendly GUIs
4. Contrast the between applet and Swings
5. Build an Internet based application using networking concepts in java

Text Book(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

- Ability to differentiate Java and C,C++ and basic environment required for implementing Java program.
- Introduce the concept of class and object and Ability to apply inheritance concepts
- Illustrate concept of user defined exceptions
- Demonstrate usage of a package and thread implementation in application development
- Develop applets with various graphical aspects and Develop GUI forms using different AWT Components.

19EME371: QUANTITATIVE TECHNIQUES FOR MANAGEMENT

L	T	P	C
2	1	0	3

This course aims at introducing the student with basic concepts of quantitative techniques.Quantitative technique for managementis a scientific approach to managerial decision-making. The successful use of a quantitative technique for management would help the organization in solving complex problems on time, with greater accuracy and in the most economical way.

Course Objectives

- To study the fundamentals of linear programming and its application to special cases like transportation and assignment models.
- To understand the complex nature of operations research, problem, define the problem, formulate and solve the model and to perform the follow-up procedures.
- Demonstrate how analytical techniques and statistical models can help enhance decision making by converting data to information and insights for decision-making.
- Categorize and construct multistage decision analysis problems using decision trees.
- Categorize and construct multifactor problems with multiple objectives and uncertainty.
- Critically evaluate decisions of others and develop ways they could have improved their decision making

Unit I **10 L**

Introduction, Measures of Central Tendency Mean, Median, Mode, Concept of Testing of Hypothesis, Types of Errors, Confidence intervals, Z- test for Means, Standard deviations and Proportions; T-test; F-test for two variances.

Learning outcomes:

L1: To memorize how statistical data can be read for analysis and give valid inferences.
L2: To describe and discuss the key terminology, concepts tools and techniques used in business statistical analysis.
L4: Analyze the data and give valid inferences.
L6: Able to design, conduct and analyze the experiments more efficiently and effectively.

Unit II **8L**

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:

L2: Explain and critically discuss the issues surrounding sampling and significance
L3: Apply Regression analysis based on the experimental data and give valid inference.
L5: Determine the influential factors and also the interaction effects on the response function

Unit III **8 L**

Decision analysis, Decisions under risk, Decision trees- Decision analysis with experimentation, Decisions under uncertainty.

Learning outcomes:

L2: To understand the need of decision analysis

L3: To develop the decision making table and tree.

L4: To correlate the applications of decision making principles to different environments like uncertain and risky

Unit IV **10 L**

Introduction to multi-objective decision making, Concept of Pareto optimality, Goal programming formulation, the weighting method of solution, Utility theory, Analytic hierarchy process

Learning outcomes:

L2: To describe the phenomena of Pareto-optimality.

L3: To apply the multi-objective solving concepts like utility and analytic hierarchy process

L5: To choose the appropriate multi-objective making concept for solving

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:

L1. To define, contrast between the different terminologies of real time field.
L2. To outline the wide applicability of operations research technology from agriculture to defense, covering almost all domains of science, arts, commerce and technology.
L3. To develop optimum solution for numerous problems of operations research by systematic defining, formulating, analyzing, developing an optimum solution and further refining the solution.
L6. To anticipate a high level of mathematical, analytical and problem solving skills for problems that are of spontaneous nature, whose solution will be individualistic in application.

Course Outcomes

- obtain the basic terminology of Quantitative Techniques.**[L1]**
- evaluate the Correlation Of The Data By Various Quantitative Techniques.**[L2]**
- analyze various decision tree under certainty and uncertainty **[L3]**
- examine different multivariate optimization techniques.**[L3]**
- adapt and build linear programming model for optimum solutions.**[L2]**

Text Books:

1. Anderson, Sweeney, Williams, 2005, An introduction to management science Thomson South Western
2. Barry Render, RalphMStairJr, 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.

19EME369: COMPUTATIONAL METHODS

L T P C
2 1 0 3

This course provides a unique method to apply previously acquired knowledge of numerical methods into real life civil engineering problems. The problems once framed can be solved by coding in MATLAB. This course hence aims to expose students to the various ways in which numerical techniques can solve a multitude of civil engineering problems computationally.

Course Objectives:

- To frame a civil engineering problem in a numerical framework
- To apply numerical methods to solve civil engineering problems.
- To understand the use of interpolation techniques.
- To use statistical analysis in civil engineering.
- To use techniques to solve differential equations appearing in civil engineering.

UNIT- I **8L**

Linear system of equations: Problems in structural analysis – slopedeflection method, formulation of simultaneous equations, solution of simultaneous equations using Gauss elimination method, solution of simultaneous equations by using iterative method – Gauss Seidal iterative method (max 3 unknowns), developing computer programming for gauss-Seidal method, solution of problems using MATLAB.

Learning Outcomes:

Post completion of the unit the student will be able to:

- Explain the formulation of linear equations in beam problems. (L2)
- Relate the use of matrices in solution of linear eqautions. (L2)
- Illustrate the various techniques to solve matrix equations. (L2)

UNIT- II **9L**

Numerical Integration: Determination of areas and volumes, calculationof volume of earthwork using trapezoidal rule and Simpson's rule, measurement of discharge through rivers using Weddle's rule, development of computer programs for trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Boole's and Weddle's rules, development of computer programs for trapezoidal and Simpsons 1/3rd rule, solution of problems using MATLAB.

Learning Outcomes:

Post completion of the unit the student will be able to:

- Build a problem where numerical integration is required. (L3)
- Understand the various techniques of numerical integration.(L2)
- Formulate the solution of a problem using numerical integration. (L6)

UNIT- III **8L**

Interpolation: Forward differences, backward differences, centraldifferences, interpolation using difference techniques, forecasting of traffic demand, forecasting of water demand for a city and other applications of civil engineering problems, solution of problems using computer programming and MATLAB.

Learning Outcomes:

Post completion of the unit the student will be able to:

- Build a problem for solving using interpolation technique. (L3)
- Apply the various interpolation techniques to problems in civil engineering (L3)
- Solve and predict data required using interpoltion. (L3)

UNIT- IV **9L**

Data Analysis: Calculation of mean, variance, standard deviation,coefficient of variation of a sample, construction of histograms and determination of mean and standard deviation of cube strengths of concrete, determination of correlation coefficient of correlation such as cube strength vs cylinder strength of concrete and other civil engineering problems, solution of problems using MATLAB.

Learning Outcomes:

Post completion of the unit the student will be able to:

- Relate the various parameters required in statistical analysis. (L2)
- Apply statistical methods to solve civil engineering problems (L3)
- BuildMATLAB programs to solve the same. (L6)

UNIT- V **8L**

Finite Difference Method: Introduction, application of finite differencemethod in the determination of deflections of beams, indeterminate beams (propped cantilever beam) determination of

Deflections at the centre of simply beam subjected to UDL w per unit run over the entire span.

ii) Deflections at the centre of simply beam subjected to concentrated load at the mid span.

iii) Prop reaction and deflection at centre beam subjected to UDL over the entire span.

iv) Prop reaction and deflection at centre of beam subjected to concentrated load at the centre.

Learning Outcomes:

Post completion of the unit the student will be able to:

- Formulate differntail equations for beam problems. (L6)
- Apply the various boundary conditions to the problems (L3)
- Build the formulation in finite difference technique to solve the problems.(L6)

Text Book(s)

1. S.P. Venkateshan, PrasannaSwaminathan, Computational Methods in Engineering, 1/e, Academic Press - Published by Elsevier, ISBN 978-0-12-416702-5, 2014.
2. S.S. Sastry, Introducion to Numerical Methods,4/e, Printice Hall of India Private Limited, New Delhi, 2006.

References

1. S.C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 3/e, McGraw-Hill Companies Inc, 2011.
2. S. Chapra, and R, Canale, Numerical Methods for Engineers, 6/e, McGraw-Hill Higher Education, 2009.

Course Outcomes:

- To explain theuse of numerical methods to solve linear equations in civil engineering.(L2)
- To assess the use of numerical integration to solve civil engineering problems..(L5)
- To deduce with the aid of interpolation techniques.(L5)
- To rule on the usage of statistical techniques in civil engineering.(L5)
- To evaluate the solution of differential equation using numerical techniques. (L5)

19ECE323: SURVEY CAMP

L	T	P	C
0	0	0	2

Course Objectives:

The objectives of survey camp are

- Students will be able to identify best suited instruments for carrying survey camp.
- Students will be able to collect data in the field in systematic ways.
- Students will be able to prepare and present the field data in diagrammatic and tabular form in order to be understood by others.
- Students will be able to apply theoretical surveying concepts under actual field conditions.
- Students will be encouraged to build up interpersonal skills.

The survey camp will be organized by the Department of Civil Engineering, GITAM Institute of Technology, GITAM (Deemed to be University) for students as the compulsory part of the academic curriculum during fifth semester. The duration of the camp is for 2 weeks. Students will be divided into group of 5 students monitored by the faculty coordinators.

In this camp student will learn all the technical skills required for surveying by performing seven major activities which includes Reconnaissance survey (safety, schedule, site visit, etc.) and Topographical survey with hands on compass traversing, profile levelling, fly levelling, contouring, curve setting and heights & distances on the selected study area.

The study is focussed on various locations in the GITAM campus with different topographies. GITAM tunnel, Hostel area, Main entrance and exit areas, all major buildings and bhavans are identified as main places to conduct survey camp. Students in the camp will make use of all traditional surveying methods along with sophisticated instruments like total station and auto levels for accuracy and precision.

Course Outcomes:

At the end of camp, the student will be able

- The students are expected to carry out basic survey works in the field with apt technical knowledge and confidence.
- Student should be able to relate classroom learning to real world situations.
- To tackle the mistakes and incomplete data from the field observations.

19ECE391: **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/

Semester VI

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19ECE302	Design of Steel Structures	PC	3	0	0		3
2.	19ECE304	Water Resources Engineering	PC	3	0	0		3
3.	19ECE322	Architectural planning & CAD Lab	PC	0	0	3		1.5
4.	19ECE3XX	Program Elective II	PE	2	1	0		3
5.	19ECE3XX	Program Elective III	PE	2	1	0		3
6.	19EOE3XX	Open Elective II	OE	3	0	0		3
7.	19EHS302	Engineering Economics and Management	HS	3	0	0		3
8.	19EMC382	Engineering Ethics	MC	3	0	0		0
9.	19ECE392	Comprehensive Skill Development - V	PW	0	0	0	6	1
10.	**HSMCH102**	**Universal Human Values: Understanding Harmony**	**MC**	**2**	**1**	**0**		**3**
Total								**23.5**

Program Elective-II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE342	Advanced Structural Analysis	PE	2	1	0	3
2	Geotechnical Engineering	19ECE346	Rock Mechanics	PE	2	1	0	3
3	Transportation Engineering	19ECE352	Pavement Analysis and Design	PE	2	1	0	3
4	Water Resources Engineering	19ECE356	Hydropower Engineering	PE	2	1	0	3
5	Environmental Engineering	19ECE362	Sanitary Engineering	PE	2	1	0	3

Program Elective- III

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE344	Advanced Reinforced Concrete Structures	PE	2	1	0	3
2	Geotechnical Engineering	19ECE348	Advanced Foundation Engineering	PE	2	1	0	3
3	Transportation Engineering	19ECE354	Remote Sensing and Geographic Information Systems	PE	2	1	0	3
4	Water Resources Engineering	19ECE358	Open Channel Hydraulics	PE	2	1	0	3
5	Environmental Engineering	19ECE364	Air Pollution & Its Control	PE	2	1	0	3

Open Elective- II

S. No.	Course Code	Course Title	Category	L	T	P	C
1	19EOE302	German for Beginners	OE	3	0	0	3
2	19EOE304	Chinese for Beginners	OE	3	0	0	3
3	19EOE306	Analytical Essay Writing	OE	3	0	0	3
4	19EOE308	Indian Economy	OE	3	0	0	3
5	19EOE310	Public Administration	OE	3	0	0	3
6	19EOE312	Environmental Management	OE	3	0	0	3
7	19EOE327	Professional Communication	OE	3	0	0	3
8	19MOE301	Basics of Finance	OE	3	0	0	3
9	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
10	19EOE313	Personality Development	OE	3	0	0	3
11	19MOE305	Basics of Marketing	OE	3	0	0	3
12	GEL345	Work Place Communication-Basic	OE	3	0	0	3
13	GEL347	Work Place Communication-Advanced	OE	3	0	0	3

19ECE302: DESIGN OF STEEL STRUCTURES

L T P C
3 0 0 3

The design of structural members using steel as a construction material will be studied in this course.The student will be able to design various types of structural members such as tension members, compression members, flexural members and their connections using Indian Standard codalprovisions. The course is a prerequisite for Design of Advanced Steel Structures.

Prerequisite: Mechanics of Solids and Structural Analysis.

Course Objectives

- To explain the design of bolted connections.
- To explain the design of welded connections.
- To demonstrate the behavior and design of tension members
- To enable the design of compression members.
- To impart the design of flexural members.

Unit I **8L**

General: Fundamental concepts of design of structures, Types of structural steel – Mechanical properties of structural steel, Indian standard rolled steel sections, Design process, Steel Structural systems, Loads & load combinations, Concept of Working stress and limit state method of design.

Bolted Connections: Types of fasteners, Bolts & Bolted Connection, Failure of a joint, strength and efficiency of a joint, Design of lap joint, butt joint and eccentric connections.

Learning Outcomes

After completion of this unit, students will be able to

- list the different rolled steel and built up sections(L1)
- estimate the strength and efficiency of a joint (L2)
- design of bolted joints subjected to combined loadings(L3)

Unit II **8L**

Welded Connections: Types of welds, stresses in welds, design of welded joints subjected to axial load, eccentric welded connections.

Learning Outcomes

After completion of this unit, students will be able to

- list different types of welded joints (L2)
- designwelded joints for axial loads (L3)
- designwelded joints for eccentric loads (L3)

Unit III **8L**

Tension Members: Types of tension members and sections, behaviour of tension members, Modes of failures, net effective sectional area for plates and angle sections, design of tension members using plates, single angles and double angles, lug angles.

Learning Outcomes

After completion of this unit, students will be able to

- demonstrate the net effective section area (L3)
- design of tension members (L3)
- design of lug angles (L3)

Unit IV **10L**

Compression Members: Types of compression members and sections, Behaviour and failures of Compression members, Effective length, radius of gyration and slenderness of compression members, design compressive stresses in compression, design of struts, design of axially loaded compression members, built up compression members (I section and two channels) laced and battened columns, design of eccentrically loaded columns.

Learning Outcomes

After completion of this unit, students will be able to

- design of axially loaded column (L3)
- design of built up Columns (L3)
- design of eccentrically loaded column (L3)

Unit V **8L**

Beams: Introduction, Types of steel beam sections, Classifications of sections, lateral stability of beams, factors affecting lateral stability, behavior of simple beams in bending, design strength of laterally supported & unsupported beams, design of laterally supported and unsupported beams.

Learning Outcomes

After completion of this unit, students will be able to

- classifythe types of rolled steel sections (L2)
- design of laterally supported beams (L3)
- design of laterally unsupported beams (L3)

Text Book(s)

1. S.K. Duggal, Limit state Design of Steel Structures, 2/e, Tata McGraw Hill, 2017.

2. N. Subramanyam, Design of Steel Structures, 2/e, Oxford University Press, 2016.

References

1. V.L. Shah and Veena Gore, Limit State Design of steel structures IS:800- 2007, Structures Publications,3/e, 2012.

2. M.L. Gambhir, Fundamentals of Structural Steel Design, McGraw Hill Education, 2013.

3. Ramachandra and V. Gehlot, Design of Steel Structures, 2/e, Scientific Publishers, 2015.

4. Shiyekar M R, Limit State Design in Structural Steel, 3/e, Prentice Hall of India Pvt Ltd, 2017.

5. https://nptel.ac.in/courses/105106112/3

Course Outcomes

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

- design of bolted connections (L3).
- design of welded connections (L3).
- design of tension members (L3).
- design of compression members using rolled steel and built up sections (L3).
- design of flexural members using rolled steel sections (L3).

19ECE304: WATER RESOURCES ENGINEERING

L	T	P	C
3	0	0	3

This course helps the learner to acquire the comprehensive knowledge of physical process of surface and ground water hydrology and able to apply the principles to estimate the runoff resulting from rainfall. The learner will be able to determine the safe yield from a well. This course introduces the concept of flow mass curve to determine the required capacity of reservoir. This course illustrates the systems and methods of irrigation. The learner will gain the knowledge of silt theories to design an unlined canal.

Course Objectives:

- to teach the physical process of surface and ground water hydrology
- to illustrate the principles of rainfall-runoff relationship.
- to provide an over view to solve the problems related to hydrograph analysis, well hydraulics, reservoir capacity.
- to impart the skill to design the canal capacity for crop water requirement and design of unlined canal.

Unit I **9 L**

Hydrology: Hydrologic cycle, precipitation, types of rainfall and its measurement, computation of mean depth of rainfall over an area, double mass curve; evaporation and evapo-transpiration, infiltration, infiltration indices W-index, ø - index.

Learning outcomes:

After completion of Unit-I, students will be able to

- understand the basics of engineering hydrology (L-1)
- learn the characteristics of rainfall and infiltration (L-2)
- solve problems related to mean depth of rainfall and ø – index ((L-3)
- distinguish between infiltration and runoff (L-4)

Unit II **9 L**

Hydrograph Analysis: runoff, methods of determination of runoff, Storm hydrograph, Unit hydrograph, applications of unit hydrograph, hydrograph of different durations,S-hydrograph.

Ground Water Hydrology: Types of aquifers, Darcy's law, well hydraulics, steady flow into wells in un-confined and confined aquifers, recuperation test method for determination of yield of an open well.

Learning outcomes:

After completion of Unit-II, students will be able to

- understand the concept of unit hydrograph and its application (L-2)
- attain the knowledge of relationship between unit hydrograph and storm hydrograph and steady flow into wells (L-2)
- solve problems related to unit hydrograph and well hydraulics (L-3)
- differentiate the flow in un-confined and confined aquifers (L-4)

Unit III **8 L**

Reservoir Planning: Investigations for reservoir planning, selection of site for a reservoir, zones of storage in a reservoir, reservoir yield, mass curve and demand curve, determination of reservoir capacity, yield from a reservoir, reservoir sedimentation, control of reservoir sedimentation, useful life of a reservoir.

Learning outcomes:
After completion of Unit-III, students will be able to
- understand the required investigations for reservoir planning (L-2)
- learn the relationship between mass curve and demand curve (L-2)
- determine the reservoir capacity (L-3)
- calculate the useful life of a reservoir (L-3)

Unit IV **8 L**
Irrigation: Introduction of irrigation, types of irrigation systems, methods of irrigation: surface, sub-surface and sprinkler methods, drip irrigation; soil moisture constants, depth and frequency of irrigation, water requirements of crops, duty, delta, base period and their relationship, crop seasons, factors affecting duty, consumptive use of water, irrigation efficiencies.

Learning outcomes:
After completion of Unit-IV, students will be able to
- list the types of irrigation (L-1)
- explain the methods of application of irrigation water (L-2)
- solve problems related to canal capacities for cropping patterns (L-3)
- compare the irrigation efficiencies (L-4)

Unit V **8 L**
Canal Systems: Classification of irrigation canals, canal alignment, , determination of canal capacities for cropping patterns, regime silt theories, design of unlined canals, Kennedy's and Lacey's theories, unlined canal design problems, cross section of a canal, balancing depth of canal.

Learning outcomes:
After completion of Unit-V, students will be able to
- classify the types of canals (L-2)
- learn and implement the regime silt theories (L-2)
- compute the balancing depth of canal (L-3)
- design the unlined canal (L-3)

Course Outcomes:
At the end of course the students will be able to
- estimate the storm water runoff resulting from rainfall (L-3)
- determine the safe yield from a well (L-3)
- determine the reservoir capacity and useful life of reservoir (L-3)
- compute the discharge requirement for cropping patterns (L-3)
- design the unlined canal using silt theories (L-3)

Text Books
4. B.C.Punmia and Pande B.B.Lal, Irrigation and Water Power Engineering, Laxmi Publications Pvt. Ltd., New Delhi
5. P.N.Modi, Irrigation, Water Resources and Water Power Engineering, Standard Book House, Delhi

Reference Books
1. S.K.Garg, Irrigation Engineering, and Hydraulic Structures, Khanna Publishers, Delhi
2. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, Standard Book Publishing, Delhi
3.Jayarami Reddy P., Engineering Hydrology, Laxmi Publications Pvt. Ltd., (2013), Delhi
4. Subramanya K., Engineering Hydrology, Tata McGraw-Hill Education Pvt Ltd, (2013), Delhi

5. Chow V.T., D.R Maidment and L.W. Mays, Applied hydrology, Tata McGraw Hill Education Pvt Ltd, (2011), Delhi.
6. Mays L.W, Water Resources Engineering, Wiley India Pvt. Ltd, (2013)

Fluid Mechanics and Water Resources Engineering NPTEL Course:
https://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm
https://nptel.ac.in/courses/105105110/

19ECE322: ARCHITECTURAL PLANNING & CAD LAB

L T P C
0 0 3 1.5

Drawing is the civil engineer's language. The student will be able to drawa layout of site, plan, elevation and section with interior details. This course provides an overview of planning aspects of various buildings as per bye laws. This course is a prerequisite for Estimation and Costing.

Prerequisite: Engineering Graphics and Civil Engineering Workshop

Course objectives:

- To explain the basic architectural principles.
- To introduce the fundamentals of computer aided drawing.
- To familiarize with building bye-laws
- To train to draw the plan, section, elevation and site plan.
- To teach BIM and modeling the structural components using Revit.

PLANNING ASPECTS & REGULATIONS

Unit-I: Introduction to drawing **3L**

Introduction to concept of drawings, Interpretation of typical drawings, Scales – Elements of a building drawing – Plan, Section and Elevation from the given line drawing/Site plan/floor plan of residential and public buildings, Introduction to computer aided drawing, Drawing commands

Learning outcomes:

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

- recall elements of a building drawing (L1).
- make use of computer applications in developing drawings(L3).
- outline various drawing commands (L2).

Unit-II:Sign conventions and symbols: **2L**

Layers and Annotations in AUTOCAD, Conventional Signs- Conventional signs – Materials, Architecture, Structure, Electrical and Plumbing, Rebar drawings, Brick Bonds – Header, Stretcher, English and Flemish, one and half, two and two and half brick walls. Doors and Windows

Learning outcomes:

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

- select conventional signs for different materials (L1).
- choose symbols used in plumbing and electrical(L1).
- choose symbols used in brick masonry(L1).

Unit-III:Building Planning & Building Byelaws: 3L

Classification of buildings - principles of planning - dimensions of buildings.
Building bye-laws for floor area ratio, floor space index, Height of Building, open spaces – orientation of buildings - lighting and ventilation-space standards for residential, commercial & institutional categories, climatology and climatic considerations.

Learning outcomes:

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

- list various types of buildings (L1).
- apply building byelaws (L3).
- apply principles of planning (L3).

Unit-IV: Preparation of Building Plan: 3L

Planning and preparing sketches and working drawings of Residential buildings.

Learning outcomes:

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

- develop floor plans, elevations and section (L3).
- plan sketches of residential buildings (L3)
- build working drawings of buildings (L3).

Unit-V: Introduction to BIM: **3L**

Principles of isometrics and perspective view of building.Fundamentals of Building Information Modelling (BIM) using Revit. Introduction Revit software tools; Drawing of structural components, walls, floors, ceiling, roof, stairs; modify tools; structural modelling, column and beam system, foundations.

Learning outcomes:

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

- explain about basics of Building Information Modelling(L2).
- list out various tools of Revit Software (L1).
- model a structural components of a Residential building (L3).

Drafting of following Using CAD software

1. Introduction of CAD and Practicing Commands
2. Drawing of conventional signs using CAD.
3. Foundation details of a building.
4. English bond and Flemish bond.
5. Drawing of stair case.
6. Drawing of cross section of door

7. Drawing of plan, section, elevation and site plan of residential single room building.
8. Drawing of plan, section, elevation and site plan of residential two bed room house.
9. Drawing of plan, section, elevation and site plan of of duplex type house.
10. Preparation of plan, section, elevation and site plan of residential buildings given specifications.
11. Reading of one Architectural Drawing set of Single/Multi-storeyed Building.
12. Modelling of structural components, walls, floors, ceiling, roof, and stairs in a residential building using Revit.

Text Book(s)

1. Subhash C Sharma and Gurucharan Singh, Civil Engineering Drawing, Standard Publishers, 2005.
2. N. Kumara Swamy, A. Kameswara Rao, Building Planning and Drawing , 8/e, 2015.

References

3. M.G. Shah, C.M. Kale and S.Y. Patki, Building Drawing with an Integrated Approach to Build Environment, Tata McGraw- Hill Publication, 2002.
4. Ajeet Singh, Working with AUTOCAD 2000 with updates on AUTOCAD 2001, Tata- Mc Graw-Hill Company Limited, 2002.
5. B.P. Verma, Civil Engineering Drawing and House Planning, Khanna Publishers, 2014.
6. V.M. Marimuthu, R. Murugesan, S. Padmini, S. Pratheeba, Civil Engineering Drawing-I, Publishers, 2008.
7. Venugopal, Engineering Drawing and Graphics + AUTOCAD, New Age International Pvt. Ltd.,2007.

Course Outcomes:

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

- apply knowledge of building bye laws (L3).
- demonstrate and draw conventional signs, foundation details, cross section of a door and staircase (L2).
- construct plan, section and elevation of a residential building (L2).
- examine the efficiency of CAD design and reading of CAD drawings (L4).
- model structural components using BIM (L3)

(Program Elective-II)

19ECE342: ADVANCED STRUCTURAL ANALYSIS

LT P C
2 1 0 3

The prerequisite for this course would be Mechanics of Solids and Structural Analysis. The effects produced in arches, cables, suspension bridges and framesdue to various loads are discussed. The student will be able to analyze statically determinate beams subjected to moving loads. Plastic analysis gives an insight into the structural behavior upto collapse. This course is a pre-requisite for Advanced Design of Steel Structures.

Course Objectives:

- To analyze three hinged and two hinged arches subjected to various loads.
- To analyze portal frames using moment distribution and Kani's method.
- To construct influence line diagrams for determinate structures.
- To assess the maximum shear force and bending moment in determinate structures under rolling loads.
- To analyze cables and suspension bridges.
- To determine the collapse loads using plastic analysis.

Unit I **8L**

Arches:

Three hinged Arch:

Introduction, Analysis of three hinged arch, B.M, S.F and normal thrust in three-hinged arches, Three hinged parabolic arch subjected to concentrated loads and uniformly distributed loads

Two hinged Arch:

Introduction, Analysis of two hinged arch, B.M, S.F and normal thrust in two-hinged arches, Two hinged parabolic arch subjected to concentrated loads and uniformly distributed loads

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

- find reactions at the supports in Three-Hinged arch (L1).
- find B.M, S.F and Normal thrust in three-hinged parabolic arch subjected to concentrated and uniformly distributed loads (L1).
- find reactions at the supports in Two-Hinged arch (L1).
- find B.M, S.F and Normal thrust in two-hinged parabolic arch subjected to concentrated and uniformly distributed load (L1).

