MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
MADANAPALLE
(UGC-AUTONOMOUS)

www.mits.ac.in

DEPARTMENT OF CIVIL ENGINEERING

Course Structure &
Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the academic year 2018-19

and

B. Tech. Lateral Entry Scheme from the academic year 2019-20

B.TECH. CIVIL ENGINEERING

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: CIVIL ENGINEERING

Total Credits: 160 (4 Year Course)

I. **Induction Program and Holistic Development Activities**

Sl. No.	Title	Duration
1	Induction Program (Mandatory)	Three weeks duration at the start of First Year (Refer Annexure - I)
2	Holistic Development Activities (Every Student from Semester 2 – 8 should register for at least one activity)	Three hours per week (Activity list is enclosed in Annexure - I)
3	Virtual Laboratory (Students are encouraged to choose and register for any of the Virtual laboratories he /she is interested)	As specified by the Virtual Laboratory

II. **Semester-wise Structure of Curriculum**

(L = Lecture, T = Tutorial, P = Practical, C = Credit)

I Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18ENG101	Professional English	2	0	2	4	3
2	Basic Science Course	18MAT101	Engineering Calculus	3	1	0	4	4
3	Basic Science Course	18CHE101	Engineering Chemistry	3	0	0	3	3
4	Engineering Science Course	18ME101	Engineering Graphics	2	0	3	5	3.5
5	Engineering Science Course	18CSE101	Programming for Problem Solving (Python)	2	0	2	4	3
6	Basic Science Course	18CHE201	Chemistry Laboratory	0	0	3	3	1.5
7	Engineering Science Course	18ME201	Workshop Practice	0	0	3	3	1.5
			Total	**12**	**1**	**13**	**26**	**19.5**

I Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Basic Science Course	18MAT102	Linear Algebra and Differential Equations	3	1	0	4	4
2	Basic Science Course	18PHY101	Engineering Physics	3	1	0	4	4
3	Engineering Science Course	18EEE101	Basic Electrical Engineering	3	0	0	3	3
4	Engineering Science Course	18CSE102	C Programming and Data Structures	3	0	0	3	3
5	Basic Science Course	18PHY201	Physics Laboratory	0	0	3	3	1.5
6	Engineering Science Course	18EEE201	Electrical Engineering Laboratory	0	0	3	3	1.5
7	Engineering Science Course	18CSE201	C Programming and Data Structures Laboratory	0	0	3	3	1.5
			Total	**12**	**2**	**9**	**23**	**18.5**

II Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18HUM101	Economics and Financial Accounting for Engineers	3	0	0	3	3
2	Basic Science Course	18BIO101	Life Science for Engineers	3	0	0	3	3
3	Engineering Science Course	18CE101	Fundamentals of Engineering Mechanics	3	0	0	3	3
4	Professional Core Course	18CE102	Surveying and Geomatics	3	0	0	3	3
5	Professional Core Course	18CE103	Mechanics of Fluids	3	1	0	4	4
6	Professional Core Course	18CE201	Construction Technology Laboratory	0	0	3	3	1.5
7	Professional Core Course	18CE202	Surveying and Geomatics Laboratory	0	0	3	3	1.5
8	Professional Core Course	18CE203	Mechanics of Fluids Laboratory	0	0	3	3	1.5
9	Mandatory non-credit Course		Mandatory Course – I (Refer Annexure - V)	2	0	0	2	0
			Total	**17**	**1**	**9**	**27**	**20.5**

II Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18HUM102	Principles of Management	3	0	0	3	3
2	Basic Science Course	18MAT104	Probability and Statistics	3	0	0	3	3
3	Professional Core Course	18CE104	Engineering Hydrology	3	0	0	3	3
4	Professional Core Course	18CE105	Concrete Technology	3	0	0	3	3
5	Professional Core Course	18CE106	Environmental Engineering	3	0	0	3	3
6	Professional Core Course	18CE107	Strength of Materials	3	0	0	3	3
7	Humanities, Social Sciences including Management	18ENG201	English Communication – Listening & Speaking Laboratory	0	0	3	3	1.5
8	Professional Core Course	18CE204	Environmental Engineering Laboratory	0	0	3	3	1.5
9	Professional Core Course	18CE205	Strength of Materials Laboratory	0	0	3	3	1.5
10	Mandatory non-credit Course		Mandatory Course – II (Refer Annexure - V)	2	0	0	2	0
			Total	**20**	**0**	**9**	**29**	**22.5**
Summer Internship								

III Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Humanities, Social Sciences including Management	18ENG102	English Communication - Reading and Writing	2	0	0	2	2
2	Professional Core Course	18CE108	Structural Analysis-I	2	1	0	3	3
3	Professional Core Course	18CE109	Geotechnical Engineering	3	0	0	3	3
4	Professional Core Course	18CE110	Water Resources and Irrigation	3	0	0	3	3
5	Professional Elective Course		Discipline Elective-I (Refer Annexure - III)	3	0	0	3	3
6	Open Elective Course		Open Elective – I (Refer Annexure - II)	3	0	0	3	3
7	Engineering Science Course	18CE206	Computer Aided Building Drawing Laboratory	0	0	3	3	1.5
8	Professional Core Course	18CE207	Concrete Technology Laboratory	0	0	3	3	1.5
9	Professional Core Course	18CE208	Geotechnical Engineering Laboratory	0	0	3	3	1.5
10	Mandatory non-credit Course		Mandatory Course – III (Refer Annexure - V)	2	0	0	2	0
			Total	**18**	**1**	**9**	**28**	**21.5**

III Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Professional Core Course	18CE111	Structural Analysis -II	2	1	0	3	3
2	Professional Core Course	18CE112	Transportation Engineering	3	0	0	3	3
3	Professional Core Course	18CE113	Design of Concrete Structures	2	1	0	3	3
4	Professional Elective Course		Discipline Elective-II (Refer Annexure - III)	3	0	0	3	3
5	Professional Elective Course		Discipline Elective-III (Refer Annexure - III)	3	0	0	3	3
6	Open Elective Course		Open Elective – II (Refer Annexure - II)	3	0	0	3	3
7	Humanities, Social Sciences including Management	18ENG202	Corporate Communication Laboratory	0	0	2	2	1
8	Professional Core Course	18CE209	Transportation Engineering Laboratory	0	0	3	3	1.5
9	Professional Core Course		Virtual Laboratory (Refer Annexure - IV)	0	0	2	2	0
10	Mandatory non-credit Course		Mandatory Course – IV (Refer Annexure - V)	2	0	0	2	0
			Total	**18**	**2**	**7**	**27**	**20.5**
Summer Internship								

IV Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Professional Core Course	18CE114	Design of Steel Structures	2	1	0	3	3
2	Professional Core Course	18CE115	Quantity Surveying and Construction Management	3	0	0	3	3
3	Professional Elective Course		Discipline Elective -IV (Refer Annexure - III)	3	0	0	3	3
4	Professional Elective Course		Discipline Elective -V (Refer Annexure - III)	3	0	0	3	3
5	Open Elective Course		Open Elective -III (Refer Annexure - II)	3	0	0	3	3
6	Professional Core Course	18CE210	Structures Laboratory	0	0	2	2	1
7	Professional Core Course	18CE211	Instrumentation and Sensor Technology Laboratory	0	0	2	2	1
8	PROJ-CE	18CE701	Project Work - I	0	0	4	4	2
			Total	**14**	**1**	**8**	**23**	**19**

IV Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
1	Professional Elective Course		Discipline Elective- VI (Refer Annexure - III)	3	0	0	3	3
2	Open Elective Course		Open Elective - IV (Refer Annexure - II)	3	0	0	3	3
3	PROJ - CE	18CE702	Project Work - II	0	0	24	24	12
			Total	**6**	**0**	**24**	**30**	**18**

ANNEXURE – I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

    - Basic Computer Proficiency
    - Interpersonal skills
    - Computer Graphics
    - Web programming
    - Mobile Apps
    - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-development
6. Nature and Environment
7. Innovation

ANNEXURE - II

OPEN ELECTIVE – I (To be offered under MOOC's Category from SWAYAM – NPTEL) Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	18ENG3M01/ 18ENG3M01C	Soft Skills	English & Training
2	18ENG3M02/ 18ENG3M02C	Developing Soft Skills and Personality	English & Training
3	18ENG3M03/ 18ENG3M03C	Soft Skill Development	English & Training
4	18HUM3M01/ 18HUM3M01C	Project Management for Managers	Humanities
5	18HUM3M02/ 18HUM3M02C	Ethics in Engineering Practice	Humanities
6	18ME3M01/ 18ME3M01C	Six Sigma	Mechanical
7	18ME3M02/ 18ME3M02C	Operations Research	Mechanical
8	18ME3M03/ 18ME3M03C	Design Thinking and Innovation	Mechanical
9	18EEE3M01/ 18EEE3M01C	Non-Conventional Energy Sources	EEE
10	18EEE3M02/ 18EEE3M02C	Design of Photovoltaic Systems	EEE
11	18ECE3M01/ 18ECE3M01C	Semiconductor Opto-Electronics	ECE
12	18ECE3M02/ 18ECE3M02C	Digital VLSI Testing	ECE
13	18CSE3M01/ 18CSE3M01C	Social Networks	CSE
14	18CSE3M02/ 18CSE3M02C	Privacy and Security in Online Social Media	CSE
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future			

OPEN ELECTIVE – II (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	18MAT301	Advanced Numerical Methods	Mathematics
2	18MAT302	Engineering Optimization	Mathematics
3	18PHY301	Optical Physics and its Applications	Physics
4	18PHY302	LASER Physics and Advanced LASER Technology	Physics
5	18CHE301	Introduction to Petroleum Industry	Chemistry
6	18CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
7	18HUM301	Intellectual Property Rights	Humanities
8	18HUM302	Human Resource Development	Humanities
9	18ME301	Material Science for Engineers	Mechanical
10	18ME302	Elements of Mechanical Engineering	Mechanical
11	18ME303	Basic Thermodynamics	Mechanical
12	18EEE301	Industrial Electrical Systems	EEE
13	18EEE302	Introduction to MEMS	EEE
14	18ECE301	Bio-Medical Electronics	ECE
15	18ECE302	VLSI Design	ECE
16	18CSE301	Operating Systems	CSE
17	18CSE302	E-Learning Technologies	CSE
18	18CSE303	AI Tools, Techniques and Applications	CSE

OPEN ELECTIVE – III

(To be offered under MOOC's Category from SWAYAM – NPTEL)
Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	18ENG3M04/ 18ENG3M04C	Speaking Effectively	English
2	18HUM3M03/ 18HUM3M03C	Management Information System	Humanities
3	18ME3M04/ 18ME3M04C	Power Plant Engineering	Mechanical
4	18ME3M05/ 18ME3M05C	Mechatronics and Manufacturing Automation	Mechanical
5	18EEE3M03/ 18EEE3M03C	Introduction to Smart Grid	EEE
6	18ECE3M03/ 18ECE3M03C	Introduction to Embedded Systems	ECE
7	18ECE3M04/ 18ECE3M04C	Embedded System Design with ARM	ECE
8	18ECE3M05/ 18ECE3M05C	Advanced Computer Architecture	ECE
9	18CSE3M03/ 18CSE3M03C	Human Computer Interactions	CSE
10	18CSE3M04/ 18CSE3M04C	Programming in JAVA	CSE
11	18CSE3M05/ 18CSE3M05C	Multi-Core Computer Architecture – Storage and Interconnects	CSE
12	18CSE3M06/ 18CSE3M06C	Introduction to Internet of Things	CSE
13	18IE3M01/ 18IE3M01C	Introduction to Research	General

Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.

OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
Sl. No	**Course Code**	**Course Title**	**Course Offered by Department of**
1	18ENG301	Creative Writing	English
2	18HUM303	Entrepreneurship Development	Humanities
3	18MAT303	Graph Theory	Mathematics
4	18MAT304	Mathematical Modeling and Numerical Simulation	Mathematics
5	18PHY303	Thin Film Technology and its Applications	Physics
6	18CHE303	Introduction to Nano Science and Technology	Chemistry
7	18CHE304	Computational Methods in Materials Science and Engineering	Chemistry
8	18ME304	Internet of Manufacturing Things	Mechanical
9	18ME305	Entrepreneurship	Mechanical
10	18ME306	Total Quality Management	Mechanical
11	18EEE303	Robotics	EEE
12	18EEE304	Electrical Safety	EEE
13	18ECE303	Nano Electronics	ECE
14	18ECE304	Wireless Sensor Networks	ECE
15	18CSE304	Mobile Application Development	CSE
16	18CSE305	Software Project Management	CSE
17	18CSE306	Software Testing	CSE

ANNEXURE - III

List of Discipline Electives – Civil Engineering

Discipline Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	18CE401	Engineering Geology
2.	18CE402	Construction Planning and Management
3.	18CE403	Remote Sensing and GIS
4.	18CE404	Green Buildings and Energy Conservation
5.	18CE405	Air Pollution and Solid Waste Management
6.	18CE406	Building Materials and Construction
Any advanced courses can be appended in future.		

Discipline Elective – II (To be offered under MOOC's Category from SWAYAM – NPTEL) Students can opt to be assessed either in Conventional mode or through proctored exams conducted by Swayam NPTEL		
Sl. No.	**Course Code**	**Course Title**
1.	18CE4M01/ 18CE4M01C	Modern Construction Materials
2.	18CE4M02/ 18CE4M02C	Composite Materials
3.	18CE4M03/ 18CE4M03C	Advanced Environmental Microbiology
4.	18CE4M04/ 18CE4M04C	Energy Efficiency, Acoustic and Daylighting in Building
5.	18CE4M05/ 18CE4M05C	Environmental Remediation of Contaminated Sites
6.	18CE4M06/ 18CE4M06C	Geo-synthetic and Reinforced Soil Structures
7.	18CE4M07/ 18CE4M07C	Mineral resources: Geology, Exploration, Economics and Environment
8.	18CE4M08/ 18CE4M08C	Soil and Water Conservation Engineering
9.	18CE4M09/ 18CE4M09C	Urban Governance and Development Management
10.	18CE4M10/ 18CE4M10C	Safety in Construction
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Discipline Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	18CE407	Advanced Strength of Material
2.	18CE408	Advanced Geotechnical Engineering- Foundations
3.	18CE409	River Hydraulics and Sediment Transport
4.	18CE410	Finite Element Analysis
5.	18CE411	Environmental Impact Assessment
Any advanced courses can be appended in future.		

Discipline Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	18CE412	Hydraulic Engineering
2.	18CE413	Advanced Structural Analysis
3.	18CE414	Geotechnical Exploration
4.	18CE415	Estimating and Costing
5.	18CE416	Traffic Engineering and Management
Any advanced courses can be appended in future.		

Discipline Elective – V		
Sl. No.	**Course Code**	**Course Title**
1.	18CE417	Watershed Management
2.	18CE418	Railways Engineering
3.	18CE419	Bridge Engineering
4.	18CE420	Optimization in Structural Design
5.	18CE421	Offshore Structures
6.	18CE422	Ground Improvement Techniques
7.	18CE423	Pavement Design and Analysis
Any advanced courses can be appended in future.		

Discipline Elective – VI		
Sl. No.	**Course Code**	**Course Title**
1.	18CE424	Port Engineering
2.	18CE425	Earthquake Engineering
3.	18CE426	Prestressed Concrete Structures
4.	18CE427	Soil Retaining Walls
5.	18CE428	Computational Fluid Dynamics
Any advanced courses can be appended in future.		