Unit II **10L**

Analysis of statically indeterminate frames

Moment distribution method: Analysis of single-storey, single bay portal frames under gravity and lateral loads.

Kani's method: Analysis of single-storey, single bay portal frames under gravity and lateral load

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

- construct B.M and S.F Diagram by using moment distribution method (L3).
- analyse the beam for sway by Moment Distribution method (L4).
- construct B.M and S.F Diagram by using Kani,s method (L6).
- analyse the beam for sway by Kani,s method (L4).

Unit III **8L**

Influence lines and Rolling Loads

Introduction, Influence lines for reactions, shear force, and B.M for statically determinate beams, S.F and B.M at a point due to rolling loads(point loads and udl) in statically determinate beams, Absolute maximum B.M, Absolute maximum S.F in statically determinate beams.

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

- construct influence lines for reactions (L3).
- construct influence lines for S.F (L3).
- construct influence lines for B.M (L3).
- determine Maximum B.M and S.F at a section (L5).
- determine Absolute maximum B.M and S.F (L5) .

Unit IV **10L**

Cables and Suspension Bridges:

Introduction, Analysis of Cables Under Concentrated Loads and Uniformly distributed Loads, Shape of Cable under Self-Weight, Stresses in suspended Wires due to Self-Weight, Anchorage of Suspension Cables, Stiffened Bridges, Bending moment and shear force for Three Hinged Stiffened Girders, Influence Lines for B.M and S.F in Three-Hinged Stiffening Girders, Suspension Bridges with Two-hinged Stiffening Girders.

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

- analyse cables under uniformly distributed loads (L4).
- solve stresses in suspended wires due to self-weight (L3).
- construct influence lines for B.M and S.F in Three-Hinged Stiffening Girders (L6).
- construct influence lines for B.M and S.F in Two-Hinged Stiffening Girders (L6).

Unit V **8L**

Plastic Analysis:

Introduction, Shape factor, Plastic Hinge, Collapse Mechanisms, Static and Kinetic Theorems, Methods of analysis, Fixed and Continuous Beams.

Learning outcomes

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

- examine possible plastic hinges (L4).
- estimate collapse load by static theorem(L6).
- estimate collapse load by kinetic theorem (L6).
- estimatePlastic moment for fixed beams (L6).
- estimatePlastic Moment for continuous beams (L6).

Text Book(s)

1. Vazirani and Ratwani, Analysis of Structures, Vol-II, 16/e, Khanna Publishers, 2015
2. G.S. Pandit, S.P. Gupta, R. Gupta, Theory of Structures-Vol II, 2/e, Tata McGraw-Hill,2003.

References

1.C.K. Wang, Statically Indeterminate Structures, Tata McGraw Hill, 2010.

2. J.S. Kinney, Indeterminate Structural Analysis, 1/e, Naroja Publishing, 1987.

3. Weaver and Gere, Matrix Methods of Framed Structures,2/e, CBS publisher, 1990.

4. Thandavamurthy, Structural Analysis, 2/e, Oxford University Press, 2011.

Course Outcomes:

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

- determine shear force, bending moment and normal thrust in three hinged and two hinged arches (L5).
- construct BM diagram for portal frames (L6).
- demonstrate influence lines for determinate structures (L2).
- determine the forces in cables and suspension bridges (L5).
- evaluate the shape factor and collapse loads (L5).

List of Experiments

1. Determination of horizontal thrust for various loads placed at various distances in an 3 hinged arch setup.
2. Determination of horizontal thrust for various loads placed at various distances in an 2 hinged arch setup.
3. Experimental demonstartion of sway in portal frames.
4. Plotting shear forces under rolling loads in a influence line setup.
5. Plotting bending moments under rolling loads in a influence line setup.
6. Experimental analysis of cable geometry and statics under various loading conditions.
7. Plastic hinge analysis in virtual lab

ECE346: ROCK MECHANICS

L	T	P	C
2	1	0	3

This course mainly provides an understanding of the engineering properties of rocks, geological and engineering rock classifications, rock failure theories, in-situ stresses in rock, and the fundamental concepts and principles of rock mechanics. This will help to understand the design aspects of various structures in/on rock like tunnels and other underground openings, slopes etc. The course also covers the in-situ tests on rocks through various methods to test the suitability of rock at foundation level. It also covers the methods to improve the properties of rock mass by reinforcing, grouting and with supports.

Course objectives:

- To familiarize the concepts of structural geology of rocks and the classification of rock masses
- To demonstrate the testing of rock samples in the laboratory
- To acquaint the Rock Quality Designation and its necessity
- To study the insitu strength of the rocks
- To expose how to improve the properties of rock masses

Unit I: **8 L**

Physical and structural geology, faults and shear zones - treatment -engineering classification -need - classification of intact rock and insitu rock masses -insitu state of stress mapping of joints.

Learning outcomes:

After completion of Unit I, students will be able to

- infer the concepts of physical and structural geology, faults and shear zones-L2
- explain the treatment of faults and shear zones in rocks-L2
- classify the intact rock and insitu rock masses -L2
- demonstrate the insitu state of stress mapping of joints-L1
- identify the need of engineering classification of rocks-L3

Unit II: **8 L**

Laboratory Testing: Rock sampling – Determination of density, Porosity and Water absorption – Uniaxial Compressive strength – Tensile strength – Shear Strength – Flexural strength – Swelling and slake durability – permeability – point load strength – Dynamic methods of testing – Factors affecting strength of rocks, Deformation and failure of rocks.

Learning outcomes:

After completion of Unit II, students will be able to

- list the various laboratory tests of rocks-L1
- determine the density, porosity and water absorption of rocks-L3
- explain the testing procedure of rock samples-L2
- infer the factors affecting the strength of rocks-L2

- explain the deformation and failure of rocks-L2

Unit III: **8 L**

Rock Mass Classification: Classification by Rock Quality Designation, Rock structure Rating, Geomechanics and NGI classification systems. Applications.

Learning outcomes:

After completion of Unit III, students will be able to

- explain the Rock Quality Designation (RQD) -L2
- classify the rocks based on RQD-L2
- demonstrate the rock structure rating-L2
- list the Geomechanics and NGI classification system-L1
- apply the knowledge of RQD and classification system-L3

Unit IV: **9 L**

In situ testing: Necessity and Requirements of in – situ tests – Types of in – situ tests – Flat jack Technique – Hydraulic Fracturing Technique, In-situ Permeability test, Pressure Tunnel Test, Plate Load Test, Shear Strength Test, Radial Jack Test, Goodman Jack Test and Dilatometer Test.

Learning outcomes:

After completion of Unit IV, students will be able to

- infer the necessity and requirement of insitu tests of rocks-L2
- list the types of insitu tests-L1
- determine the insitu strength of rocks-L3
- explain the working procedures of different insitu tests-L2

Unit V: **9 L**

Methods of Improving Rock Mass properties: Rock Reinforcement – Rock bolting – Mechanism of Rock bolting – Principles of design – Types of rock bolts, Cable anchorage. Pressure grouting – grout curtains and consolidation grouting, Shot creating.

Learning outcomes:

After completion of Unit V, students will be able to

- identify the methods of improving the properties of rock mass-L3
- explain the principles and design of rock bolting-L2
- list the types of rock bolting-L1
- demonstrate the pressure grouting technique-L2
- infer grout curtains and consolidation grouting-L2

Course Outcomes:

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

- explainthe concepts of structural geology and classification of rock masses – L2
- take part in the laboratory and field testing for a given project / construction – L4
- classify the rocks based on Rock Quality Designation – L2
- choose appropriate methods to improve the stability of rock mass – L3
- estimate the foundation capacity in rock mass- L3

Textbooks:

1. Goodman, R.E. "Introduction to Rock Mechanics" John Wiley & Sons, New York, 2010.
2. John A.Franklin and Maurice B. Dusseault "Rock Engineering Applications" Mc Graw Hill, Inc. 1991.

References:

1. Kiyoo Mogi "Experimental Rock Mechanics" Taylor& Francis Group, UK, 2007.
2. Jaeger, J.C., Cook, N.G. and Zimmerman, R.W. "Fundamentals of Rock Mechanics" Blackwell pub.,2012.

NPTEL Links

Module 1: **https://nptel.ac.in/courses/105106055/**

https://nptel.ac.in/courses/105106055/2

Module 2: **https://nptel.ac.in/courses/105106055/6**

https://nptel.ac.in/courses/105106055/7

Module 3: **https://nptel.ac.in/courses/105106055/11**

https://nptel.ac.in/courses/105106055/12

Module 4: **https://nptel.ac.in/courses/105106055/6**

https://nptel.ac.in/courses/105106055/7

Module 5: **https://nptel.ac.in/courses/105106055/34**

https://nptel.ac.in/courses/105106055/35

19ECE352: PAVEMENT ANALYSIS AND DESIGN

L	T	P	C
2	1	0	3

The course aims to make the students learn the principles of highways, their components and design of flexible and rigid pavements. The course also focusses different types of stresses that are developed in the pavement structures. Further, students will getacquainted with treatment for failures and remedial measures during maintenance of pavements.

Course Objectives

- Demonstrate factors affecting pavement design
- Impart knowledge on stress solutions for One, Two- and Three-Layered Systems in flexible pavements
- Familiarize stresses and deflections in rigid pavements due to loading and temperature
- Enable design of flexible pavements
- Explain design of rigid pavements.

Unit I **10L**

Factors Affecting Pavement Design: Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors.

Learning Outcomes:

After the completion of Unit, students will be able to

- list out variables considered in pavement design[L1]
- classify different layers in rigid flexible pavements along with their functions[L2]
- define the concepts of EAL, ESWL, ADT and AADT[L1]
- explaintruck and growth factors[L2]
- develop knowledge on Lane Distributions & Vehicle Damage Factors**[L3]**

Unit II **8L**

Stresses In flexible Pavement: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two- and Three-Layered Systems, Fundamental Design Concepts

Learning Outcomes:

After the completion of Unit, students will be able to

- developan understanding on visco-elastic theory and its assumptions[L3]
- findhow the concept of layered system works[L1]
- identify stress solutions for single layered system[L3]
- explainthe concepts of two- and three-layered systems[L2]
- listconcepts of flexible pavement**[L1]**

Unit III **8L**

Stresses in Rigid Pavements: Westergaard’s Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, and Stresses in Dowel Bars & Tie Bars

Learning Outcomes:

After the completion of Unit, students will be able to

- explainWestergaard’s theory along with its assumptions[L2]
- classifydifferent stresses on rigid pavements[L2]
- demonstrate stresses and deflections due to loading on rigid pavements[L2]

- explain the concept of frictional stresses[L2]
- develop knowledge on stresses in dowel bars &tie bars**[L3]**

Unit IV **8L**

Design of Flexible Pavements: Factors effecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index. IRC guidelines for Flexible Pavements. Pavement Performance and methods- AASHTO and Asphalt Institute Method. Need for Overlays, Overlays design methods

Learning Outcomes:

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

- listvarious factors effecting design of flexible pavement[L1]
- summarize variousdeflection studies in flexible pavement[L2]
- explain Flexible Pavement design as per IRC Guidelines [L2]
- compare AASHTO and Asphalt Institute Method[L2]
- demonstratedesign of overlays using different methods**[L2]**

UnitV **8L**

Design of Rigid Pavements: Factors effecting Design - Wheel load & its repetition, subgrade strength & proportion, strength of concrete - modulus of elasticity. Reinforcement in slab. Design of joints. Design of Dowel bars. Design of Tie bars. IRC and AASHTO methods of Rigid Pavement design

Learning Outcomes:

After the completion of Unit, students will be able to

- identifydifferent factors effecting the design of rigid pavement[L3]
- illustrate reinforcement in slabs[L2]
- explain design ofjoints, Dowel and Tie bars in Rigid Pavements[L2]
- demonstrate expertiseon IRC method of Rigid Pavement Design[L2]
- develop knowledge on AASHTO method of Rigid Pavement Design[L3]

Course Outcomes

After completion of the course the student will be able to

- list various factors affecting design **[L1]**
- identify stresses in flexible pavements in One, Two- and Three-LayeredSystems**[L3]**
- summarize the stresses due to loading and temperature in rigid pavements **[L2]**
- explain design of flexible pavements. **[L2]**
- demonstrate design of rigid pavements.**[L2]**

Text Book(s):

- Yoder, E.J., and Witczak, `Principles of Pavement Design', 2/e. John Wiley and Sons, 1975
- Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, 9/e, Nemchand and Bros, Roorkee, 2017

References:

1. Haas and Hudson, Pavement Management System, McGraw Hill Book Co., New York, 1978
2. IRC: 37-2012, Guidelines for the Design of Flexible Pavements.
3. IRC: 58-2015, Guidelines for the Design of Rigid Pavements.

19ECE356 : HYDROPOWER ENGINEERING

L	T	P	C
2	1	0	3

Hydropower is one of the cleanest and renewable forms of energy. It can be produced domestically without any dependence on the international fossil fuel sources, making it more reliable and This course helps the learner to acquire comprehensive knowledge of working of hydropower plants. The prerequisites for this course are fluid mechanics and hydraulic machines.

Course Objectives:

- to elucidate the functionality of the components of a hydropower scheme
- to explain various curves, factors related to hydroelectricity production
- to explicate the design criteria of penstocks
- to introduce the concepts of water hammer and surge.
- to illustrate the planning of powerhouse

Unit I **9 L**

Pumped Storage Power Plant: Classification and Components of Hydropower Plants – Advantages of Pumped storage plants – Reversible Pump turbines – Power duration curves – Problems of operation.

Learning outcomes:

After completion of Unit-I, students will be able to

- list the types and components of hydropower plants (L-1)
- explain the advantages of pumped storage plants (L-2)
- differentiate between and normal reversible pump turbines (L-2)
- solve problems related to the operation hydropower plants ((L-3)

Unit II **9 L**

Electrical Load on Hydraulic Turbines: Load curve – Load factor – Power factor – Capacity factor – Utilization factor - Load duration curve – Firm power and Secondary power – Numerical Problems.

Learning outcomes:

After completion of Unit-II, students will be able to

- define the terminology related to hydropower generation (L-1)
- distinguish between firm power and secondary power (L-2)
- solve problems related to hydropower generation(L-3)

Unit III **8 L**

Penstocks and Accessories: Classification of Penstocks – Design criteria for Penstocks – Economical Diameter of Penstocks – Anchor Blocks – Conduit Valves.

Learning outcomes:

After completion of Unit-III, students will be able to

- name the types of penstocks (L-1)
- explain the functionality of anchor blocks and conduit valves (L-2)
- compute the economical diameter of penstocks for (L-3)

Unit IV **8 L**

Water Hammer and Surge: Water Hammer – Resonance in Penstocks – Channel Surges – Surge Tanks.

Learning outcomes:

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

- explain the concept of water hammer (L-2)
- explicate the phenomenon resonance in penstocks (L-2)
- describe the phenomenon of channel surges (L-2)
- identify the uses of surge tanks (L-3)

Unit V **8 L**

Planning of Powerhouses: Powerhouse Structure – Types of Underground Power Stations – Advantages and Components of Underground Powerhouse – Different Layouts.

Learning outcomes:

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

- elucidate the structure of powerhouse (L-1)
- classify the underground power stations (L-2)
- explain the significance of underground power stations (L-2)
- draw different layouts of powerhouses (L-3)

Course Outcomes:

At the end of course the students will be able to

- acquire the knowledge of operation of pumped storage plants (L-2)
- solve problems related to various factors of hydroelectric power generation (L-3)
- design for the economical diameter of penstock (L-3)
- elucidate the concepts of water hammer and surges (L-2)
- draw different layouts of powerhouses (L-3)

Textbooks

1. M.M. Dandekar and K.N. Sharma, 2/e, Water Power Engineering, Vikas Publications, New Delhi, 2013.
2. P.N. Modi and S.M. Seth, 22/e, Hydraulics & Fluid Mechanics Including Hydraulics Machines, Standard Book House, Delhi, 2017.

Reference Books

1. A.K. Jain, Fluid Mechanics including Hydraulic Machines, 12/e, Khanna publishers, Delhi. 1998
2. Franck M. White, 7/e, Fluid Mechanics, Tata McGraw Hill, 2011

19ECE362: SANITARY ENGINEERING

L	T	P	C
2	1	0	3

Sanitation is one of the most important aspects of community well-being as it protects human health, extends life spans, and is documented to provide benefits to the economy. The main purpose of sanitation is to maintain such environments as will not affect the public health in general. Thus this course provides basic information on functionality of different sewerage systems. Further, helps to learn various design considerations to design all unit operation involved in waste water treatment process and sludge disposal techniques.

Course objective

- to study different sewerage systems and various sewer appurtenances.
- to familiarize with the characteristics of sewage
- to impart the principles involved in primary and secondary treatment of sewage
- to acquaint the decomposition process of sewage under anaerobic and facultative conditions
- to study various disposal techniques in sludge treatment

Module I **8L**

Introduction to Sanitary Engineering: Sanitation, conservancy and water carriage system, sewerage systems, relative merits,Quantity of sanitary sewage, factors affecting sanitary sewage, determination of quantity of storm water sewage, sewers, sewer appurtenances, sewage pumping, types of sewers, design of sewers, construction; testing, sewer appurtenances manholes, sewage pumping.

Learning Outcomes:

- compare conservancy and water carriage system –L2
- explain various types of sewers and sewer appurtenances –L2
- calculate the capacity of various types of sewers–L4

Module II **8 L**

Quality and Characteristics of Sewage**:** Characteristics of sewage, decomposition of sewage, physical and chemical analysis of sewage, problems on BOD. Natural Methods of Wastewater Disposal**,** disposal by dilution, types of receiving waters for dilution, self-purification of natural streams, oxygen sag curves, disposal by land treatment, comparison of disposal methods, sewage sickness; reuse of treated sewage.

Learning Outcomes**:**

- illustrate the characteristics of sewage-L2
- analyse and interpret the physico-chemical Characteristics of sewage-L4
- explain the concept of oxygen –sag curve-L2
- compare various sewage disposal methods -L2

Module III **11 L**

Primary & secondary Treatment of Sewage**:** Screens, grit chamber, grease traps, skimming tanks, sedimentation tanks,Trickling filters and ASP trickling filters, operational problems and remedies, activated sludge process vs. trickling filter process, methods of aeration, diffused air system, mechanical aeration, combined system, sludge bulking, sludge volume index.

Learning Outcomes:

- illustrate various components in primary treatment of sewage –L2
- analyze the working principle of every unit in treatment process-L4
- calculate various design parameters of waste water treatment units-L4

Module IV **8 L**

Miscellaneous Methods**:** Septic tank, septic tank effluent disposal, imhoff tank introduction, oxidation ditch, stabilization pond (oxidation pond), aerobic lagoons, anaerobic lagoons, facultative ponds, Rotating Biological Contractor. (RBC)

Learning Outcomes:

- analyze the mechanism of anaerobic/facultative treatment methods –L4
- make use of recommended design consideration to design a septic tank-L3
- Test the efficiency of designed Rotating Biological Contractor-L4

Module V **7 L**

Sludge Disposal & sanitary fittings **:** Anaerobic sludge digestion process, factors effecting sludge digestion, sludge digestion tanks, sludge thickening, sludge conditioning, methods of dewatering the sludge, methods of sludge disposal. Basic Sanitary fittings and functionalities, plumbing systems, maintenance of sanitary installations.

Learning Outcomes:

- explain various sludge disposal techniques –L2
- analyze the porces of sludge digestion –L4
- identify the basic sanitary installations for a building-L3

Course outcomes

- differentiate the types of sewerage systems and explain the working principle of every sewer appurtenance –L4.
- analyze the characteristics of sewage –L4
- select an appropriate treatment method to design various units in sewage treatment –Ll3
- test the efficiency of designed treated units under anaerobic condition –L4
- explain the functionality of sanitary fittings-L4

Text Book(s)

1. P.N. Modi (2008), Sewage treatment & Disposal and waste water Engineering – Environmental Engineering (Vol.II) – Standard Book House
2. Met Calf and Eddy, Wastewater Engineering Treatment, Disposal and Reuse, Tata McGraw Hill, 2010

References

1. Ruth F. Weiner and Robin A. Matthews (2003), Environmental Engineering, Butterworth-Heineman
2. S.C. Rangwala, Water Supply and Sanitary Engineering,1/e, Charotar, 2005.
3. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous (1995), Environmental Engineering, McGraw HillInc.,NewYork.
4. https://nptel.ac.in/syllabus/105105048/

19EID331: ARTIFICIAL NEURAL NETWORKS

(AI & ML)

L	T	P	C
2	1	0	3

Preamble:

Neural Networks can assist in the analysis, interpretation and utilization of large amounts of highly complex structured and unstructured data. Neural Network based decision support systems have been deployed in agricultural, biomedical, biometric, economic and legal applications. Neural Networks can be utilized as components of advanced robots and control systems for industrial automation. Neural Networks can also be utilized in engineering design.

Course Objectives:

The objectives of this course are to:

- introduce a variety of Neural Network architectures
- evaluate merits and demerits of learning models used by Artificial Neural Networks
- describe the algorithms for training of Neural Networks
- explain the effect of choice of parameters on training efficiency

Unit I

Introduction to Neural Networks: Architecture based classification of Neural Networks. Classification of Neural Networks based on learning methods. Activation functions and Loss functions. Factors to be considered for choice of type of Neural Network. Introduction to hardware requirements for implementation of Neural Networks.

Learning outcomes:

At the end of this Unit the student should be able to:

- classify Neural Networks based on type of architecture (L2)
- classify Neural Networks based on type of learning (L2)
- identify optimal type of Neural Network based on problem description (L4)

Unit II

Rosenblatt's perceptron model. Rosenblatt's perceptron convergence theorem. Back Propagation Method. Back propagation learning algorithm for multilayer feed forward Neural Network. Factors affecting back propagation based training of a Neural Network.

Learning outcomes:

At the end of this Unit the student should be able to:

- prove convergence for Rosenblatt's perceptron model (L2)
- calculate output of a small feed forward Neural Network with one hidden layer for specified values of architectural parameters and weights using a handheld calculator (L5)
- predict the effect of parameters on training efficiency using the backpropagation learning algorithm (L4)

Unit III

Radial basis function networks. Generalized regularization theory. Neural Network models with Hebbian learning. Introduction to Hopfield networks. Recurrent Neural Network models. Universal approximation theorem. Backpropagation through time. Real time recurrent learning. Long short term memory.

Learning outcomes:

At the end of this Unit the student should be able to:

- understand concepts of hebbian learning models (L2)
- describe recurrent Neural Networks and their applications (L1)
- evaluate a problem and identify the optimal training algorithm (L5)

Unit IV

Convolutional Neural Networks. Variants of the basic convolution function. Convolution algorithms. Recursive Neural Networks. Greedy layer-wise pretraining. Transfer learning. Structured probabilistic models for deep learning. Convolutional boltzmann machines.

Learning outcomes:

At the end of this Unit the student should be able to:

- identify advantages and disadvantages of deep learning (L2)
- describe concepts of convolutional Neural Networks (L1)
- compare merits and demerits of deep learning (L4)

Unit V

Model based calculation of reward in Reinforcement learning. Markov decision process. Bellman's optimality criteria. Policy iteration. Value iteration. Q-learning. Model free Reinforcement learning. Deep reinforcement learning. Generative adversarial networks.

Learning outcomes:

At the end of this Unit the student should be able to:

- understand the concepts of reinforcement learning (L2)
- analyze a problem and identify optimal algorithms for its solution (L4)
- evaluate reward for specified model and policy function for training a Neural Network by using reinforcement learning (L5)

Course outcomes:

At the end of this course the student should be able to:

- describe major types of Neural Networks (L1)
- classify Neural Networks based on type of architecture and learning method (L2)
- apply Neural Networks to solve simple problems (L3)
- analyze a problem and identify optimal Neural Network type for its solution (L4)
- evaluate a problem description and predict optimal training algorithm and training parameters for its solution (L5)

Text Book(s)

1. S.O.Haykin. Neural Networks & Learning Machines. 3rd Ed. Pearson. 2019

References

- S.J.Russell and P. Norvig. Artificial Intelligence: A Modern Approach. 3rd Ed. Pearson. 2016.
- Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2018.
- I.Goodfellow, Y.Bengio, A.Courville, F.Bach. Deep Learning (Adaptive Computation and Machine Learning series). MIT Press. 2016

S.O.Haykin. Neural Networks: A comprehensive foundation. 2nd Ed. Pearson. 1997.

(Programme Elective -III)

19ECE344: ADVANCED REINFORCED CONCRETE STRUCTURES

LTPC
2 1 0 3

This is an advanced course useful for the student to enable them the design of advanced RCC structuresThe student will be able to design RCC staircases, retaining walls, and water tanks. The course also includes the design of slab bridges and flat slabs.

Prerequisite: Mechanics of Solids, Structural Analysis and Design of Reinforced Concrete Structures.

Course objectives:

- To enable the design of staircases.
- To demonstrate the design of retaining walls.
- To familiarize the design methodology of flat slabs.
- To enable the design of water tanks resting on ground.
- To train on the design of simple bridge deck slab.

Unit I **8L**

Design of Staircases:

Introduction, Principles of Design, Applied Loads, Design of Stairs Spanning Transversely (Horizontally) and Stairs spanning Longitudinally.

Learning Outcomes:

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

- summarize the different components of staircases (L2).
- design of stairs spanning transversely (L6).
- design of stairs spanning longitudinally (L6).

Unit II **8L**

Retaining Walls:

Types of retaining walls, forces on retaining walls, stability requirements, Preliminary proportioning of cantilever/counterfort retaining walls, Design of cantilever and counterfort retaining walls.

Learning Outcomes:

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

- list the various forces acting on retaining walls (L1).
- explain the stability check for retaining walls (L2).
- design of cantilever retaining wall (L6).

- design of counterfort retaining wall (L6).

Unit III **8L**

Design of Flat Slabs:

Direct Design Method – Distribution of Moments in column strips and middle strip – moment and shear transfer from slabs to columns – shear in flat slabs – check for one way shear – Introduction to equivalent frame method. Limitation of direct design method – Distribution of moments in column strips and middle strip

Learning Outcomes:

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

- illustrate the different components of flat slabs (L2).
- outline the distribution of moments in column and middle strips (L2).
- design a flat slab using direct design method (L6).

Unit IV **8L**

Design of Water tanks: Introduction, Design Requirement, Methods of Analysis, Design of Circular tanks resting on ground, Rectangular tanks resting on ground.

Learning Outcomes:

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

- classify the water tanks (L2).
- estimate the reinforcement required for circular water tanks resting on ground (L3).
- design of rectangular water tanks resting on ground (L6).

Unit V **10L**

Design of slab bridge

Design loads for bridges: Introduction, load distribution theories, Design loads- Dead load, Vehicle Live Load, Impact Effect, Wind Loading, Longitudinal forces.

Slab bridges: Introduction, Wheel load on slabs, Effective Width Method-Slab supported on Two Edges (Simply Supported Slabs), Dispersion length, Design of slab bridges.