ANNEXURE - IV

CIVIL ENGINEERING – VIRTUAL LABS*

Sl.No.	Course Code	Course Title
1.	18CE212	Soft Computing Tools in Engineering
2.	18CE213	Soil Mechanics and Foundation Engineering Laboratory
3.	18CE214	Urban Transportation System Planning Laboratory
4.	18CE215	Virtual Smart Structure and Dynamic Laboratory
5.	18CE216	Basic Structural Analysis

* Only for self-learning, not for assessment

ANNEXURE - V

CIVIL ENGINEERING – List of MANDATORY COURSES

Sl. No.	Course Code	Name of the Course
1.	18CHE901	Environmental Sciences
2.	18HUM902	Indian Constitution
3.	18HUM903	Essence of Indian Traditional Knowledge
4.	18CE904	Disaster Management

Annexure VI

Honors in Civil Engineering

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Elective Course (Choose any two from three courses)**	18HDCE101	Advanced Surveying	3	0	0	3	3
2		18HDCE102	Environmental Geotechniques	3	0	0	3	3
3		18HDCE103	Applied Hydraulics	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
	III Year II Semester							
4	**Professional Elective Course (Choose any two from three courses)**	18HDCE104	Advanced Concrete Technology	3	0	0	3	3
5		18HDCE105	Design of Hydraulic Structures	3	0	0	3	3
6		18HDCE106	Transportation Infrastructure and Management	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
	IV Year I Semester							
7	**Professional Elective Course (Choose any one from three courses)**	18HDCE107	Project Planning and Implementation	3	0	0	3	3
8		18HDCE108	Basic Structural Dynamics	3	0	0	3	3
9		18HDCE109	Repair and Rehabilitation of Structures	3	0	0	3	3
10	**Project**	18HDCE701	Mini Project	0	0	10	10	5
	Sub Total			**3**	**0**	**10**	**13**	**8**
	Total			**15**	**0**	**10**	**25**	**20**

Annexure VII

Minors in Civil Engineering
(Applicable to ME)

Stream Name: Civil Engineering - I

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Core Course**	18MDCE101	Surveying and Building Technology	3	0	0	3	3
2	**Professional Core Course**	18MDCE102	Basic Soil Mechanics and Foundation Engineering	3	0	0	3	3
III Year II Semester								
3	**Professional Core Course**	18MDCE103	Structural Engineering	3	0	0	3	3
4	**Professional Core Course**	18MDCE104	Water Resources Engineering	3	0	0	3	3
5	**Professional Core Course**	18MDCE201	Civil Engineering Laboratory	0	0	4	4	2
IV Year I Semester								
6	**Professional Core Course**	18MDCE105	Economics of Transportation Systems	3	0	0	3	3
7	**Professional Core Course**	18MDCE701	Mini Project	0	0	6	6	3
			Total	**15**	**0**	**10**	**25**	**20**

Annexure VII

Minors in Civil Engineering

(Applicable to CSE/CST/CSIT/EEE/ECE)

Stream Name: Civil Engineering - II

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Core Course**	18MDCE106	Engineering Mechanics and Materials	3	0	0	3	3
2	**Professional Core Course**	18MDCE101	Surveying and Building Technology	3	0	0	3	3
III Year II Semester								
3	**Professional Core Course**	18MDCE102	Basic Soil Mechanics and Foundation Engineering	3	0	0	3	3
4	**Professional Core Course**	18MDCE104	Water Resources Engineering	3	0	0	3	3
5	**Professional Core Course**	18MDCE201	Civil Engineering Laboratory	0	0	4	4	2
IV Year I Semester								
6	**Professional Core Course**	18MDCE107	Traffic and Road Safety Engineering	3	0	0	3	3
7	**Professional Core Course**	18MDCE701	Mini Project	0	0	6	6	3
	Total			**15**	**0**	**10**	**25**	**20**

B.Tech. I Year-I Semester

18ENG101 PROFESSIONAL ENGLISH
(Common to all branches)

L	T	P	C
2	0	2	3

Course Prerequisite: None

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives:
This course enables the student to –
1. Engage effectively in a professional environment
2. Understand the intricacies and implications of professional communication
3. Use linguistic skills in any given context
4. Conduct self in a learning environment
5. Be better prepared for employment

UNIT I: GRAMMAR & VOCABULARY;
Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms. **(6)**
Practical: Dumb Charade, Giving Direction, Talking about an experiment (Tenses), Running Commentary **(6)**

UNIT II: READING SKILLS & WRITTEN COMMUNICATION;
Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing- completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence. **(6)**
Practical: Short Passages – Reading Comprehension, Paragraph Writing, Skit Writing. **(6)**

UNIT III: VERBAL & NON-VERBAL ASPECTS;
Verbal - Introducing oneself, exchanging personal information, Using 'Wh'- Questions, asking and answering, yes or no questions- asking about routine actions and expressing opinions; **Non-Verbal** – Use of body language, combating nervousness. **(6)**
Practical: Daily Activities, Role Play, JAM **(6)**

UNIT IV: CONVERSATIONS; Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, speaking about one's friend. **(6)**

Practical: Speaking: formal and informal conversations, short group conversations, speaking about oneself, speaking about one's friend, Character Portrayal.

Listening: Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures ,discussions from TV/Radio/Podcast. **(6)**

UNIT V: BUSINESS ENVIRONMENT & ETIQUETTES; sharing information of a personal kind - greeting & taking leave; Writing e-mails, memos, reports, etc. **(6)**

Practical: Mock Interview, Oral Presentation **(6)**

Course Outcomes:
At the end of the course, learners will be able to
1. Read articles and understand professional communication
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind and personal letters and emails in English.

Suggested Reading/Textbooks:
1. Guy Brook Hart & Norman Whitby; Cambridge English-Business Benchmark: Pre-Intermediate to Intermediate; Published by: Cambridge University Press.
2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Intermediate (B1+); Published by: Cambridge University Press.

Reference:
1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press, 2015.
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press, 2013.
3. K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006.
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006
6. Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7. Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012.
8. www.cambridgeenglish.org/in/
9. https://learnenglish.britishcouncil.org/en/english-grammar
10. https://www.rong-chang.com/

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

18MAT101 ENGINEERING CALCULUS

L	T	P	C
3	**1**	**0**	**4**

Course Prerequisite: Mathematics at Intermediate or Equivalent Level

Course Description

The course introduces the concepts of single variable and multivariable calculus with the view of its applications in various engineering fields. It prepares the students to develop various methods of finding derivatives and integrals; understanding of concepts related to continuous functions and enrich their experience in critical analysis.

Course Objectives

1. To introduce the basic concepts of definite integrals, improper integrals, Beta and Gamma functions,
2. To acquire knowledge on mean value theorems in calculus.
3. To illustrate various techniques of testing the convergence of infinite series and introduces the functions of sine and cosine series.
4. To familiarize the knowledge of limit, continuity and the derivatives, extreme values in Multivariable.
5. To emphasize the role of Double and Triple integrals in dealing with area and volume of the regions.

UNIT I: INTEGRAL CALCULUS

Definite integrals; Applications of definite integrals to evaluate area and length of curves, surface areas and volumes of revolutions; Beta and Gamma functions and their properties. **(12)**

UNIT II: DIFFERENTIAL CALCULUS

Rolle's Theorem Mean value theorems, Taylor's and Maclaurin theorems with remainders (without proofs); indeterminate forms, Maxima and minima. **(12)**

UNIT III: SEQUENCE AND SERIES

Sequence and Series, their Convergence and tests for convergence; Power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem. **(12)**

UNIT IV: MULTIVARIABLE DIFFERENTIAL CALCULUS

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers. **(12)**

UNIT V: MULTIVARIABLE INTEGRAL CALCULUS

Multiple Integration: double integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes (double integration), triple integrals, curl and divergence, Green's, Stokes and Gauss divergence theorems (without proofs). **(12)**

Course Outcomes

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

1. Evaluate the definite integrals, Beta and Gamma functions and calculate length of curve and underlying area.
2. Relate the results of mean value theorems in calculus to Engineering problems.
3. Use the power series and Fourier series for ascertaining the stability and convergence of various techniques.
4. Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.
5. Compute the area and volume by interlinking them to appropriate double and triple integrals.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42th Edition, 2012.
2. G. B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus Pearson education 11^{th} Edition, 2004.

Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11^{th} Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2^{nd} Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Mode of Evaluation: Assignments, Internal Mid Examination, External End Examination.

18CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Course Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description: Deals with the basic principles of various branches of chemistry like physical, organic, inorganic, analytical and nanomaterial chemistry.

Course Objectives:

Students will

1. Understand, analyse and determine the impurities present in the water.
2. Appreciate the synthetic organic reactions used in daily life
3. Learn the principles of spectroscopies to analyse them.
4. Value the basic concepts of thermodynamics and electrochemistry.
5. Be exposed to the importance of nano and engineering materials used in their daily life and industry.

UNIT I: Impurities Present in Water and Water Treatment

Impurities present in Water: Impurities in water (BIS and WHO standards), Hardness of water-determination of hardness - EDTA Method (numerical problems), Alkalinity of water (numerical problems) and its importance and Chlorides. Disadvantages (industry level) of using hard water. Softening of water (Ion exchange method), Treatment of brackish water by Reverse Osmosis method. Water treatment for civic applications: coagulation, sedimentation, filtration, sterilization - chlorination and ozonation. Concept of break point chlorination. **(9)**

UNIT II: Periodic Properties and Organic Reactions

Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, oxidation states, molecular geometries. Organic Reactions: Introduction to substitution (S_N^1 and S_N^2), elimination (E_1 and E_2) - Addition, Condensation and Free Radical Polymerization Reaction (only the mechanism). **(9)**

UNIT III: Spectroscopy

Basic Principle and Applications of UV-Visible, FT-IR, Raman, Microwave and Nuclear Magnetic Resonance (NMR) Spectroscopy. **(9)**

UNIT IV: Thermodynamics and Electrochemistry

Thermodynamics: Systems, State Functions, Thermodynamic Functions: Work, Energy, Entropy and Free energy. Estimations of Entropy in Isothermal, Isobaric and Isochoric processes and Free Energies. Electrochemistry: Free energy and EMF. Cell potentials, the Nernst equation and applications. Batteries (Lead-Acid and Lithium ion) and Fuel-Cells (H_2-O_2 and Solid Oxide). **(9)**

UNIT V: Engineering Materials, Nanoscience & Nanotechnology
EngineeringMaterials: Cement Materials and Manufacturing Process. Lubricants – definition, Properties of lubricants – Viscosity, Viscosity Index, Saponification Number, Flash Point and Pour Point. Nanomaterials: Introduction, Classes/Types, Chemical synthesis of Nanomaterials: Sol-Gel, Hydrothermal (Metal Oxide Nanoparticles) and Chemical Vapor Deposition method (Carbon Nanotubes), Characterization by powder XRD (Scherrer's equation). Applications of Nanomaterials – Energy (Hydrogen Storage and Solar Energy) and Environmental Sciences-Photocatalytic Dye Degradation (TiO_2 and ZnO) **(9)**

Course Outcomes:
At the end of the course, the students will be able to
1. Analyse and determine the impurities in water such as hardness, alkalinity for sustainable development.
2. Prepare organic compounds/polymers for environmental, safety and society need.
3. Comprehend the principles and applications of spectroscopies
4. Apply the concept of free energy in thermodynamics, electrochemistry for solving the problems evolve in the engineering processes.
5. Acquire spotlight to the nanomaterials and basic engineering materials used in academics, industry and daily life.

Text Books:
1. P.W. Atkins & Julio de Paula, 'The Elements of Physical Chemistry', Ninth edition (Oxford University Press, Oxford 2010).
2. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
3. Ralph H. Petrucci, F. Geoffrey Herring, Jeffry D. Madura, Carey Bissonnette, General Chemistry - Principles and Modern Applications, Tenth Edition, (Pearson, 2011).
4. Dr S. S. Dara and Dr S. S. Umare, A Text book of Engineering Chemistry,1st Edition.(S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1st Edition, (Tata McGraw-Hill Publishing Company Limited, 2017).

Reference Books:
1. 'Physical Chemistry', D. W. Ball, First Edition, India Edition (Thomson, 2007).
2. Perry's Chemical Engineers' Handbook, Don W. Green and Marylee Z. Southard, 9th Edition (McGraw Hill, 2018).
3. Engineering Chemistry, Dr. Suba Ramesh and others, 1st Edition (Wiley India, 2011).
4. Jain and Jain, Engineering Chemistry,16th Edition (Dhanpat Rai Publishing Company (P) Ltd, 2016).
5. Amretashis Sengupta, Chandan Kumar Sarkar (eds.), Introduction to Nano Basics to Nanoscience and Nanotechnology (Springer-Verlag, Berlin, Heidelberg, 2015)

Mode of Evaluation: Assignment / Quiz, Classroom participation, Mini-project / Report, Internal Mid Examination and external semester end examination.

18ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	3	3.5

Course Prerequisite: None

Course Description:
Introduction to AutoCAD commands, simple drawings, orthographic projections, projection of points, lines, planes; auxiliary projections; projections and sections of solids; development and intersection of surfaces; isometric projections.

Course Objectives:

1. Engineering Graphics is the primary medium for development and communicating design concepts.
2. Through this course the students are trained in Engineering Graphics concepts with the use of AutoCAD.
3. The latest ISI code of practice is followed while preparing the drawings using AutoCAD.
4. Computerized drawing is an upcoming technology and provides accurate and easily modifiable graphics entities.
5. Storage and Retrieval of Drawings is also very easy and it takes very less time to prepare the drawings. Also enhances the creativity.

UNIT I: INTRODUCTION TO AUTO CAD
Introduction to AutoCAD commands, simple drawings, Orthographic Projections-Theory, techniques, first angle projections and third angle projections. **(15)**

UNIT II: PROJECTIONS OF POINTS & LINES
Projections of points: Positions, notation system and projections. Projections of lines: positions, terms used, different cases, traces of lines and finding true lengths, auxiliary projections. **(15)**

UNIT III: PROJECTIONS OF PLANES & SOLIDS
Projections of planes: positions, terms used, different cases and projections procedure
Projections of Solids: Projections of Regular Solids inclined to one planes. **(15)**

UNIT IV: SECTIONS AND DEVELOPMENTS OF SOLIDS
Section Planes and Sectional View of Right Regular Solids-Prism, cylinder. True shapes of the sections. Development of Surfaces of Right Regular Solids-Prism, Cylinder and their Sectional Parts. **(15)**

UNIT V: INTERSECTIONS & ISOMETRIC PROJECTIONS
Intersections of surfaces of solids: Intersection between: Line-plane, Plane-plane, line-solid, solid-solid. **Isometric Projections**: Theory of isometric drawing, construction of isometric projection from orthographic. **(15)**

Course Outcomes:
The students after completing the course will be able to:
1. Identify various commands in AutoCAD and their usage for engineering graphics
2. Draw the projections of points and straight lines with AutoCAD
3. Draw the projections of the planes and sections of solids.
4. Sketch the intersections of surfaces and developments of solids
5. Draw the conversion of the orthographic views to isometric views and vice versa.

Text Book:
1. D.M. Kulkarni, A.P. Rastogi and A.M. Sarkar., Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi 2009.

References:
1. Dhananjay A Jolhe, Engineering Drawing: with an introduction to AutoCAD, Tata McGraw Hill, 2008.
2. Warren J. Luzadder& Jon M. Duff Fundamentals of Engineering Drawing, 11th edition, Prentice Hall of India, New Delhi.ss

Mode of Evaluation: Lab classes Evaluation, Mid and End Examination

18CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	2	3

Course Prerequisite: None

Course Description:
Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. This course provides knowledge on how to implement programs in python language and to solve computational problems using the various programming constructs including data structures, functions, string handling mechanisms and file handling concepts.

Course Objectives:
1. Learn Python programming constructs.
2. Implement Python programs with conditional structures and loops.
3. Use functions for structuring Python programs.
4. Handle compound data using Python lists, tuples, and dictionaries.
5. Manipulate data using files handling in Python.

UNIT-I
Introduction: Algorithms, building blocks of algorithms (flow chart), History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. **Data Types** - Integers, Strings, Boolean.

a) Develop a flowchart for the various arithmetic operations on numbers.
b) Develop a flowchart to check whether the number is positive or negative.
c) Develop a flowchart for finding whether a given number is even or odd.
d) Develop a flowchart for finding biggest number among three numbers.
e) Develop a flowchart for displaying reversal of a number.
f) Develop a flowchart to print factorial of a number using function.
g) Develop a flowchart to generate prime numbers series up to N using function.
h) Develop a flowchart to check given number is palindrome or not using function.
i) Alexa travelled 150 kms by train. How much distance in miles she actually covered?

(12)

UNIT-II
Operators and Expressions: Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations . **Control Flow** - if, if-elif-else, for, while,break,continue,pass.

a) Swapping of two number with and without using temporary variable.

b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.
c) Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard. The operator codes are as follows:
   - For code '+', perform addition.
   - For code '-', perform subtraction.
   - For code '*', perform multiplication.
   - For code '/', perform division.
d) Implement the python program to generate the multiplication table.
e) Implement Python program to find sum of natural numbers
f) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.
g) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the MITS examination policy as shown below.

% OBTAINED	GRADE
90 - 100	O (Outstanding)
80 - 89	A+ (Excellent)
70 - 79	A (Very Good)
60 - 69	B+ (Good)
50 - 59	B (Above)
45 - 49	C (Average)
40 - 44	P (Pass)
< 40	F (Fail)

h) Implement Python Script to generate prime numbers series up to N.
i) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371. Write a program to find all Armstrong number in the range of 0 and 999.

(12)

UNIT-III

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. **Functions** - Defining Functions, Calling Functions, Passing Arguments, variable in python-Global and Local Variables.

a) Write a Python script to
   - create a list
   - access elements from a list
   - slice lists
   - change or add elements to a list
   - delete or remove elements from a list

b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.
c) Write a Python script to compute the similarity between two lists.
d) Write a Python script to read set of values from a Tuple to perform various operations.
e) Write a Python script to perform basic dictionary operations like insert, delete and display.
f) Write a Python program to count the occurrence of each word in a given sentence.
g) Define a dictionary named population that contains the following data.

Keys	Values
Shanghai	17.8
Istanbul	13.3
Karachi	13.0
Mumbai	12.5

h) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.
i) Implement Python script to display power of given numbers using function.
j) Implement a Python program that takes a list of words and returns the length of the longest one using function. **(12)**

UNIT-IV

String Handling -Modules: Creating modules, import statement, from.import statement, name spacing-**Files and Directories**

a) Implement Python program to perform various operations on string using string libraries.
b) Implement Python program to remove punctuations from a given string.
c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string is "computer", your program should output "COMPUTER" without using library functions.
d) Implement Python program to capitalize each word in a string. For example, the entered sentence "god helps only people who work hard" to be converted as "God Helps Only People Who Work Hard"
e) Write a Python script to display file contents.
f) Write a Python script to copy file contents from one file to another.
g) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.
h) Write a Python commands to perform the following directory operations.
   - List Directories and Files
   - Making a New Directory
   - Renaming a Directory or a File
   - Removing Directory or File

(12)

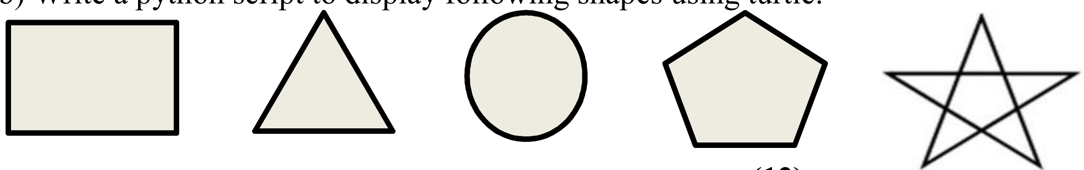
UNIT-V

Python packages, Introduction to PIP, Installing Packages via PIP(Numpy, Pandas etc.., Using PythonPackages. **Brief Tour of the Standard Library** - Dates and Times, Data Compression, Turtle Graphics.

(10)

a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the __init__.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.

b) Write a python script to display following shapes using turtle.



(12)

Course Outcomes:

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

1. Understand problem solving techniques and their applications.
2. Apply the basic elements and constructs of python to solve simple logical problems.
3. Demonstrate different data structures using functions.
4. Demonstrate different file operations and modules.
5. Apply object-oriented principles to build simple applications.

Text Book:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

References:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.

3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.

5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Mode of Evaluation: Model Lab Examinations, External Lab End Examination.

18CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: Basic Chemistry at Intermediate or equivalent level.

Course Description: It deals with basic principles of volumetric and instrumental analytical methods.

Course Objective:

This Engineering Chemistry Laboratory is common to all branches of I Year B Tech. At the end of the course the student is expected to Students will

1. Learn to estimate the chemical impurities present in water such as hardness, alkalinity, chlorine, etc.
2. Understand and experience the formation of inorganic complex and analytical technique for trace metal determination.
3. Be trained to use the instruments to practically understand the concepts of electrochemistry.
4. Bridge theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in engineering.
5. Learn and understand the practical implementation of fundamental concepts.

Lab Experiments (12 Experiments)

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Adsorption of acetic acid by charcoal.
4. Determination of molecular weight of a polymer by using Ostwald's viscometer.
5. Determination of rate constant of an ester hydrolysis (Pseudo First Order reaction).
6. Determination of strength of a Strong acid (conc. H_2SO_4) by conductometric titration (Neutralisation Titration).
7. Conductometric titration of $BaCl_2$ Vs Na_2SO_4 (Precipitation Titration).
8. Dissociation constant of weak electrolyte by Conductometry.
9. Determination of percentage of Iron in Cement sample by colorimetry.
10. Estimation of ferrous ion by Potentiometric titration (Redox Titration).
11. Saponification value of oil.
12. Formation of Iron- 1,10-phenanthroline complex and determination of iron by colorimetry.

Course Outcomes :

After the completion of the Engineering Chemistry Laboratory experiments, students will be able to

1. Develop and perform analytical chemistry techniques to address the water related problems (for e.g., hardness, alkalinity present in water) technically.
2. Handle electro-analytical instruments like digital conductivity meter and potentiometer to perform neutralization, precipitation and redox titrations respectively.
3. Acquire practical skills to handle spectro-photochemical methods to verify Beer-Lambert's Law.
4. Operate various instruments for the analysis of materials and produce accurate results in a given time frame.
5. Think innovatively and improve the creative skills that are essential for solving engineering problems.

Text Book:

1. Engineering Chemistry Lab Manual (2017-18), Dept. of Chemistry, Madanapalle Institute of Technology and Science, Madanapalle – 517325, Chittoor Dist., Andhra Pradesh, India.
2. "Vogel's Textbook of Qualitative Chemical Analysis", Arthur Israel Vogel, Prentice Hall, 2000.
3. Laboratory Manual on Engineering Chemistry, by Dr Sudha Rani, Dhanpat Rai Publishing house, 2009.
4. A Text book on Experiments and calculations in Engineering Chemistry, by SS Dara, S Chand publications, 2015.
5. Laboratory Manual of Organic Chemistry, by Raj K Bansal, Wiley Eastern Limited, New age international limited, 2009.

Mode of evaluation: Continuous evaluation of the lab experiments, record, viva-voce and external lab examination.

18ME201 WORKSHOP PRACTICE

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
This course will provide students with a hands-on experience on various basic engineering practices. This course will also provide an opportunity to the students to experience the various steps involved in the industrial product fabrication.

Course Objectives:
1. Introduction to the use of Tools, Machinery and Power tools,
2. Hands on practice in Carpentry, Fitting, Forging, Tinsmith, Plumbing, Foundry, Welding, Fabrication of plastic components, Metrology, Fabrication of Polymer Composite materials, simple machine turning and wood turning, and basic electrical connections.
3. Introduction to 3 D Printing
4. Fabrication of final product at end of the semester.

LIST OF TRADES
1. Carpentry (Cross half lap Joint and Miter Joint)
2. Fitting (Square and 'V' fit)
3. Turning (Ball pane hammer and handles)
4. Forging (S hook L hook)
5. Tin smithy (Square tray)
6. Plumbing (Wash basin and simple connection)
7. Foundry (Solid and Split pattern)
8. Welding (Arc and Gas welding)
9. Fabrication of plastic components (Pen Stand)
10. Metrology (Internal and External dimension)
11. Composite Material Sample Preparation (Demo Only)
12. Introduction of Power Tools and CNC (Demo Only)
13. Introduction to 3D Printing (Demo Only)

Course Outcomes
On successful completion of this course, the student will be able to
1. Fabricate carpentry components with suitable joint and pipe connections including plumbing works.
2. Perform welding operation to join various structures.
3. Perform basic machining operations.
4. Create the models using sheet metal and plastic works.
5. Illustrate the operations of foundry, fitting and smithy
6. Fabricate a product using composite and plastic material
7. Design and fabricate a product using the tools and skills learned in the workshop.

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998. (v) Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.
4. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

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B.Tech. I Year-II Semester

18MAT102 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

Course Prerequisite: 18MAT101

Course Description: The course is an introduction to Linear Algebra and Differential Equations. The classical methods for solving system of linear equations, ordinary and partial differential equations are covered. Basics of matrices and its applications are highlighted. The methods of solving first and second order ordinary and partial differential equations have been introduced.

Course Objectives:

1. To solve the system of linear equations and find the eigenvalues and eigenvectors.
2. To formulate and solve first order ordinary differential equations.
3. To solve second order differential equations of various kinds.
4. To find the solution of first order linear and non-linear partial differential equations.
5. To obtain the solutions of homogeneous and non-homogeneous linear partial differential equations representing initial and boundary value problems in engineering.

UNIT I: MATRICES

Algebra of matrices, Determinants, Inverse and rank of a matrix, Symmetric, skew-symmetric and orthogonal matrices, system of linear equations, eigen values and eigen vectors, diagonalization of matrices. Applications: Balancing chemical equation & curve fitting. **(12)**

UNIT II: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS

Exact, linear and Bernoulli's equations, Equations of the first and higher degree, equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Applications: Newton's law of cooling and orthogonal trajectories. **(12)**

UNIT III: SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS

Second order linear differential equations with constant and variable coefficients, Wronskian, method of variation of parameters, Cauchy-Euler equation. Power series solutions: ordinary and regular singular point, Legendre polynomials, Bessel functions of the first kind and their properties. **(12)**

UNIT IV: FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations (PDEs), solution of linear and non-linear PDEs by Lagrange's and Charpit's methods. **(12)**

UNIT V: **HIGHER ORDER PARTIAL DIFFERENTIAL EQUATIONS**

Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear differential equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation; Separation of variables method: The Laplacian in plane, cylindrical and spherical polar coordinates, One dimensional unsteady diffusion equation. **(12)**

Course Outcomes:

At the end of the course the student should be able to

1. Solve the system of linear equations and analyze applications of matrices in various fields and obtain Eigen values and Eigenvectors.
2. Understand and solve first order ordinary differential equationssolvable for p, y or x.
3. Apply the knowledge of identifying, formulating and solving engineering problems represented bysecond order differential equations.
4. Find and interpret the solutions offirst partial order linear and non-linear partial differential equations.
5. Represent the relevant engineering system into pertinent partial differential equation, solve it and interpret the results.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
3. Walter A. Strauss, Partial Differential Equations, 2nd Edition, 2008.

Text/Reference Books:

1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

18PHY101 ENGINEERING PHYSICS

L	T	P	C
3	**1**	**0**	**4**

Course Prerequisite: Plus two level physics course

Course Description: Engineering Physics for Civil and Mechanical Engineers is a physics course which provides fundamental knowledge to understand the concepts of mechanics, waves and oscillations, interference, diffraction, and lasers.

Course Objectives:

1. Expose students to the fundamental principles and laws of mechanics in Physics to understand the types of motion.
2. Demonstrate the ability to identify and apply the appropriate analytic, numerical, and mathematical reasoning, to situations of the physical world.
3. Analyze the concepts of mechanics, oscillations, waves and optics to prepare the students for advanced level courses.
4. Expose students to theoretical and mathematical aspects of interference and diffraction of light for testing of materials.
5. Adaptability to new developments in science and technology.

UNIT I: MECHANICS OF PARTICLES

Velocity and Acceleration, Motion in one dimension, several dimensions, formal solution of kinematical equations. Polar Co-ordinates, velocity and acceleration in polar coordinates. Newton's Laws, applications of Newton's laws (Constraint equations, Block on string, Conical Pendulum, Block and Wedge). **(12)**

UNIT II: MOMENTUM & WORK ENERGY

Momentum, law of conservation of linear momentum, flow of mass, Rocket Equation, Rocket in free space and in a gravitational field. Integrating equation of motion in one-dimension-work energy theorem, orbital velocity and escape velocity, Potential energy, Potential energy of a uniform force field, potential energy of an inverse square force, stability, conservation laws and particle collisions. **(12)**

UNIT III: WAVES AND OSCILLATIONS

Simple Harmonic Motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Superposition of vibrations along same direction (equal frequency) and in perpendicular directions, Lissajous figures. Transverse waves, solution of wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, standing waves, standing wave ratio. **(12)**

UNIT IV: INTERFERENCE & DIFFRACTION

Interference of light by division of wavefront- Young's double slit experiment, expression for fringe width, intensity distribution graph, interference of light by division of amplitude-interference in thin film by reflection, Newton's rings experiment, Michelson interferometer, applications of Interference (colours of thin films). Diffraction, Farunhofer diffraction due to single slit, double slit and, Diffraction grating (N-slit), applications of Diffraction (List only)

(12)

UNIT V: LASERS

Introduction to Lasers, characteristics of Laser, interaction of radiation with matter-spontaneous and stimulated emission, Einstein's coefficients; amplification of light by population inversion, excitation mechanism, types of lasers: solid-state lasers – ruby laser, gas lasers - He-Ne Laser, semiconductor p-n junction diode laser; applications of lasers.

(12)

Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Describe and explain the fundamental physical principles and laws of Mechanics in Physics.
2. Explain the concepts conservation of momentum, energy, and predict the future state of a system based on its present state.
3. Apply the physical principles of waves together with logical and mathematical reasoning, to situations of the physical world of vibrations.
4. Define and evaluate the fundamentals of materials testing using Interference and Diffraction techniques.
5. Identify the working elements of different lasers and estimate laser operation parameters.

Text Books:

1. An Introduction to Mechanics, by D. Kleppner and R. Kolenkow, Tata McGraw-Hill Edition, 2007.
2. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
3. A. Ghatak, "Optics", McGraw Hill Education, 2012.
4. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

Reference Books:

1. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.
2. Berkeley Physics Course Volume I, Tata-McGraw Hill.
3. Engineering Mechanics, 2nd ed. — MK Harbola
4. Introduction to Mechanics — MK Verma
5. Theory of Vibrations with Applications — WT Thomson

Mode of Evaluation: Assignment, Class room participation, Mid term examinations, Mini project / Term paper and External End Examination.

18EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisite: Intermediate Physics

Course Description:
This course equips the students with a basic understanding of Electrical circuits and machines for specific applications. In specific, the course covers basic of DC circuit & its analysis, introduction to single-phase and three-phase AC Systems, magnetic circuits, transformers, DC & AC electrical machines, basic converters and Components of LT Switchgear.

Course Objectives:
1. To learn the basics of the D.C. circuit analysis.
2. To have an idea about single-phase and three-phase A.C. electrical circuits.
3. To gain knowledge about basic magnetic circuits and transformers.
4. To learn the construction and operation of D.C. and A.C. machines.
5. To understand the operation of basic rectifiers and various components of LT Switchgear.

UNIT I: DC CIRCUIT ANALYSIS
Electrical circuit elements (R, L and C), voltage and current sources, Series and parallel resistive circuits, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits with dc excitation. Source Transformation, Star-Delta Transformation, Superposition Theorem. **(9)**

UNIT II: AC CIRCUIT ANALYSIS
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections. **(9)**

UNIT III: MAGNETIC MATERIALS AND TRANSFORMERS
Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency. **(9)**

UNIT IV: DC AND AC MACHINES
Construction, working, emf equation of DC generator, methods of excitation, speed control of dc motor. Generation of rotating magnetic fields, construction and working of a three-phase induction motor. Introduction of Single-phase induction motor. Introduction to Alternators. **(9)**

UNIT V: RECTIFIERS AND ELECTRICAL INSTALLATIONS
PN junction diode, half wave, full wave and bridge rectifiers. Components of LT Switchgear: switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables, earthing. **(9)**

Course Outcomes:

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

1. To understand and analyze basic DC electric circuits.
2. To measure and analyze various electrical quantities of single phase and three AC electric circuits.
3. To develop magnetic circuits to experiment and analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

Text Books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

References:

1. Abhijit Chakrabarti, “Circuit Theory : Analysis and Synthesis”, Dhanpat Rai & Co., 2014
2. J.B. Gupta, “Theory & Performance of Electrical Machines”, S. K. Kataria & Sons, 2013.
3. John Bird, “Electrical Circuit Theory and Technology”, Fourth edition, Elsevier Ltd., 2010.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

18CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisite: 18CSE101

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of C programming language
3. Develop algorithms for manipulating stacks, queues, searching and sorting.

UNIT I: C PROGRAMMING
Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions. **Control Structures**: Conditional Statements (Simple if, if-else, Nested - if-else, Switch). Iterative Statements (for, While, Do-While), Jump Statements (break, Continue). **(9)**

UNIT II: FUNCTIONS & ARRAY
Functions Introduction, User defined function, accessing a function, Function prototypes, Recursion, storage classes **Arrays**: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. **Searching:** Linear and Binary search **Sorting:** Bubble Sort and Insertion Sort. **(9)**

UNIT III: POINTERS AND STRUCTURE
Pointers: Fundamentals of pointer, Pointer Declarations, Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference. Dynamic memory allocation. **Structures:** Defining a structure, processing a structure. **(9)**

UNIT IV: STACK AND QUEUES
Classification of Data Structure, **Stack and Queues:** stack, stack operations, stack implementations using arrays.Queue, queue operations, queue implementations using array, types of queues, applications of stack and queue. **(9)**

UNIT V: STRINGS & FILES
Declaring and Defining a string, Initialization of strings, Strings Library functions **Files:** File Definition, Opening and closing a data file, Reading and Writing a data file, Files I/O Functions. **(9)**

Course Outcomes:

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

1. Illustrate the use of control structures, decision making and looping statement.
2. Build programs using arrays and functions.
3. Implement the concepts of pointer, structure and list.
4. Implement storage and retrieval of ordered data using stacks and queues.
5. Illustrate the concepts of Strings and File processing.

Text Books:

1. The C Programming Language, Kernighan and Ritchie, 2nd Edition, Prentice Hall, India 1988.
2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.

References:

1. Programming in ANSI C, E. Balagurusamy, Sixth Edition, Tata Mc-Graw Hill Publishing Co.Ltd.-New Delhi
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education,5th edition, 20007.
3. K. N. King ,"C Programming ": A Modern Approach, 2nd Edition 2nd Edition
4. Byron Gottfried , Jitender Chhabra , Programming with C (Schaum's Outlines Series)

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

18PHY201 PHYSICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
Physics Practical course is meant for making the students to gain practical knowledge to co relate with the theoretical studies. It covers experiments on Principles of Mechanics and Optics, Measurement of Magnetic field and studying Resonance using LCR Circuit.

Course Objectives:
1. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
2. Illustrate the basics of mechanics, waves and optics to analyze the behavior and characteristics of various materials for its optimum utilization.
3. Develop an ability to apply the knowledge of physics experiments in the later studies.

LIST OF EXPERIMENTS: (Any 10 Out of 18)
1. Spring constant - Coupled Pendulums.
2. Study of resonance effect in series and parallel LCR circuit.
3. Determination of radius of curvature of a curved surface - Newton's Rings.
4. Wavelength of a laser - Diffraction Grating
5. Wavelength of the spectral lines - Diffraction Grating.
6. Magnetic field along the axis of a current carrying coil - Stewart Gees' Apparatus
7. Ferroelectric hysteresis (B-H Curve). ***(ECE)***
8. Thickness of a given wire - Wedge Method.
9. Determination of Planck's constant. ***(EEE, CSE, CSIT, CST)***
10. Dispersive power of prism – Spectrometer.
11. Frequency of the tuning fork - Melde's apparatus.
12. Energy gap of a material of p-n junction. ***(EEE, CSE, CSIT, CST)***
13. Width of single slit - Diffraction due to Single Slit.
14. Measurement of e/m of electron (Helical Coil method) ***(ECE)***
15. Biot -Savart Law with Helmholtz Coil. ***(ECE)***
16. The Wheatstone Bridge. ***(ECE)***
17. Determination of particle size using Laser.
18. Torsional Pendulum. ***(ME & Civil)***

Course Outcomes:

Upon successful completion of this course, the students should be able to:

1. Apply the scientific process in the conduct and reporting of experimental investigations.
2. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
3. Verify the theoretical ideas and concepts covered in lecture by doing hands on in the experiments.
4. Know about the characteristics of various materials in a practical manner and gain knowledge about various optical technique methods.
5. Acquire and interpret experimental data to examine the physical laws.