Learning Outcomes:

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

- identify different types of wheel loads (L3).
- estimate maximum live load intensity. (L3).
- design a simple bridge deck slab(L6).

Text Books:

1. P.C.Varghese, Advanced Reinforced Concrete Design, 2/e, Prentice Hall of India, 2010.
2. S.S.Bhavikatti, Advance R.C.C Design(R.C.C. Volume- II),2/e, New Age International Publishers, 2012.

References:

1. Pillai and Menon, Reinforced Concrete Design, 3/e, Tata McGraw Hill, 2017.
2. T.R.Jagadeesh and M.A.Jayaram, Design of Bridge Structures, 2/e, Prentice Hall of India, 2014.
3. P.C.Varghese, Limit State Design of Reinforced Concrete, 2/e,Prentice Hall of India, 2015.

Course outcomes:

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

- design a staircase (L6)
- design a cantilever and counterfort retaining walls (L6).
- analyze and design flat Slabs (L4).
- design water tanks resting on ground (L6).
- design a bridge deck slab (L6).

ECE348: ADVANCED FOUNDATION ENGINEERING

L	T	P	C
2	1	0	3

*This course describes the principles of design of shallow foundation and settlement analysis. It also covers designing of footings for different soil conditions. Basic principles of determination of bearing capacity and design of pile foundations using various methods are also covered in this course. Foundations on highly problematic soils like expansive soils and its design practices are also discussed***.**

Course Objectives:

- To familiarise the fundamental concepts of foundation analysis and design.
- To acquaintthe analysis of bearing capacity and settlement of foundations using different methods
- To enable the proportionatingof different types of footings and develop beams on elastic foundations
- To study the determination of the load carrying capacity and settlement of pile foundations and under reamed piles.
- To train the identification of expansive soils and practice foundations on expansive soils.

Unit I **7 L**

Introduction: Principles of Design of Foundations, Types of shear failures in foundation soils, Types of foundations, Design Loads, Basic Concepts of safe and allowable bearing capacity. Shallow Foundations

Learning outcomes:

After completion of Unit I, students will be able to

- demonstrate the principles of design of foundations-L2
- list the types of shear failures –L1
- identify the types of foundations, design loads-L3
- explain the basic concepts of safe and allowable bearing capacity-L2
- infer the concepts of shallow foundations-L2

Unit II **9 L**

Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods, Bearing capacity evaluation from Standard Penetration test and Plate load test.
Settlement Analysis: Uniform and Differential Settlements, Elastic and Consolidation Settlements, Penetration tests; Permissible settlements as per IS 1904-1978, causes of settlement, settlement Control.

Learning outcomes:

After completion of Unit II, students will be able to

- demonstrate the bearing capacity theories-L2
- evaluate the bearing capacity from Standard Penetration test and Plate load test-L2
- compare the uniform and differential settlements-L4
- apply the settlement codes in the design-L3
- identify the causes of settlement-L3

Unit III **9 L**

Proportioning of footings: Isolated column footings, Strip, combined Footings and Strap Footing. Raft Foundations: Bearing capacity of raft foundation, floating raft, Types of rafts, Beam on Elastic foundation and Conventional methods of Design, determination of modulus of subgrade reaction.

Learning outcomes:
After completion of Unit III, students will be able to

- illustrate the proportioning of footings-L2
- explain the bearing capacity of raft foundation-L2
- list the types of rafts-L1
- develop beam on elastic foundation and conventional methods of design-L3
- determine the modulus of subgrade reaction-L3

Unit IV **9 L**
Deep Foundations: Pile Foundations: Types, load capacity- dynamic formulae, static formula; pile load tests- Vertical load test, lateral load test, Cyclic load test; settlement of piles and pile groups, negative skin friction on single pile and pile groups;
Well Foundations: Types, Bearing Capacity of well foundations, Tilts and Shifts: precautions, Remedial measures

Learning outcomes:
After completion of Unit IV, students will be able to

- list the types of pile foundation-L1
- determine the load capacity of pile and under reamed foundations-L3
- estimate the settlement of piles and pile groups-L3
- apply IS codes for designing pile foundation-L3
- classify the types of well foundations-L2

Unit V **8 L**
Foundations in Expansive Soils: Introduction, Identification of expansive soils, Swell potential and swelling pressure, Active depth, Foundation Problems, Foundation practices in expansive soils, Soil Replacement and 'CNS' concepts.

Learning outcomes:
After completion of Unit V, students will be able to

- identify expansive soils–L3
- explain the foundation problems-L2
- formulate the foundation practice in expansive soils-L3
- infer swell potential and swelling pressure-L2
- illustrate the concepts of soil replacement and CNS concepts-L2

Course Outcomes:
Students will be able to:

- outline the design philosophy of foundation engineering – L2
- interpret field and laboratory data to get design parameters for foundation analysis – L2
- design the piles for various types of loadings– L4
- identify the typical failure modes of common foundations - L3
- solve foundation problems with the given procedures and the soil properties, and understand their limitations – L3

Text Books:

1. Foundation Analysis and Design by J.E. Bowles, Mc Graw Hill Publishing Co, 2001.
2. Foundation Design by W.C. Teng, John Wiley, New York, 1962.

Reference Books

1. Analysis and Design of Substructures by Swami Saran, Oxford &IBH Publishing Co, 2006.

2. Foundation Engineering by P.C. Vargheese, Prentice Hall of India, 2005.

NPTEL LINKS

1. **Shallow foundations http://nptel.ac.in/courses/105107120/**
2. **Pile foundations http://nptel.ac.in/courses/105107120/13**

19ECE354: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

L	T	P	C
2	1	0	3

Remote Sensing (RS) is the science and art of obtaining information about an object, area orphenomenon, using either recording or real time sensing devices that are not in physicalcontact with the object. Geographic Information Systems (GIS) and their applications emphasis on cartographic concepts, strengths and limitations of different GIS data formats, spatial statistics, and spatial analysis. Students use a variety of specialized GIS tools to solve spatial problems and map spatial phenomena.

Course Objectives:

The purpose of this course is to

- Familiarize about the concept of GIS, its components, along with its advantages
- Focus about different available data formats in GIS
- Impart knowledge on spatial data structures details and input, management and output processes
- Explain different possible areas of GIS application
- Impart the knowledge of GIS in implementing in various case studies

Unit I **8L**

Overview of remote sensing: Introduction Definitions of remote sensing and related terminology, Historical Perspective, Principles of remote sensing, components of remote sensing, Energy source and electromagnetic radiation, Energy interaction, Spectral response pattern of earth surface features.

Learning Outcomes:

After the completion of Unit, students will be able to

- **define** various terminology used in Remote Sensing**[L1]**
- **Summarize**the historical perspective of Remote Sensing**[L2]**
- **explain** the principles and components of remote sensing**[L2]**
- **develop**knowledge on Electro Magnetic Radiation**[L3]**
- **outline** various energy interactions in related to Electro Magnetic Radiation**[L2]**

Unit II **9 L**

Remote sensing technology: Classification of Remote Sensing Systems, Energy recording technology, Aerial photographs, Photographic systems – Across track and along track scanning, Multispectral remote sensing, Thermal remote sensing, Indian space programme - Research and development. Characteristics of remote Sensing data, Photogrammetry – Satellite data analysis – Visual image interpretation, Digital image processing –Image rectification, enhancement, transformation

Learning Outcomes:

After the completion of Unit, students will be able to

- **classify** systems in Remote Sensing and energy recording technologies**[L2]**
- **identify** the historical perspective of Remote Sensing**[L3]**
- **outline**the developments in Indian Space Program**[L2]**
- **interpret** satellite data (remote sensing data)**[L2]**
- **Develop**knowledge on process involved in digital image processing**[L3]**

Unit III **8 L**

Introduction to Geographical Information System (GIS): Introduction-Definitions of GIS - The Evolution of GIS, Components of GIS, Approaches to the study of GIS, Major application areas of GIS, Map scale, Classes of maps, The Mapping process, Plane Coordinate systems and transformations, Geographic Co-ordinate systems on earth, Map projection, Classification of map projections, aspects of map projections, Establishing a spatial framework for mapping locations on earth: Geo-referencing.

Learning Outcomes:

After the completion of Unit, students will be able to

- **Classify**and **explain** different components of GIS**[L2]**
- **identify** different application areas of GIS**[L3]**
- **define** terms and concepts related to GIS**[L1]**
- **develop**knowledge on map projections and their classifications**[L3]**
- **explain** the process of geo-referencing**[L2]**

Unit IV **9 L**

Application of GIS system and Remote Sensing:GIS Concepts – Spatial and non-spatial data, Vector and raster data structures, analysis, Database management – GIS software, Monitoring and management of environment, Conservation of resources, Sustainable land use &, Coastal zone management

Learning Outcomes:

After the completion of Unit students will be able to

- **Classify different**data in GIS**[L2]**
- **compare** vector and raster data structures**[L2]**
- **outline**concepts of Database Management System**[L2]**
- **Identify** usage of GIS in day to day activities**[L3]**

Unit V **8 L**

Case Study: A case study in GIS implementation, the consultant, the client, the initial applications, types of GIS analysis used for case study.

Learning Outcomes:

After the completion of Unit, students will be able to

- **choose** a case study of their interest **[L3]**
- **apply** the knowledge of GIS in analyzing the case study**[L3]**

List of Experiments:

1. Map Composition in ArcGIS and m ArcGIS to Illustrator
2. Joining Tables to Boundary Files
3. Visualizing Data in ArcScene and Working with Data
4. Geoprocessing,GeoCoding and Georeferencing
5. Geodatabase Creation,
6. Project Work – to demonstrate their expertise on GIS

Course Outcomes:

The student will be able to

- show knowledge on RS-GIS concepts and terminology along with various commercially available GIS software**[L1]**
- develop skills in collecting, editing different types of GIS data**[L3]**
- demonstrate expertise on database management in RS- GIS**[L2]**
- summarize the applications of GIS**[L2]**
- Interpret case studies with GIS applications**[L3]**

Text Book(s):

- Lillesand, T.M. and Kiefer, R.W, Remote Sensing and Image Interpretation, 6/e, John Wiley and sons, New York, 2011
- GolfriedKonechy, Geoinformation: Remote sensing, Photogrammetry and Geographical Information Systems, 1/e, CRC press, 2002

References:

- Burrough, P.A. and McDonnell, R.A., Principles of Geographic Information Systems,3/e, Oxford University Press, New York, 2001.

- Lintz, J. and Simonet, Remote sensing of Environment, Addison Wesley Publishing Company, New Jersey, 1977
- NPTEL Web course on Remote Sensing: https://nptel.ac.in/courses/105108077/
- NPTEL Web course on GIS in Civil Engineering: https://nptel.ac.in/courses/105102015/

19ECE358: OPEN CHANNEL HYDRAULICS

L	T	P	C
2	1	**0**	**3**

The prerequisite for this course would be fluid mechanics.This course helps the learner to acquire the comprehensive knowledge of open channel hydraulics. This course provides the concepts of hydraulically efficient channel sections of uniform flow. The learner will gain the knowledge and able to apply the principles of specific energy and critical depth. The learner will understand the over view of gradually varied flow and rapidly varied flow of hydraulic jump and flood routing through channel.

Course Objectives:

- to explain types of flows, velocity distribution in open channels
- to teach the significance of specific energy, specific force, section factor, and channel transitions.
- to compute hydraulically efficient channel sections.
- to outline the features of GVF profiles.
- to impart the significance of hydraulic jump in energy dissipation.
- to explain the flood routing through reservoir and channel.

Unit-I: 9 L

Introduction, types of channels, classification of flows, velocity distribution, pressure distribution, specific energy, critical depth – calculation, section factor, channel transitions.

Learning outcomes:

After completion of Unit-I, students will be able to

- define section open channel, factor (L-1).
- classify the types of flows in open channels (L-2).
- illustrate the characteristics of channel transitions (L-2).

Unit-II: 9 L

Uniform Flow: Chezy's equation, Manning's formula, velocity distribution, uniform flow computations, hydraulically efficient channel sections, Specific Energy, Specific Force, Critical Flow, Compound channel section, Irrigation canal.

Learning outcomes:

After completion of Unit-II, students will be able to

- compute required channel dimensions (L-3).
- draw the velocity distribution in channels (L-3).
- compute hydraulically efficient channel sections (L-3).
- compute the specific energy, critical depth for channel sections (L-3).

Unit-III: 8 L

Gradually Varied Flow (GVF): Differential equation for GVF, classification and features of flow profiles, control sections, simple numerical solutions of GVF problems.

Learning Outcomes:

After completion of Unit-III, students will be able to

- derive GVF differential equation (L-3).
- classify various GVF surface profiles (L-2).
- explain about control section, transitional depth (L-2).
- solve Gradually Varied Flow problems in channels (L-3).

Unit-IV: **8 L**

Rapidly Varied Flow: Hydraulic jump in horizontal rectangular, use of jump as energy dissipator, location of jump, ogee spillway, sharp crested weir, broad crested weir, sluice gate flows.

Learning Outcomes:

After completion of Unit-IV, students will be able to:

- explain the significance of Hydraulic jump (L-2).
- calculate the energy dissipation, location of jump (L-3).
- explain the flowcharacteristics of spillway, weir, sluice gate (L-2).

Unit-V: **8 L**

Flood Routing through reservoirs and flood routing through channel, Muskingum method of flood routing.

Learning Outcomes:

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

- explain the flood routing through reservoir (L-2).
- explain the flood routing through channel (L-2).
- calculate the flood routing through channels using Muskingum method (L-3).

Course Outcomes:

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

- Classify types of channels, flows, GVF profiles (L-2).
- Solve problems related to uniform flow in open channels, hydraulically efficient sections, GVF, hydraulic jump (L-3).
- Familiarise specific energy, Critical energy, section factor, GVF, RVF, surges.
- Draw the velocity distribution in channels (L-3).
- Explain the use of channel transitions, compound channels, irrigation canals, flow characteristics of spillway, weir, sluice gate, flood routing through reservoirs and channels (L-2).
- Derive GVF differential equation (L-4).

Text Books

1. K. Subramanya, Flow in Open Channels, 5/e, Tata McGraw Hill, 2015.
2. VenTe Chow, Open-Channel Hydraulics, McGraw-Hill, 2009.

Reference Books

1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, 20/e, Standard Book House, 2015.
2. A.K. Jain, Fluid Mechanics, 12/e, Khanna publishers, 2014

19ECE364: AIR POLLUTION & ITS CONTROL

L	T	P	C
2	1	0	3

Air pollution is a major contributor to global warming and climate change. In fact, the abundance of carbon dioxide in the air is one of the causes of the greenhouse effect. But the excessive concentration of these gases in the atmosphere is the cause of the recent climate change. The meteorological parameter plays a key role in control of air pollution. Thus this course imparts knowledge on the basic causes of air pollution and their control of indoor/particulate/gaseous air pollutant and its emerging trends

Course Objective is

- to study various air pollutants and to compare various air quality standards.
- to introduce the mechanism of various plume behaviours.
- to study various effects of air pollutant and to recollect various case histories
- to familiarize with various methods of controlling air pollution
- to impart the basics of noise pollution and its control and prevention methods

Module -I **8 L**

Basic Introduction: Air Pollution and its definition, Factors influencing air pollution, Sources and Classification of air pollutants –natural and manmade, primary and secondary air pollutants. National & International air emission standards.

Learning Outcomes:

- identify various sources of air pollution –L2
- classify the Air Pollutants –L2
- compare the national & International air emission standards- L2

Module–II **8 L**

Meteorology: Importance of meteorological parameters, stability conditions, types of inversions lapse rate, mixing depth, mixing height, atmospheric dispersion, plume behaviour -effective stack height Gaussian plume models.

Learning Outcomes:

- Outline the importance of meteorological parameters-L2
- Classify the types of inversions-L2
- Analyze the plume behavior from stacks –L4
- Make use of Gaussian plume models-L3

Module–III **8 L**

Effects and sampling procedures: Effect of air pollution on humans, plants and materials. Basic Principles of Sampling, Source and Ambient Sampling, Analysis of air Pollutants. Air pollution episodes (India & Abroad)

Learning Outcomes:

- summarize the effect of air pollution on humans, plants and materials-l2
- acquaint with sampling procedure-l3

- analyze the air pollutants- l4
- summarize the Air Pollution episodes (India & Abroad)-L2

Module–IV **8 L**

Noise pollution: Sources of Noise Pollution, Effects, Assessment procedures, Standards of noise pollution, Control Methods and Prevention.

Learning Outcomes:

- Identify the Sources of Noise pollution –L3
- Analyze the effect of Noise pollution-L4
- Assess the Noise Pollution-L5
- Explain various Controlling methods of noise pollution-L4

Module–V **8 L**

Air Pollution Control: Selection Criteria for Equipment, Principles of Control Measures, Particulates Control by Gravitational, Centrifugal, Filtration, Scrubbing, Electrostatic Precipitation, Gaseous Pollutant Control by Adsorption, Absorption, Condensation, Combustion.

Learning Outcomes:

- summarize the selection criteria for equipments-l2
- explain the methods of particulate matter control –l4
- importance of different control methods –l5
- justify the best method for Gaseous Pollutant Control –L5

Course Outcomes:

- classify various types of air pollutants –L2
- explain the mechanism of plume behaviour -L2
- summarize the effects of air pollution on humans, plants and materials–L4
- paraphrase various controlling methods of air pollutions-L5
- evaluate various sources of noise pollution and their preventive methods-L5

Text books

1. M.N. Rao and H.V.N. Rao, Air Pollution, Tata McGraw, 2017.
2. C.S. Rao, Environmental Pollution Control, 2/e, Wiley Eastern, 2006.

References:

1.Colls, J., Air Pollution: Measurement, Modelling and Mitigation, CRC Press, 2009
2.Heumann. W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 2007.
3.Anjaneyulu, D., "Air Pollution And Control Technologies", Allied Publishers, Mumbai, 2002
4. https://nptel.ac.in/courses/105102089/8

OPEN ELECTIVE II

19EOE302: GERMAN FOR BEGINNERS

L	T	P	C
3	0	0	3

Unit I **9 hours**

Introduction to the German language, grammar and pronunciation. Lan-guage: Greetings; Introducing oneself, asking the way, giving directions. Grammar: The nouns, gender distinctions, cases, definite and indefinite articles. Pronunciation: Vowels.

Unit II **8 hours**

Language: Asking for and giving information; Discussing home and the household. Grammar: Conjugation of verbs, verbs with separable and inseparable prefixes, modal verbs. Pronunciation: Vowels.

Unit III **8 hours**

Language: Describing people and their qualities, describing shape, size and colour of objects. Grammar: Personal pronouns, possessive pronouns, reflexive pronouns. Pronunciation: Consonants.

Unit IV **8 hours**

Language: The Working World: Returning faulty goods to a shop, asking someone to repeat something; Refusing or declining politely. Grammar: Cases: nominative, accusative, dative. Pronunciation: Diphthongs.

Unit V **9 hours**

Language: Making Comments and Suggestions: Asking for and giving opinions. Grammar: Structure of sentence and categories of sentences; subordinate clause - causative and conditional sentences. Pronunciation: Umlaut.

References

1. Deutsch als Fremdsprache IA Grundkurs
2. Ultimate German Beginner - Intermediate (Coursebook), Living Language, 2004.

19EOE304: CHINESE FOR BEGINNERS (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 sen-tence. Pronunciation: Initials: d t g k f; Finals: ei ou an ang eng iao iou(iu); Second tone.

Unit III **8 hours**

Language: Introducing oneself; Asking for permission. Grammar: Sentence with an adjectival predicate; "Yes-no" question. Pronunciation: Initials: zh ch sh r; Finals : -I / ai uai ong; Third tone.

Unit IV **8 hours**

Language: Introducing oneself; Asking for permission. Grammar: Ques-tions with an interrogative pronoun. Pronunciation: Initials: j q x; Finals: ia ian iang / uei(-ui) uen(-un) üe üan; Fourth tone.

Unit V **9 hours**

Language: Making comments and suggestions; Asking someone to repeat something; Refusing or declining politely. Grammar: Sentences with a verbal predicate. Pronunciation: Initials: z c s; Finals:-i er iong ua uan uang ün; Neutral tone; Retroflex ending.

*The course will focus on the pronunciation system, the introduction of common Chinese expressions and every-day phrases in the context of communicative activities.

References

1. Liu, Yuehua, Integrated Chinese: Simplified Characters Textbook, Level 1, Part 1. Cheng and Tsui Company, Inc. Boston, 2008.

19EOE306: ANALYTICAL ESSAY WRITING (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 specifictask instructions, discussing the extent to which one agrees or disagrees with the statement, rationale for the position one takes, developing and supporting one's position, discussion on the validity of the given statement/ claim, addressing the different views that are presented, remaining unbi-ased in assessing a claim, taking a stand and justifying it, writing a re-sponse.

Unit IV **9 hours**

Writing an Argumentative Essay on a Topic of Contemporary Inter-est: Planning, writing and revising, clear, concise and defined thesis state-ment that occurs in the introduction, clear and logical transitions. BodyParagraphs that include Evidential Support (factual, logical, statisticalor anecdotal), conclusion that does not simply restate the thesis, but re-addresses it in light of the evidence provided.

Unit V **7 hours**

Peer Review: Preparing a template for peer review that is derived fromthe response rubric given to the student and assessment rubric used for evaluation, formulating and communicating constructive feedback on a peer's work, responding to feedback on one's work, checklist for peer review-lead strategy use in the introduction, thesis statement, supporting details given in the body, the writer's acknowledgement of a counterargument and

his/her response to it, closing strategy used in the conclusion.

References

1. Bailey S., Academic Writing: A Handbook for International Students, Routledge, London and NewYork, 2001.
2. Jordan R.R., Academic Writing Course, Nelson/Longman, London, 1999.
3. Hamp-Lyons L., Heasley B., Study Writing, Cambridge University Press, 2006.

19EOE308: INDIAN ECONOMY (Elective)

L	T	P	C
3	0	0	3

Unit I **9 hours**

Structure of Indian Economy: Meaning of economic growth and devel-opment, 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: Popu-lation size and growth rates, age and gender distribution, trends of urban-ization, 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, directand 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 Manage-ment 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 controlover administration, role of media, interest groups, NGOs, civil society, Right to Information Act (RTI), social audit, citizen chapters.

Unit IV **8 hours**

Union and State Governments Administration: President, prime min-ister, council of ministers, cabinet, central and state secretariats, boards and commissions, governor, chief minister and council of ministers, cen-tral- state relations, finance commission, Neeti ayog.

Unit V **8 hours**

Civil Services: Recruitment, training and other condition of services, districtadministration, role of collector, local self governing institutes-73rd and 74th constitutional amendments act.

Text Book(s)

1. Avasti, Maheswari, Public Administration, 31/e, Lakshmi Narain Agarwal Books, India, 2014.
2. B. L. Fadia, Kuldeep Fadia, Indian Administration, 8/e, Sahitya Bhawan, India, 2014.

References

1. Nicholas Henry, Public Administration and Public Affairs, 21/e, Prentice Hall of India, 2012.
2. D. Ravindra Prasad, V. Sivalinga Prasad, P. Satyanarayana, Administrative Thinkers, 2/e, Sterling Publishers, 1991.
3. D. D. Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis Butterworths, Wadhwa Nagpur, 2013.
4. Ramesh K. Arora, Rajni Goyal, Indian Public Administration, 3/e, New Age International Publishers, India, 1995.

19EOE 312: ENVIRONMENTAL MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives:

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 ofbiomedical 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-Labeling Collection-Transport-Disposal methods.

Unit – III - Environmental Impact Assessment (EIA)

Introduction-Definition-Scope-Objectives of EIA-Basic EIA Principles, Classification of EIA-Life Cycle Assessment-Environmental Policy of India. BASELINE DATA ACQUISITION: Environmental Inventory- Rapid EIA.

Unit – IV - E-Waste management

E-waste : Sources- Types- components; Collection process- Segregation-Disposal methods; Effect on air, water and soil; Health hazards; Role of individual for E-waste management. Current E-waste Management Rules.

Unit – V- Environmental Audit

Introduction- Environmental audit Significance for Industry-Elements of Environmental audit. Process of environmental audit-Pre audit- Activity -Activities at site- Post audit.

Course Outcome:

1. To explain the concepts of green buildings –L2.
2. To outline the disposal techniques in biomedical waste –L2.
3. To explain the preparation of EIA statements-L4
4. To Summarize e-waste management rules-L2
5. To identify various acytiviites involved in environmental audit –L3

Text Books

1. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007.

2. Rittmann, B.E., and McCarty, P.L., Environmental Biotechnology : Principles and Applications, McGraw Hill, 2001.

Reference Books

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

4. Seely, John, Oxford Guide to Effective Writing and Speaking, Oxford University Press, India, 2013.
5. Olsen Leslie, Huckin Thomas, Technical Writing and Professional Communication for Non-Native Speakers, McGraw Hill, 1991.
6. Rizvi, M. Ashraf, Effective Technical Communication, Tata McGraw Hill, 2005. 193

19MOE301: BASICS OF FINANCE

LT 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
3. 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 Perspectivesof Cyber Law - Legal Issues &Challenges in India, USA and EU - Data Protection - Cyber Security, etc.

UNIT-II
International Perspectives - Budapest Convention on Cybercrimes - ICANN's core principles and the domain names disputes - Net neutrality - EU electronic communications regulatory framework - Web Content Accessibility Guidelines (WCAG).

UNIT-III
Information Technology Act, 2008 as amended - Overview of the Act - Jurisdiction -Electronic Governance - Electronic Evidence (Relevant portions of Indian Evidence Act) - Digital Signature Certificates (DSCs) - Duties of Subscribers of DSCs - Role of DSC Certifying Authorities - The Cyber Regulations Appellate Tribunal - Internet Service Providers and their Liability – Powers of Police - Impact of the Act on other Laws - Social Networking Sites vis-à-vis Human Rights.

UNIT-IV
Cyber Laws vis-à-vis IPRs - Copyright in Information Technology - Software - Copyrights Vs Patents debate - Authorship and Assignment Issues - Copyright in Internet - Multimedia and Copyright issues - Software Piracy - Patents - European Position on Computer related Patents - Legal position of U.S and India on Computer related Patents - Trademarks in Internet - Domain name registration - Domain Name Disputes & World Intellectual Property Organization (WIPO) - Databases in Information Technology - Protection of database in USA, EU &India.

UNIT-V
Mobile Technology- SIM (Subscriber Identity Module) cloning–Mobile frauds - Usage of mobile software - Special reference to the relevant provisions of IT ACT 2008, India Penal Code and Evidence Act.

Textbooks:
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.

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.

19MOE305: BASICS OF MARKETING

L T P C
3 0 0 3

Unit I: Introduction to Marketing – Nature, Scope and Importance of Marketing – Concepts and Approaches to Marketing – Product Vs. Service Marketing, Role of Marketing in the Economic Development – Latest Trends in Marketing.

Unit II: Analyzing Consumer Markets and Buyer Behaviour – Factors Influencing the Buyer Behaviour; Market Segmentation and Targeting.