Reference Books:

1. Physics Laboratory Manual
2. Optics, A. Ghatak, 4th Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4th edition, McGraw-Hill Inc., 1981.
4. Engineering Mechanics, 2nd ed. — MK Harbola
5. Introduction to Electrodynamics- David J Griffiths

Mode of Evaluation: Continuous Internal Evaluation, Practical End Examination.

18EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: None

Course Description:
The laboratory facilitates the students to deal with electrical instruments which further strengthen the concepts & operation of various AC & DC circuits, and machines, and their characteristics. The lab also reinforce the concepts discussed in class with a hands-on approach which enable the students to gain significant experience with electrical instruments such as ammeter, voltmeter, digital multimeters, oscilloscopes, tachometer, switches, fuses and power supplies.

Course Objectives:
1. To provide hands on experience in setting up simple electrical circuits (DC and AC).
2. To get exposure to handle different electrical equipment's.
3. To measure various electrical parameters with different measuring instruments.
4. To get hands on experience in operating DC and AC machines.
5. To understand the operation of basic converters and various components of LT Switchgear.

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:
DEMONSTRATIONS:
1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Study of passive components - resistors, capacitors and inductors.
2. Demonstration of voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). In star and delta connections.
3. Demonstration of cutout sections of transformer and DC & AC machines.
4. Demonstration of induction machine. Motor operation and generator operation of an induction machine driven at super-synchronous speed.
5. Familiarization of (i) different types of cables/wires and switches and their uses, (ii) different types of fuses & fuse carriers; MCB, ELCB, MCCB their ratings and uses (components of LT switchgear).

EXPERIMENTS:
1. Wiring of a simple circuit for controlling (1) a lamp/fan point, (2) Staircase or Corridor Winding.
2. Wiring of a power circuit for controlling an electrical appliance (16A Socket).
3. Verification of Kirchhoff's current and voltage laws (KCL & KVL).
4. Verification of superposition theorem
5. Sinusoidal steady state response of R-L, and R-C circuits (impedance calculation and verification).
6. Measurement of voltage, current and power in a single phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.

7. Measurement of active power for star and delta connected balanced loads (single wattmeter method).
8. Open-circuit and short-circuit test on a single phase transformer.
9. Speed control of separately excited DC motor.
10. Wiring of a power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter (or residential house wiring).
11. Regulated power supply for generating a constant DC Voltage.
12. Fabrication of a given electronic circuit on a PCB and test the same.

Course Outcomes:
Upon successful completion of the course, the students are expected to
1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of various power electronic converters.

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination

18CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisite: Computer Programming

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand problem solving techniques and their applications
2. Students will be able to understand the syntax and semantics of C programming language
3. Develop algorithms for manipulating linked lists, stacks, queues, searching and sorting.

LIST OF EXPERIMENTS

1. a) Write a C program to swap the two numbers.
   b) Write a C Program to find the eligibility of admission for a Professional course based on the following criteria:
   Marks in Maths >=65
   Marks in Physics >=55
   Marks in Chemistry>=50
   OR
   Total in all three subject >=180

6. a) Write a C program to list all the factorial numbers less than or equal to an input number n.
A number N is called a factorial number if it is the factorial of a
Positive integer. For example, the first few factorial numbers are
1, 2, 6, 24, 120, ...
Note - We do not list the factorial of 0.
b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1.
Print the sum of all the integers that you have read before you encountered -1

7. a) Given three points (x1, y1), (x2, y2) and (x3, y3), write a program to check if all the three points fall on one straight line.
b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by an iterative process of summing digits. Digital sum of 65536 is 7, because 6+5+5+3+6=25 and 2+5 = 7. Write a program that takes an integer as input and prints its digital root.

8. a) Write a C program to find the series of prime numbers in the given range.
b) Write a C Program to Check Whether a Number is Palindrome or Not.

9. a) Write a c program to check whether a given number is a perfect number or not. (Perfect number is a positive number which sum of all positive divisors excluding that number is equal to that number. For example 6 is perfect number since divisor of 6 are 1, 2 and 3. Sum of its divisor is 1 + 2+ 3 = 6)

b) Write a C function to find the kth occurrence of an integer n in a sequence of non-negative integers, and then call your function from main.

Your function should be according to the following declaration:

int find(int n, int k);

sample example: input 3 2

1 1 3 2 3 -1

Output: 4

10. Write a C program to find Factorial, GCD, Fibonacci, (Using recursion)

11. Your program should take as input: dimension of a square matrix N, two matrices of size N x N with integer values, and one operator symbol (+, - ,*). It must perform the Corresponding operation given below

a) Matrix Addition b) Matrix Subtraction c) Matrix Multiplication

12. One needs to first input a set of N number of ALPHABETIC Strings each representing a name of a student in an array studname [N] . Assume each string can be Max. 40 Characters long. subsequently, one needs to input Marks obtained by those students in another array marks [N] Assume that studname [I] i.e. ith student in the list of student names has obtained Marks [I] in the Marks List. You need to find out and print the Max Marks obtained by a student and also print the name of the student who has obtained this mark.

13. Implement the following searching techniques

a) Linear Search b) Binary Search

10 .a) Bubble sort is a sorting algorithm that works by repeatedly stepping through lists that need to be sorted, comparing each pair of adjacent items and swapping them if they are in the wrong order. This passing procedure is repeated until no swaps are required, indicating that the list is sorted. Bubble sort gets its name because smaller elements bubble toward the top of the list. Consider an array of size 10. It will be filled it by reading 10 integers. The final output will be sorted output in Ascending Order.

b) Insertion sort is a sorting algorithm in which the elements are transferred one at a time to the right position. Here the first element in the array is considered as sorted, even if it is an unsorted array. Then each element in the array is checked with the previous elements, resulting in a growing sorted output list. With each iteration, the sorting algorithm removes one element at a time and finds the appropriate location within the sorted array and inserts it there. The iteration continues until the whole list is sorted. First an array of size 10 will be taken. We will fill it by reading 10 integers. The final output will be sorted output in Ascending Order.

11 a) Write a C program to swap two integers using pointers. You have to write a swap function that will accept the address of two integer and swap their values

b) Write a program in C to add two numbers using pointers. You have to write the fsum() function which accepts the address of two variables and returns the sum of their values to the main function.

12 Write a C program to compute internal marks of students for five different subjects using Structures.

13 Implement the following Data Structures
a) Stack ADT b) queue ADT c) Circular queue ADT

14 a)Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using standard string library functions.

b) Write a C program for reading a string and assigning its base address to the character pointer
to count characters are vowels or consonants.

15 a) Write a C program to copy the file contents from one file to another file (pass file names as Command line arguments).
b) Write a C program to count no of lines, words and characters in a file.

Course Outcomes:
After completing this course the students should be able to
1. Apply the concepts of control structures using C.
2. Implement the concepts of arrays and functions through C programming.
3. Develop the source code to implement the concepts of Strings, Pointers and File processing.
4. Implement sorting and searching algorithms using arrays.
5. Implement stack and queue data structures using arrays.

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

B.Tech. II Year-I Semester

18HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the position of financial statements. Funds flows statements and cash flow statements are explained to know the analysis of financial matters.

Course Objectives

The course is intended to

1. Describe the nature of engineering economics in dealing with the issues of scarcity.
2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets.
3. Explain the performance of firms under different market structures and Price determination in various market conditions.
4. Explain the accounting principles, types of accounting and preparation of final accounts.
5. Describe the financial analysis through ratios, funds flow and cash flow statements.

UNIT I

DEMAND ANALYSIS: Scope and Significance of Economics- Understanding the problem of scarcity and choice - Elements of market Economy: Demand, Supply and Market Equilibrium-Theory of Demand, Elasticity of Demand, Supply and Law of Supply. **(9)**

UNIT II

PRODUCTION AND COST ANALYSIS: Production Function - Short-run and long- run production - Cost Analysis: Cost concepts - Cost Structure of Firms and output decision- Break-Even Analysis (BEA) - Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems). **(9)**

UNIT III

MARKET STRUCTURE: Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic, Oligopoly, Duopoly - Price determination and various market conditions. **(9)**

UNIT IV

BASICS OF ACCOUNTING: Uses of Accounting - Book Keeping Vs Accounting - Double Entry System - Accounting Principles - Classification Of Accounts - Rules Of Debit & Credit. Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems). **(9)**

UNIT V

BASICS OF FINANCIAL ANALYSIS: Ratio Analysis - Liquidity, Leverage, Solvency and Profitability Ratios - Interpretation of Financial Statements - FundS Flow Statement - Capital Budgeting. **(9)**

Course Outcomes

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

1. Understand Engineering economics basic concepts,
2. Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,
3. Compare different market structures and identify suitable market,
4. Demonstrate an understanding and analyzing the accounting statements, and
5. Demonstrate the ability to apply knowledge of accounting concepts through Financial Statements Analysis.

Text Books

1. Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8th Edition, 2007.
2. Financial Accounting, S.N.Maheshwari, Sultan Chand, 2009.
3. Financial Statement Analysis, Khan and Jain, PHI, 2009.
4. Financial Management, Prasanna Chandra, T.M.H, 2009.

Reference Books

1. Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11th Edition, 2007.
2. Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18th Edition, 2007.
3. Financial Management and Policy, Van Horne, James,C., Pearson ,2009.
4. Financial Management, I.M.Pandey, Vikas Publications.

Mode of Evaluation: Assignment, Seminar, Written Examination.

18BIO101 LIFE SCIENCES FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisites: Basic knowledge about sciences up to intermediate or equivalent level.

Course Description

The course deals with basic concepts of life sciences, its impact on human & universe, biological systems and functions, human physiology and metabolism.

Course Objectives

1. Introduce the molecular basis of life.
2. Provide the basis for classification of living organisms.
3. Describe the transfer of genetic information.
4. Introduce the techniques used for modification of living organisms.
5. Describe the applications of biomaterials

UNIT I: Introduction to Life Sciences & Living Organisms

Why we need to study Life Sciences? Comparison and differences of biological organisms with manmade systems (Eye & Camera, Bird flying & Aircraft), Biological observations of 18th Century that led to major discoveries. Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources. (**8**)

UNIT II: Biomolecules & Macromolecules

Molecules of life: Water, Sugars, Starch, Cellulose, Amino acids, Structure and functions of proteins (primary, secondary, tertiary and quaternary structure), Structure and functions of nucleotides, nucleic acids, DNA (single and double strand) & RNA, hemoglobin, antibodies and enzymes, Industrial applications of enzymes and Fermentation process. (**10**)

UNIT III: Human Physiology

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Human physiology, Neurons, Synaptic and Neuromuscular junctions. (**7**)

UNIT IV: Genes, DNA & RNA

Mendel's laws, gene mapping, Mitosis and Meiosis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation. Discuss the concept of complementation using human genetics. Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips. (**10**)

UNIT V: Metabolism

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Mechanism of Photosynthesis). (**10**)

Course Outcomes

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

1. **CO 1: explain** the differences between biological organisms and manmade systems and classify organisms (L2)
2. **CO 2: interpret** the relationship between the structure and function of proteins, nucleic acid and summarize the industrial applications of biomolecules (L2)
3. **CO 3: explain** the mechanism of respiration
4. **CO 4: demonstrate** the mapping of genes. (L2) and explain the medical importance of gene disorders. (L2)
5. **CO 5: apply** thermodynamic and kinetic principles to biological systems (L2)

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.
3. Cell and Molecular Biology by De Robetis and De Robertis.

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

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE101 FUNDAMENTALS OF ENGINEERING MECHANICS

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Objectives

The course is intended to

1. To study the basics of statics of particles and rigid bodies.
2. To understand various support connections and loadings.
3. To analyze trusses for various loading conditions.
4. To study the problems involving ladder, wedge and belt friction.
5. To learn the geometric properties of the different shapes.
6. To study kinematics and kinetics of particles and rigid bodies.

UNIT I

STATICS OF PARTICLES Introduction to Mechanics - System of Units -Laws of mechanics - Lame's theorem - Parallelogram and triangular Law of forces -Resolution of coplanar forces - Free body diagram - Equilibrium of particles

STATICS OF RIGID BODY: Moment of a force - Varignon's theorem - Moments and Couples -Equivalent system of forces - Requirements of stable equilibrium - Equilibrium of Rigid bodies subjected to two, three and four force system. **(9)**

UNIT II

ANALYSIS OF PIN JOINTED TRUSSES: Classification of trusses -Reactions at supports and connections -Types of loading - Reaction for simply supported and over hanging beams - Analysis of Trusses using method of joints and methods of sections (Simply supported and cantilever beams)

FRICTION: Classification of friction - Laws of friction - Angle of repose -Force required to move a body along horizontal and inclines planes - Analysis of ladder,wedge and belt friction. **(9)**

UNIT III:CENTROIDS, CENTER OF GRAVITY AND MOMENTS OF INERTIA:

Center of Gravity and Centroid - Area and polar moment of inertia - Radius of Gyration -Parallel and Perpendicular Axis Theorems -Mass Moment of inertia - Problems on centroid and area moment of inertia of plane figures and buildup sections. **(9)**

UNIT IV: KINEMATICS OF PARTICLES

Displacements - Velocity and acceleration - their relationship, relative motion - Curvilinear motion - Kinetics of Particles - Linear and angular momentum - Equations of motion -Energy and momentum methods -Work and energy - Principle of Impulse and Momentum Impact. **(9)**

UNIT V: DYNAMICS OF RIGID BODIES

General plane motion -Velocity and Acceleration- Absolute and Relative motion method - Equilibrium of rigid bodies in plane motion- D'Alembert's Principle - Principle of Work Energy Principle for a rigid body -Principle of impulse momentum for rigid bodies in plane motion. **(9)**

Course Outcomes

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

1. Understand force systems for a particle and rigid body under equilibrium, use free body diagram and resolve forces.
2. Analyze trusses and calculate friction.
3. Determine centroid, center of gravity and moment of inertia of various surfaces and solids.
4. Solve the problems involving kinematics of particles.
5. Solve the problems involving kinetics of rigid bodies

Text Books

1. Ferdinand P. Beer, E. Russell Johnston (2010), Vector Mechanics for Engineers: Statics and Dynamics (9^{th} Edition), Tata McGraw-Hill International Edition.

References

1. S. S. Bhavikatti, (2008), Engineering Mechanics, New Age International.
2. Irving H. Shames, (2003), Engineering Mechanics - Statics and Dynamics, PrenticeHall of India Private limited.
3. S. Timoshenko D.H. Young J.V. Rao, SukumarPati, Engineering Mechanics, McGraw Hill Education; 5^{th} edition

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE102 SURVEYING AND GEOMATICS

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

This course is designed to introduce the fundamental concepts of surveying. Different measurement methods such as chain, compass, plane table and leveling and also, the various advanced measuring methods like trigonometric levelling, traverse surveying, and curves is included. Furthermore, in this course introduction to advanced surveying methods like GPS, GIS, introduction to Geodetic Surveying and total station surveying is also included.

Course Objectives

1. To apply knowledge of mathematics, science, and engineering to understand the measurement
2. techniques and equipment used in land surveying
3. To Prepare the student to plan and conduct field work and application of scientific methodology in handling field samples.
4. To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
5. To develop the skills in surveying and thematic mapping.

UNIT I

INTRODUCTION TO SURVEYING: Principles of surveying; Maps - scale, coordinate system; Survey stations, Survey lines- ranging, bearing of survey lines, levelling: Distance and angle measurement;Errors and their adjustments; Plane table surveying; Principles of levelling- booking and reducing levels; Classifications of direct levelling methods; Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses. **(9)**

UNIT II

TRIANGULATION AND TRILATERATION: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation -network-Signals. Baseline - choices - instruments and accessories - Satellite station - reduction to centre - Intervisibility of height and distances **(9)**

UNIT III: CURVES

Elements of simple and compound curves; Method of settingout- Elements of Reverse curve; Transition curve - length of curve - Elements of transition curve; Vertical curves. **(9)**

UNIT IV: MODERN FIELD SURVEY SYSTEMS

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments,Total Station - Parts of a Total Station - Accessories -Advantages and Applications,; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations. **(9)**

UNIT V: REMOTE SENSING & GIS

Introduction to GIS, different GIS software, basic data types and coordinate systems, Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: types of resolutions, platforms and sensors; visual image interpretation; digital image processing. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Apply the knowledge, techniques, skills, and applicable tools for surveying activities.
2. Determine the horizontal and vertical angles of real world boundaries and points.
3. Understand the different types of curves at field.
4. Understand apply the basics of modern survey instrument for surveying and mapping purpose.
5. Apply the knowledge of Remote Sensing and in the field of surveying.

Text Books

1. Surveying and Levelling Parts 1 & 2 by T.P.Kanetkar and S.V.Kulkarni.
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

Reference Books

1. Elements of Geomatics by P.R. Wolf.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
3. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
4. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
5. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
6. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE103 MECHANICS OF FLUIDS

L	T	P	C
3	1	0	4

Course Prerequisites: 18MAT101, 18MAT102

Course Description

Properties of fluids; fundamental laws of fluids in motion; differential and integral expressions for conservation of mass, momentum and energy; applications of conservation laws to solve the transport phenomena involving mass, momentum and energy interactions in a given system, Dimensional analysis and similarity, Flow in pipes.

Course Objectives

1. To provide a basic understanding of the properties and behavior of matter (fluids) by means of analytical equations.
2. To develop an understanding about hydrostatic and dynamics law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
3. To measure the flowusing Bernoulli equation, flow through pipes, boundary layer flow and flow past immersed bodies.
4. To provide a basic knowledge on the importance of dimensional analysis and similarity techniques.

UNIT I : FLUID PROPERTIES

The Concept of a Fluid - Classification of fluid flows - System & Control volume - Dimensions and Units -Density - Specific gravity - Thermodynamic Properties of a Fluid - Viscosity - Surface Tension - Capillarity - Coefficient of compressibility - Coefficient of volume expansion - Vapor pressure and Cavitation. Lagrangian and Eulerian descriptions - material derivative - velocity and acceleration field - streamlines - pathlines and streaklines - vorticity and circulation. **(12)**

UNIT II : FLUID STATICS

Pressure at a point - Barometer and atmospheric pressure - Manometer - Introduction to fluid statics - Hydrostatic forces on submerged plane surfaces - hydrostatic forces on submerged curved surfaces - Buoyancy and stability - Fluids in rigid body. **(12)**

UNIT III : FLUID KINEMATICS AND DYNAMICS

Methods of describing fluid motion - types of fluid flow - discharge - continuity equation - velocity and acceleration - potential function and stream function - types of motion and vertex flow - equations of motion - Euler's equation - Bernoulli's equation - applications of Bernoulli's equation - Momentum equation - free liquid Jets - Venturimeter - Orifices and Mouthpieces. **(12)**

UNIT IV : OPEN CHANNEL AND PIPE FLOW

Laminar and turbulent flows - Laminar flow in pipes - Turbulent flow in pipes - Minor losses - static - dynamic and stagnation pressures - HGL - EGL - Open Channel flow- Classification - Chezy's formula - Specific energy - Uniform and varied flow - most economical sections - Hydraulic jump. **(12)**

UNIT V : BOUNDARY LAYER THEORY

Boundary layer (BL) - concepts - drag force on plate due to BL -Turbulent Boundary layers - BL separation - control of boundary layer - flow around submerged objects-Drag and Lift-Magnus effect. Dimensional and model analysis: Buckingham's π theorem - model analysis - dimensionless number - scales ratios for distributed models. **(12)**

Course Outcomes

The students after completing the course will be able to:

1. Calculate common fluid properties and explain the effects of fluid compressibility.Use the concepts of viscosity and surface tension.
2. Determine the pressure at various locations in a fluid at rest
3. Understand the concepts in fluid kinematics and dynamics.
4. Calculate pressure and head losses in a pipeline and in pipe networks and understand basic concepts of open channel flow.
5. Calculate boundary layer parameters for flow past a flat plate and calculate lift and drag forces for various objects.

Text Books

1. Yunus A Cengel and John M Cimbala, "Fluid Mechanics Fundamentals and Applications" (SI Units), Tata McGraw-Hill Education, 3rd Edition, 2017.

Reference Books

1. R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines (SI Units), Laxmi Publication
2. Frank M White, "Fluid Mechanics", Tata McGraw-Hill, 7^{th} Edition, 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE201 CONSTRUCTION TECHNOLOGY LABORATORY

L	T	P	C
0	**0**	**3**	**1.5**

Course Prerequisites: None

Course Description

The course will provide knowledge and skills of construction material and technologies.

Course Objectives

1. To provide an opportunity to learn how to construct the masonry walls with different bonds.
2. To learn the principles and procedures of marking the building plan in site.
3. To gain the knowledge of reinforcement in different structural elements.
4. To become familiar with plumbing, wiring, sanitary supply, paints etc.

Experiments

1. Construction of Bonds: English and Flemish bonds.
2. Marking of building plan in site.Setting out buildings.
3. Demonstration of different types of doors, windows and ventilators.
4. Study on different types of roofs.
5. Bar Bending schedule.
6. Study on Reinforcement details of Beams, Columns and slabs.
7. Study on Plumbing, sanitary application, wiring etc.,
8. Study on paints and painting methods.
9. Demonstration of models of Shoring and Underpinning.
10. Centering - Materials and methods.

PROJECT BASED LEARNING

Different buildings will be alotted to the students divided in batches and they will have to study various details related those buildings and submit report at the end.

Course Outcomes

1. Understand the construct of masonry walls with different bonds.
2. Mark the building plan in site.
3. Understand the different types of doors, windows, ventilators and reinforcement in different structural elements.
4. Prepare the Bar Bending schedule
5. Identify the equipment used for plumbing, wiring, sanitary supply, paints etc., in construction of building.

Reference Books

1. Duggal, S.K., Building material, New Age International Publishers, Second Edition.
2. Punmia, B.C, Ashok Kumar Jain and Arun Kumar Jain., Building Construction - Laxmi Publications (P) ltd., New Delhi.
3. Varghese, P.C, Building Construction, Prentice-Hall of India private Ltd, New Delhi.
4. Arora, S.P. and Bindra, S.P., Building Construction, DhanpathiRai Publications.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

18CE202 SURVEYING AND GEOMATICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: None

Course Description

This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes and elevations.

Course Objectives

1. To Use different surveying instruments for field measurements and apply knowledge to resolve various field challenges through suitable techniques.
2. To understand the differences in the field and office works.
3. To represent field measurements into a document form
4. To Perform calculations in obtaining necessary requirements from the data obtained during field work

LIST OF EXERCISES

1. Determination of distance between two inaccessible points with compass.
2. Surveying of a given area by prismatic compass (Closed traverse) and plotting after adjustment.
3. Radiation method and intersection methods by plane Table survey
4. Fly leveling (differential leveling)
5. Study of theodolite in detail - practice for measurement of horizontal and vertical angles.
6. Measurement of horizontal angles by method of repetition and reiteration.
7. Heights and distance using Principles of tachometric surveying (Two Exercises) [one plane andtwo plane methods]
8. Setting out works for buildings.
9. Determine of area using total station
10. Traversing using total station
11. Contouring using total station
12. Determine remote height using total station

LIST OF MAJOR EQUIPMENT

1. Chains, Tapes, Ranging Rods (2M and 3M), Cross Staff, Arrows
2. Compasses and Tripods, Optical square.
3. Plane tables, Alidade, Plumbing fork, trough compasses.
4. Leveling instruments and leveling staves.
5. Box sextants, planimeter.
6. Theodolites, and leveling staffs.
7. Total station.
8. GPS

Course Outcomes

The students after completing the course will be able to:

1. Use different surveying instruments by identifying suitable instrument to perform field measurements.
2. Resolve various field challenges through right surveying method.
3. Produce drawings and reports from field work.
4. Perform calculations in obtaining necessary requirements from the data obtained during field work.
5. Use total station for different surveying purposes

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

URLs

1. NPTEL `http://nptel.ac.in/courses/105107122/home.htm`
2. Video Lectures, IIT Kanpur
   Online Course `http://freevideolectures.com/Course/98/Surveying`
3. `http://www.aboutcivil.org/surveying-levelling%20II.html`

18CE203 MECHANICS OF FLUIDS LABORATORY

L	T	P	C
0	**0**	**3**	**1.5**

Course Prerequisites: None

Course Description

The course includesCalibration of flow meters; Bernoulli's apparatus;performance of turbines andpumps; various losses through pipes.

Course Objectives

Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS (any 10 experiments from the list)

1. Determination of Coefficient of discharge for Venturimeter
2. Determination of Coefficient of discharge for Orifice meter.
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable headmethod.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes
9. Performance test on Pelton wheel turbine.
10. Performance test on Francis turbine
11. Efficiency test on centrifugal pump
12. Efficiency test on reciprocating pump

LIST OF EQUIPMENTS

1. Venturimeter setup
2. Orifice meter setup.
3. Small orifice setup.
4. External mouthpiece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Pelton wheel and Francis turbines.
10. Centrifugal and Reciprocating pumps.

Course Outcomes

The students after completing the course will be able to:

1. Use flow measurement instruments and notches.
2. Apply Bernoulli's equation to find the losses in pipe and discharge.
3. Perform the test on pumps and turbines to find their efficiency.
4. Prepare reports on the data collected and use graphical techniques to interpret the data.
5. Use pumps and turbines for supply of water and power generation for the benefit of society

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B.Tech. II Year-II Semester

18HUM102 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: None

Course Description

The course provides students with a practical and concrete explanation of management concepts and techniques they will need to manage today's and tomorrow's organizations. The course will follow the "planning, organizing, leading, controlling" format of managerial functions while putting together many small pictures presented by individual modules into one bigger meaningful picture in which managerial knowledge would apply. At the end of the course students are expected to understand role of components of bigger picture and interactions between and among components.

Course Objectives

The course is intended to

1. Describe the concepts of Management theories, approaches and their application with organizations around us;
2. Know the concepts of planning and management;
3. Explain the basic concepts of organization, types and structure of organization;
4. Make the students know leading, good communication, theories of motivation; and
5. Explain about controlling, managing operations and functional areas of marketing and financial management.

UNIT I

INTRODUCTION: Introduction to Management and Organizations- Management definition, skills, roles, goals and functions of a manager, organization, value of studying management - Managing in a Global Environment- Global Perspective, Understanding global environment, - Social Responsibility and Managerial Ethics. **(9)**

UNIT II

PLANNING: Decision-making process, Types of decisions and decision making conditions, styles, biases and errors, Planning: Meaning of planning, establishing goals and developing plans, contemporary issues in planning - Strategic Management-Importance of strategic management, strategic management process, types of organizational strategies, current issues in strategic management. **(9)**

UNIT III

ORGANIZING: Organizational structures - HRM process, Contemporary issues in HRM Departmentation- decentralization- delegation of Authority - Managing Change and Innovations. **(9)**

UNIT IV

COMMUNICATION, MOTIVATION AND LEADING: Functions of communication, Inter-personal communication, Barriers of Communication-Understanding Information Technology-Motivation: Theories of motivation and current issues in motivation. Leading: Leaders and Leadership, Leadership theories - Leadership issues in twenty first century. **(9)**

UNIT V

CONTROLLING: Process of control-Types of Control - feed-forward, concurrent and feedback controls, contemporary issues in control-Strategic role of Operations Management - Value Chain Management. **(9)**

Course Outcomes

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

1. Understand the various concepts, approaches and theories of management in the real situation.
2. Analyze the concept of planning and apply on the decisions in strategic management.
3. Compare organization structure designs and chart diligently with theoretical learning concepts.
4. Apply communication and theories of motivation in an organization.
5. Understand various tools for controlling organizational performance and apply to achieve the corporate objectives.

Text Books

1. Stephen P. Robbins, Mary Coulter "Management", Pearson Education, 2010, 10^{th} edition.

Reference Books

1. Gary Dessler, "Management", Prentice Hall, Inc., 1998, 1^{st} edition.
2. Daft Richard L. "Management"Thomson South Western, 5^{th} edition.
3. Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int. ed., 2004, 6^{th} Edition.

Mode of Evaluation: Assignment, Seminar, Written Examination.

18MAT104 PROBABILITY AND STATISTICS

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18MAT101, 18MAT102

Course Description

This course provides an introduction to probability, distributions and statistics with applications. Topics include: Conditional probability, Random variables, Probability distributions, Joint densities, Bayesian inference, Hypothesis testing, Confidence intervals, Correlation and linear regression.

Course Objectives

1. To revise the elementary concepts of probability
2. To extend and formalize knowledge of the theory of probability and random variables.
3. To analyze and interpret basic summary and modeling techniques for Multi-variate data
4. To introduce techniques for carrying out probability calculations and identifying probability distributions.
5. To understand the foundations for statistical inference involving confidence intervals and hypothesis testing.

UNIT I: BASIC PROBABILITY

Introduction to Probability - sample space and events - Axioms of probability - theorems on probability - conditional probability - multiplication theorem and independence of events - Bayes theorem. **(9)**

UNIT II: RANDOM VARIABLES & EXPECTATION

Random Variables - Types of Random Variables - Probability Mass Function - Probability Density Function- Distribution Function and its properties-. Expectation - Properties of Expected Value - Variance - Moment generating function- Chebychev's inequality. **(9)**

UNIT III: BI-VARIATE RANDOM VARIABLES

Joint Densities and Independence - Marginal Distributions (discrete & continuous)- Transformation of Random Variables - Conditional Distributions and Expectations - Covariance-Correlation - Multiple Linear Regression Models. **(9)**

UNIT IV: PROBABILITY DISTRIBUTIONS

Discrete Distributions: Bernoulli trail - Binomial distribution - Poisson approximation to the binomial distribution - Poisson distribution and Hyper geometric distribution - properties.
Continuous Distributions: Uniform distribution - Exponential distribution - Gamma distribution - Normal distribution. **(9)**

UNIT V: HYPOTHESIS TESTING

Point and interval estimation - Hypothesis Testing - Introduction - Significance Levels - Tests Concerning the Mean of a Normal Population (σ know and unknown) - Testing the Equality of Means of Two Normal Populations - Case of Unknown and Unequal Variances - The Paired t-Test - Hypothesis Tests Concerning proportions. **(9)**

Course Outcomes

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

1. Understand the probability concepts and their importance in engineering.
2. Apply discrete and continuous probability distributions to solve various engineering problems.
3. Get an idea about joint density functions, distribution functions to the random variables and analyze the multivariate problems in engineering
4. Apply the method of least squares to estimate the parameters of a regression model.
5. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.

Text Books

1. Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Elsevier, Academic Press, 2010.

Reference

1. J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, 4th edition, 2003 Tata McGraw-Hill Publications.
2. Walpole, R.E., Myers R.H., Myer S.L., Ye. K: Probability and Statistics for Engineers and Scientists, 8^{th} Ed., Pearson Education, 2008.
3. Johnson, R.A. Miller Freund's: Probability and Statistics, 7^{th} Edition, PHI, 2005.
4. Sheldon Ross: A First Course in Probability, 6^{th} Edition, Pearson Education, 2002.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE104 ENGINEERING HYDROLOGY

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18MAT104, 18CE103

Course Description

The course covers Hydrological cycle, Measurement of precipitation and various losses, Infiltration, Evaporation, Runoff and its measurement, Stream Flow Measurement, Hydrographs, Concept of Unit Hydrographs and its use in practical field, Estimation and Prediction of Floods, Wells and aquifers, well discharge.

Course Objectives

1. To introduce the basics/fundamentals of hydrological cycle, precipitation, runoff, evaporation and other losses,
2. To introduce the concepts of Hydrographs and their use.
3. To measure and predict runoff and flood
4. To understand the concepts in flood and well hydraulics

UNIT I: HYDROLOGIC CYCLE AND PRECIPITATION

Introduction - hydrologic cycle - watershed and water-budget equation - history of hydrology - world water balance - applications in engineering,
Precipitation - forms of precipitation - characteristics of precipitation in India - measurement of precipitation - rain gauge network - mean precipitation over an area - depth-area-duration relationships - maximum intensity/depth-duration-frequency relationship - Probable Maximum Precipitation (PMP) - rainfall data in India. **(9)**

UNIT II: ABSTRACTION FROM PRECIPITATION

Eaporation process - evaporimeters - evapotranspiration - measurement of evapotranspiration - evapotranspiration equations - potential evapotranspiration over India - actual evapotranspiration - interception - depression storage - infiltration - infiltration capacity - measurement of infiltration - modelling infiltration capacity - classification of infiltration capacities - infiltration indices. **(9)**

UNIT III

RUNOFF MEASUREMENT-Surface Runoff Models - SCS-CN method of estimating runoff volume - flow-duration curve - flow-mass curve,
STREAM FLOW MEASUREMENT: Measurement of Stage and Velocity - Direct and Indirect methods - Stage-Discharge relationships-Rating curve - Extrapolation of rating curve.
HYDROGRAPHS: hydrograph - factors affecting runoff hydrograph - components of hydrograph - base flow separation - effective rainfall - unit hydrograph - S-Curve - Instantaneous UH - Synthetic UH. **(9)**

UNIT IV: FLOODS

FLOOD ESTIMATION: Flood Estimation by Rational method - empirical method - Unit Hydrograph Method - Flood frequency studies: Gumbel's method - Log-Pearson Type III Distribution

FLOOD HYDRAULICS: Basic Equations - Flood Routing-Reservoir routing - Channel routing - Hydrologic Storage Routing - Attenuation - Hydrologic Channel Routing - Muskingum Method - Runge Kutta Method **(9)**

UNIT V: WELL HYDRAULICS

Well Hydraulics: Introduction-Forms of Subsurface water - Aquifer Properties - Compressibility - Equation of Motion - Wells - Steady flow into well - Unsteady flow in a confined aquifer - Well Losses - Specific capacity - Ground water recharge **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Estimate the areal average precipitation over the basin using the knowledge of hydrological cycle.
2. Identify losses and calculate runoff excluding the initial losses.
3. Measure runoff and stream flow, use hydrograph to estimate runoff.
4. Estimate flood using flood routing techniques.
5. Estimate ground water flow under various circumstances.