Unit III: Marketing Mix Strategies & Extended Marketing Mix : Product, Service Product, Classification of Products – Product Life Cycle Stages, New Product Development

Unit IV: Pricing & Channels of Distribution: Pricing Objectives – Factors Influencing the Pricing Policy – Pricing Methods, Channels of Distribution – Channel Design Decisions – Channel Management.

Unit V: Promotion Mix – Importance of Promotion – Managing Advertising – Sales Promotion –, Personal Selling and Direct Marketing– Publicity and Public Relations.
Case study (Not exceeding 250 words).

TEXT BOOK

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: WORK PLACE COMMUNICATION-BASIC

L	T	P	C
3	0	0	3

Introduction

The course is used to teach contemporary international business communication. An integrated skills approach is followed to enable students to communicate effectively in business contexts. It is a topic-based course with ample opportunity for practise to develop LSRW skills. It motivates and engages the students who wish to pursue various careers.

Course Objectives

- To enable students to hone their language skills with special focus on effective communication in business contexts
- To reinforce learning and enhance the ability to understand business communication
- To conduct business correspondence, write reports and suggestions, make presentations and participate in discussions
- To prepare students for BEC certification (B2 Level)

Unit 1: Listening

Understanding general idea; listening for specific information to complete notes, forms, and messages based on telephone conversations; recognising functions such as complaining, greeting, apologising; recognising topics and contexts; ability to follow extended speech during interviews, discussions, and presentations; ask relevant questions to indicate one's understanding of the main points of the speech

Learning Outcomes

At the end of the Unit the learners will be able to

- understand and follow a range of spoken business communication
- collect specific information from telephone conversations, interviews, discussions and presentations
- recognise different language functions such as greeting, apologising, and complaining
- make inferences and draw conclusions

Unit 2: Speaking

Interactive communication: sharing and participating in a conversation; giving a presentation or speaking at a business meeting: structuring a speech and connecting ideas; discussing on a given topic and expressing opinions, agreeing, disagreeing, comparing and contrasting ideas to reach a decision; speaking at length about the topic in a logical way

Learning Outcomes

At the end of the Unit the learners will be able to

- communicate with clarity and precision in business contexts
- understand and apply effective discourse management strategies
- make structured mini presentations/ elevator pitches
- participate in targeted discussions

Unit 3: Reading

Understanding the meaning, structure and cohesion of the text; reading in detail; scanning for specific details/information; identifying the writer's purpose and main idea of a paragraph; understanding opinions and ideas expressed in the text; understanding sentence structure; identifying and correcting errors in text.

Learning Outcomes

At the end of the Unit the learners will be able to

- comprehend business texts with focus on meaning, structure and cohesion
- get the gist, identify specific details and understand the writer's purpose
- make inferences and draw conclusions
- read short texts for error identification and correction

Unit 4: Writing

Writing for internal communication: a note/memo/email/message (formal); writing requests, instructions, explanations, ask for information, etc.; writing concisely and cohesively: linking your ideas; writing reports and proposals based on notes, charts, and tables.

Learning Outcomes

At the end of the Unit the learners will be able to

- identify formal internal communication contexts and write a note/ memo/ email/ message accordingly
- write instructions and explanations for process oriented activities
- produce different pieces of writing concisely and cohesively with appropriate discourse markers based on charts and tables.
- write effective letters, emails, reports, and proposals

Unit 5: Grammar and Vocabulary in Context

Countable and uncountable nouns; present perfect and past simple; phrasal verbs; collocations; linking words; infinitives and verb + -ing; formal requests; first and second conditionals; prepositions in time clauses; modal verbs: perfect forms; referencing; passives; the definite article; tense changes in reported speech; relative clauses

Learning Outcomes

At the end of the Unit the learners will be able to

- demonstrate appropriate use of a range of grammatical structures and vocabulary
- understand various forms of nouns, verb tense, voice, and reported speech
- use phrasal verbs, collocations and discourse markers as required
- be consistent in the correct use of grammar and effective word choice in written and oral communication

References:

Whitby, N. (2014). *BusinessBenchmark: 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 : WORK PLACE 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

This course aims at introducing the student with basic concepts of engineering economic analysis, principles of management and its role in engineering decision making. The students are introduced to the basic tools needed for presentation of the effect of the time value of money on engineering problem solving. The tools introduced include topics such as demand and supply analysis, depreciation, costing analysis and break even analysis. It also helps the students to analyze financial statements.

Course objectives

- Define the basic terms of economics and analyze law of demand and elasticity of demand.
- Analyze the cost concepts and interpret financial statements.
- Apply break even analysis concept in business organization.
- Discuss the advantages of different forms of organization.
- Elaborate the principles of Management.

UNIT I **8 L**

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, problems.

Learning Outcomes:

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

- define utility and time value of economic goods. [**L-1**]
- distinguish between necessities, comforts and luxuries . [**L-2**]
- classify demand for different types of goods. [**L-2**]
- analyze the elasticity of demand for various economic goods. [**L-4**]

UNIT II **8 L**

Costing: Cost concepts, elements of cost, marginal cost, marginal revenue, sunk cost, opportunity costs, 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:

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

- list elements and types of costs. **[L-1]**
- apply cost analysis to determine profit. **[L-3]**
- classify accounts.**[L-2]**
- compose & interpret balance sheet for a given enterprise. [**L-3**]

UNIT III **6 hours**

Break-Even Analysis: Assumptions, break-even charts, simple problems.

Depreciation: Depreciation methods - Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Simple problems.

Learning Outcomes:

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

- apply break even analysis in business organization. **[L-3]**
- examine the impact of fixed and variable costs on profits. **[L-2]**
- list depreciation methods. **[L-1]**
- compute the depreciation of assets. **[L-3]**

UNIT IV **10 L**

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:

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

- comprehend the pros and cons of different forms of business organization. **[L-1]**
- distinguish types of organization. **[L-2]**
- illustrate advantages and disadvantages of each form of organization. **[L-2]**
- evaluate the effect of span of management on decision making. **[L-2]**

UNIT V **10 L**

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:

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

- summarize the function of management. **[L-1]**
- assess the role of manager. **[L-1]**
- compare and contrast between Leader and Manager. **[L-2]**
- list the characteristics of Leader. **[L-1]**

Text Book(s):

1. Tara Chand, Engineering Economics, Vol - 1, 13/e, Nem Chand & Bros, 2012
2. O.P Khanna, Industrial Engineering and Management, 14/e, Dhanpat Rai Publications, 2011.

References:

1. Maheswari, Engineering and Managerial Economics, 19/e, Sultan Chand & Co, 2009
2. Shukla, Grewal, Cost Accounting, 12/e, S.Chand & Company, 2007
3. L.M.Prasad, Principles and Practice of Management, 8/e, Sultan Chand & Sons, 2012

Course outcomes

- obtain the basic terminology, laws of demand and supply.**[L1]**
- evaluate the economic theories and cost concepts.**[L2]**
- analyze various accounting concepts and financial management techniques for preparing effective profit and loss statements.**[L3]**
- examine and analyze break even evaluation concepts for identification of minimum production volume for survival and to gain profits.**[L3]**
- adapt and build good manager skills by employing the concepts of various skills like good leadership qualities, utilizing motivation capabilities and incorporating communications skills.**[L2]**

19EMC382: ENGINEERING ETHICS (Mandatory Course)

L	T	P	C
3	0	0	0

Unit I **8 hours**

Basic Concepts: Terminology, morals, ethics, values, integrity and spiri-tuality, edicts-religious, social and constitutional edicts, the question of universality, personal and professional ethics, emotional intelligence, dimensions of ethics.

Unit II **8 hours**

Rights and Responsibilities: As citizens, as professionals, concepts ofjustice and fairness, preservation, production, exchange for mutual fulfilment vs. storage for future use, social responsibility and individual rights.

UnitIII **9 hours**

Global Issues in Ethics: Technology and globalization, business ethics,corporate social responsibility, environmental ethics, media ethics, pro-tecting the common good while respecting the values and beliefs of nations/ ethnic groups, issues of compliance and governance, equal opportunities.

Unit IV **8 hours**

Ethical Integrity and Attitudes: Integrity as wholeness and consistencyof 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 at-titude change.

Unit V **9 hours**

Ethical Living: Needs of life, materialistic and non-materialistic, quali-tative 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 condi-tions, reappraising economic sectors and work practices, developing green technologies, ethical consumerism.

References

1. G. Subba Rao, Roy Chowdhury, P.N. Ethics, Integrity and Aptitude: For Civil Services Main Examination Paper V, Access Publishing, 2013.
2. Singer, Peter. Practical Ethics, Cambridge University Press, 1999.
3. Swami Tathagatananda, Healthy Values of Living, Advaita Ashrama, Kolkata, 2010.
4. M. Frost (Ed), Values and Ethics in the 21st Century, BBVA,

Available at https://www.bbvaopenmind.com/wp-content/uploads/2013/10/Val-ues-and-Ethics-for-the-21st-Century_BBVA.pdf

19ECE392: 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

Structural Engineering: Construction Materials: Structural Steel – Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties. Bending moment and shear force in statically determinate beams; Simple stress and strain relationships

Geotechnical Engineering: Soil Mechanics, index properties, Engineering Properties, Permeability, Compaction of soils, Shear Strength

Environmental Engineering: Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index, Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal.

Geomatics Engineering: Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement – Levelling, Theodolite, Total station.

Transportation Engineering: Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances**,** Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes **,** Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data

References:

- S.C. Rangwala, Engineering Materials, 4/e, Charotar Publishing House, 2014
- V.N Vazirani and M.M Ratwani, Analysis of Structures Vol-I, Khanna Publishers,2003.
- B.C. Punmia, Soil Mechanics and Foundations, (SI Modules), 16/e Laxmi Publications, Sixteenth edition (2017).
- Water supply and sanitary engineering by G.S. Birdi, Dhanpat Rai & Sons publishers,2014
- B.C. Punmia, A.K.Jain, Arun Jain, Surveying I and II, Laxmi Publications, 2005.
- Khanna, S.K.,Justo, C.E.G., Veeraragavan. A. Highway Engineering, Nemchandand Bros,Roorkee, 2015
- Highway Material Testing & Quality Control, by G. Venkatappa Rao (Author), K. Ramachandra Rao (Author), Kausik Pahari (Author), D.V. Bhavanna Rao.
- Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018

HSMCH102: Universal Human Values: 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 -1. This exposure is to be augmented by this compulsory full semester foundation course.

Course objectives:

- Development of a holistic perspective based on self-explanation about themselves (human being), family, society and nature/existence
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

Module I:	Course Introduction – Need, basic guidelines, content and process for value education	8	L

1. Purpose and motivation for the course, recapitulation from universal human values-1
2. Self-exploration-what is it? – Its content and process; 'Natural Acceptance' and Experimental Validation – as the process for self- exploration
3. Continuous happiness and prosperity – A look at basic human aspirations
4. Right understanding, relationship and physical facility – the basic requirements for 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 coexistence) rather than as arbitrariness in choice based on linking-dislinking.

Module II:	Understanding harmony in the human being – harmony in myself?	9	L

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 III:	Understanding harmony in the family and society-harmony in human-human relationship	9	L

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. Discus with scenarios. Elicit examples from students' lives.

Module IV:	**Understanding harmony in the nature and existence – whole existence as coexistence**	9	L

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 V:	Implications of the above Holistic Understanding of Harmony on Professional Ethics	10	L

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:
7. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
8. At the level of society: as mutually enriching institutions and organizations
9. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

Text Books(s)

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Book(s)

1. J eevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakash an, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditS underlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - M aulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Course Outcomes:

By the end of the course, students 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

Semester VII

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19ECE401	Estimation & Costing	PC	3	0	0		3
2.	19ECE421	Computer Applications in Civil Engineering Lab	PC	0	0	3		1.5
3.	19EYY4XX	Interdisciplinary Elective II	ID	2	1	0		3
4.	19ECE4XX	Program Elective IV	PE	2	1	0		3
5.	19ECE4XX	Program Elective V	PE	2	1	0		3
6.	19EHS401	Construction Management	HS	3	0	0		3
7.	19ECE491	Project Phase I	PW	0	0	2		1
8.	19ECE493	Internship*	PW	-	-	-		1
9.	19ECE495	Comprehensive Skill Development VI	PW	0	0	0	6	1
Total								**19.5**

Interdisciplinary Elective- II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19AID471	Introduction to Green Buildings	ID	2	1	0	3
2		19EEE471	Renewable Energy Resources	ID	2	1	0	3
3	Computer Oriented Courses	19ECS475	Introduction to Web Technologies	ID	2	1	0	3
4		19ECS473	Introduction to software Engineering	ID	2	1	0	3
5	Management Courses	19EME456	Optimization Techniques	ID	2	1	0	3
6		19EME366	Project Management & Optimization	ID	2	1	0	3
7		19ECE371	Disaster Management	ID	2	1	0	3

Program Elective- IV

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE441	Advanced Design of Steel Structures	PE	2	1	0	3
2	Geotechnical Engineering	19ECE445	Soil Dynamics and Machine Foundations	PE	2	1	0	3
3	Transportation Engineering	19ECE449	Transportation Infrastructure Engineering	PE	2	1	0	3
4	Water Resources Engineering	19ECE453	Irrigation Management	PE	2	1	0	3
5	Environmental Engineering	19ECE457	Solid and Hazardous Waste Management	PE	2	1	0	3

Program Elective- V

S. No.	**Stream**	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	Structural Engineering	19ECE443	Prestressed Concrete	PE	2	1	0	3
2	Geotechnical Engineering	19ECE447	Ground Improvement Techniques	PE	2	1	0	3
3	Transportation Engineering	19ECE451	Urban Transport Planning	PE	2	1	0	3
4	Water Resources Engineering	19ECE455	Watershed Management	PE	2	1	0	3
5	Environmental Engineering	19ECE459	Environmental Impact Assessment	PE	2	1	0	3

19ECE401: Estimation and Costing

L T P C

3 0 0 3

The primary purpose of estimating and costing is the preparation for submission of a project according to administrative approval and technical sanction. The various elements of engineering involved in it viz. planning, preparing bill of quantities and abstracts of cost, drawing and detailing (specially at the actual construction stage) and organisation of labour and material with a view to provide a durable structure most economically.

Course Objectives:

- To explain thebasics terms and standard units used in construction of civil engineeringstructures.
- To demonstrate the different methods of estimating the quantities of items.
- To familiarize the schedule of rates of different item of works by using standard data book.
- To explain the estimation of earthwork in different roads and also calculate the weight of steel required in R.C.C. element.
- To familiarize about construction contracts and tenders.

UNIT – I **8 L**

Introduction: General items of work in building, standard modules, principles of working out quantities for detailed and abstract estimates,approximate method of estimating, errors in estimation, types, related termsin estimate, contingencies, different types of approvals, rules.

Specification: purpose and basic principle of general and detailedspecification (writing the detailed specification for various constructionsshould be covered in term work).

Learning outcomes:

After completion of Unit – I, students will be able to

- Explain various items of work in construction of civil structures.[L-2]
- List different types of approvals and rules needed to construct a building. [L-1]
- Identify errors occurred in estimation. [L-3]
- Summarize general and detailedspecifications for items of work. [L-2]

UNIT – II **8 L**

Detailed Estimate of Buildings: Different items of works in building,detailed measurement form, estimate of RCC building long wall- shortwall method and centre line method.

Learning outcomes:

After completion of Unit – II, students will be able to

- Explain the terms used in detailed measurement form. [L-2]
- Interpretapproximate method of estimating. [L-2]
- Make use of estimating of RCC building with long wall-shortwall method and centre line method.[L-3]

UNIT – III **9 L**

Rate Analysis: Working out of data sheet for materials and various itemsof work in buildings, standard data book, schedule of rates, and abstract estimate of buildings.

Learning outcomes:

After completion of Unit – III, students will be able to

- Identify the various materials in standard data sheet. [L-1]
- Demonstratethe schedule of rates.[L-2]
- Explainrate analysis of various items of buildings. [L-2]

UNIT – IV **9 L**

Roads: Estimation of earth work, different formulae for calculations, concrete roads, bituminous roads.

Bar bending: Introduction to bar bending schedule, beams.

Learning outcomes:

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

- Classifythe different methods to calculate the earthwork of roads. [L-1]
- Interpretbar bending schedule.[L-2]
- Explain steel requirement in RCC beams.[L-2]

UNIT – V **8 L**

Contracts: Definition, element of contract, offer acceptance and consideration, valid contract, types of contracts, conditions of contract, sub-contracts, joint ventures, muster roll form 21, piecework agreement

form, work order.

Tender: Definition quotation, earnest money- security money, tender notice, tender form, bidding types and procedure, irregularities in bidding, award, arbitration- disputes settlement.

Learning outcomes:

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

- Identify types of contracts in construction of civil structures. [L-2]
- Explain the conditions of contract and muster roll form.[L-2]
- Illustrate different terms used in tender document. [L-2]
- Define requirement of earnest money & security money. [L-1]
- Explain the procedure of evaluating the tender. **[L-2]**

Text Books:

1. S. C. Rangwala, Estimating, Costing and Valuation, 17/e ,Charotar Publishing House, 2017.
2. B.N. Dutta, Estimating and Costing in Civil Engineering, 27/e, UB Publishers, 2014.

Reference:

1. V N Vazirani& S P Chandola, A Text book of Civil Engineering Estimation and Costing, 3/e, Khanna Publishers, 2001.
2. D.D. Kohli and R.C. Kohli, Textbook on Estimating, Costing and Accounts (Civil), 13/e , S. Chand & Company Pvt. Ltd, 2013.
3. M. Chakraborti, Estimation Costing Specifications and Valuation in Civil Engineering, 24/e , Khanna Publishers, 2014.
4. Kumar NeerajJha, Construction Project Management: Theory and Practices, 2/e, Pearson Education, 2015.
5. NPTEL Web Course- Construction Planning and managementhttps://nptel.ac.in/courses/105103093

Course Outcomes:

At the end of the Course the Students will be able to

- find out the dimensions and descriptions of construction work in a methodical way.[L-1]
- interpretthe purpose of estimating and quantify the materialsby standard method in construction projects.[L-2]
- constructthe different items of materials,labour and machinery with standard unit rates for a various construction work in building.[L-3]
- interpret the quantities of estimating the road work and bar-bending schedule.[L-2]
- illustrate the procedure of contract by process of bidding. [L-2]

19ECE421: COMPUTER APPLICATIONS IN CIVIL ENGINEERING LABORATORY

L T P C

0 0 3 1.5

The student gets familiarity in i)analysis and design of RCC and steel Structure using STAAD Pro., ii)design water distribution network using EPANET, iii)schedule and plan a project using Construction Management principles, and iv) reading of spatial data using GIS. The student will be able to perform design of real time structures.

Prerequisite: Structural Analysis, Design of Reinforced ConcreteStructures, Design of Steel Structures, Water Resources Engineering and Project Planning and Management.

Course Objectives:

- To demonstrate the modeling of a building.
- To train in generating the maps using GIS software.
- To demonstrate the design of water distribution network.
- To facilitate project planning and scheduling.

List of Analysis or Design to be performed using Various software STAAD.Pro

1) Introduction to STAAD Pro software and basic beam analysis.
2) Analysis of RC plain and three-dimensional frames.
3) Analysis and design of structures subjected to wind and earthquake loads. (minimum five storey),
4) Typical detailing of structural elements.
5) Analysis and design of steel truss.

GIS

1) Creation of spatial data using different methods.
2) Creation of Maps with different data formats.
3) Analysis of data using GIS.
4) Generation of reports based on specific queries.

EPANET

1) Calculation of major head loss in pipes
2) Calculation of minor head losses for bends and fittings.
3) Design of a simple pipe network
4) Analysing the movement of a tracer material
5) Conducting water quality simulation

CONSTRUCTION MANAGEMENT APPLICATIONS

1) Introduction to project managementsoftwares
2) Planning and Scheduling of residential project using PERT and CPM Techniques.
3) Resource Allocation for activities of residential project
4) Controlling the time schedule of residential project.
5) Generating reports for residential project

Note: Students should learn any three software packages,

Course Outcomes:

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

- analyze a building (L3).
- design a building (L3).
- develop maps using GISdata (L3).
- design water distribution network (L3).
- plan the project activities(L3).

INTER DISCIPLINARY ELECTIVE-II

19AID471: INTRODUCTION TO GREEN BUILDINGS

L	T	P	C
2	1	0	3

Green Buildings are the need of the 21st century as the construction industry must contribute towards reducing the effects of climate change. This course is designed to provide basic guidelines for the construction of Green Buildings and it gives an overview of all the processes involved from the start of site construction management to material selection, services management, energy & resources management and managing the indoor environment quality during building operation.

Course Objectives:

- To emphasize the need for energy efficient buildings
- To understand the considerations for an Energy Efficient building design.
- To give an overview on the resource management during construction, operation and post demolition.
- To have an insight into the existing Green Rating Systems in India.
- To illustrate various techniques that can be applied in buildings to make them green.

UnitI **8L**

Introduction to green buildings: Concept of green building design. Need for energy and resource efficient design. Factors affecting the Energy use in Buildings – Pre-Building Stage, Construction Stage & Post Occupancy stages. Building life cycle analysis. Need for Green Building rating Systems. Brief introduction to green rating systems in India.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Define the concept of Green Buildings. (L1)*
- *Explain the need of resource conservation. (L2)*
- *Illustrate the energy use in buildings as different stages. (L2)*
- *Select appropriate building rating systems. (L3)*

Unit II **8L**

Sustainable site construction and management – Selection of site, preserving and protecting landscape during construction, Top soil conservation, reducing hard paving on site, provide sanitation and safety facilities for construction workers Efficient design of services – water management: water supply and treatment methods, rain water harvesting, water recycling, reuse of water and installation of water efficient fixtures. Waste management: reduction of waste during construction, efficient segregation of waste, resource recovery from waste.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Choose appropriate methods of construction management. (L1)*
- *Summarise the process of site management. (L2)*
- *Identify the techniques of energy, water and waste management in buildings. (L3)*

Unit III **8L**

Building physics: heat transfer in buildings (conduction, convection and radiation) and importance material selection for building envelope. Specification of materials for walls and roofs in different climates. Building materials and resources: Sustainable Building Materials– Biodegradable & Non- Biodegradable Materials, resource reuse, recyclable materials, recycled content, Regional materials. Energy Efficient Construction Technology – Filler Slab, Rat trap Bond. Technologies developed by CBRI. Contemporary and future trends- Nanotechnology, smart materials.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Show the process of heat transfer through buildings. (L2)*
- *Examine the performance of building envelopes for heat transfer. (L4)*
- *Identify appropriate building materials. (L3)*
- *Demonstrate various energy efficient construction technologies being developed. (L2)*

Unit IV **8L**

Energy conservation: Optimizing building design to reduce conventional energy demand, reducing material usage and time of construction by adopting efficient technologies, conserving energy through selection energy efficient equipment. Alternative sources of energy: Renewable energy sources, Photo Voltaic Cells, small scale hydro and wind systems, photovoltaic cells.

Post completion of the unit the student will be able to:

- *Relate the process of building design with energy conservation. (L1)*
- *Outline the process of time & cost reduction in construction projects. (L2)*
- *Identify alternate sources of renewable energy on-site. (L3)*

Unit V **10L**

Indoor environmental quality: Need to improve indoor air quality-sick building syndrome, building related illness, multiple chemical sensitivity. Reducing indoor air pollutants- low-VOC paints / adhesives /sealants, Minimize ozone depleting substances, required levels of indoor ventilation. Indoor and outdoor noise levels.Case Study/Desktop Study: Case study of a live project on Green Buildings or a desktop study of a Green building.

Post completion of the unit the student will be able to:

- *Explain the need for high indoor air quality. (L2)*
- *List the indoor air pollutants and their sources like VOC, dust, noise, etc. (L1)*
- *Analyse the green aspects of a live project/case study. (L4)*

Text Book(s):

1. Abridged Version reference guide for New Buildings (IGBC rating system)
2. ECBC reference guide.

References:

1. New buildings reference guide
2. Heather L. Venhaus, Designing the Sustainable Site: Integrated Design Strategies for Small Scale Sites and Residential Landscapes
3. Faisal Zia, Vasudevan Rajaram, Solid and liquid waste management,
4. Siddiqui, Sanjeev Agrawal, Mohammed Emran Khan, Introduction to Architectural Science
5. S. V. Szokolay, The Basis of Sustainable Design

6. Sustainable Construction Techniques. From structural design to interior fit-out:
7. Sebastian / John, Viola / Zeumer, Martin Assessing and improving the environmental impact of buildings by El khouli,

Course Outcomes: The students will be to

- Outline the importance of green building design.-L2
- Interpret the efficient techniques of optimizing resource usage in the process of building construction, building operation and post demolition.-L2
- Extend the knowledge on effective selection of materials and other equipment.-L2
- Distinguish between green and inefficient practices relating to water & energy consumption and waste production.-L4
- analyze the sustainability any building and check for green features.-L4

19EEE471: RENEWABLE ENERGY SOURCES

L	T	P	C
2	1	0	3

In this course it is aimed to introduce to the students the basic principles of different renewable energy sources such as solar, wind, tidal and bio-energy. The basic concepts of solar energy resource, wind statistics and wind driven induction generators are explained.

Course Objectives:

The purpose of the course is to

- Summarize the potentially of renewable energy sources in India.
- Studyof various fundamentals of photovoltaic cell and characteristics.
- Expose various basic concepts of wind turbines.
- Familiarizevarious ways of power generation using tidal energy and geothermal energy.
- Interpret the feasibility of bio-energy based power generation.

UNIT I: General 8 L

Primary and conventional energy resources – study of availability, Energy consumption pattern and growth rate in India, Non-Conventional energy sources – availability, Economics and efficiency.

Learning outcomes:

After completion of Unit I, students will be able to

- Definethe basic of conventional energy sources. (L1)
- Contrast the difference between conventional and non-conventional energy sources(L2)
- Identify the different potential ways to generate power. (L3)
- Analyze the economical characteristics for non-conventional energy sources. (L4)
- Justify the use of non-conventional power sources over conventional power sources. (L5)

UNIT II: Solar Energy and applications 10 L

Solar radiation – Introduction to photovoltaic and thermoelectric conversion – principles of Solar energy collection – types of collectors. Characteristics and principles of different types of collectors and their efficiencies. Solar energy applications – water heaters, air heaters, Solar cooling, Solar drying and power generation – solar tower concept (Solar plant) – Solar pump.

Learning outcomes:

After completion of Unit II, students will be able to

- Definethe basic characteristics of Sunlight (L1)
- Contrast the difference between direct radiation and diffuse radiation (L2)
- Identify the different ways to generate power from solar (L3)
- Analyze characteristics of Photovoltaic cells (L4)
- Justify the use of PV cells over conventional power sources. (L5)

UNIT III: Wind Energy **8 L**

Energy from the wind – General theory of wind mills – types of wind mills – Elementary design principles – performance of wind machines – wind power – efficiency.

Learning outcomes:

After completion of Unit III, students will be able to

- Definethe basic characteristics of wind source (L1
- Demonstrate the calculations of wind statistics(L2)
- Develop the equations for forces developed in different parts of turbine (L3)
- Survey wind availabilities based on different methodologies (L4)
- Appraisethe performance of the wind power plant. (L5)

UNIT IV:Tidal Energy **8 L**

Energy from tides and waves – working principles of tidal plants – tidal Power generations – Geothermal energy – principle of working of Geothermal power plants.

Learning outcomes:

After completion of UnitIV, students will be able to

- Listthe various ways the Tidal power is available(L1)
- Develop power generation equations for Tidal power.(L2)
- Analyze various techniques used for tidal power generation (L4)
- Evaluate integration issues in geothermal energy (L5)
- Elaboratevarious geothermal plants. (L6)

UNIT V:Bio-Energy **8 L**

Energy from Bio-mass – Bioconversion processes. Bio-gas - its generation and utilization Bio-gas plants – various types – Industrial Wastes – Municipal waste – Burning – Plants – Energy from the Agricultural wastes – Applications.

Learning outcomes:

After completion of Unit V, students will be able to

- Relate bioconversion processes with power generation.(L1)
- Illustrate various bio-gas plants.(L2)
- Analyze about the industrial wastes. (L4)
- Interpret energy from the agricultural wastes. (L5)
- Justifythe applications of bio-energy. (L6)

Text Books:

1.G.D.Rai ,Non-Conventional Energy Sources , Khanna publishers.

2.M.P.Agrawal ,Future Sources of Electrical Power , 1st edition, S.Chand& Co., 1999.

Reference Books:

1. S.Rao ,Energy Technology – Non-Conventional, Renewable & Conventional , Khanna

Course Outcomes: Upon completion of the course, the students would be able to

- Correlate conventional and non-conventional energy sources.(L3)
- Identify various basic concepts of PV cells.(L2)
- Estimate various parameters in wind statistics. (L3)
- Assess about feasibility of geothermal and tidal energy sources.(L5)
- Appraise the bio-energy systems. (L6)

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

- Analyze the uses of CSS in developing web technologies.
- Learn the uses of HTML and its basic tags and their uses.
- Understand the way CSS helps us develop full-fledged graphic web pages.-
- Inspect how java script is used in our day to day life.
- Learn the basics of Elements in java script.

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

- Inspect initial concepts of PHP.
- Using conditional and looping statements to develop full-fledged PHP programmes.
- Understanding Forms in PHP.
- Acquaint yourself with Arrays in PHP.
- Using functions and Iterators to create programs in PHP.

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

- Analyze the syntaxes of XML.
- Learn the different XML schemas used to develop web technologies
- Understand other XML technologies like XLink, XPointer and XQuery.
- Connecting to a database using PHP and MySQL.
- Applying the concept of tables in Databases using PHP and MySQL.

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

- Introduction to servlets in JAVA and how servlets can be used to develop web pages.
- Learning the Lifecycle of a Servlet.
- Understanding the concept of cookies and session tracking

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

- Learn the uses of JSP in creating web applications.
- Understanding the different stages of JSP Lifecycle.
- Inspect the concepts used in Programming Using JDBC.
- Learning the javax.sql.* package and how it is useful in JSP.
- Analyze the components of JSP and how it helps us to connect to a database.

Text book(s)

1. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Black Book bykogentleanrning 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:

- Students are able to develop a dynamic webpage by the use of java script and DHTML.

- Students will be able to write a well formed / valid XML document.
- Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.
- Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.
- Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database

19ECS473: INTRODUCTION TO SOFTWARE ENGINEERING

L T P C
2 1 0 3

This course provides the fundamentals of software engineering, including understanding system requirements, effective methods of design, coding and testing, team software development, and the application of engineering tools. By applying the above scientific knowledge we can create practical, cost effective solutions to computing and information processing problems.

Course Objectives:

- Have a good understanding of the Software Development Life Cycle [SDLC].
- Good Knowledge about how to the design based on the project requirements and planning.
- Knowing what kind of process model has to be implemented based on the Communication and Planning.
- Understanding of the Project, Quality and Risk Managements in the Project.
- All will have good expose to the S/W testing strategies, Tactics and Software Metrics.
- They will have the good understanding of the Good software development practices.

UNIT I **10hours**

Introduction: Evolution, Software Development Projects, Exploratory Style of Software Development, Emergence of Software Engineering, Notable Changes in Software Development Practices, Computer Systems Engineering

Software Life Cycle Models: A Few Basic Concepts, Waterfall Model and its Extensions, Rapid Application Development (RAD), Agile Development Models, Spiral Model, A Comparison of Different Life Cycle Models.

Learning Outcomes

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

- illustrate the importance of software engineering.(L2)
- identify the changes in software development practices.(L3)
- outline different software life cycle models(L2).
- select which model fits for different types of problems(L3)

UNIT II **10hours**

Requirements Analysis And Specification: Requirements Gathering and Analysis,

Software Requirements Specification (SRS), Formal System Specification, Axiomatic Specification, Algebraic Specification, Executable Specification and 4GL

Software Design : Overview of the Design Process, How to Characterise a Good Software Design?, Cohesion and Coupling, Layered Arrangement of Units, Approaches to Software Design.

Learning Outcomes

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

- find the requirements for different types of problems(L1)
- list different specification methods for a given problem(L1)
- identify project constraints and solutions, problem decomposition, requirements elicitation(L3)
- develop a model for a given problem using different levels of design methodologies(L3)

UNIT III **8 hours**

Function-Oriented Software Design : Structured Analysis, Developing the DFD, Model of a System, Structured Design, Detailed Design, Design Review

Basic Object-Orientation Concepts : Unified Modelling Language (UML), UML Diagrams, Use Case Model, Class Diagrams, Interaction Diagrams, Activity Diagram, State Chart Diagram

User Interface Design : Characteristics of a Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology

Learning Outcomes

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

- develop a design for software problem using UML diagrams(L3)
- show the solution of software problem in various UML diagrams(L2)
- understand the multiple levels of detail and abstraction of a solution(L2)
- identify design patterns that best suits for a problem solution(L3)

UNIT IV **10 hours**

Coding and Testing: Coding, Software Documentation, Testing, Unit Testing, Black-box Testing, White-Box Testing, Debugging, Program Analysis Tools, Integration Testing, Testing Object-Oriented Programs, System Testing

Software Reliability and Quality Management : Software Reliability, Statistical Testing, Software Quality, Software Quality Management

Learning Outcomes

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

- distinguish various types of testing methods and their importance(L4)
- Apply these methods for testing the solution of a problem(L3)
- Develops a reliable software solution for a problem(L3)
- Understand the importance of software quality(L2)

UNIT V **10 hours**

Computer Aided Software Engineering, Case and its Scope, Case Environment, CASE Support in Software Life Cycle, Other Characteristics of Case Tools, Towards Second Generation CASE Tool, Architecture of a Case Environment.

Software Maintenance: Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models, Estimation of Maintenance Cost.

Learning Outcomes

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

- explain three different perspectives for CASE tools classification(L2)
- compare and contrast the fitness of existing CASE Tools to the needs of specific software development context(L2).
- construct documentation and presentations for effective software reuse(L3)

Text Book(s):

1. Rajib Mall, Fundamentals of Software Engineering, 4/e, PHI, 2009.

References:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7/e, McGraw Hill, International Edition, 2009
2. K.K. Agarwal &Yogesh Singh, Software Engineering, New Age International Publishers, 2007.
3. Waman S Jawadekar, Software Engineering Principles and Practice, McGraw Hill, 2004.

Course Outcomes

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

- make use of different process models in the SDLC.(L3)
- construct system design by using different types of modeling i.e., object oriented, scenario based, flow oriented, class based(L3)
- understand Pattern based design, Architectural Design; Component based Design, user Interface Design(L2)
- develop different test strategies, understand different test tactics.(L3)
- understand project estimation and quality, of Risk and Quality Management and apply in applications(L2)

19EME456: OPTIMIZATION TECHNIQUES

L	T	P	C
2	1	0	3

Optimization is a scientific approach to decision making that aids to design the best system, usually under conditions requiring the allocation of scarce resources. Due to the complexity of most real-world optimization problems, it has been necessary for researchers and practitioners to reduce the complexity of the problem by either simplifying the problem or constraining it by making reasonable assumptions. In this course, the practical aspects of optimization methodology, with a major focus on the techniques and stratagem relevant to manufacturing, design and operations applications. Attention is given primarily to techniques applicable to problems in linear, integer, non-linear programming, and integer models.

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 knownmethod *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 **[L-2]**
- classify design constraints, constraint surface, objective functions, optimization problems and techniques **[L-2]**
- familiarize optimization problems to suitably choose the method needed to solve the particular type of problem **[L-1]**

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 **[L-2]**
- apply numerical methods to solve multi variable unconstrained Non-Linear programming problems **[L-3]**

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 **[L-6]**
- formulate optimization techniques like Hooke and Jeeves method, Powell's method as random search methods. **[L-6]**

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

- evaluate calculus method like dynamic programming for optimization solving. **[L-5]**
- integrate multistage decision processes**.[L-5]**

- apply dynamic programming method towards optimization of linear programming problems.**[L-3]**
- apply different approaches in dynamic programming problems **[L-3]**

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

- evaluate Integer programming concepts **[L-5]**
- familiarize with the need of a well known method *Gomory's cutting plane method*.**[L-1]**
- 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. **[L-3]**

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.

Course outcomes:

- understand the need and origin of the optimization methods**[L-2]**
- classify optimization problems to suitably choose the method needed to solve the particular type of problem**[L-2]**
- use computer software efficiently for modelling and solving the ILP problems. **[L-3]**
- identify the logic underlining the idea in the Branch and Bound method and use that method to solve ILPs**[L-4]**
- describe the logic underlining the idea in the Cutting Plane algorithm and use that method to solve ILPs **[L-2]**

19EME366: PROJECT MANAGEMENT & OPTIMIZATION

L	T	P	C
2	1	0	3

*This course provides an in-depth insight into the concepts, principles, formulation of projects and network techniques of project management, The appraisal Techniques to evaluate the projects which could be successfully used for improving the quality of managerial decisions. The students will study this course with a generalist approach***.**

Course Objectives:

- This course is an introduction to the basic processes of project management for instructional design projects.
- Students will be introduced to organizational issues, methods of planning, and techniques for managing the business and creative processes that determine the success of a project.
- Students will learn to use project management software for organizing, scheduling and monitoring project progress.

UNIT I **8 L**

Project Planning: Analysis and Appraisal Generation of project ideas, Scouting for project ideas, Preliminary screening, Project rating index, Cost of project.

Investment Appraisal: Social cost benefit analysis, UNIDO approach, Net benefit in terms of economic prices, Measurement of impact on distribution, Savings impact and its value, Income distribution impact, Adjustment for merit and demerit, Goods Little Mirrless approach, Shadow prices.

Learning outcomes:

After completing this unit, the student will be able to

- understand the role of Project Management in instructional technology and project development **[L-2]**
- applytheoretical aspects and approaches to managing technology based projects **[L-3]**
- comprehend the importance of Social cost benefit analysis**[L-2]**
- interpret the usage of Social cost benefit analysis, UNIDO approach**[L-2]**

UNIT II **10 L**

Project Implementation: Development of project network, Dummy activities, Activity on node networks, Cyclic network, Forward pass and backward pass computations, Algorithm for critical path, Total slacks, free slacks and their interpretations.

Time-cost Trade off Procedure: Schedule related project costs, Time cost trade off, lowest cost schedule.

PERT Network: Three time estimates for activities, Estimation of mean and variance of activity times, Event oriented algorithm for critical path, Probability of meeting a schedule date.

Learning outcomes:

After completing this unit, the student will be able to

- identify major stakeholders and organizational dynamics in a projects life cycle [L-1]
- identify potential factors that impact successful project management including scope creep, budgeting, team dynamics and working with overseas development vendors[L-1]
- apply knowledge and skills to create a formal project planning document [L-3]

UNIT III **8 L**

Network Analysis:

Algorithms for shortest route problems-Dijkstra's, Floyd’s, and Pollack’s, algorithms;
Algorithms for minimal spanning tree- Kruskal's algorithm and Prim's algorithm;
Algorithms for maximal flow problems-Ford and Fulkerson's algorithm.

Learning outcomes:

After completing this unit, the student will be able to

- recognize the importance of evaluating emerging technology in technology project management[**L-2]**
- explores algorithms and uses them in real time environments**[L-6]**

UNIT IV **8 L**

Linear Programming Formulation of Network Problems: A flow network interpretation for determination of critical paths, Time cost trade off and maximal flow, Chance constrained linear programming for probabilistic durations of activities in PERT network.

Learning outcomes:

After completing this unit, the student will be able to

- applytheoretical aspects and approaches to managing technology based projects in network problems[**L-3]**
- explores linear programming problems and uses them in real time environments[**L-6]**

UNIT V **8 L**

Project Scheduling with Limited Resources: Complexity of project scheduling with limited resources, leveling the demands on key resources, a simple heuristic program for resource allocation.

Learning outcomes:

After completing this unit, the student will be able to

- identify the technical requirements of project management using MS Project[**L-1]**
- create and manipulate a projects specifics using Microsoft Project **[L-6]**
- apply knowledge and skills to create a formal scheduling project**[L-3]**

Text books:

1. Parameshwar P. Iyer. Engineering Project Management with Case Studies, Vikas Publishing House Pvt. Ltd. New Delhi, 2005.
2. Prasanna Chandra, Projects Planning, Implementation and Control, Tata McGraw Hill Publishing Company Limited, New Delhi, 1995.

References:

1. Project Management Institute (PMI), A Guide to the Project Management of Knowledge Newton Square, PA, 1996
2. J.R. Meredith and S.J. Mantel. Project Management: A Managerial Approach. John Wiley and Sons, New York, 1995.
3. L.S. Srinath, PERT & CPM Principles & Applications, 3rd edition, East west Press,2001.

Course Outcomes:

- explain the project management principles and philosophy[**L-2]**
- understand the project environment through feasibility study[**L-2]**
- familiarize to identify the investment opportunities and to formulate the projects.[**L-1]**
- discuss the development of project network-Time Estimation[**L-1]**
- outline the operation of projects under resource constrained environment and closing the projects[**L-4]**

19ECE371 - DISASTER MANAGEMENT

L	T	P	C
2	**1**	**0**	**3**

Most of the hazards turn into disasters due to unsustainable activities of human beings and cannot be completely avoided. However,the impact can be mitigated by proper planning, preparedness and organizing at various levels. Civil Engineers may have to work in varied locations where in they have to encounter a variety of disaster scenarios. Hence, they need to have adequate knowledge to deal with these disasters. This subject is aimed at providing a detailed understanding of various phases of disaster management, vulnerability profileand organizational structure of disaster management in India, and applications of science & technology for better disaster management.

Course objectives

- Familiarize Disaster management activities and phases
- Demonstrate the Vulnerability profile of India towards various disasters
- Explain the Components of disaster relief, disaster management policies
- enable latest trends in disaster management
- expose outcomes from various disasters in India

UNIT-I **9 hours**

Introduction to disaster management: Basic terminology (hazard, vulnerability, disaster, risk, exposure, resilience, capacity), classification of disasters, disaster mitigating agencies and their organizational structure at different levels (NDMA, NDRF, SDMA, DDMA), disaster management cycle.

Learning outcomes

After completion of Unit-I, students will be able to

- list various terms related to disaster management (L-1).
- classify various types of disasters (L-2).
- illustrate the organizational structures of disaster mitigating agencies (L-2).
- outline the significance of Disaster Management Cycle (L-2).
- explain the disaster management cycle (L-3).

UNIT -II

Learning outcomes **8 hours**

Vulnerability of profile of India: Vulnerability towards wind and cyclone, floods, earthquakes, heat waves, cold waves, dust storms, droughts, tsunamis, landslides, forest fires.

Learning outcomes

After completion of Unit -II, students will be able to

- explain the vulnerability scenario of India with respect to various disasters (L-2).
- select the vulnerable zones with respect to various disasters in India (L-3).

UNIT -III **8 hours**

Components of disaster relief: Water, food, shelter, protection and security, sanitation, health, waste management, financial assistance.

Institutional arrangements: Disaster management act 2005 and national policy on disaster management 2009.

Learning outcomes

After completion of Unit -III, students will be able to

- state the components of disaster relief (L-1).
- illustrate the significance of disaster relief components (L-2).
- explain the significance of institutional arrangements (L-2).

UNIT -IV **9 hours**

Applications of science and technology for disaster management: Geo-informatics in disaster management (RS, GIS, GPS), disaster communication system (early warning and its dissemination), land use planning and development regulations, disaster safe designs and constructions, structural and non-structural mitigation of disasters.

Learning outcomes

After completion of Unit -III, students will be able to

- explain the significance of Geo-informatics in disaster management**,** disaster safe designs and constructions (L-2).
- demonstrate the functioning of disaster communicationsystem (L-2).
- outline the land use planning and development regulations (L-2).

UNIT -V **8 hours**

Case studies: Related to various recent disasters of earthquake, tsunami, cyclone, flood, drought, landslides, volcanic eruption, forest fire, heat wave, cold wave.

Learning outcomes

After completion of Unit -III, students will be able to

- name various disasters occurred in India and worldwide (L-1).
- identify major disasters in each category (L-3).
- analyze various disaster management case studies (L-4).

Course outcomes:

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

1. classify various types of disasters and explain disaster management cycle (L-2).
2. explain the vulnerability scenario of India with respect to various disasters (L-2).
3. demonstrate the significance of disaster relief components, institutional arrangements (L2).
4. apply the knowledge of geo-informatics, communication system in disaster Management (L-3).
5. analyse various disaster management case studies (L-4).

Text Books

1. R.B.Singh, Disaster Management, Rawat Publications, 2000.

Reference Books

1. Iyengar, Natural Hazards in the Urban Habitat, C.B.R.I., Tata McGraw Hill, 1997.
2. Jon Ingleton, Natural Disaster Management, Tulor Rose Holdings Pvt. Ltd., 1999.

Program Elective -IV

19ECE441: ADVANCED DESIGN OF STEEL STRUCTURES

L T P C

2 1 0 3

This is an advanced course useful for the student to enable them the design of advanced Steel structuresThe student will be able to design various components of plate girders under different loading condition.The design of column foundations and gantry girders will be helpful in designing industrial structures.

Prerequisite: Mechanics of Solids, Structural Analysis and Design of Steel Structures

Course Objectives

- To train on the design of welded plate girder without stiffeners.
- To train on the design of welded plate girder with stiffeners.
- To enable the design of truss members.
- To demonstrate the designof column bases.
- To familiarizewith the design of Gantry Girder.

Unit I **8L**

Welded Plate Girders: Components of a plate girder, economical depth, design of flanges, design of cross section of plate girders, design of connection.

Learning Outcomes

After completion of this unit, students will be able to

- Listthe various components of a plate girder (L1).
- find the economical depth and thickness of plate girder (L1).
- design of plate girders without stiffeners (L6).

Unit II **8L**

Welded Plate Girders: Web stiffeners - design of vertical, horizontal and bearing stiffener, web splice.

Learning Outcomes

After completion of this unit, students will be able to

- classify various types of stiffeners (L2).
- design various types of stiffeners (L6).
- design of splices (L6).

Unit III **8L**

Roof Trusses: Types of trusses, economical spacing of roof trusses, loads on roof trusses, estimation of wind load on roof trusses as per IS:875, design of members of roof truss and joints, design of purlins.

Learning Outcomes

After completion of this unit, students will be able to

- determine the wind load on roof trusses (L5).
- design purlins of roof truss (L6).
- design roof joints (L6).

Unit IV **8L**

Column Foundations: Slab base, gusset base and grillage foundations for axially loaded columns.

Learning Outcomes

After completion of this unit, students will be able to

- outline various types of Column bases (L2).
- design column bases (L6).
- design grillage foundation (L6).

Unit V **10L**

Gantry Girder: Introduction - loading consideration and maximum load effect - selection of gantry girder – design of gantry girders for primary loads only.

Learning Outcomes

After completion of this unit, students will be able to

- distinguish between the loadson gantry girder (L4).
- choose the effective section for gantry girder (L3).
- design the gantry girder (L6).

Text Book(s)

1. S.K. Duggal, Limit state Design of steel structures, 2/e, Tata McGraw Hill, 2017.

2. N. Subramanyam, Design of Steel Structures, 2/e, Oxford University Press, 2016.

References

1. V.L. Shah and Veena Gore, Limit State Design of steel structures IS:800- 2007, Structures Publications, 2012.
2. M.L. Gambhir, Fundamentals of Structural Steel Design, McGraw Hill Education, 2013.
3. Ramachandra and V. Gehlot, Design of Steel Structures, 2/e, Scientific Publishers, 2015

Course Outcomes

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

- design a welded plate girder without stiffeners (L6).
- design a welded plate girder with stiffeners (L6).
- design of membersin a truss (L6).
- design of column bases. (L6).
- design of Gantry Girder (L6).

19ECE445: SOIL DYNAMICS AND MACHINE FOUNDATIONS

L	T	P	C
2	1	0	3

This course mainly deals with the behavior and properties/response of soil as material subjected to the dynamic or cyclic time dependent loading. It also discuss about design and principles for machine foundations by considering soil and foundation as a combined mass. The concepts of Fundamentals of vibration and analysis, wave propagation through soils during earthquakes, dynamic soil properties and soil damping were very essential in the machine foundation design will be covered in this course.

Course Objectives:

- To familiarize the Fundamentals of Vibrations and Damping
- To demonstrate wave propagation and dynamic properties of soil.
- To train to analyse the different methods of Vibration Analysis
- To create an understanding about the importance of designing machine foundation for reciprocating and impact machines.
- To enable the design procedure of machine foundations on piles.

Unit I **9L**

Fundamentals of Vibration: Definitions, simple harmonic motion,response of SDOF systems Of Free And Forced Vibrations With And Without Viscous Damping, Frequency Dependent Excitation, Systems Under Transient Loads, Rayleigh's method of fundamental frequency, logarithmic decrement, determination of viscous damping, transmissibility, systems with two and multiple degrees of freedom, vibration measuring instruments.

Learning Outcomes:

After completion of Unit-1, Students will be able to

- explain the simple harmonic motion and various Vibrations and other definitions-L2
- demonstrate the response of SDOF of free and forced vibrations withand without Viscous Damping-L2
- analyze Systems Under Transient Loads-L3
- demonstrate the Rayleigh's method of fundamental frequency,-L2
- determine damping and viscous damping-L3
- classify the various vibration measuring instruments-L2

Unit II **8L**

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits attenuation of stress waves, seismic site classification, stress-strain behaviour of cyclically loaded soils, dynamic soil properties, laboratory and field testing techniques, correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand, liquefaction of soils.

Learning Outcomes:

After completion of Unit -II, Students will be able to

- explain the Propagation of seismic waves in soil deposits and attenuation of stress waves-L2
- demonstrate the stress-strain behaviour and strength of cyclically loaded soils -L2
- classify various dynamic soil properties and laboratory and filed testing techniques-L3
- interpret correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand-L3
- demonstrate the liquefaction of soils-L2

Unit III **8L**

Vibration Analyses: Types, general requirements, permissible amplitude,allowable soil pressure, modes of vibration of a rigid foundation block, methods of analysis, lumped mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, vibration isolation.

Learning Outcomes:

After completion of Unit -III, Students will be able to

- classify the different types of Vibration Analyses-L3
- explain the general requirements and permissible amplitude for Vibration Analyses-L2
- demonstrate the various modes of vibration of a rigid foundation block and methods of analysis-L2
- examine the effect of footing shape on vibratory response and dynamic response of embedded block foundation-L4
- explain the Vibration isolation.-L2

Unit IV **9L**

Design of Machine Foundations: Analysis and design of blockfoundations for reciprocating engines, dynamic analysis and design procedure for a hammer foundation, is code of practice design procedure for foundations of reciprocating and impact type machines, vibration isolation and absorption techniques.

Learning Outcomes:

After completion of Unit -IV, Students will be able to

- demonstrate design considerations of block foundations for reciprocating engines-L2
- apply the dynamic analysis and design procedure for a hammer foundation-L3
- apply the codes and standards foundations of reciprocating and impact type machines-L3
- explain different Vibration isolation techniques for reciprocating and impact type machines.-L2

Unit V **8L**

Machine Foundations on Piles: Introduction, analysis of piles undervertical vibrations, analysis of piles under translation and rocking, analysis of piles under torsion, design procedure for a pile supported machine foundation.

Learning Outcomes:

After completion of Unit -V, Students will be able to

- analyse the behaviour of piles under vertical vibrations-L3
- analyse the piles under translation and rocking-L3
- analyse the piles under torsion –L2
- demonstrate the design procedure for a pile supported machine foundation.-L2

Course Outcomes:
Students will be able to:

- demonstrate the fundamentals of vibrations in soil.-L2
- determine the dynamic properties of soil and various design parameters required for the design of machine foundation.-L3
- explain the different vibration analysis methods.-L2
- design a foundation for various reciprocating and impact type of machines-L3
- develop skills for designing machine foundations on piles-L2

Text Book(s)

1. I. Chowdhary and S P Dasgupta, Dynamics of Structures and Foundation, CRC Press 2009.
2. S.D. Arya, M. O'Neil, and G. Pincus, Design of Structures and Foundations for Vibrating Machines, Gulf Publishing, 1979.

References

1. F.E. Richart, J.R. Hall, and R.D. Woods, Vibrations of Soils and Foundations, Prentice Hall, 1970.
2. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia Publications Pvt Ltd-New Delhi (2016).

NPTEL Links:

1. Unit-1:https://nptel.ac.in/courses/105101005/2

2. Unit-2:https://nptel.ac.in/courses/105101005/15 and https://nptel.ac.in/courses/105101005/18

3. Unit-3:https://nptel.ac.in/courses/105101005/2

4. Unit-4:https://nptel.ac.in/courses/105101005/25

5. Unit-5 https://nptel.ac.in/courses/105101005/25

19ECE449: TRANSPORTATION INFRASTRUCTURE ENGINEERING

L	T	P	C
2	1	0	3

This course imparts the student's knowledge of planning, design, construction and maintenance of railway tracks. The students acquire proficiency in the application of modern techniques such as GIS, GPS and remote sensing in Railway Engineering. The student develops skills on airport planning and design with the prime focus on runway and taxiway geometrics. Students become conversant with the definition, purpose, location and materials of coastal structures such as piers, breakwaters, wharves, jetties, quays and fenders. The students acquire knowledge on site reconnaissance for location and planning of harbours.

Course Objectives:
The purpose of this course is to

- Familiarize about the history of non-highway transportation i.e. Railways, Air Transportation, Harbour and Dock Engineering
- Enable to design railway infrastructure along with design and analysis of railway track system
- Explain about layout and design of airport
- Familiarize on the orientation of the runways and geometrical design of the airport infrastructure,
- Impart knowledge on planning of a seaport and its infrastructure and aids

Unit I **8 L**
Railways - Introduction and Planning: Development of railways in India, components of a permanent way and its functions, rails, sleepers, ballast, formation, rail fittings and fastenings, comparison of roadways and railways, engineering surveys for track alignment and GIS, GPS and RS applications, track alignment considerations, track construction and track maintenance, track drainage, introduction to modern developments in railways.