Text Books

1. V. T. Chow, D. R. Maidment, and L. W. Mays; Applied Hydrology, McGraw Hill International Editions

Reference Books

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc- Graw Hill.
3. G L Asawa, Irrigation Engineering, Wiley Eastern
4. L W Mays, Water Resources Engineering, Wiley.
5. J D Zimmerman, Irrigation, John Wiley & Sons
6. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE105 CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

This course covers ingredients of concrete and admixtures,properties of fresh concrete and hardened concrete, testing of hardened concrete and mix design. The course further covers special concretes used in construction industry.

Course Objectives

1. The main aim of this course is to explain properties of ingredients of concrete admixtures and procedures for testing concrete ingredients.
2. To make the student to understand fresh and hardened characteristics of concrete and also to enable the students to identify different mix design procedures and produce concrete mix proportions.
3. To explains the characteristics of emerging concretes.

UNIT I

CEMENTS & ADMIXTURES: Portland cement - chemical composition - Hydration, Setting of cement - Structure of hydrate cement - Test on physical properties - Different grades of cement - Admixtures - Mineral and chemical admixtures.
AGGREGATES: Classification of aggregate - Particle shape & texture - Bond, strength & other mechanical properties of aggregate - Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate - Bulking of sand - Deleterious substance in aggregate - Soundness of aggregate - Alkali aggregate reaction - Thermal properties - Sieve analysis - Fineness modulus - Grading curves - Grading of fine & coarse Aggregates - Gap graded aggregate - Maximum aggregate size. **(9)**

UNIT II

FRESH CONCRETE: Workability - Factors affecting workability - Measurement of workability by different tests - Setting times of concrete - Effect of time and temperature on workability - Segregation & bleeding - Mixing and vibration of concrete - Steps in manufacture of concrete - Quality of mixing water.
HARDENED CONCRETE: Water / Cement ratio - Abram's Law - Gel space ratio - Nature of strength of concrete - Maturity concept - Strength in tension & compression - Factors affecting strength - Relation between compression & tensile strength - Curing.. **(9)**

UNIT III

TESTING OF HARDENED CONCRETE: Compression tests - Tension tests - Factors affecting strength - Flexure tests - Chemical analysis of hardened concrete.
ELASTICITY, CREEP & SHRINKAGE: Modulus of elasticity - Dynamic modulus of elasticity - Posisson's ratio - Creep of concrete - Factors influencing creep - Relation between creep & time -Nature of creep - Effects of creep - Shrinkage - types of shrinkage.. **(9)**

UNIT IV

MIX DESIGN: Factors in the choice of mix proportions - Durability of concrete - Quality Control of concrete - Statistical methods - Acceptance criteria - Proportioning of concrete mixes by various methods - methods of mix design.. **(9)**

UNIT V

SPECIAL CONCRETES: Light weight aggregates - Light weight aggregate concrete - Cellular concrete - No-fines concrete - High density concrete - Fibre reinforced concrete - Different types of fibers - Factors affecting properties of F.R.C - Applications - High performance concrete - Self consolidating concrete - SIFCON.. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Identify different properties of concrete ingredients and estimate the properties through various test procedures.
2. Explain the basic characteristics of fresh and hardened concrete
3. Test the mechanical properties of hardened concrete.
4. Design the concrete mix as per various international codes.
5. Explain the characteristic and applications of special concrete.

Text Books

1. Neville, A.M., Properties of Concrete, Low priced Edition, 4th edition.
2. Shetty, M.S., Concrete Technology, S.Chand & Co, 2004.

Reference Books

1. Gambhir, M.L., Concrete Technology, Tata Mc. Graw Hill Publishers, New Delhi.
2. Santha Kumar, A.R., Concrete Technology, Oxford university Press, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE106 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: 18CHE101, 18CE103

Course Description

The course covers demand, quality, treatment and distribution of water along with characterization, collection, low cost treatment of waste water and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included. Further the course also covers basic laboratory

Course Objectives

1. To explain water quality standards, treatment, distribution of water and design of various water treatment units.
2. To analyze the characteristics of wastewater and design various units of sewage treatment system.
3. To design various low cost wastewater treatment system and sludge disposal units.
4. To explain various impacts of air and noise pollution and various methods to control them air and noise pollution
5. To describe about solid waste generation, characterization, impacts and various management techniques

UNIT I: WATER TREATMENT

Water- Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demands, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs, water treatment plant layout and design of various treatment units. **(9)**

UNIT II: SEWAGE TREATMENT

Sewage- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes. **(9)**

UNIT III: LOW COST WASTEWATER AND SLUDGE TREATMENT

Working principle of oxidation ponds, oxidation ditches, design of - septic tanks, soak pits and Imhoff tanks, Sludge characterization, sludge thickening, sludge digestion, factors affecting sludge digestion, Biogas recovery, various methods of sludge conditioning, dewatering and disposal. **(9)**

UNIT IV: AIR AND NOISE POLLUTION

Air - Composition and properties of air, urban air pollution, Air quality standards, Measures and major equipment for air pollution control, Noise - Basic concept, measurement and various noise control methods. **(9)**

UNIT V: SOLID WASTE MANAGEMENT

Solid waste management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle, Disposal methods. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Estimate water demand and design various units of surface water treatment plant
2. Estimate sewage generation and perform basic design of the unit operations that are used in sewage treatment.
3. Explain various low cost wastewater and sludge treatment techniques
4. Describe the impacts of air and noise pollution and review various air and noise pollution control methods
5. Discuss about the impacts of solid waste and various solid waste management techniques

Text Books

1. Garg, S. K., Water Supply Engineering, Khanna Publishers, 2008.
2. Garg, S. K., Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2008.
3. Rao M and Rao H. V. N. Air Pollution, McGraw Hill Education, 2017.
4. Jagbir Singh and Ramanathan A. L., Solid Waste Management: Present and Future Challenges, I K International Publishing House Pvt. Ltd., 2009
5. Advanced Air and Noise Pollution Control

Reference Books

1. Birdie, G.S, Birdie, J.S., Water supply and sanitary Engineering, Including Environmental Engineering, Water and Air Pollution Laws and Ecology, Dhanpat Rai Publications, 1996.
2. Punmia, B.C, Ashok Kr Jain, Arun Kr Jain., Waste Water Engineering, Laxmi Publications, 1998.
3. Peavy, H., Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985
4. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
5. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE107 STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101

Course Description

This course covers simple stresses and strains, shear force and bending moment for determinate beams, flexural and shear stresses. Furthermore, this course includes principal stresses and strains, torsion of circular shafts, direct and combined stresses, columns and struts.

Course Objectives

1. To understand the nature of stresses and strains developed in simple geometries
2. To understand the concepts of shear force and bending moment
3. To understand concept of flexural and shear stresses
4. To understand the effect of torsion on shafts, combined stresses and strains
5. To understand the deflection of different types beams subjected to different loading conditions

UNIT I : SIMPLE STRESSES AND STRAINS

Concept of stress and strain- Types of stresses and strains- St. Venant's principle, Elasticity and plasticity - Hooke's law - Stress - Strain diagram for mild steel - Working stress - Factor of safety - Lateral strain, Poisson's ratio and volumetric strain - Elastic moduli and the relationship between them - Bars of varying section - composite bars - Temperature stresses. Strain Energy - Resilience - Gradual, sudden, impact and shock loadings - simple applications. **(9)**

UNIT II : SHEAR FORCE AND BENDING MOMENT

Concept of Shear Force (SF) and Bending Moment (BM) - SF and BD diagrams for Cantilever and Simply supported and Overhanging beams (One side and both sides) under point load(s) (Vertical and Inclined), part and whole Uniformly Distributed Load(s), Uniformly Varying Load(s) and moment(s) -Calculation of maximum value and its location of SF and BM for all above load cases- Analyzing the basic problems from SF diagram.
COLUMNS AND STRUTS - Axially loaded compression members- Crushing load and Buckling load - Euler's theory for long columns- Rankine's theory. **(9)**

UNIT III : FLEXURAL AND SHEAR STRESSES

BENDING STRESSES: Assumptions - Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis - Determination of bending stresses - Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle, Channel sections and built-up sections - Design of simple beam sections.Shear Stresses- Derivation of shear stress formula - Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, Built-up sections. **(9)**

UNIT IV : TORSION AND COMPOUND STRESSES AND STRAINS

TORSION: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.
COMPOUND STRESSES AND STRAINS: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress and their applications, Two dimensional stress-strain system, principal strains and principal axis of strain **(9)**

UNIT V : DEFLECTIONS OF BEAMS

Slope and deflection- Relationship between moment, slope and deflection, Determine slopes and deflections of the determinate beams (Simply supported and Cantilever) using Double integration method, Macaulay's method, Moment area method and Conjugate beam method. **(9)**

Course Outcomes

1. Understand the concepts of stress and strain in mechanics of solids
2. Analyse the beams to find shear force and bending moment
3. Analyse bending and shear stresses for different types of beams with different sections
4. Analyse structural members subjected to torsion, compound stresses and strain.
5. Compute deflections of various beams

Text Books

1. S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Company
2. R K Rajput, Strength of Material, S Chand Publications

Reference Books

1. Beer, F. P., Johnston, E. R. and DeWolf, J. T., Mechanics of Materials, Third Edition, McGraw- Hill International Edition, 2002.
2. Lardner, T. J, Archer, R. R., Mechanics of Solids, an introduction, International Edition, McGraw-Hill, 1994.
3. Shames, I. H., Introduction to Solid Mechanics, 2nd Edition, Prentice Hall of India Private Ltd. New Delhi, 1980.
4. Vaidyanathan R., Perumal P. and Lingeswari S., Mechanics of Solids and Structures, Volume I, Laxmi Publications (P) Ltd., New Delhi II, First Ed. 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18ENG201 ENGLISH COMMUNICATION - LISTENING & SPEAKING LABORATORY

(Common to all branches)

L	T	P	C
0	**0**	**3**	**1.5**

Course Prerequisites: 18ENG101

Course Description

As the students are being exposed to the global language 'English; it has become a widespread need. This course builds on what was offered in the first semester and facilitates deeper understanding into the mechanics of the English language, especially in regard to two particular skills, i.e. Listening and Speaking. This course is offered in order to help students cultivate and nurture a mind that "thinks in English." Intricate issues of pronunciation, modulation, timbre are dealt with in regard to Speaking and also the sub-skills of Listening, thus the whole course is entirely lab oriented.

Course Objectives

This course enables students to:

1. Hone in on their listening skills
2. Grasp the differences between native level and mother-tongue influenced pronunciation.
3. Develop crucial speaking skills.
4. Enhance vocabulary for greater communicative impact.
5. Overall development of thinking in the English language.

UNIT I:

Listening - Understanding key vocabulary - Listening for main ideas - Listening in detail - Syllable stress - Sentence stress - Presentation.

UNIT II:

Vocabulary for important places (bank, library, restaurant, etc.) - Prepositions for places - Stress determiners (this & that) - Intonation.

UNIT III:

Using background knowledge - Collocations - Pronouncing clusters of consonants (e.g. -gh, -ing, ph, ck) - Mapping ideas - Pronunciation of phrases - Listening for opinion - Vocabulary and collocations for jobs.

UNIT IV:

Listening for lecture organization - Text organization features - Phrases with make - Evaluating and proposing ideas - Expressing attitudes.

UNIT V:

Identifying opposing viewpoints - Silent letters - Idioms - Fixed expressions - Phrasal verbs.

Course Outcomes

At the end of the course, learners will be able to:

1. Listening with intent
2. Pronounce more fluently
3. Develop crucial thinking skills
4. Enhance vocabulary
5. Overall development in the English language

Suggested Reading/Textbook

1. Sabina Ostrowska; Unlock 3 series(B1): Listening & Speaking; Published by: Cambridge University Press.

Reference

1. Gary Buck; Assessing Listening; Cambridge University Press, 2010.
2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Upper Intermediate (B2+); Published by: Cambridge University Press.
3. Josh Sreedharan; The Four Skills for Communication; Cambridge University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006.
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006.
6. Miles Carven; Listening Extra; Cambridge University Press, 2008.
7. Jayashree Mohanraj; Speak Well; Orient Blackswan, 2013.
8. F. Kipple; Keep Talking; Cambridge University Press, 2013.
9. www.cambridgeenglish.org/in/
10. https://learnenglish.britishcouncil.org/en/english-grammar
11. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

18CE204 ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: None

Course Description

This course covers laboratory experiments to predict the water and wastewater quality. The experiments include determination of water quality and estimation of chemicals required to treat the wastewater.

Course Objectives

1. To conduct experiments to determine the concentrations of various contaminants in water and wastewater.
2. To determine the amount of coagulant required to treat surface water.

LIST OF EXPERIMENTS (Any 8 out of the total)

1. Determination of pH, Conductivity and Turbidity of water sample
2. Determination of alkalinity of water samples
3. Determination of hardness of water samples
4. Analysis of solids content of water: Dissolved, suspended, total, volatile, inorganic etc.
5. Determination of optimum coagulant dose by jar test apparatus.
6. Determination of Iron.
7. Determination of Chloride concentration
8. Determination of Dissolved Oxygen of water
9. Determination of Phosphates from wastewater
10. Determination of Biochemical Oxygen Demand of wastewater
11. Determination of Chemical Oxygen Demand
12. Determination of Break point Chlorination.

LIST OF EQUIPMENTS

1. pH meter,
2. Turbidity meter,
3. Conductivity meter,
4. Hot air oven,
5. Muffle furnace,
6. Dissolved Oxygen meter,
7. UV visible spectrophotometer,
8. COD Open Reflux Apparatus,
9. Jar Test Apparatus,
10. BOD incubator.

Course Outcomes

The students after completing the course will be able to:

1. Analyse the contaminants in water and wastewater quality and compare it with prescribed standards
2. Estimate the quantity of chemicals required to treat the water.
3. recommend for the suitability of water for drinking, construction, agriculture etc.
4. Demonstrate the knowledge of water treatment methods for safety of society
5. Treatment of wastewater generated from various activities such as domestic, industry, etc.

Text Books

1. Clair Sawyer, Perry McCarty and Gene Parkin "Chemistry for Environmental Engineering and Science" Mc GraHill, 2003.
2. Standard Methods for Analysis of Water and Wastewater - APHA.
3. Dr. Kotaiah, G. and Dr. KumaraSwamy, N., "Environmental Engineering Lab Manual", Charotar Publishers, Anand, 2004.

References

1. Relevant IS Codes.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

18CE205 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: None

Course Description

This course covers the different tests that are necessary for any structure before construction. The materials to be tested in the laboratory are MS steel, HYSD steel, Wood, Concrete/Brick, springs.

Course Objectives

1. To understand the behavior of materials under different types of loading.
2. To find tensile strength, compressive strength, bending strength and shear strength of the supplied specimen.
3. To find the hardness of different materials
4. To find the modulus of elasticity and modulus of rigidity of the materials
5. To find the strain energy required to break the specimen.

LIST OF EXPERIMENTS

1. Tension test on HYSD bar.
2. Bending test on (Steel/Wood) Cantilever beam
3. Bending test on simply supported beam.
4. Torsion test
5. Hardness test (Rockwell/Brinell).
6. Compression test on wood or concrete.
7. Shear test
8. Impact test (Izod and Charpy)
9. Verification of Maxwell's Reciprocal theorem on beams.
10. Continuous beam - deflection test.
11. Spring test.
12. Use of electrical resistance strain gauges.

LIST OF EQUIPMENTS

1. UTM for conducting tension test on rods
2. Steel or Wooden beam for flexure test
3. Torsion testing machine
4. Brinell /Rock well hardness testing machine
5. Spring testing machine
6. Compression testing machine
7. Izod / Charpy Impact machine
8. Beam setup for Maxwell's theorem verification.
9. Electrical Resistance gauges
10. Continuous beam setup

Course Outcomes

The students after completing the course will be able to:

1. Determine the tensile and shear strength of various types and grades of ductile materials
2. Examine the compressive strength of various types of brittle materials
3. Analyse the deflections at various positions along the length of the beam for different types of beams/spring and correlate it with existing theorems
4. Determine the torsional properties of ductile materials
5. Examine the hardness and impact value for different kinds of metals

Text Books

1. Moondra, H. S., and Gupta R., Laboratory Manual for Civil Engineering, CBS Publication, 2013

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

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B.Tech. III Year-I Semester

18ENG102 ENGLISH COMMUNICATION - READING AND WRITING

(Common to all branches)

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

Course Prerequisites: 18ENG101

Course Description

As the students being exposed to the global language ’English; it has become a widespread need. This course builds on what was offered in the first semester and facilitates deeper understanding into the mechanics of the English language, especially in regard to two particular skills, i.e. Reading and Writing. This course is offered in order to help students cultivate and nurture a mind that "think in English." Intricate issues of understanding academic texts, vocabulary needed to comprehend texts, evaluate and analyze writing tasks, etc.

Course Objectives

This course enables students to:

1. Hone in on their listening skills
2. Cultivate critical reading and writing skills
3. Develop crucial comprehension of texts, graphs and graphics.
4. Enhance vocabulary for greater communicative impact.
5. Overall development in the English language.

UNIT I:

Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Understanding discourse. **(6)**

UNIT II:

Identifying audience; Reading for detail; Using visuals; Academic vocabulary, collocations and synonyms. **(6)**

UNIT III:

Scanning to find crucial information; Using critical thinking to identify purpose; Previewing; Topic related vocabulary; Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion. **(6)**

UNIT IV:

Analyzing essay questions; Writing a problem-solution based on graphs and graphics; Developing own ideas. **(6)**

UNIT V:

Writing cause-effect paragraphs; Evaluating diagrams; Brainstorming; Academic verbs and topical language. **(6)**

Course Outcomes

At the end of the course, learners will be able to:

1. Read and comprehend academic texts, graphs, diagrams and graphics.
2. Develop crucial thinking skills.
3. Write purposefully and effectively.
4. Enhance vocabulary.
5. Overall development in the English language.

Suggested Reading/Textbook

1. Carolyn Westbrook; Unlock 3 series (B1): Reading & Writing; Published by: Cambridge University Press.

Reference

1. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Upper Intermediate (B2+); Published by: Cambridge University Press.
2. Josh Sreedharan; The Four Skills for Communication; Cambridge University Press, 2014.
3. V. Sasikumar,P.Kiranmai Dutt, Geetha Rajeevan; A Course in Listening & Speaking II; Cambridge University Press, 2014.
4. Liz Driscoll; Reading Extra; Cambridge University Press, 2004.
5. Graham Palmer; Writing Extra; Cambridge University Press, 2004.
6. Writing Tutor; Advanced English Learners' Dictionary, 9th Edition; Oxford University Press, 2012.
7. https://www.nypl.org/blog/2012/11/28/11-great-free-websites-practice-english
8. www.readbrightly.com/6-great-websites-teen-writers/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE108 STRUCTURAL ANALYSIS - I

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

Course Prerequisites: 18MAT101, 18MAT102, 18CE101, 18CE107

Course Description

This course includes the basics of Structural analysis including the idealizations of different types of structures, support conditions and its loadings, and analysing the determinate and indeterminate structures using different methods.

Course Objectives

1. To analyse the fixed and continuous beams behaviour of structures in Civil Engineering.
2. To understand the basic concepts and analyse the continuous beams using classical methods.
3. To analyse the deflection od beams using energy methods.
4. To understand the significance of moving loads and influcence lines and its effects on structures.
5. To analyse the three hinged arches, Cables and Suspension Bridges.

UNIT I: FIXED AND CONTINUOUS BEAMS:

Introduction to statically indeterminate beams - Analysis of fixed beam subjected to different types of loading - Deflection of fixed beam - Effect of sinking of support - effect of rotaion of a support - Advantages and Disadvantages - Continuous beams - Clapeyron's theorem of three moments - Analysis of continuous beams with different end conditions and different loadings - Propped Cantilever beams. **(9)**

UNIT II BASIC CONCEPTS IN STRUCTURAL ANALYSIS

Idealised structures - support connections - tributary loading - principle of super position - Determinacy and stability.
CLASSICAL METHODS: Analysis of continuous beams using Slope deflection method - Moment distribution method - Kani's method. **(9)**

UNIT III DEFLECTION USING ENERGY METHODS

External work and strain energy, principle of work and energy, principle of virtual work, method of virtual work - Trusses, beams and frames, virtual strain energy caused by axial load, shear, torsion and temperature; Castigliano's theorem for trusses; Castigliano's theorem for beams and frames, unit load method. **(9)**

UNIT IV ROLLING LOADS

Introduction to rolling loads - Types of loading - simply supported beams - Absolute maximum BM and SF - Equivalent uniformly distributed load.
INFLUENCE LINES: Introduction to influence lines - Influence line diagram for shear and bending moment - Statically determinate beams - Influence lines for forces in truss members. **(9)**

UNIT V THREE HINGED and TWO HINGEDARCHES

Introduction - Hinges - Arch action - Parabolic arches - Eddy's theorem - Problems - Circular arches - Influence lines for three hinged arches - Determination of horizontal and Normal thrust, Bending moment, Radial shear - RIb shortening and tempareture Stresses
CABLES AND SUSPENSION BRIDGES: Introduction - Cables - Suspension bridges - Components and functions -Passing the cable over the pylons - Reactions - Tension and length of suspension cable - Temperature effects - Stiffening griders - Necessity and types. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Analyse the inderteminate beams and develop the ability to investigate the structures in terms of deflection
2. Apply the appropriate method for finding the end moments of indeterminate beams under different loadings
3. Use basic energy-based analysis techniques for analysing structures
4. investigate the forces and its effects on three hinged arches, Cables and Suspension bridges
5. Determine the design forces in a structure like bridges subjected to moving loads.

Text Books

1. Ramamrutham, S., & Narayan, R.,Theory of Structures, Dhanpat Rai Publishing Co. (P.) Ltd., 2017.
2. Menon, D., Structural Analysis, Narosa publishers, 2008.

Reference Books

1. Ghali,A., Nevilee, A.M., & Brown, T.G., Structural Analysis, CRC Press, 2012
2. Wang, C. K., Intermediate Structural Analysis, McGraw Hill, 1989.
3. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, 2007.
4. Hibbler, R. C., Structural Analysis, Pearson Education, 2006.
5. Negi, L. S., and Jangid R.S, Structural Analysis, Tata McGraw Hill, 2006

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE109 GEOTECHNICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: 18MAT101, 18CE101, 18CE103, 18CE107

Course Description

This course covers physical properties of soils, soil classification, soil structure, moisture effects; permeability and seepage, compressibility and consolidation; stress, deformation, Shear strength characteristics; stress distribution and analysis. Further the course also covers basic laboratory experiments.

Course Objectives

1. To establish and understanding of the fundamental concepts of mechanics of granular materials; including the behavior of multiphase materials and their constitutive behavior.
2. To provide students with exposure to the systematic methods for solving engineering problems in soil mechanics.
3. To discuss the basic mechanical principles underlying modern soil mechanics and to create an understanding of assumptions that are inherent to the solution of geotechnical problems.

UNIT I: SOIL FORMATION AND CLASSIFICATION

Soil formation - Types of soils -Three-phase system - phase relationships. Index properties of soils : Moisture content - Specific gravity - In-situ density - Relative density- Grain size analysis - Sieve and hydrometer methods - Plasticity of soils - Consistency limits and indices - I.S. Classification of soils - Sensitivity of soils. **(9)**

UNIT II: PERMEABILITY, EFFECTIVE STRESS AND STRESSES IN SOILS

Permeability of Soil - factors affecting permeability of soil - Determination of coefficient of permeability. Seepage through soils. Effective Stress - Introduction- effective stress principle- effect of water table. Fluctuations of effective stress-effective stress in soils saturated by capillary action- seepage pressure- quick sand condition.
Stresses in soils - Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factor- Isobars- Boussinesq's equation-Newmark's Influence Chart. **(9)**

UNIT III: COMPACTION AND CONSOLIDATION OF SOIL

Compaction of Soil- theory of compaction- laboratory determination of optimum moisture content and maximum dry density. Compaction in field-compaction specifications and field control.
Consolidation of Soil - comparison between compaction and consolidation- primary & secondary consolidation-spring analogy for primary consolidation- interpretation of consolidation test results, Terzaghi's theory of consolidation- final settlement of soil deposits- computation of consolidation settlement and secondary consolidation. **(9)**

UNIT IV: SHEAR STRENGTH OF SOIL

Shear Strength - Mohr circle and its characteristics-principal planes- relation between major and minor principal stresses- Mohr-Coulomb theory- types of shear tests: direct shear test- merits of direct shear test-triaxial compression tests, behaviour of UU- CU and CD tests- pore-pressure measurement, computation of effective shear strength parameters. Unconfined compression test-vane shear test. **(9)**

UNIT V: INTRODUCTION TO FOUNDATION ENGINEERING

Earth pressure theories - Rankine and Coulomb - Types of Foundations - Location and depth of foundation - Bearing capacity of shallow foundation on homogeneous deposits - Terzaghi's formula and BIS formula - Factors affecting bearing capacity - Bearing capacity from in-situ tests (SPT, SCPT and Plate Load). **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Discuss fundamental concepts of mechanics of granular materials; including the behavior of three phase materials.
2. Analyze Permeability of soil and estimate using various field methods and stresses of soil in various conditions.
3. Find compaction and onsolidation of soil using constant and variable head methods.
4. Analyze the shear strength behavior of soil.
5. Design of foudantion and determination of earth pressures.

Text Books

1. Arora, K.R., Soil Mechanics and Foundation Engg, 7th Edition, Standard Publishers and Distributors, Delhi.
2. Punmia B. C., Ashok Kumar and Arun Kumar., Soil Mechanics and Foundation. Laxmi Publications, 17th Ed.

Reference Books

1. Venkataramiah, C., Geotechnical Engineering, New Age International Pvt. Ltd, New Delhi, 2002
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
4. Principles of Foundation Engineering, by Braja M. Das, 7th Edition, Cengage Learning

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE110 WATER RESOURCES AND IRRIGATION

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE103, 18CE104, 18CE107

Course Description

In this course introduction to irrigation engineering, different irrigation methods are included. Further, estimation of quantity of water required for various types of crops, analysis & design of gravity dams and earth dams, estimation of reservoir capacity, canal regulation and cross drainage works are emphasized. In addition to the above spillways and water power engineering are incorporated.

Course Objectives

1. To introduce the concepts of irrigation, its importance and various methods,
2. Learn various components of canal irrigation system e.g. regulation works, headworks, cross drainage works
3. To analyse and learn basic design gravity, earth dams and their components,
4. to understand various causes of failures
5. To know about the hydropower

UNIT I: IRRIGATION

Introduction-Irrigation methods, their merits and demerits-Duty, Delta, Crop and crop seasons - consumptive use of water -evapo-transpiration , - Irrigation efficiencies, Crop water requirements, Field Capacity, Permanent wilting point, Available Moisture, Irrigation Scheduling. Irrigation water quality, Water logging: causes, effects and remedial measures. **(9)**

UNIT II: CANALS

Canal Irrigation System - Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular, and modular outlets. Lining of canals, types of lining.
Canal Regulation Works: Canal falls: Necessity and location of falls - Types of falls - Classification of falls, Canal regulators, off-take alignment - head regulators and cross-regulators - regulator, outlets and escapes. **(9)**

UNIT III

HEADWORK: Barrage-Components-description.
Cross Drainage Works: Introduction - types of cross drainage works - selection of suitable type of cross drainage work - classification of aqueducts and siphon aqueducts.
RESERVOIR PLANNING: Investigations for reservoir planning - selection of site for a reservoir - Zones of storage in a reservoir - Storage capacity, Catchment Yield and Reservoir Yield - Mass inflow curve and demand curve - Calculation of reservoir capacity for a specified yield from the

mass inflow curve - Determination of safe yield from a reservoir of a given capacity - Sediment flow in streams: Reservoir Sedimentation - Life of reservoir. Reservoir sediment control, Reservoir Losses, Economic height of a dam. **(9)**

UNIT IV: DAMS

GRAVITY DAMS: Introduction - Forces acting on a gravity dam - Combination of loading for design, Modes of failure, stability requirements - principal and shear stresses - Stability analysis, Elementary Profile of a Gravity dam - Practical profile of a gravity dam - Limiting height of a gravity dam- High and low gravity dams - Galleries - Stability analysis of non - overflow section of Gravity dam.
EARTH DAMS: Introduction - Types of earth dams - Causes of failure of earth dams - Criteria for safe design of earth dams - Section of an earth dam - Design to suit available materials - Seepage control measures - Slope protection. Seepage through earth dam.
SPILLWAYS: Types of Spillways - Types of Energy Dissipators. **(9)**

UNIT V: HYDROPOWER

Development of hydro power in India - Classification of hydel plants - run off river plants, storage plants and pumped storage plants - low, medium and high head schemes - Investigation and planning - components of hydel schemes, Selection of suitable type of turbine - Power Potential Study - definition of gross head - operating head, effective head - Flow duration curve - Power duration curve - Load duration curve - Load curve - primary power and secondary power - installed capacity, dependable capacity - firm power, secondary power - power factor - load factor - capacity factor - utilization factor and Diversity factor, Hydropower Potentials of India. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Calculate irrigation water demand and schedule irrigation.
2. Plan and design canal irrigation system.
3. Identify head works and various cross drainage works, Plan and fix reservoir capacity.
4. Analyse stability of gravity and earth dams
5. Identify components and operation of hydro power plant.

Text Books

1. S. K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers

Reference Books

1. G L Asawa, Irrigation Engineering, Wiley Eastern
2. L W Mays, Water Resources Engineering, Wiley.
3. J D Zimmerman, Irrigation, John Wiley & Sons
4. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE206 COMPUTER AIDED BUILDING DRAWING LABORATORY

L	T	P	C
0	**0**	**3**	**1.5**

Course Prerequisites: None

Course Description

This course deals with building by laws and regulations of private and public buildings, sign conventions and bonds. Further, in this course the drawings related to doors, windows, ventilators and roofs will be discussed. Drawing of a building using AUTOCAD will also be covered.

Course Objectives

1. To introduce the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

LIST OF DRAWING EXPERIMENTS

1. Buildings with load bearing walls including details of doors and windows.
2. Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500 -700 words.
3. RCC framed structures
4. Reinforcement drawings for typical slabs.
5. Reinforcement drawings for different beams.
6. Reinforcement drawings for columns.
7. Reinforcement drawings for different types of footings.
8. Industrial buildings - North light roof structures - Trusses
9. Perspective view of one and two storey buildings.

Course Outcomes

The students after completing the course will be able to:

1. Develop graphical skills for communicating concepts, ideas and designs of engineering products graphically/ visually as well as understand another person's designs.
2. Get exposure to National standards relating to technical drawings using Computer Aided Design and Drafting practice
3. Develop Parametric design and the conventions of formal engineering drawing
4. Produce and interpret 2D & 3D drawings
5. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.

Text Books

1. Subhash C Sharma & Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 2001", Tata- Mc Graw-Hill Company Limited, New Delhi

Reference Books

1. Sham Tickoo Swapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education
2. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd.,
3. Balagopal and Prabhu (1987), "Building Drawing and Detailing", Spades publishing KDR building, Calicut,
4. (Corresponding set of) CAD Software Theory and User Manuals.
5. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian.
6. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria & Sons,

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

18CE207 CONCRETE TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: 18CE104

Course Description

The course will provide knowledge and skills of concrete material testing.

Course Objectives

1. To gain experience regarding the determination of properties of different building materials.
2. To provide an opportunity to learn how to measure the parameters which governs the quality of the materials,
3. To learn the principles and procedures of testing concrete materials and to get hands on experience by conducting the tests and evolving inferences.

LIST OF EXPERIMENTS

Aggregate:

1. Specific Gravity and Water Absorption of aggregates.
2. Sieve analysis of coarse and fine aggregates
3. Bulk density for aggregates
4. Bulking of sand

Cement:

5. Normal Consistency of cement
6. Fineness of cement.
7. Initial setting time and final setting time of cement.
8. Specific gravity and soundness of cement.
9. Compressive strength of cement mortar cube.

Concrete:

10. Workability test on concrete by compaction factor, slump, Vee-bee and flow table.
11. Young's modulus and compressive strength of concrete.
12. Non-Destructive testing on concrete (for demonstration)

Special concretes:

13. Tests on Self Compacting Concrete
14. Tests on Recycled aggregate concrete.

Brick:

15. Compressive strength of brick
16. Water absorption of brick
17. Efflorescence of brick

LIST OF EQUIPMENT

1. Pycnometers.
2. Vicat's apparatus
3. Specific gravity bottle.
4. Le-chatelier's apparatus.
5. Slump cone and compaction factor apparatus
6. Rebound hammer, Pulse velocity equipments.
7. CTM
8. Flow table

Course Outcomes

The students after completing the course will be able to:

1. Identify different properties of aggregates through various test procedures.
2. Apply different test method to check the physical and mechanical properties of cement.
3. Test the mechanical properties of fresh and hardened concrete.
4. Get the knowledge in NDT and special type of concrete.
5. Evaluate physical and mechanical properties of brick masonry.

PROJECT BASED LEARNING

The students will be divided into groups and will be allowed to determine of properties of different building materials procured from different places, using the apparatus available in the laboratory following the standard procedures and the Indian Standard codes. The students are required to submit those findings in documented form.

References

1. Concrete Technology Laboratory Manual Prepared by MITS Staff.
2. Shetty.M.S (2002), Concrete Technology, S.Chand& Co., Ltd, Ramnagar.
3. IS: 10262 - 2009, Indian Standard specification for Methods of Mix design.
4. IS: 383 - 1987, Indian Standard specification for Test for Fine and Coarse aggregates.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

18CE208 GEOTECHNICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites: None

Course Description

This course covers laboratory experiments to predict soil characteristics. The experiments include determination of Index and Engineering properties of soil.

Course Objectives

1. To understand different test methods based on soil type to characterize soil
2. To demonstrate tests in the laboratory to obtain different soil properties
3. To analyze the test data to obtain relationships among different properties of soil

LIST OF EXPERIMENTS

1. Specific gravity of Soils.
2. Differential Free Swell Index (DFSI) of Soils.
3. Field Density using Core Cutter method and Sand replacement method.
4. Grain size distribution by Sieve Analysis.
5. Liquid limit and Plastic limit.
6. Permeability test using Constant-head test method.
7. Permeability test using Falling-head method.
8. Compaction test: Standard Proctor test.
9. Unconfined Compression Strength Test
10. CBR Test.
11. Consolidation Test.
12. Triaxial Test (UU).
13. Vane shear test.
14. Direct Shear Test.
15. Swelling Pressure test

LIST OF EQUIPMENT

1. Pycnometers or density bottle
2. Casagrande's liquid limit apparatus.
3. Field Density apparatus for
4. Core cutter method
5. Sand Replacement method
6. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
7. Apparatus for Liquid and plastic and Shrinkage limits
8. Permeability Apparatus for
9. Constant Head test

10. Variable Head test
11. Universal Auto compactor for I.S light and heavy compaction tests.
12. Apparatus for CBR test
13. Sampling tubes and sample extractors.
14. 10 tons loading frame with proving rings of 5 tons and 10 tons capacity
15. One dimensional consolation test apparatus with all accessories.
16. Tri-axial cell with provision for accommodating 38 mm dia specimens.