Learning Outcomes:
After the completion of Unit, students will be able to

- identify components of permanent way and explain their functions[L3]
- compare between railways and roadways[L2]
- summarizethe engineering surveys for track alignment[L2]
- developknowledgeon track construction, maintenance and drainage[L3]
- outlinelatest happenings the field of Railways Engineering**[L2]**

Unit II **9 L**
Railways – Geometric Design, Points and Crossings, Signalling and Interlocking: Gradient and grade compensation on curves, speed on curves, super elevation and negative super elevation, widening of gauge on curves, types of stations and station yards, station equipment's, types of points switch and crossings, design calculation of turnout, various types of track junctions, signalling and interlocking, different types of signals, their working and location, control systems of signals, track circuiting.

Learning Outcomes:

After the completion of Unit, students will be able to

- define concepts of gradient and grade compensation[L1]
- developknowledge on aspects of geometric design of tracks[L3]
- classifydifferent types of stations and yards[L2]
- identify difference between points, switches and crossings and their usage[L3]
- explainaspects in signaling and interlocking**[L2]**

Unit III **9 L**

Airport Engineering: Layout and Design: Introduction, classification of airports, factors influencing site selection, components of airport landing areas, terminal area and terminal buildings, cross sectional components of runway and taxiway, components, drainage, airport zoning, clear zone, approach zone, buffer zone, turning zone, clearance over highways and railways.

Learning Outcomes:

After the completion of Unit, students will be able to

- list various factors influencing site selection for airport[L1]
- explaincomponents of airport[L2]
- identifycross sectional components of runway and taxiway[L3]
- developknowledge on airport zoning[L3]
- find clearance over highways and railways as per norms**[L1]**

Unit IV **8 L**

Airport Planning and Air Traffic Control: Hangers and helipads, turning radius, taxiway as per Indian standards, wind rose diagram, runway orientation, landing aids, air traffic control, airfield marking and lighting- sign, aircraft parking system, flight planning and operations, design standards, planning and design of airport as per Indian condition.

Learning Outcomes:

After the completion of Unit, students will be able to

- developknowledge on Hangers and helipads, turning radius[L3]
- interpret taxiway as per Indian standards[L2]
- develop the influence of wind rose diagram on runway orientation[L3]
- explainaircraft parking system, flight planning and operations[L2]
- make use of design standardsas per Indian conditions**[L3]**

Unit V **8 L**

Harbours Docks and Management: Dock, different types, functional design and various types and their usage, navigational aids, necessity and type of signals and different types of dredges and their applications, classification and requirements of harbours, classification and construction, wharves, piers and bulkheads, dolphins, fender and other mooring devices, typical layout of existing harbours.

Learning Outcomes:

After the completion of Unit, students will be able to

- classifydifferent types of ports and harbours[L2]
- develop knowledge onfunctional design and their usage[L3]
- explain the necessity and type of signals[L2]

- extendknowledge on wharves, piers and bulkheads, dolphins, fender and other mooring devices[L2]
- explain typical layouts of existing harbours**[L2]**

Course Outcomes:
Students will be able to

- summarizethe history of the railway development in India, track alignments, construction and maintenance**[L2]**
- apply the concepts in designing of railway tracks, curves, crossings, signalling and interlocking**[L3]**
- list the elements of airport engineering and design airport terminals along with runways**[L1]**
- demonstrate knowledge on helipads, windrose diagrams and air traffic control**[L2]**
- develop knowledge on harbour and dock engineering such as different types, functional design, navigational aids, types of signals, buoys, beacons, wharves, piers and Bulkheads, Dolphins, Fender and other mooring devices**[L3]**

Text Book(s):

- Ashford N.J., MumayizS.A., and PWright.H., Airport Engineering: Planning, Design and Development of 21stCentury Airports, 4/e, John Wiley and Sons,2011
- Subhash C. S, and Arora S, A course in Railway Engineering, 7/e, Dhanpat Rai and sons, Delhi, 2009
- Srinivasan R., Harbour, Dock and Tunnel Engineering, 1/e, Charotar Publications, 2016

References:

- Agarwal M.M., Indian Railway Track, 5/e, Prabha and Co, 2007
- Anita K.F., “Railway Track”, 1/e, New Book Company, 2000
- Young S.B., and Wells A.T., Airport Planning and Management, 6/e, McGraw-Hill,2011
- NPTEL Video Course for Transportation Engineering –II https://nptel.ac.in/courses/105107123/

19ECE453: IRRIGATION MANAGEMENT

L	T	P	C
2	1	**0**	**3**

Irregular temporal and spatial distribution of rainfall and over exploitation of groundwater in India necessitates efficient irrigation management. India is agriculture prime country but has only 4% of world's renewable water resources in contrast to its 18% population. The comprehensive knowledge of efficient irrigation management is significant for civil and irrigation engineers. Prerequisites for studying this course are fluid mechanics and water resources engineering.

Course Objectives:

- to impart the significance of irrigation management.
- to elucidate the soils-plant-water relationships
- to impart the significance of irrigation governance
- to explain the importance of participatory irrigation management
- to introduce Integrated Water Resources Management (IWRM) and the associated legal aspects in water management

Unit I **9 L**

Introduction: Need for proper management of land and water resources. Planning of irrigation projects – Inadequacies in the present approaches in canal irrigation management – command area development programmes.

Learning outcomes:

After completion of Unit-I, students will be able to

- explain the need for proper land management (L-2)
- explicate the planning of irrigation projects (L-2)
- summarize the inadequacies in canal irrigation management ((L-2)
- elucidate command area development programmes (L-2)

Unit II **9 L**

Soil Management: Classification of irrigable soils – soils-plant-water relationships – soil management. Water logging and salinity – water quality for irrigation – Reclamation of salt affected (saline) soils

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Learning outcomes:

After completion of Unit-II, students will be able to

- list the types of irrigable soils (L-1)
- understand the soils-plant-water relationships (L-2)
- explain the problems arising due to water logging and salinity (L-2)
- elucidate the processes of reclamation of saline soils(L-2)

Unit III **8 L**

Irrigation Governance: Irrigation management – Irrigation Management Matrix – Society and irrigation – perceptions of various stake holders on irrigation system performance.

Livelihood and Production Thinking Philosophy – the different approaches. Macro and precision irrigation.

Learning outcomes:
After completion of Unit-III, students will be able to
- explain the elements of irrigation management matrix (L-2)
- outline the production thinking philosophy(L-2)
- differentiate between macro and precision irrigation (L-3)
- explain the perceptions of stake holders on the performance of irrigation system (L-3)

Unit IV **8 L**
Participatory irrigation management (PIM) –farmer's management of irrigation systems - acts - conflict resolution.

Learning outcomes:
After completion of Unit-IV, students will be able to
- state the irrigation system acts (L-1)
- explain the importance of participatory irrigation management(L-2)
- understand the farmer's management of irrigation systems (L-2)
- explain about conflict resolution in irrigation management (L-3)

Unit V **8 hL**
Legal aspects in water sharing and management – potential conflict (PC) to co-operation potential (CP) - case studies on IWRM.

Learning outcomes:
After completion of Unit-V, students will be able to
- explain the PC -CP(L-2)
- write a critical review of the legal aspects in water sharing and management(L-3)
- present a case study explaining the features of the IWRM (L-3)

Course Outcomes:
At the end of course the students will be able to
- elucidate the planning of irrigation projects (L-2)
- understand various aspect of soil management in irrigation (L-2)
- explicate the aspects of irrigation governance (L-3)
- explain the significance of PIM (L-3)
- present a case study signifying IWRM (L-3)

Text Books

1. Asawa, G.L, Irrigation and Water Resources Engineering, New Age International Pvt Ltd Publishers, 2005

Reference Books

1. Chambers, R, Managing canal irrigation: practical analysis from South Asia, Oxford & IBH Publishing.
2. V.V.N. Murty and Madan K. Jha, Land and Water Management Engineering, Kalyani Publishers, 2013.

19ECE457: SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	C
2	1	0	3

The proper disposal of urban waste is not only absolutely necessary for the preservation and improvement of public health but it has an immense potential for resource recovery. From this need, the course work is structured to provide an understanding of solid and hazardous waste characteristics. This course imparts students to acquire proficiency in processing technologies and disposal methods for municipal solid waste and hazardous waste generated from a community.

Course Objectives:

- to study various types of solid wastes and their characteristics
- to familiarize with different solid waste disposal techniques
- to introduce various methods of composting and influence of plastic waste on environment
- to expose to various hazardous wastes and to evaluate the possible health risks on humans and environment
- to impart various characteristics of soil pollution and to assess the controlling measures of soil pollution

UNIT -I **8 L**

Municipal solid waste Definition - Sources and types of solid waste- composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization. Collection and transfer of Municipal Solid Waste.

Learning Outcomes:

- summarize various types of solid wastes and their characteristics-L2
- estimate the quantity of solid waste generated-L5
- explain various methods of sampling of MSW-L2

UNIT – II **8 L**

Disposal of Solid Wastes: Refuse disposal – various methods – incineration – principle features of an incinerator – site selection and plant layout of an incinerator - sanitary landfill- methods of operation – advantages and disadvantages of sanitary land fill - site selection – reactions accruing in completed landfills – gas and leachate movement and control – equipments necessary

Learning Outcomes:

- outline various methods of disposal of solid waste-L2
- analyze the reactions involved in landfill method of disposal-L4
- choose appropriate equipment required disposal techniques-L3

UNIT –III **8L**

Composting: Principle – types- factors affecting compost process- mechanical composting methods. Reuse and recycling of paper, glass, rubber. Plastic waste status in India. Effect of plastic wastes on environment, management of plastic waste.

Learning Outcomes:

- classify different types of composting –L2
- explain the importance of reuse & recycling of materials-L4
- summarize the scenario of plastic waste in India-L2

UNIT –IV **8 L**

Hazardous waste Management: Sources and classification of hazardous wastes – Storage and collection of hazardous wastes – Treatment and disposal techniques: Physical, chemical and biological - Protection of public health and the environment. Biomedical wastes – Types – Management and handling and control. Radioactive wastes- sources and types - control and management.

Learning Outcomes:

- classify various hazardous wastes-L2
- summarize the treatment and disposal techniques of hazardous waste-L2
- explain the mitigation measures of radioactive waste-L4

UNIT – V **8 L**

Soil Pollution – Physical, Chemical, Mineralogical and Biological properties of soil, sources of soil pollution, Pollution and residual toxicity from the application of insecticides, pesticides and fertilizers; Soil erosion and land degradation. Control of Soil pollution**.**

Learning Outcomes:

- Outline the different properties of soil pollution –L2
- Explain the impact of soil pollution on environment-L2
- Comapre various methods of controlling soil pollution-L4

Course outcomes:

- categories various types of solid wastes-L2
- select an appropriate solid waste disposal technique-L2
- differentiate different methods of composting and explain the impact of plastic waste-L3
- evaluate hazardous waste management techniques –L4
- summarize the impact of soil pollution on environment –L2

Text Book:

1. B.B. Hosetti, Prospects and Perspective of Solid waste management, New age international (p) limited, 2006.
2. Tchobanoglous G, Theisen H and Vigil SA ‘Integrated Solid Waste Management, Engineering Principles and Management Issues’ McGraw-Hill, 2002.

References:

1. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management,Mc Graw – Hill,1997.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. of. India, New Delhi, 2000.
3. Ramanatha Ayyar, T.S. “ Soil Engineering in Relation to Environment “ Published by LBS Centre for Science and Technology, Thiruvananthapuram, 2000
4. https://nptel.ac.in/courses/120108005/

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).

10 L

Unit III:

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 Neighbour Learning, Locally Weighted Regression.

Learning outcomes:

After completion of this unit, student will be able to

- define bayestheorem (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)

Program Elective –V

19ECE443: PRESTRESSED CONCRETE

L T P C
2 1 0 3

Prestressed concrete is often preferred in construction of bridges and buildings.This course discusses on various materials used,types of prestressing system and prestressing losses. The student will be able to design prestressed concrete members including end block as per Indian Standard code.

Prerequisite: Mechanics of Solids, Structural Analysis and Design of Reinforced Concrete Structures

Course objectives

- To familiarize different prestressing methods.
- To explainthe analysis of prestressed concrete beams.
- To demonstrate various losses in prestressed concrete members.
- To impart the design of prestressed concrete members.
- To enable design of end block.

Unit-I **8L**

Introduction and Systems of prestressing

Introduction:

Basic concepts of prestressing, Historical Development, Need for high strength steel and concrete, Terminology, Advantages of prestressed concrete, Applications of prestressed concrete.

Systems of prestressing:

Classification of prestressed concrete. Pre tensioning techniques - long line system (Hoyer system), post - tensioning Techniques (a) Freyssinet system and (b) Gifford Udall system.

Learning Outcomes:

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

- outline materials used in prestressed concrete (L2).
- list applications of prestressed concrete (L1).
- distinguish between different prestressing systems (L4).

Unit-II **8L**

Analysis of prestress and Bending stresses:

Basic assumptions, Analysis of prestress, Resultant stresses at a section, Pressure line or thrust line and internal resisting couple, Concept of load balancing, Stresses in tendons, Cracking moment.

Learning Outcomes:

- explain basic assumptions in prestressed concrete members (L2).
- estimate the resultant stresses at a section (L5).
- determine the location of thrust (L5).

Unit-III **10L**

Losses of Prestress:

Nature of losses of Prestress, Loss due to elastic deformation of concrete, Loss due to shrinkage of concrete, Loss of prestress due to creep of concrete, Loss of prestress due to relaxation of stress in steel, Loss of prestress due to friction, Loss due to Anchorage slip, Total losses allowed for in design.

Learning Outcomes:

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

- explain the reasons for losses (L5).
- discuss various losses in prestressed concrete members (L3).
- estimate various losses in prestressed concrete members (L5**).**

Unit IV **8L**

Design of prestressed concrete sections:

Design of sections for flexure.

Learning Outcomes:

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

- design width and depth of beam (L3).
- determine the profile of cable and its eccentricity (L5).
- evaluate the maximum horizontal spacing of cables (L5).

Unit V **8L**

Anchorage zone stresses in post-tensioned members:

Introduction, Stress distribution in end block, Investigations on anchorage zone stresses, comparative analysis, Anchorage zone reinforcement.

Learning Outcomes:

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

- explain anchorage zone of post tensioned members (L3).
- construct stress distribution diagram in end blocks (L3).
- design of anchorage reinforcement (L3).

Text Book(s):

1. N. Krishna Raju, Prestressed concrete, 4/e, Tata McGraw Hill, 2012.
2. G.S. Pandit, Prestressed concrete, CBS Publishers, 2014.

References:

1. P. Dayaratnam, Prestressed Concrete Structures, Oxford and IBH Publishing Company, 2014.
2. T.Y. Lin, and H. Ned, Burhns, Design of Prestressed Concrete Structures, 3/e, John Wiley and Sons, 2010.
3. H. Arthur, Nilson, Design of prestressed concrete, Wiley India Pvt.ltd, 2011.
   J.R. Libby, Modern prestressed concrete,CBS Publishers, 2007.

Course Outcomes

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

- distinguish between different prestressing methods (L4).
- analyze prestressed concrete beams for flexure(L5).
- estimate various losses in prestressed concrete members (L5).
- design prestressed concrete beams (L6).
- construct stress distribution diagram in end block (L6).

19ECE447: GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
2	1	0	3

The course introduces the need for ground improvements and brief descriptions of methods used for cohesive and cohesionless soils. Detailed procedures of ground improvement techniques such as compaction, vibro-floatation and stone column, preloading, soil nailing and reinforced earth, dewatering techniques, and deep soil mixing will be covered in this course. Basic concepts of soil reinforcement using different types of geosynthetics and their wide applications are also discussed. The various grouting materials and their techniques are also covered in this course.

Course Objectives:

- To familiarize the various types of improvement methods of engineering properties of soils.
- To study the need and various methods of dewatering for ground improvement
- To expose the various methods of insitu densification of cohesive and cohesion less soils
- To acquaintthe concept of reinforcement and various applications of reinforcement for soil
- To demonstrate the different grouting techniques and materials for stabilisation of soil

8 L

Unit I

Introduction: Role of ground improvement in foundation engineering, methods of ground improvement, geotechnical problems in alluvial, laterite and black cotton soils, selection of suitable ground improvement techniques based on soil condition.

Learning outcomes:

After completion of Unit I, students will be able to

- infer the need of ground improvement in foundation engineering-L2
- identify the various methods of ground improvement-L3
- distinguish the various geotechnical problems in alluvial, laterite and black cotton soil-L4
- choose the method of ground improvement technique based on soil type-L1
- solve the various problems of soil with the knowledge of ground improvement-L3

9 L

Unit II

Drainage and Dewatering: Drainage techniques, well points, vacuumand electro osmotic methods, seepage analysis for twodimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only), Analysis methods for dewatering of soils.

Learning outcomes:

After completion of Unit II, students will be able to

- list the various types of dewatering technique-L1

- explain the need of dewatering in the construction process-L2
- select the type of dewatering technique based on the existing ground table-L3
- illustrate the working procedure of well points, vacuum and electro osmosis methods-L2
- analyse the seepage for two dimensional fully and partially penetrating slots in homogeneous deposits-L4

9 L

Unit III

Insitu Treatment of Cohesionless and Cohesive Soils: Insitu densificationof cohesionless and consolidation of cohesive soils, dynamic compaction and consolidation, vibrofloation, sand pile compaction, preloading with sand drains and fabric drains, stone columns, lime piles, installation techniques only - relative merits of various methods and their limitations.

Learning outcomes:

After completion of Unit III, students will be able to

- distinguish the various insitu densification process for cohesionless and cohesive soils-L3
- explain the working mechanism of dynamic consolidation and compaction, vibroflotation and sand pile compaction-L2
- analyse the working of procedure with sand drains and fabric drains, stone columns and lime piles-L3
- outline the installation techniques of various insitu densification methods-L2
- summarize the merits and limits of various insitu densification methods-L2

8 L

Unit IV

Earth Reinforcement: Concept of reinforcement, types of reinforcementmaterial, applications of reinforced earth, use of geotextiles for filtration, drainage and separation in road and other works, use of Geogrids, Geocells, Geomats.

Learning outcomes:

After completion of Unit IV, students will be able to

- demonstrate the concepts of reinforcement-L2
- explain the different types of reinforcement-L2
- apply the concepts of reinforcement to solve soil problems-L3
- explain the use of geotextiles for filtration, drainage and separation-L2

8L

Unit V

Grout Techniques: Types of grouts, types of grouting, grouting equipment and machinery,injection methods, grout monitoring, stabilisation with cement, lime and chemicals, stabilisation of expansive soils, Permeation grouting, Compaction grouting, Displacement grouting.

Learning outcomes:

After completion of Unit V, students will be able to

- list the types of grouts-L1
- identify the grouting equipment and machinery-L3

- explain the stabilisation of soils with cement, lime and chemicals-L2
- classify the different injection methods-L2
- analyse the stabilisation of expansive soils-L4

Course Outcomes:
Students will be able to:

- illustrate the importance of ground improvement techniques – L2
- explain various drainage and dewatering techniques to reduce the consolidation time – L2
- identify the various insitu densification process for cohesionless and cohesive soils-L3
- apply the principles of soil reinforcement and confinement in the constructions – L3
- demonstrate the stabilization of soils using grouting techniques –L2

Text Book(s)

1. R.M. Koerner, Construction and Geotechnical Methods in Foundation Engineering, Tata McGraw Hill, 1994.
2. Dr.P. Purushothama Raj, Ground Improvement Techniques, Tata McGraw Hill,2016.

References

1. M.P. Moseley, Ground Improvement Block, IE Academic and Professional, Chapman and Hall, 2004.
2. J.E.P. Jones, Earth Reinforcement and Soil Structure, Butterworths, 1996.

NPTEL Links

Unit 1:
https://nptel.ac.in/courses/105108075/
https://nptel.ac.in/courses/105108075/2
https://nptel.ac.in/courses/105108075/3
Unit 2:
https://nptel.ac.in/courses/105108075/12
https://nptel.ac.in/courses/105108075/13
https://nptel.ac.in/courses/105108075/14
Unit 3:
https://nptel.ac.in/courses/105108075/7
https://nptel.ac.in/courses/105108075/8
https://nptel.ac.in/courses/105108075/6
Unit 4:
https://nptel.ac.in/downloads/105106052/
Unit 5:
https://nptel.ac.in/courses/105108075/21

19ECE451: URBAN TRANSPORT PLANNING

L	T	P	C
2	1	0	3

This course will offer an introduction to transportation planning, including both theoretical and practical approaches. This course will provide an understanding of the evolution and role of urban public transportation modes, systems and services. This course will include characteristics of different modes (rail, bus, air), scheduling, budgeting, grants, modeling, route design considerations, transit-oriented development, public involvement, and project development.

Course Objectives

- Familiarize basic concepts and methods of urban transportation planning in the India.
- Explain methods of designing, conducting and administering surveys to provide the data required for transportation planning.
- Impart knowledge on trip generation and trip distribution models
- Demonstrate travel demand modelling, Mode Choice Modelling and Traffic Assignment Modelling.
- Focus on principles of travel demand modelling in solving problems.

Unit I: **8 L**

Land use and Transportation System: Introduction-Urban system Components-Concepts and definitions-Criteria for measuring urban sprawl— Location theory-urban growth or decline

Learning Outcomes:

After the completion of Unit, students will be able to

- Outline the role of transportation in urban development[L2]
- define concepts of transportation system[L1]
- list urban system components[L4]
- identify criteria for measuring urban sprawl[L3]
- explain aspects in urban growth or decline[L2]

Unit II: **8 L**

Transportation Planning Process: Introduction-Definition-Factors to be considered; Land use transportation planning; systems approach-Stages-Inventory of Existing Conditions-Difficulties in implementation.

Learning Outcomes:

After the completion of Unit, students will be able to

- outlinethe transportation planning process in the urban area [L2]
- interpret the factors to be considered in transportation planning [L3]
- explain land use transportation planning[L2]
- develop inventory of existing conditions[L3]
- identify difficulties in implementation of plan [L3]

Unit III: **9 L**

Transport Surveys: Basic Movements- Study Area-Zones-Surveys- Planning of different types of surveys and interpretation, Travel demand; Traffic surveys for mass transit system planning.

Learning Outcomes:

After the completion of Unit, students will be able to

- classify basic movements of trips[L2]
- outlineconcepts of study area and zoning[L2]
- interpret different transportation surveys for transportation planning[L2]
- define concept of travel demand[L1]
- plan traffic surveys for mass transit system planning[L3]

Unit IV: **9 L**

Trip Generation and Distribution: Factors governing trip generation and attraction – Application of Regression Analysis- Methods of trip distribution; Growth and Synthetic Models- Calibration and Application of gravity model-Category analysis. Problems

Learning Outcomes:

After the completion of Unit, students will be able to

- outlinefactors governing trip generation and attraction[L2]
- utilize regression analysis and its applications[L3]
- explain concepts and methods of trip distribution[L2]
- apply growth and synthetic models in trip distribution[L3]
- interprettrips for future year using gravity model [L2]

Unit V: **8 L**

Modal Split and Assignment: Factors affecting modal split; Modal split in transport planning; Principles of traffic assignment; assignment techniques. Problems

Learning Outcomes:

After the completion of Unit, students will be able to

- define model split and traffic assignment[L1]
- develop knowledge on factors affecting model split[L3]
- apply concepts of modal split in transportation planning[L3]
- make use of principles of traffic assignment in transportation planning[L3]
- utilize traffic assignment techniques [L3]

Course Outcomes:

After completion of the course the student will be able to

- Develop and conduct surveys to provide the data required for transportation planning**[L3]**
- Model zonal demand generation and attraction regression models**[L3]**
- Develop demand distribution models (gravity models) and modal split models for mode choice analysis**[L3]**
- Develop and calibrate trip generation rates for specific types of land use developments**[L3]**
- Solve problems related to modal split om transportation planning **[L3]**

Text Book(s):

- Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018
- Khisty C. J and Lall B. K, Transportation Engineering: An Introduction, 3/e, Prentice Hall India, 2017

References:

- Hutchinson, B.G., Principles of Urban Transport System Planning, 1/e,Taylor& Francis Inc, 1987
- NPTEL Web Course on Urban Transportation Planning - https://nptel.ac.in/courses/105107067/

19ECE455: WATERSHED MANAGEMENT

L	T	P	C
2	1	**0**	**3**

A watershed is an area through which water flows across the land and drains into a common body of water such as a lake or a river. Contamination of the watershed and its surrounding is threatening the ecosystems. It is essential to consider the downstream impacts when developing and implementing water quality protection and restoration actions. This course provides a basic overview of watershed management. Prerequisites for this course are fluid mechanics and water resources engineering.

Course Objectives:

The objectives of this course are to

- explain the significance of watershed management
- teach the principles of soil management.
- elucidate the methods of water harvesting
- explain the methods of groundwater recharge
- introduce the case studies on watershed management

Unit I **9 L**

Introduction: Concept of watershed, need for watershed management, concept of sustainable development. Hydrology of small watersheds.

Learning outcomes:

After completion of Unit-I, students will be able to

- define the concept of watershed management (L-1)
- explain the concept of Sustainable development of watershed (L-2)
- describe the hydrology of small watersheds ((L-2)

Unit II **9 L**

Soil Management: Principles of soil erosion, causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds. Control of soil erosion, methods of soil conservation – structural and non-structural measures.

Learning outcomes:

After completion of Unit-II, students will be able to

- list the types and causes of soil erosion (L-1)
- estimate the soil erosion from small watersheds (L-2)
- explain the methods for soil conservation (L-2)
- differentiate between the structural and non-structural measures(L-2)

Unit III **8 L**

Principles of water harvesting, methods of rainwater harvesting, design of rainwater harvesting structures.

Learning outcomes:

After completion of Unit-III, students will be able to

- explain the principles of water harvesting(L-2)
- expound the methods of rainwater harvesting (L-2)
- design the rainwater harvesting structures(L-3)

Unit IV **8 L**

Conservation of ground water, methods of artificial recharge of groundwater, methods of artificial recharge, consumptive use of water

Learning outcomes:

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

- explain the methods of artificial recharge of groundwater(L-2)
- explicate significance of consumptive use of water (L-2)

Unit V **8 L**

Micro farming, biomass management on the farm - Case studies of Watershed Management**.**

Learning outcomes:

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

- define micro farming(L-1)
- understand the biomass management on the farm (L-2)
- present the case studies on efficient watershed management(L-3)

Course Outcomes:

At the end of course the students will be able to

- Identify the causes of soil erosion (L-1)
- Plan for soil conservation measures in a watershed (L-3)
- Plan and design water harvesting / recharging structures (L-3)
- Plan the measures for reclamation of saline soils (L-3)

Text Books

1. Muthy, J. V. S., Watershed Management, New Age International Publishers, 2017

Reference Books

1. V.V.N. Murty and Madan K. Jha, Land and Water Management Engineering, Kalyani Publishers, 2013
2. Chatterjee, S. N., 1/e, Water Resources Conservation and Management, Atlantic Publishers and Distributors Pvt Ltd., 2018.

19ECE459: ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
2	1	0	3

The Environmental Impact Assessment procedure in India has been developed primarily as an aid to the environmental planning of new developmental projects. EIA essentially is a preventive process and it seeks to avoid costly mistakes in project planning and development. The main focus of this course is to expose the students to the need, methodology, documentation and application of Environmental Impact Assessment and to develop the skill to prepare Environmental Management Plan

Course objectives :

- to introduce basic ideology of EIA
- to expose the procedure of EIA analysis
- to study various EIA methodologies
- to impart about environmental auditing
- to acquaint about the preparation of EIA statements for various industries

UNIT- I **8 L**

EIA – Introduction -Definition – Basic concepts and principles of EIA – Origin and development of EIA - Short-term and Long- term objectives – EIA guidelines 2006 (Notification of Government of India) — Merits and Demerits of EIA.

Learning Outcomes

- explain the objectives of EIA –L2
- summarize EIA-guidelines L2
- conclude the merits and demerits of EIA-L4

UNIT –II **8 L**

Basis for Environment Impact Assessment – Types of impacts (Negative & Positive, Primary & Secondary, Reversible and Irreversible Tangible and Intangible) Components of EIA: Screening of Projects - Public Participation - Preparing environmental impact statements. Factors affecting E-I-A, Impact evaluation and analysis - preparation of Environmental Base map.

Learning Outcomes

- illustrate types of impacts of EIA-L2
- explain the components of EIA-L2
- utilize the procedure of EIA to evaluate and analysis EIA report –L3

UNIT –III **10 L**

EIA Methodologies: Introduction- Criteria for the selection of EIA Methodology, EIA methods - Adhoc Method, Checklist Approach, Matrix Methods, Network Methods, overlay methods-cost/benefit Analysis - Introduction and Methodology for the assessment of soil and ground water-Delineation of study area- Identification of actives.

Learning Outcomes

- explain various EIA methodologies-L2
- make use of best EIA methodology- L3
- identify the best EIA methodology –L3

UNIT –IV **8 L**

Environmental Auditing: Scope, Objectives and Procedures for environmental auditing. Types of environmental Audit- benefits of environmental audit- stages of Environmental Audit -Post Audit activities. Environmental Management System (EMS): EMS standards, The ISO 14000 series, The ISO 14001.

Learning Outcomes

- illustrate tell the objectives of Environmental audit –L2
- explain various stages of Environmental audit –L2
- distinguish EMS standards –L4

UNIT -V **8 L**

Preparation of Environmental Impact assessment statement for various Industries.

Learning Outcomes

- analyze various parameters included in EIA study –L4
- assess every parameter included in EIA –L4
- evaluate EIA statements of various industries –L5

Course outcomes :

- outline the concepts and principles involved in EIA –L2
- make use of environmental base map –L3
- select best EIA methodology to assess the impact – L3
- summarize the concepts of environmental audit –L2
- analyze EIA statements of various industries –L5

Text Books:

1. Y. Anjaneyulu., Environnemental Impact Assessment Methodologies , B. S. Publications, Kakinada, 2010.
2. N. S. Raman, A. R. Gajbhiye, S. R. Khandeshwar., Environnemental Impact Assessment, I.K.International Publishing house Pvt,Ltd, New Delhi,2014.
3. Anji Reddy Mareddy , Anil Shah , Naresh Davergave., Environmental Impact Assessment: Theory and Practice,Butterworth-Heinemann , 2017.

Reference Books :

1. V.V.N. Murty, Madan K. Jha, “Land and Water Management Engineering”, Kalyani Publishers, 6 th Edition, 2013.
2. Charles H.Eccleston , Environnemental Impact Assessment-A Guide to Best Professional practices, CRC Press,Taylor & Franci

19EHS401: CONSTRUCTION MANAGEMENT

L T P C

3 0 0 3

This course Construction Management focuses planning, scheduling and monitoring of construction projects. Complexresearch and development projects can be managed effectively if the project managers have the means to plan and control the schedules and costs of the work required to achieve their technical performance objectives. To present the basic principles of PERT and CPM in a such a way that they can be effectively applied to the solution of management problems.

Course Objectives:

- To facilitate the basics tools used in construction projects.
- To impart the idea about planning and scheduling of activities.
- To explain about the time cost trade off model.
- To demonstrate about principals of Construction Management.
- To familiarize the Policy and Rules of the Organisation.

UNIT – I **8 L**

Introduction to Construction Management: Introduction : Origin of PERT and CPM, Planning, Scheduling and controlling,Barcharts, Milestone charts, weaknesses in Barcharts, PERT and CPM networks and Problems, Comparison, Event, Activity, Rules fordrawing networks Numbering the events (Fulkerson's law), Dummy activities, Work Break-down structure.

Learning outcomes:

After completion of Unit – I, students will be able to

- OutlineBar Charts and Milestone charts.[L-2]
- Identify weaknesses in Barcharts.[L-3]
- Apply network rules for developing networks.[L-3]
- Make use of Fulkerson's law fornumbering the events.[L-3]
- Infer PERT and CPM networks.[L-2]

UNIT – II **8 L**

CPM-PERT-Network Analysis: Time estimate-Expected time, Earliest allowable occurrence time, Latest allowable occurrence time, slack and Problems, Problems on Network Analysis, project duration, probability of completion, Start and Finish time estimates, Floats and Problems, Project scheduling, Critical and sub-critical path.

Updating – Process of updating; when to update

Learning outcomes:

After completion of Unit – II, students will beable to

- OutlinePERT and CPM networks.[L-2]
- Interpretexpected time for determining project duration.[L-2]
- Make use of slack and float for determining critical path.[L-3]
- ApplyProcess of updating for update progress of a project.[L-3]

UNIT – III **8 L**

CPM Cost Model & Resources allocations, resource scheduling: Cost Analysis; direct and indirect costs,

operation time, Normal and crash times and costs, Problems on cost analysis, Optimising project cost, crash limit, Free float limit, Optimization Resource smoothening. Resource levelling.

Learning outcomes:

After completion of Unit – III, students will beable to

- Summarize direct and indirect costs in a project[L-2]
- Interpretthe total cost require for execution of the project.[L-2]
- Choose optimum time required for execution of the project using crashing technique.[L-1]
- Apply Process of updating for update progress of a project.[L-3]

UNIT – IV **10 L**

Management-Scope of Construction Management; Significance of Construction Management, Concept of Scientific Management; Safety in Construction, Qualities of Manager; The roles/functions performed by effective and competent Managers, The Manager: i) as a decision maker; ii) as a motivator; iii) as a communication-link; iv) as a conflict resolver; v) as a well – wisher of co-employees and the employer; etc

Learning outcomes:

After completion of Unit – IV, students will beable to

- InferScope of Construction Management[L-2]
- RelateScientific Management in construction[L-2]
- InterpretQualities of competent Manager[L-2]
- Classifyroles performed by effective construction managers[L-2]

UNIT – V **10 L**

Organization – Types of organization; Merits and demerits of different types of organization – Authority –Policy– Labour Problems; Labour Legislation in India; 'Workmen's compensation Act of 1923 and Minimum Wages Actof 1948', and subsequent amendments

Learning outcomes:

After completion of Unit – V, students will beable to

- Infer types of organization with their merits and demerits.[L-2]
- Define Labour Problems in construction management.[L-1]
- RelateLabour Legislation in India with Labour Problems.[L-1]
- Interpretvarious acts related to workmen.[L-2]

Text Books:

1. Dr. B. C. Punmia and K. K. Khandelwal, Project Planning and Control with PERT and CPM, 4/e, Laxmi Publications, 2016.
2. Kumar NeerajJha, Construction Project Management: Theory and Practices, 2/e, Pearson Education, 2015

References:

1. Dr. P. N. Modi, Rajeev Modi, PERT and CPM - Project Evaluation Review Technique and Critical Path Method, 5/e, Standard Book House, 2012.
2. L. S.Srinath, PERT and CPM Principles and Applications, 3/e, Affiliated East-West Press, 2001.
3. U.K. Shrivastava, Construction Planning and Management, 2/e, Galgotia Publications - New Delhi, 2000.
4. Kerzner H., Project Management- A systems approach to planning, scheduling and controlling, 10/e, John Wiley & Sons, Inc., New Jersey, USA, 2009.
5. NPTEL Web Course- Principles of Construction Management- https://nptel.ac.in/courses/105104161/

Course Outcomes:

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

- **choose** best method to implement in construction projects.**[L-1]**
- **interpret**on various time estimates in construction projects.**[L-2]**
- **identify** the optimum time corresponding to optimum cost by cpm cost model analysis.**[L-3]**
- **plan** and develop management solutions to construction projects.**[L-3]**
- **summarize**on the characteristics & policies of the Organization.**[L-2]**

19ECE491: PROJECT PHASE - I

L	T	P	C
0	0	2	1

Course Objectives:

- To introduce knowledge to choose a problem statement in the area of Civil Engineering.
- To explain methodology for arriving the original solution for the problem statement.
- To enable ideas for attaining the proposed solution.

The student is required to come up with a problem statement pertaining to the field of Civil Engineering and suggest an innovative/original solution to the same. The student has to justify the viability of the problem statement with the support of literature and he/she shall be valuated periodically on the same. Each student is required to submit a report of first part of project work i.e. about the problem definition, literature review and methodology to be adopted including experiments and tests to be performed on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester end in front of a panel of examiners.

Course Outcomes:

The student will be able to

- choose a proper problem statement in the area of Civil Engineering. (L1)
- construct methodology to obtain original solution for the problem statement. (L3)
- develop ideas for attaining the proposed solution. (L3)

19ECE493: INTERNSHIP

L	T	P	C
0	0	0	1

The companies recruiting fresh civil engineering graduates look for the industry-ready skills. Internship in civil engineering projects at reputed companies provides ample opportunity for the students to acquire these abilities.In the internship, students can not only relate the theory learnt in class to on-site aspects of construction, but also learn about advancements in the usage of construction materials and technology. Through internship, the students can also learn about the significance of effective communication, time management in the industry. Thus, internship significantly assists the budding civil engineers to enhance their capabilities and make them industry oriented.

Course Objectives:

- Impart industry oriented skills.
- Acquaint people skills, and communication skills.

Course Outcomes:

At the end of the course student will be able to:

- adapt to industry work culture (L-6).
- develop effective communication and people skills and time management(L-3).

19ECE495: 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**

Structural Engineering:

Statically determinate and indeterminate structures by force and displacement methods, Analysis of trusses, arches, beams, cables and frames; Concrete Structures: Working stress and Limit state design concepts; Design of beams, slabs, Columns. Concept of plastic analysis.

Geotechnical Engineering:

Sub-surface investigations, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests;, Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table , Deep foundations – dynamic and static formulae , Earth pressure theories, Rankine and Coulomb, Stability of slopes – Finite and infinite slopes.

Water Resources Engineering:

Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow, Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing.

Construction Management:

Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation, BIM

References:

- Pillai and Menon, Reinforced Concrete Design, 3/e, Tata McGraw Hill, 2017.
- P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, Standard Book House, 2017.
- Gopala Ranjan and A.S.R, Rao, Basic and Applied Soil Mechanics, 2/e, New Age International Publishers, Third edition 2016.
- B.C.Punmia and Pande B.B.Lal, Irrigation and Water Power Engineering, Laxmi Publications Pvt. Ltd., New Delhi
- U.K. Shrivastava, Construction Planning and Management, 2/e, Galgotia Publications - New Delhi, 2000

Semester VIII

S.No	Course Code	Course Title	Category	L	T	P	A	C
1.	19EYY4XX	Inter Disciplinary Elective III	ID	2	1	0		3
2.	19ECE4XX	Program Elective VI	PE	2	1	0		3
3	GSS115	Gandhi for the 21st Century	PW					1
4	19ECE492	Project Phase II	PW	0	0	12		6
Total								**13**

Interdisciplinary Elective-III

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19AID472	Introduction to Interior Design	ID	2	1	0	3
2		19EEI479	Instrumentation and Sensor Technologies of Civil Engineering Applications	ID	2	1	0	3
3	Computer Oriented Courses	19ECS478	Introduction to Data Science	ID	2	1	0	3
4		19ECS474	Introduction to Cloud Computing	ID	2	1	0	3
5	Management Courses	19EME349	Total Quality Management	ID	2	1	0	3
6		19EME357	Supply Chain Management	ID	2	1	0	3

Program Elective- VI

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Structural Engineering	19ECE442	Introduction to Earthquake Engineering	PE	2	1	0	3
2	Geotechnical Engineering	19ECE444	Geosynthetics	PE	2	1	0	3
3	Transportation Engineering	19ECE446	Road Safety Auditing	PE	2	1	0	3
4	Water Resources Engineering	19ECE448	Advanced Water Resources Engineering	PE	2	1	0	3
5	Environmental Engineering	19ECE452	Industrial Waste Management	PE	2	1	0	3

INTER DISCIPLINARY ELECTIVE-III

19AID472: INTRODUCTION TO INTERIOR DESIGN

L	T	P	C
2	1	0	3

This course orients students to understand the profession of interior design, role, need and characteristics of an interior designer. Further interior design principles, elements, its application, space planning, human dimensions, lighting, furniture, art and materials of interior design are also covered in this course. The relevance of colour in interior design, colour symbolism and psychology are also discussed.

Course Objectives:

- Develop orientation to understand the profession of interior design, role of interior designer.
- An understanding of the elements and principles of interior design and its application.
- Introduction to the fundamentals of interior design, interior space planning and human dimensions.
- An understanding of colours-symbolism and psychology.
- An overview of interior lighting, indoor landscaping and accessories.

UNIT-I

Introduction to Interior Design; Role of an Interior Designer, Need of an Interior Designer, Characteristics of an interior designer, difference between Designer and decorator.

Learning outcomes:

After completion of module-I, students will be able to

- Define the definition of Interior design L1
- Explain the role and need of Interior designer L2
- Outline the characteristics of an interior designer L2
- Illustratethe difference between a designer and decorator L2

UNIT 2

Interior Design Process. Interior Design and Concepts: Elements and Principles of design- an overview and their applications in interior designing.

Learning outcomes:

After completion of module-II, students will be able to

- **Demonstrate** the process of Interior design L2
- **Explain** the interior design concepts L2
- **Classify** the principles and elements of interior design and their applications L2

UNIT 3
Interior Space planning and human dimensions. Introduction to the fundamentals of Interior Design such as Lighting, Furniture, Space, Materials, Furnishings, Art etc.

Learning outcomes:

After completion of module-III, students will be able to

- **Explain** the space planning and human dimensions.L2
- **Outline** the fundamental of interior design – lighting, furniture, space, material **etc L2**

UNIT 4
Colours in interiors – Colour Theory, various colour schemes, Colour symbolism. Psychology of colour. Introduction to Furniture and Accessories.

Learning outcomes:

After completion of module-IV, students will be able to

- **Explain** the colours in interior design. L2
- **Classify** the colour schemes L2
- **Relate** the colour symbolism and Psychology.

UNIT 5
Market survey of Interior Materials & Hands on Exercise on small interior Projects.

After completion of module-V, students will be able to

- **Survey** the interior materials L4
- **Develop** a small interior design project L3

Course Outcomes:

- **Illustrate** The course make informed design decisions based on aesthetics, building technologies, human needs and the health, safety and the welfare of the public **L2**
- **Design** The course transforms conceptual design ideas into a detailed solution that takes into account existing building constraints, user needs and a program of spaces **L5**
- **Assess** It inculcates strong professional communication skills in students which helps them to present their design ideas and solutions with confidence**.L4**

- **Categorize** The course also helps students to categorize different interior products in the market and their appropriate applications in projects.**L4**

- **Create** Students will be globally –conscious interior designers **L5**

Text books:

1. Premavathy Seetharaman, Parveen Pannu: Interior Design & Decoration
2. Ahmed Kasu, Interior Design – 6th Edition.

Reference Books:

1. Miller, E. William. Basic Drafting for Interior Designers. Van Nostrand Reinhold,
    a. New York, 1981.
2. Kurtich, John and Eakin, Garret. Interior Architecture, VanNostrand Reinhold, New York, 1993.

NPTEL LINKS

1. Role of Craft and Technology in Interior https://nptel.ac.in/courses/124107006/

19EEI479: INSTRUMENTATION AND SENSOR TECHNOLOGIES OF CIVIL ENGINEERING APPLICATIONS

L	T	P	C
2	1	0	3

This course emphasis on principles and applications of various sensors used in structural health monitoring. Students understand the acquisition of data from the sensors and transmission of information through transmission media.The students are exposed to different types of point sensors, Displacement sensors, temperature sensors, strain sensors and fiber optic sensors and their characteristics.

Course Objectives

- To provide a clear understanding on need and challenges in structural health monitoring.
- To understand the working of various types of mechanical, electrical and temperature sensors.
- To acquire knowledge on operating principles of various types of displacement and fiber optic sensors.
- To select the type of data acquisition needed for a particular application.
- To deploy a wireless sensor network for structural health monitoring system.

UNIT-I **8 L**

Introduction: Need for Structural and Performance Health Monitoring, Technical Challenges in SHM and Performance Assessment, Measurands, Sensor Performance Benchmarks, Data Collection, Storage, and Transmission. Data processing, Decision making and prognosis.

Learning Outcomes:

After completion of Unit I, student will be able to

- explain the need for structural health monitoring (L2).
- demonstrate the challenges in SHM (L2).
- outline data processing and aggregation(L2).
- define Sensor Performance Benchmarks (L1).

UNIT-II **9 L**

Point Sensors: Mechanical Sensors: Accerometer, Vibrating-Wire Strain Gages, Crack and Joint Width Measurement Systems, **Electrical Sensors:** Resistive Strain Gages, 2-D and 3-D Strain Gage Rosettes, Load Cells, and cantilever beam, **Temperature sensors:** RTD, Thermocouple.

Learning Outcomes:

After completion of Unit II, student will be able to

- explain the operating principles of various types of point sensors (L2).
- demonstrate the working of different electrical sensors (L2).
- interpret the principles of temperature sensors (L2).
- choose a suitable sensor required for an application (L3).

UNIT-III **8 L**

Displacement Sensors: Crack measurement using LVDT, Capacitive Sensors, Piezoelectric and Magnetostrictive Sensors, **Fiber Optic Sensors:** SOFO Interferometric Sensors, Polarization-Based Sensors, Fibre Bragg-Grating Sensors.

Learning Outcomes:

After completion of Unit III, student will be able to

- summarize the operating principles of various displacement sensors (L2).
- demonstrate the working of different fiber optic sensors (L2).
- relate crack measurement using displacement sensors (L2).
- plan the proper sensor based on the accuracy (L3).

UNIT-IV **8 L**

Data Acquisition: Analog to Digital conversion, data handling steps in a typical SHM system, Digitization in Time and Space, Generic SHM communication system, Analog Wired Data Transmission, Standard Wired Data Buses, Radio Wireless Telemetry.

Learning Outcomes:

After completion of Unit IV, student will be able to

- construct analog to digital conversation of signals (L3).
- compare digitization in time and space domain (L3).
- examine generic SHM communication system (L4).
- demonstrate wired and wireless telemetry (L2).

UNIT-V **9 L**

Wireless sensors and networks for structural health monitoring: Introduction, Challenges in wireless monitoring, Hardware requirements for wireless sensors, wireless sensing prototypes, embedded data processing.

Learning Outcomes:

After completion of Unit V, student will be able to

- understand the need for WSN for SHM (L2).
- explain the challenges in wireless monitoring (L2).
- choose the hardware required for WSN (L4).
- select the wireless sensing prototypes (L3).

Text books

1. D. Huston, Structural Sensing, Health Monitoring, and Performance Evaluation,CRC press,2010
2. VistaspM.Karbhari and Farhad Ansari, Structural Sensing, Health Monitoring of civil infrastructure systems, CRC press,2009.

Reference books.

1. Waltenegus W .Dargie, Cristian Poellabaeur , Fundamentals of wireless sensor networks Theory and Practice, Wiley Publications,2010
2. PuneetSawhney, A.K. Sawhney, A Course In Mechanical Measurements And Instrumentation & Control, Dhanpat Rai,2013

Course Outcomes:

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

- understand the philosophy and challenges in SHM (L2).
- demonstrate the working of mechanical sensors (L2).
- summarize the principles of electrical sensors(L2).
- apply the concept of signal acquisition and processing (L3).
- plan to create WSN for SHM (L3).

19ECS478: INTRODUCTION TO DATA SCIENCE

L T PC

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

- 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
- Understand the limitations of data sets based on their contents and provenance
- Knowledge of data organization, management, preservation, and reuse
- Knowledge of general linear models and cluster analysis methods for statistical analysis
- Describe the Data Science Process and how its components interact.
- Reason around ethical and privacy issues in data science conduct and apply ethical practices.

Unit I **9 L**

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: The student will be able to

1. Understand the terminology of Big data
2. List Big Data characteristics
3. Know different types of data
4. Analyze Big data with business perspective

Unit II **9 L**

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: The student will be able to

1. Illustrate how to handle data and its preprocessing
2. Appraise the usage of OLTP Vs. OLAP and ETL
3. Know what is a datawarehouse
4. Analyze how Big Data plays a role in BI

Unit III **8 L**

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: The student will be able to

1. Analyze file system and distributed file system
2. Explain Sharding and replication
3. Understand Big data processing concepts
4. Know MapReduce Algorithms
5. Appraise complex event processing

Unit IV **8 L**

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: The student will be able to

1. Explain Big data storage technology
2. Analyze various Big data analysis techniques
3. Illustrate Natural Language Processing
4. Appraise Text Analytics and sentiment analysis

Unit V **8 L**

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, conscientitious and Conscious responsibility, privacy may be the wrong focus, can data be anonymized? Balancing for Counterintelligence and Now What?

Learning Outcomes: The student will be able to

1. Understand the overview of Big data
2. Know Big Data computational limitations
3. Explain Big Data emerging technologies
4. Appraise Data privacy and ethics

Textbooks

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 course the student will be able to

- Understand the terminology of Big data, its characteristics and various types of data
- Analyze a datawarehouse, OLTP Vs. OLAP Vs. ETL
- Appraise Big Data Storage and Processing Concepts
- Examine Big Data Storage Technology and analysis techniques
- Know Big Data Computational Limitations, emerging technologies, Privacy and ethics

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 **9 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
- identify parallel computing
- describe cloud characteristics
- develop Cloud
- develop distributed computing

UNIT II **9 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
- state REST.
- identify Virtualization
- formulate Types of virtualization
- examine Virtualization Support

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.
- apply Iaas, Paas
- compare Cloud Services
- choose Cloud storage
- evaluate Cloud Storage providers

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
- interpret Resource Provisioning
- evaluate Security Overview
- learn VMS
- determine Security Standards
- explain Security Governance

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
- describe GoogleApp Engine
- inspect OpenStack
- explain Federation in cloud

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.
- Apply the key and enabling technologies that help in the development of cloud.
- Explain use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

19EME349: TOTAL QUALITY MANAGEMENT

L	T	P	C
2	1	0	3

Quality is the success mantra for the survival of any organization in this competitive global market. Total Quality Management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival in world-class competition. It integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach. At the end of the course the students are expected to recognize the quality issues in an organization and analyze the ways to solve those using TQM techniques, and demonstrate skills in using modern TQM tools and software to analyzeproblems.

Course objectives

- Comprehend the philosophy and fundamental values of TQM.
- Interpret the difference between product centred and customer centred perspectives.
- Decipher quality perspectives through industry related case studies
- Analyze the influence and impact of quality on economic performance and long-term success of an organization
- Application and evaluation of best practices to obtain total quality
- Conceptualize the importance of implementing basic and modern quality tools to identify analyse and solve industrial problems

Unit I **8L**

Quality Pioneers: Deming's approach, Juran"s quality trilogy, Crosby and quality treatment, Imia's Kaizen, Ishikawa"s company-wide quality control, and Feigenbaum"s theory of TQC.

Learning Outcomes:

After completing this unit, the student will be able to

- Explain the evolution of quality concepts **[L-2]**
- Describe the core concepts of Total Quality Management. **[L-1]**
- explain the TQC principles for entire company**[L-2]**

Unit II **8 L**

Continuous Improvement: Improvement as problem solving process, Management by process, WV model of continuous improvement, process control and process improvement, process versus creativity.

Reactive Improvement: Identifying the problem, standard steps and tools, seven steps, seven QC tools.

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

- Enumerate the techniques to delight customers through continuous improvement of the quality of products and services. **[L-1]**
- evaluate and select the appropriate framework for continuous improvement**.[L-5]**
- apply the reactive methodologies for problem solving in organizations**[L-3]**

Unit III **8 L**
Proactive Improvement: Introduction to proactive improvement, standard steps for proactive improvement, semantics, example-customer visitation, Applying proactive improvement to develop new products- three stages and nine steps.
Learning Outcomes:
After completing this unit, the student will be able to

- apply the reactive and proactive improvement methodologies for problem solving in organizations. **[L-3]**
- understand the need for Quality systems of international standards. **[L-2]**

Unit IV **8 L**
Total Participation; Teamwork skill, Dual function of work, teams and teamwork, principles for activating teamwork, creativity in team processes, Initiation strategies, CEO involvement, Strategies for TQM introduction, Infrastructure for mobilization., Phase-in.
Learning Outcomes:
After completing this unit, the student will be able to

- Interpret the importance of team work in problem solving processes. **[L-5]**
- Implement the Quality Management Systems in a different organization environment **[L-3]**

Unit V **8 L**
Hoshin Management: Definition, Concepts, Phases in Hoshin Management – overview.
Societal Networking: Networking and societal diffusion, infrastructure for networking. TQM as learning system, a TQM model for skill development
Learning Outcomes:
After completing this unit, the student will be able to

- define the business excellence models implemented in various organizations**[L-5]**
- design & implement TQM projects in organizational situations**[L-6]**

Text Books:
1. Shoji Shiba, Alan Graham and David Walden -A New American TQM Four Practical Revolutions in Management, Productivity Press, Portlans (USA) -2001.
2. N Logothetis-Management for Total Quality, Prentice Hall of India, New Delhi - 2002.

References:
1. Roger C Swanson - The Quality Improvement Hand Book, Publisher Vanity Books,

International, New Delhi, 9th Edition, 1995
2. William C Johnson and Richard J Chavla, -Encyclopedia of Total Quality Management, New Delhi, 1995
3. N.V.R Naidu, K.M.Babu, G. Rajendra - Total Quality Management, New Age International Publishers-2008 edition,
4. Kesavan R -Total Quality Management, I K International Publishing house Pvt. Ltd, 2ndedition, 2008.

Course outcomes

- understand the various quality concepts. **[L-2]**
- apply continuous improvement models to satisfy customers. **[L-3]**
- apply proactive improvement techniques to improve quality of products. **[L-3]**
- develop total participation methods among employees to satisfy internal and external customers. **[L-3]**
- implementation of societal networking and Hoshin management. **[L-3]**

19EME357: SUPPLY CHAIN MANAGEMENT

L	T	P	C
2	1	0	3

This course provides an update to the knowledge of the students about existing logistical and supply-chain practices within the private and public sector of society. Students gain knowledge on applying logistics and supply-chain principles to achieve competitive advantage. Students will be exposed to ideas from business strategy, project management, risk management, trade-off analysis and economics, as well as tools from probability/statistics, and optimization.

Course Objectives:

- Introduce the major building blocks, functions, business processes, performance metrics and decisions (Strategic, tactical and operational) in Supply chain.
- Analyse the inventory management methodologies to improve the performance of supply chain.
- Explore three fundamental design concepts: component commonality, modularity vs. integral design, and universality, and a cost/benefit framework.
- Compare various procurement strategies and Impact of technology on supply chain optimization in procurement strategy.
- Acquire knowledge on Risks and issues in Local and Global supply chains.

UNIT I ` **8 L**

Introduction to Supply Chain Management (SCM):

Concept of supply management and SCM, importance of supply chain flows, core competency, value chain, elements of supply chain efficiency, key issues in SCM, decision phases, supply chain integration, process view of a supply chain, competitive strategy and supply chain strategies, uncertainties in supply chain, supply chain drivers.

Learning Outcomes:

After completing this unit, the student will be able to

- understand and analyze operations and supply chain management issues in a firm.**[L-2]**
- use critical thinking skills in business situations. **[L-3]**
- analyze the manufacturing operations of a firm**[L-4]**

- apply logistics and purchasing concepts to improve supply chain operations**[L-3]**
- analyze the global business environment. **[L-4]**

UNIT II **8 L**

Inventory Management: Introduction, selective control techniques, cost involved in inventory system, single stage inventory control, economic lot size models, application to economic production quantity, effect of demand uncertainty, single period models, initial inventory, multiple order opportunities, deterministic models, quantity discounts. periodic and quantity review policies, mathematical modelling under known stock out costs and service levels, joint replenishment for multiple items, inventory system constraints, working capital restrictions, and storage space restrictions.

Learning Outcomes:

After completing this unit, the student will be able to

- understand a system to keep track of inventory**[L-2]**
- understand the classification systems of Effective Inventory Management**[L-2]**
- analyze the satisfactory levels of customer service while keeping inventory costs within reasonable bounds.**[L-4]**

UNIT III **8 L**

Designing Supply Chain Network: Introduction, network design, factors influencing network design, data collection, data aggregation, transportation rates, warehouse costs, capacities and locations, models and data validation, key features of a network configuration, impact of uncertainty on network design, network design in uncertain environment, value of information: Bullwhip effect, information sharing, information and supply chain trade-offs, distribution strategies, direct shipment distribution strategies, transshipment and selecting appropriate strategies.

Learning Outcomes:

After completing this unit, the student will be able to

- understand the supply chain management in all its diverse aspects and its applicability **[L-2]**
- develop comprehensive strategic and tactical plans for an organization**[L-6]**
- understand how supply chain design facilitates network integration**[L-2]**
- apply the main network design and implementation steps. **[L-3]**
- identify the factors that are to be taken into account during during network design and

in locating facilities. **[L-1]**

UNIT IV **8 L**

Supply Chain Integration: Introduction, push, pull and push-pull supply chains, identifying appropriate supply chain strategy, Sourcing and procurement, outsourcing benefits, importance of suppliers, evaluating a potential supplier, supply contracts, competitive bidding and negotiation. Purchasing, objectives of purchasing, relations with other departments, centralized and decentralized purchasing, purchasing procedure, types of orders, e-procurement, tender buying, role of business in supply chains.

Learning Outcomes:

After completing this unit, the student will be able to

- identify the components of an integrated logistics management system. [**L-1]**
- identify the decisions involved in transportation management. **[L-1]**
- develop different alternatives and get a solution to be implemented. **[L-6]**
- analyze suitable methodologies to design a solution for an LSM problem. **[L-4]**

UNIT V **10 L**

Issues in Supply Chain Management: Introduction, risk management, managing global risk, issues in international supply chain, regional differences in logistics. Local issues in supply chain, issues in natural disaster and other calamities, issues for SMEs, organized retail in India, reverse logistics.

Learning Outcomes:

After completing this unit, the student will be able to

- understand fundamental issues in supply chain management. **[L-2]**
- apply knowledge to evaluate and manage an effective supply chain by minimizing the risk factors. **[L-3]**
- ability to align the management of a supply chain with corporate goals and strategies. **[L-2]**
- analyze the issues and search for methodologies improve supply chain processes. **[L-4]**

Text Books

1. Simchi-Levi, D. Kaminsky, P.Simchi-Levi, E. and Ravi Shankar, Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies, 3/e, Tata McGraw-Hill, 2008.

2. Chopra, S. and Meindl, Supply Chain Management: Strategy, Planning and Operations, 2/e, Pearson Education, 2004

References

1. Doebler, D.W. and Burt, D.N, Purchasing and Supply Management-Text and Cases, 6/e, McGraw-Hill, 1996.

2. Tersine, R.J, Principles of Inventory and Materials Management, 4/e, Prentice Hall, 1994.

Course Outcomes:

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

- explain strategic and operational frameworks to analyze supply chains. **[L-4]**
- design a supply chain network. **[L-6]**
- understand inventory control models and develop inventory control systems under deterministic and constrained scenarios **[L-2]**
- develop inventory control systems under probabilistic scenarios**[L-6]**
- Develop a detailed knowledge on the inventory management in improving the performance of supply chain. **[L-6]**
- understand different collaboration method in supply chain performance enhancement**[L-2]**

Program Elective –VI

19ECE442: INTRODUCTION TO EARTHQUAKE ENGINEERING

L T P C
2 1 0 3

This course is organized to cover three major areas of earthquake engineering such as Structural Dynamics & Response Spectra, Seismology, and Ductile Detailing of Beams. The student will be able to develop and solve equations of motion for SDOF subjected to free and forced vibrations. The student will be able to perform ductile detailing of RCC beams using Indian Standard codes.

Prerequisite: Engineering Mechanics, Structural Analysis and Design of Reinforced Concrete Structures.

Course Objectives:

- To familiarize with the basic principles of structural dynamics for SDOF.
- To demonstratedynamic equilibrium and the equation of motion.
- To impart knowledge on the response characteristics of a structure.
- To provide basic knowledge in engineering seismology.
- To train on codal provisions for ductile detailing of beams.

Unit I **8L**

Single-Degree- of – Freedom (SDF) Systems - Equations of Motion and Free Vibration
Simple Harmonic Motion, Mass-Spring- Damper System, Equation of Motion,D'Alembert'sPrinciple), Degrees of Freedom, Single Degree of Freedom, MathematicalModeling,Equation of Motion for Free Vibration for Damped and Un dampedSystem (Single Degree of Freedom System)

Learning Outcomes:

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

- define generalized degrees of freedom (L1).
- developthe equation of motion for SDOF for free vibrations (L3).
- solve equation of motion for free vibration for SDOF system (L3).

Unit II **8L**
Single-Degree- of – Freedom (SDF) Systems - Equations of Motion and Forced Vibration
Equation of Motion for Forced Vibration for Damped and Un damped System(Single Degree of Freedom System), Logarithmic Decrement

Learning Outcomes:

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

- developthe equation of motion for SDOF for forced vibrations (L3).
- solve equation of motion for forced vibration SDOF system (L3).
- explain the logarithmic decrement (L2).

Unit III **10L**

Earthquake Response of Linear Systems:

Earthquake excitation, Equation of motion, Response quantities, Response history, Response spectrum concept, Deformation, Pseudo-velocity, and Pseudo-acceleration, Response spectra, Peak structural response from the response spectrum, Response spectrum characteristics

Learning Outcomes:

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

- interpret the response history for a given earthquake excitation (L5).
- demonstrate the construction of response spectrum (L2).
- estimatepeak structural response quantities (L5).

Unit IV **8L**

Engineering seismology
Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic Regions, Intensity and Isoseismal of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zoning, Seismic effects on structure.

Learning Outcomes:

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

- outline terminology related to earthquake (L2).
- classify different seismic waves (L2).
- distinguish between earthquake magnitude and intensity (L4).

Unit V **8L**

Ductile detailing of Beams as per IS 13920

Ductility in Reinforced Cement Concrete Structures, Detailing Principles to ensure sufficient Ductility, Ductile detailing as per IS 13920, Longitudinal reinforcement, Shear reinforcement, Anchorage of reinforcement and concept of development length.

Learning Outcomes:

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

- illustrate the concept of ductile detailing in RC design of reinforced concrete beams (L3).
- discuss the importance of anchorage and development length (L3).
- estimate the shear reinforcement required for a ductile failure (L5).

Text Book(s):

1.Jai Krishna and Chandrasekharan, SarithaPrakasham, Elements of Earthquake Engineering, 2/e, South Asian Publishers, Dec.2000.

2. Anil K.Chopra,Dynamics of Structures, Theory and Applications to Earthquake Engineering, 4/e, Prentice Hall of India, 2011

References:

1. Vinod Hosur, Earthquake-Resistant Design of Building Structures, 1/e, Wiley India Pvt Ltd. 2013.

Course outcomes:

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

- solve equation of motion for SDOF for free vibration(L3).
- solve Equation of motion for SDOF for forced vibration(L3).
- explain the concept of Response spectrum(L2).
- summarize the propagation of waves causing earthquake (L2).
- design beams as per ductility provisions(L3).

19ECE444: GEOSYNTHETICS

L	T	P	C
2	1	0	3

Geosyntheticsare made of eco-environmental biodegradable polymeric resins or natural materials that maintain their needed performance such as durability, design strength, hydraulic property, etc., during the service period. The use of geosynthetics is, though, still novel in the field of civil engineering and construction industry, its use is nevertheless increasing every year in sectors such as reinforcement of fill, management of pore water pressure, foundations and pavements. These products are mainly categorized in to Geotextiles, Geogrids, Geomembranes,Geocomposites

Course Learning Objectives:

- To familiarize the evolution of new construction materials in geotechnical engineering and to initiate geosynthetic materials.
- To expose the properties and applications of different types of materials of geosynthetics.
- To acquaint the concepts of application of geotextiles for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers.
- To demonstrate the designing criteria of reinforced earth retaining walls, gabions, pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures, dams and embankments.
- To study the additional advantages of geocomposites, geowebs and geocells, and moisture barriers and natural geotextiles etc. for applications to meet various functions.

Unit I: ` **8 L**

Geosynthetics: Introduction to Geosynthetics – Basic description – Polymeric materials– Uses and Applications. Properties and classification Geotextiles – Geogrids – Geomembranes – Geocomposites.

Learning Outcomes:

After completion of Unit-1, Students will be able to

- evaluate the suitability of Geosynthetics materials in geotechnical engineering-L3
- demonstrate the Polymer chemistry-L2
- explain the uses and applications of Geosynthetics-L2
- classify the various types of Geosynthetics-L3

Unit II: **8 L**

Geotextiles: Geotextiles as Separation – Reinforcement – Stabilization – Filtration – Drainage and Moisture barriers. Geogrids: Suitability for Reinforcement – Stabilization – Design considerations Gabions – Construction methods.

Learning Outcomes:

After completion of Unit-II, Students will be able to

- explain the various applications of Geotextiles and Geogrids-L2
- demonstrate the suitability of Geotextiles for Separation – Reinforcement – Stabilization – Filtration – Drainage-L2
- illustrate the suitability of Geogrid for Reinforcement – Stabilization-L2
- explain the suitability and application of Gabions-L2
- demonstrate the various Construction methods of Gabions.-L2

Unit III: **9 L**

Use of Geosynthetics in Roads: Geosynthetics in road ways- applications- role of sub grade conditions-survivability-application in paved roads.Geosynthetics for separation and reinforcement in flexible pavements, Use of geosynthetics for construction of heavy container yards and railway lines

Learning Outcomes:

After completion of Unit-III, Students will be able to

- explain the various applications of geosynthetics in pavements.-L2
- apply the geosynthetic materials for sub grade soil to improve its performance-L3
- examine the survivability of geosynthetics in Pavements.–L4
- demonstrate the Use of geosynthetics for construction of heavy container yards and railway lines-L2

Unit IV: **9 L**

Reinforced Earth Retaining Walls: Components, Different types of walls like wrap-around walls, full-height panel walls, discrete-facing panel walls, modular block walls Design methods as per BS-8006 and FHWA methods Construction methods for reinforced soil retaining walls, Stability Analysis.

Learning Outcomes:

After completion of Unit-IV, Students will be able to

- explain the concept of Reinforced Earth Retaining Wall over conventional Retaining wall-L2
- explain the various types of Reinforced Earth Retaining Wall-L2
- indentify various components of Reinforced Earth Retaining Wall-L3
- demonstrate the design considerations as per BS-8006FHWA methods-L2
- illustrate and Determine the External stability and internal stability-L2

Unit V: **8 L**

Geomembranes: Pond Liners – Covers for Reservoirs – Canal Liners – Landfill Liners– Caps and closures, moisture barriers. Geocomposites: An added advantage – Geocomposites in Separation – Reinforcement – Filtration – Geocomposites as Geowebs and Geocells.

Learning Outcomes:

After completion of Unit-V, Students will be able to

- explain the various applications of Geomembranes-L2
- demonstrate the Geomembranes as liner and covers for different hydraulic bodies-L2
- illustrate the Geocomposites and its added advantages over single geosynthetic material-L2

Course Outcomes

After completion of this course the student will be able to

- demonstrate the various applications and different types of geosynthetic materials – L2
- explain the concepts of geosynthetics for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers – L2
- illustrate survivability requirements of geosynthetics in the field of roads and role of geosynthetics in sub grade soil – L2
- outline the design considerations of reinforced earth retaining walls and gabions – L2
- select suitable geomembrane for pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures – L3

Text book(s):

1. 'An Introduction to Soil Reinforcement and Geosynthetics' by G.L.SivakumarBabu (2009), Universities Press (India) Pvt. Ltd.
2. 'Engineering with Geosynthetics', by G. Venkatappa Rao and GVS Suryanarayana Raju – Tata McGraw Hill Publishing Company Limited – New Delhi.

References:

1. 'Designing with Geosynthetics by Robert M. Koerner, Prantice Hall, and Eaglewood Cliffs, NJ 07632.
2. 'Construction and Geotechnical Engineering using Synthetic Fabries' by Robert M. Koerner and Josoph P. Welsh. John Willey and Sons, New York.

NPTEL Links

Module 1: https://nptel.ac.in/downloads/105106052/

https://nptel.ac.in/courses/105108075/module8/Lecture24.pdf

Module 2: https://nptel.ac.in/courses/105101143/downloads/Lecture%2016.pdf

Module 3: https://nptel.ac.in/courses/105101143/downloads/Lecture%2020.pdf

https://nptel.ac.in/courses/105101143/20

Module 4: https://nptel.ac.in/courses/105108075/module8/Lecture31.pdf

https://nptel.ac.in/courses/105101143/27

Module 5: https://nptel.ac.in/courses/105108075/23

19ECE446: ROAD SAFETY AUDITING

L	T	P	C
2	1	0	3

The prime objective of the Roads Safety Audit is to address the safe operation of a roadway and to ensure high level of safety for all its users. This course exposes the various road safety policies nationally as well as internationally. Further, it attempts to address the problems relating to urban road safety, identifying the indicators of safety in urban areas and provide a comprehensive solution for urban road safety audit.

Course Objectives

- To explain different types of road accidents and causes
- To impart the road transport policies to prevent accidents
- To demonstrate road safety auditing techniques
- To focus on prioritizing of road safety improvement methods
- To familiarise on safety audit procedures

Unit I **8 L**

Road Safety Policy-I: The scale and nature of the road accident problem in the India and how it compares internationally. Road Safety responsibilities. Definition of road accidents and accident causation

Learning Outcomes:

After the completion of Unit, students will be able to

- identify the scale and nature of road accident problem[L3]
- compareroad accident scenario in India and outside India[L2]
- listvarious responsibilities of road safety[L1]
- defineroad accidents[L1]
- summarizecauses of accidents[L2]

Unit II **9 L**

Road safety policy-II: Role of road safety in national and local transport policy, managing the safety process, urban and rural road safety management, road safety research and recent road safety developments with special emphasis on pedestrian safety.

Learning Outcomes:

After the completion of Unit, students will be able to

- compare the role of road safety in national and local transport policy[L2]
- planhow to manage safety process[L3]
- classifyurban and rural road safety management[L2]
- explain research on road safety[L2]
- tellrecent road safety developments[L1]

Unit III **9 L**

Collision Prevention and reduction-I: Road accidents, causes, recorded cases, method of recording, accident data, storing of accident data, the use of accident data, the use of accident data and interpretation of accident data.

Learning Outcomes:

After the completion of Unit, students will be able to

- listvarious causes of road accidents[L1]
- demonstratemethods of recording road accidents[L2]
- explainthe methods of storing accident data[L2]
- identify the use of accident data[L3]
- interpretthe accident data for better understanding**[L2]**

Unit IV **8 L**

Collision Prevention and reduction-II: Selecting and prioritizing locations for investigation, statistical analysis of accidents, in depth analysis of individual locations, defining the road accident problem, difference between site and route analysis, area wide road safety schemes, options for treating for accident problems, monitoring the effectiveness of measures and estimating accident savings and economic benefits. Importance of road markings, traffic signs and signals, traffic control devices.

Learning Outcomes:

After the completion of Unit, students will be able to

- illustratemethods for Selecting and prioritizing locations for investigation[L2]
- solvethe accident data statistically[L3]
- comparesite analysis and route analysis[L2]
- identifyoptions for treating for accident problems[L3]
- explainthe importance of road markings, traffic signs and signals, traffic control devices[L2]

Unit V **8 L**

Safety Audits: The road safety audit procedure, and what are aims and objectives, roles and responsibility. History of road safety audit, road safety audit and design standards.Road safety audit tasks, various stages of safety audits, common identifiable problems. Structure of a road safety audit report,identity common problems, Case studies.

Learning Outcomes:

After the completion of Unit, students will be able to

- outline the road safety audit procedure along with aims and objectives[L2]
- define concepts of transportation system[L1]
- listvarious stages of safety audits along with common identifiable problems[L1]
- interpret the structure of a road safety audit report[L2]
- applythe concepts of road safety using case studies[L3]

Course Outcomes:

students will be able to

- identify different types of road accidents and causes**[L3]**
- interpret the road transport policies to prevent collisions **[L2]**
- organize road safety audits**[L3]**
- identify accidents hot spots and recommend corrective measure**[L3]**
- apply the knowledge of road safety audit **[L3]**

Text Book(s):

1. Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, 9/e, Nemchand and Bros, Roorkee, 2017
2. Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018

3. Belcher, M., Proctor, S., Cook, P., Practical Road Safety Auditing,3/e, ICE Publishing, 2015

References:

1. Papacostas, C.A., Fundamentals of Transportation Engineering, 3/e, Prentice-Hall of India Private Limited, New Delhi, 2001
2. Garber, N.J., and Hoel, LA., Traffic and Highway Engineering, 5/e, Cengage learning, 2018
3. IRC SP 88: Manual on road safety Audit (2010)

19ECE448: ADVANCED WATER RESOURCES ENGINEERING

L	T	P	C
2	1	0	3

The prerequisite for this course would be fluid mechanics and water resources engineering. This course helps the learner to acquire the comprehensive knowledge of gravity dams, earth dams, spillways. The learner will gain the knowledge on the principles of stability analysis of gravity dams and seepage analysis of earth dams. This course introduces the over view of spillways and design principles of stilling basins. The learner will gain the knowledge of design principles to design the minor irrigation structures of canal regulation works and cross drainage works.

Course Objectives:

- to explain the forces acting on gravity dam, seepage analysis of earth dam
- to teach the principles of stability analysis and theories of subsurface flow
- to solve the problems related to stability analysis of gravity dam and earth dam.
- to design the Canal Regulator and Cross Drainage structures

Unit - I: **9 L**

Gravity Dams: Classification of dams, gravity dams: forces acting, elementary profile, safety criteria, stability analysis of gravity dam including earthquake effects, construction joints, openings in dams-galleries, foundation treatment of gravity dam.

Learning outcomes:

After completion of Unit-I, students will be able to

- find the forces acting gravity dams (L-2)
- explain the safety criteria for stability analysis (L-2)
- solve problems related to stability analysis of gravity dam ((L-3)
- explain the drainage galleries and construction joints of gravity dams (L-2)

Unit – II: **9 L**

Earth Dams: Types, causes for failure of earth dams, phreatic line, seepage analysis for homogeneous dams, stability analysis of earth dam by slip circle method, seepage control in earth dams.

Learning outcomes:

After completion of Unit-II, students will be able to

- list the causes for failure of earth dams (L-1)
- explain the phreatic line (L-2)
- analyze the seepage flow through earth dams ((L-3)
- solve problems related to stability analysis of earth dam (L-3)

Unit – III: **9 L**

Spillways: Essential requirements, spillway capacity, components, types of spillways and their working, profile of ogee spillway, spillway crest gates, energy dissipation below spillway, use of hydraulic jump as energy dissipator – design of stilling basins – IS standard basins.

Learning outcomes:

After completion of Unit-III, students will be able to

- list the essential requirements of spillway (L-1)
- classify the types of spillways (L-2)
- Compute the profile of ogee spillway ((L-3)
- design the energy dissipation below spillway - stilling basins (L-3)

Unit – IV: **9 L**

Diversion Head Works: Location and components, weirs and barrages, causes of failure of weirs, design of impervious floor of weirs on permeable foundation, Bligh's, Lane's and Khosla's theories, hydraulic design of vertical drop weir,

Learning outcomes:

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

- list the components of Diversion Head works (L-1)
- explain the causes of failure of weirs (L-2)
- apply the Bligh's, Lane's and Khosla's theories (L-3)
- design the vertical drop weir (L-3)

Unit – V: **9 L**

Canal Regulatory Works: Canal regulator – hydraulic design of canal head regulator and cross regulator.

Cross Drainage Works: Types, factors affecting the suitability of each type, hydraulic design of Aqueduct and Syphon Aqueduct (Type-III), Canal outlet and canal escape.

Learning outcomes:

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

- list the types of Cross Drainage Works (L-1)
- explain the suitability of Cross Drainage Works (L-2)
- design the canal head regulator and canal cross regulator (L-4)
- design the Aqueduct and Syphon Aqueduct (Type-III) (L-4)

Course Outcomes:

At the end of course the students will be able to

- estimate the forces acting on gravity dams (L-2)
- check the stability of gravity dams and earth dams (L-3)
- apply the stability criteria of dams (L-4)
- compute the required thickness of impervious floor(L-4)
- design the Canal Regulator and Cross Drainage structures (L-6)

Text Book(s)

1. P.N. Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House, Delhi
2. B.C.Punmia and Pande B.B.Lal, Irrigation and Water Power Engineering, Laxmi Publications Pvt. Ltd., New Delhi

Reference books :

1. S.K.Garg, Irrigation Engineering, and Hydraulic Structures, Khanna Publishers, Delhi
2. Ch.Satyanarayana Murty, Water Resources Engineering, New Age International, Delhi
3. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, Standard Book Publishing, Delhi

19ECE452: INDUSTRIAL WASTE MANAGEMENT

L	T	P	C
2	**1**	**0**	**3**

With uncontrolled urbanization and pressurized industrialization, India is flooded with very good numbers of small, medium and large sized industries. The liquid effluent generated from various industries would pose a great hazard to the environment, if not treated properly. Hence, industrial wastewater management will be of great importance in maintaining the quality of the environment for sustainable living. This course work deals with characterization of industrial effluents, possible treatment methods, alternate treatment techniques and reuse option for the generated wastewater.

Course Objectives:

- to study the various sources of pollution and their impacts
- to familiarize with collection system of waste
- to expose to various method adapted to remove suspended and colloidal solids
- to impart the characteristic of waste from various industries
- to study about pollution control aspects of various industries

UNIT – I **8 L**

Interdiction of Industrial Waste Treatment: Principles of industrial waste management, sources of pollution, physical, chemical, organic and biological properties, effects of waste water on streams, land environment and human health.

Learning Outcomes:

- iIllustrate the principles of industrial waste management –**L2**
- identify the sources of industrial pollution –**L3**
- explain the effect of waste water on streams and Human Health- **L2**

UNIT – II **8 L**

Waste reduction, alternatives for raw materials, process changes, housekeeping – pre treatment of wastes, collection of wastes, segregation – equalization – reduction in volume and strength by other methods – theories of neutralization – equalizations and proportioning.

Learning Outcomes:

- summarize waste reduction processes –**L2**
- outline the waste volume reduction-**L2**
- asses Effect of waste water on streams and Human Health-**L3**

UNIT – III **8 L**

A review of the methods adopted for the removal of suspended, colloidal and dissolved organic solids, removal of inorganic solids – disposal of sludge – selection of site for the plant.

Learning Outcomes:

- interpret the removal of suspended, colloidal solids-**L2**
- summarize the methods of sludge disposal-**L2**
- select the best site for disposal of sludge –**L3**

UNIT – IV **10 L**

Manufacturing processes, flow sheets, characteristics and composition of wastes including waste reduction, treatment and disposal methods of Material Industries: Paper, Steel plant, Metal Plating and Food Industries: Sugar, Dairy.

Learning Outcomes:

- outline the characteristics of waste from various industries –**L2**
- analyze the treatment methods of waste from specific Industries –**L3**
- distinguish the flow sheets of treatment options for various industries-**L4**

UNIT – V **8 L**

Process and characteristics of waste, pollution effects and treatment methods for Textile, Tanning, Fertilizers Industries and Atomic energy plants.

Learning Outcomes:

- compare the charactersitcs of various industrial waste water –**L2**
- summarize various methods of treatment of industrial waste water-**L2**
- select the best treatment method for every industrial wastewater Treatment –**L5**

Course outcomes

- illustrate the sources of industrial wastewater –**L2**
- explain the treatment process of industrial effluent-**L4**
- summarize sludge disposal methods- **L2**
- identify the treatment options for industrial effluents - **L3**
- calculate and design unit operations of various treatment methods –**L4**

Text book:

1. Nelson Leonard Nemerow, Industrial Waste Treatment, Butterworth-Heinemann, 2007

2. Metcalf and Eddy, Wastewater Engineering - Collection, Treatment, Disposal and Reuse, McGraw Hill Pub. Co., 1995

Reference Books:

1. M.N. Rao and A.K. Datta, Industrial Waste Management, xford & IBH Publishing Co Pvt.Ltd, rd edition edition,2018

   - https://nptel.ac.in/courses/105106119/36

GSS115: GANDHI FOR 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.

19ECE492: PROJECT PHASE - II

L	T	P	C
0	**0**	**12**	**6**

Course Objectives:

- Instruct experiments with the solution to the problem statement defined in Project Phase I.
- Impart knowledge on various solution techniques for the problem
- Train to evaluate and justify the results

The student is required to work the solution for the problem proposed afore**(191ECE491)**. The solution can be arrived through experimentation, modelling and simulation or any other suitable method as approved by the panel of examiners. The student will be assessed periodically on the progress of the work. The project work is to be evaluated through Presentations and Viva-Voce during the semester and Final evaluation will be done at the end of semester before a panel of examiners as per the guidelines decided by the department from time to time.

Course Outcomes: The student shall be able to

- examine the various solution techniques of the problem. (L4)
- evaluate and justify the results from the solution of the problem. (L5)