Course Outcomes

The students after completing the course will be able to:

1. Determine index properties of soils
2. Classify soils
3. Determine engineering properties of soils
4. Perform various tests according to the standard procedure
5. Analyse the available test data to obtain related parameters

PROJECT BASED LEARNING

The students will be divided into groups and will be allotted places. The students are will be allowed to perform different test methods to determine the properties and characteristics of the soil in that particular place. The students are required to submit present those findings in documented form.

Text Books

1. Soil Mechanics and Foundation Engg.- Punmia B.C. (2005), 16th Edition Laxmi Publications Co. , New Delhi.
2. BIS Codes of Practice: IS 2720

Reference Books

1. Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol. I, II, III, Princeton Press, London.
2. Engineering Properties of Soil and Their Measurements- Bowles J.E. (1988), - Mc-Graw Hill Book Co. New York.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

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B.Tech. III Year-II Semester

18CE111 STRUCTURAL ANALYSIS - II

L	T	P	C
2	1	0	3

Course Prerequisites: 18MAT101, 18MAT102, 18CE101, 18CE107, 18CE108

Course Description

this course deals with the analysis of indeterminate continuous beams using different force and displacement methods like slope deflection method, moment distribution method, Kani's method, stiffness method and flexibility method. In addition to this it also deals with analysis of indeterminate trusses and plastic analysis of beams and frames using equilibrium and mechanism methods.

Course Objectives

1. To introduce the concepts of static and dynamic indeterminacy and analyse indeterminate trusses
2. To analysing statically indeterminate structures using slope deflection method, moment distribution method and Kani's method.
3. To analyse statically indeterminate beams and frames using stiffness method
4. To analyse statically indeterminate beams and frames using flexibility method
5. To explain the concept of plastic analysis using equilibrium method and mechanism method.

UNIT I: ANALYSIS OF INDETERMINATE TRUSSES

Determination of static and kinematic indeterminacies - Solution of trusses with upto two degrees of internal and external indeterminacies using compatibility method. **(9)**

UNIT II: CLASSICAL METHODS FOR ANALYSIS OF FRAMES

Analysis of single bay single storey portal frames with and without sway using Slope deflection method, Moment distribution method and Two bay two storeyed portal frame using Kani's method. **(9)**

UNIT III: FLEXIBILITY METHOD OF ANALYSIS OF BEAMS AND FRAMES

Flexibility method of analysis of continuous beams with and without settlement of supports subjected to different types of loading and end conditions - Analysis of single bay single storey portal frame with and without settlements. **(9)**

UNIT IV: STIFFNESS METHOD OF ANALYSIS OF BEAMS AND FRAMES

Stiffness method of analysis of continuous beams and frames with and without settlement of supports subjected to different types of loading and end conditions - Analysis of single bay single storey portal frame with and without settlements. **(9)**

UNIT V: PLASTIC ANALYSIS

Plastic theory - introduction - plastic hinge concept - plastic modulus - shape factor -redistribution of moments - collapse mechanism - plastic analysis of beams and portal frames by equilibrium and mechanism methods. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Identify static and kinemtic indeterminacy of structures and their analysis.
2. Perform the analysis of statically indeterminate structures using slope deflection method, moment distribution method and Kani's method.
3. Perform the analysis of statically indeterminate structures using stiffness method.
4. Perform the analysis of statically indeterminate structures using flexibility method.
5. Perform plastic analysis by equilibrium method and mechanism method

Text Books

1. Ramamrutham, S., & Narayan, R.,Theory of Structures, Dhanpat Rai Publishing Co. (P.) Ltd., 2017.
2. Menon, D., Structural Analysis, Narosa publishers, 2008.

Reference Books

1. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, 2007.
2. Wang, C. K., Intermediate Structural Analysis, McGraw Hill, 1989.
3. Negi, L. S., and Jangid R.S, Structural Analysis, Tata McGraw Hill, 2006
4. Timoshenko, S. P. and Young, D. H., Theory of Structures, McGraw Hill, 1988.
5. Hibbler, R. C., Structural Analysis, Pearson Education, 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE112 TRANSPORTATION ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18MAT101, 18PHY101, 18CE105

Course Description

Course covers the basic understanding of traffic engineering and its components, planning and geometric design of highways; traffic characteristics and measurement; intersection design. Furthermore, this course covers highway material and properties; analysis and design of flexible and rigid pavements, importance of accessibility and safety in transportation systems, and introduction to different modules of transportation systems.

Course Objectives

1. To understand the principles and design of highway, traffic and railway engineering

UNIT I: BASICS OF TRANSPORTATION ENGINEERING

Introduction to Transportation Engineering; Role of transport; Types of transport systems; Evolution of transport modes; Transport problems and mobility issues; Urban form and Transport patterns; Classification of roads; Typical cross sections of roads in urban and rural area; Flexible and Rigid pavement; Geometric elements of road; Requirements of road alignment; Highway materials and testing. **(9)**

UNIT II: GEOMETRIC DESIGN OF HIGHWAYS

Importance of Geometric Design- Design controls and Criteria, pavement surface characteristics, camber and width requirements; Sight distances - over taking zone requirements and related problems; Design of horizontal alignment - speed - radius - super elevation - extra widening - transition curves- methods of attainment of super elevation - related problems; Design of vertical alignment - gradient and grade compensation - sight distance requirements on summit and valley curves -simple problems on design of vertical alignment; Design of flexible and rigid pavement. **(9)**

UNIT III: TRAFFIC ENGINEERING

Traffic characteristics-various traffic studies and their applications, Basic Parameters of Traffic Volume, Speed and Density; Parking Studies and Parking characteristics; Traffic control devices- Traffic signs- markings- traffic signals and traffic islands; Principles of highway lighting; Design of Traffic Signals. **(9)**

UNIT IV: TRANSPORT ACCESSIBILITY AND ROAD SAFETY

TRANSPORT ACCESSIBILITY: Design Standards and public policies for Barrier Free Transport; Universal Design Theory; Barrier Free Public Transportation; Access Audit;
ROAD SAFETY: Road accidents - Causes and Preventive measures, Scientific Investigations and Data Collection; Ensuring Traffic Safety in new design, reconstruction and operation; Road safety audit; Traffic management techniques. **(9)**

UNIT V

URBAN TRANSPORTATION SYSTEMS: Importance of collective transportation v/s individual transportation, freight transportation, Physical system components of urban transportation, Overview of different type of urban transit system (Mass rapid transit, Light rail transit, Personal rapid transit, guided way systems, Para transit systems, Mono rail, bus rapid transit systems).
RAILWAY ENGINEERING: Geometric design elements; Alignment of railway lines, railway track gauge; Points and Crossings, Level Crossings, Signaling and Interlocking
AIRPORT ENGINEERING: Overview of air transportation, Runway orientation, Basic runway length and corrections required, Geometric design of runways, Complexities in airport planning, Elements of airport planning.
HARBOURS AND PORTS: Elements of harbour and port planning, Role of harbours and ports in transportation, National waterways, Characteristics. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Understand the basic concepts of transportation engineering in and its components.
2. Design the various components of roads
3. Determine the planning and management aspects of various transportation systems.
4. Understand the safety issues and accessibility requirements in transportation and evaluate the risks involved.
5. Develop brief understanding of all other modules of transportation systems.

Text Books

1. Khanna, S. K, Justo, A and Veeraragavan, A., Highway Engineering, Nem Chand publications.
2. Kadiyali, L. R, Traffic Engineering and Transportation Planning, Khanna Publishers, New Delhi, 2003.

Reference Books

1. Horonjeff R. & McKelvy, F., Planning and Design of Airports, McGraw Hill, 5e, 2010
2. IRC: 37-2001, Guidelines for the Design of Flexible Pavements, IRC 2001, New Delhi
3. O’ Flaherty, C.A (Ed.)., Transport Planning and Traffic Engineering, Elsevier, 1997

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE113 DESIGN OF CONCRETE STRUCTURES

L	T	P	C
2	1	0	3

Course Prerequisites: 18CE101, 18CE107, 18CE111

Course Description

This course includes design philosophies of structural elements. Furthermore, it includes design of singly and doubly reinforced beams, flanged beams, shear and development length, slabs, columns, foundations and staircase as per IS 456-2000 and SP 16-1984 codes.

Course Objectives

1. To understand the fundamental principles and procedures of reinforced concrete design;
2. To apply the principles of reinforced concrete design to real world problems; and
3. Prepare students for entry level structural engineering employment.

UNIT I: BASIS OF STRUCTURAL DESIGN

Introduction to Methods of Design - Loads & Forces acting on structures - Stress-strain curve for concrete - Size effect - behaviour of concrete in tension - properties of Steel - Stress-strain curve for steel - A review on various design Philosophies - Types of Limit States - partial safety factors for materials and loads. **(9)**

UNIT II: FLEXURE

Assumptions and basic principles of Working Stress and Limit State method - Analysis and design of singly and doubly reinforced concrete beams- Limit State method, Analysis and Design of Flanged sections for various cases. **(9)**

UNIT III: SHEAR, TORSION AND BOND

Design bond strength - development length - check for development length in tension - Anchoring of reinforcing bars - bearing stress at bonds - reinforcement splicing - Design for bond - Development length - Curtailment of reinforcement - Lap splice. Modes of failure due to shear - shear strength of concrete - critical section for shear minimum shear reinforcement - Design of shear strength - check for shear at point of tension reinforcement curtailment - Design of beams for combined bending, shear and torsion.
LIMIT STATE OF SERVICEABILITY: Short term deflection calculation for beams - Deflection due to shrinkage and creep **(9)**

UNIT IV: SLABS AND STAIRCASE

Design shear strength of concrete in slabs - design consideration for slabs - design and reinforcement detailing of one way simply supported and continuous slabs - design and reinforcement detailing of two way slabs - Types of stair cases - components of staircase - structural system of stair cases - effective span - Design of stair cases spanning transversely and longitudinally. **(9)**

UNIT V: COLUMNS AND FOOTINGS

Classification of columns based on slenderness ratio, reinforcement & loading, Design of columns subjected to axial load,uni-axial bending and bi-axial bending.
Different Types of Footings - Design of isolated, square, rectangular and combined footings. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Explain the basic concepts of structural design methods and behavior of materials under loading.
2. Analyze and design R.C beam for flexure.
3. Apply the concept of strength and serviceability and design R.C. beams for shear, torsion, deflection.
4. Analyze and design slabs and staircase.
5. Analyze and design R.C. columns and footings.

Text Books

1. Bandhopadhyay, J. N., Design of Concrete Structures, Prentice-Hall of India, New Delhi, 2008.
2. Krishna Raju, N. and Pranesh, R.N. Reinforced Concrete Design, New age International Publishers, New Delhi, 2007.

Reference Books

1. IS 456-2000, Code of practice for Plain and Reinforced concrete, Bureau of Indian Standards, New Delhi.
2. Special Publication SP 16, Design aids for reinforced concrete to IS 456-2000, Bureau of Indian Standards, New Delhi.
3. Varghese, P. C., Limit State Design of Concrete, 2nd edition, PHI Pvt. Ltd., New Delhi, 2011.
4. Pillai, S.U. and Devdas Menon, Reinforced Concrete Design, 3rd Edition, TMH, New Delhi, 2009.
5. Jain, A.K., Reinforced Concrete: Limit State Design, 6^{th} Edition, Nemchand & Bros, Roorkee, 2002.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18ENG202 CORPORATE COMMUNCATION LABORATORY

(Common to all branches)

L	T	P	C
0	0	2	1

Course Prerequisites: 18ENG201

Course Description

English is practical and it is a must for any institution to provide students with opportunities to indulge in actively applying their language skills. Thus the Communication Skills Lab facilitates students with adequate opportunities to put their communication skills in use. It also accommodates peer learning by engaging students in various interactive sessions. This lab will be accompanied by a practical lab component.

Course Objectives

This course enables students to:

1. Focus on their interactive skills.
2. Develop their communicative competency.
3. Fortify their employability skills.
4. Empower their confidence and overcome their shyness.
5. Become effective in their overall performance in the industry.

UNIT I: LISTENING AND SPEAKING SKILLS:

Conversational skills (Formal and Informal); Group Discussion; Making effective presentations using Computers; Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures, discussions from TV/Radio/Podcast. **(9)**

UNIT II: READING AND WRITING SKILLS

Reading different genres of texts ranging from newspapers to creative writing; Writing job applications and resume; Emails; Letters; Memorandum; Reports; Writing abstracts and summaries; Interpreting visual texts. **(8)**

UNIT III: ACCLIMATIZING STUDENTS TO OTHER EXAMS

Test of English as a Foreign Language (TOEFL); Civil Service Examinations; Verbal- -ability. **(5)**

UNIT IV: INTERVIEW SKILLS

Different types of interviews: Answering questions and offering information; Mock interviews; Body Language; Articulation of sounds; Intonation. **(8)**

Course Outcomes

At the end of the course, learners will be able to:

1. Read articles from magazines and newspapers.
2. Participate effectively in informal conversations.
3. Introduce themselves and their friends and express opinions in English.
4. Comprehend conversations and short talks delivered in English.
5. Write short essays of a general kind, draft Reports and personal letters and emails in English.

Suggested Reading/Textbook

1. Sanjay Kumar and Pushp Lata; Communication Skills; Oxford University Press, 2012.
2. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.
3. S.P. Dhanavel; English and Communication Skills for Students of Science and Engineering; Orient Blackswan, 2009.
4. M. Ashraf Rizvi; Effective Technical Communication; Tata Mc Graw Hill Co. ltd, 2005.

Reference

1. Dr. M.Adithan; Study Skills for Professional Students in Higher Education; S.Chand & Co. Pvt., 2014.
2. Guy Brook Hart & Vanessa Jakeman; Complete IELTS: Cambridge University Press, 2014.
3. Vanessa Jakeman & Clare Mcdowell; Action Plan for IELTS: Cambridge University Press, 2006.
4. Guy Brook Hart; Instant IELTS; Cambridge University Press, 2004.
5. S.P.Bakshi & Richa Sharma; Descriptive General English; Arihant Publications, 2012.
6. Charles Browne, Brent Culligan 7 Joseph Phillips; In Focus (level 2); Cambridge University Press.
7. Steven Gershon; Present Yourself 2 (second edition); Cambridge University Press.
8. Leo Jones; Let's Talk 3 (second edition); Cambridge University Press.
9. Nutall J. C.; Reading Comprehension; Orient Blackswan.
10. www.cambridgeenglish.org/in/
11. https://learnenglish.britishcouncil.org/en/english-grammar
12. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.

18CE209 TRANSPORTATION ENGINEERING LABORATORY

L	T	P	C
0	**0**	**3**	**1.5**

Course Prerequisites: None

Course Description

The course will provide knowledge and skills of road/highway material testing to those in the field of road construction or who intend to join this field of specialization.

Course Objectives

To make the students to learn the principles and procedures of testing Highway materials and to get hands on experience by conducting the tests and evolving inferences.

LIST OF EXPERIMENTS

TEST ON BITUMEN

1. Softening point of Bitumen
2. Ductility test on Bitumen
3. Flash and fire point test
4. Stripping value test
5. Penetration test on bitumen

TESTS ON COARSE AGGREGATES

1. Aggregate crushing value test
2. Impact value test
3. Shape tests - Flakiness index and elongation index
4. Los angles abrasion test

TESTS ON MIXES

1. Marshall stability value

Any eight experiments shall be completed

LIST OF EQUIPMENTS

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Los angles Abrasion test machine
4. Length and elongation gauges
5. Bitumen Universal Penetrometer
6. Bitumen Ductility test setup
7. Ring and ball Softening Point apparatus
8. Penskey - Morten's open cup flash and fire point apparatus
9. Marshall's stability apparatus

Course Outcomes

The students after completing the course will be able to:

1. Perform various quality tests on aggregate and bitumen related to road and highway construction using various test methods.
2. Use and operate various tools and apparatus of road material testing.
3. Select the appropriate materials for the use in different layers of road construction through the test outcomes.
4. Evaluate the quality and performance of unbound and bound road materials.
5. Analyse the material requirements of road elements for road construction.

PROJECT BASED LEARNING

Students will be alotted a place where road has to be built. They will investigate the area, collect samples, perform various tests on them and make a report on those materials at the end.

Text Books

1. Khanna, S.K, Justo, A and Veeraragavan, A., Highway Materials and Pavement Testing, Nem Chand and Bros, Fifth Edition, 2009.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

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B.Tech. IV Year-I Semester

18CE114 DESIGN OF STEEL STRUCTURES

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

Course Prerequisites: 18CE101, 18CE107, 18CE108, 18CE111

Course Description

The course covers basic design concepts of steel structures, loads and stresses to be used as per Indian standards for steel design work. The course deals with designing of Steel structural elements subjected to axial tension, axial Compression and bending. Emphasis, will be also given to the special structures such as plate girders. In addition, analysis and design of various types of connections such as bolted and welded will be discussed. All design approaches will be based on Limit State of strengths and serviceability.

Course Objectives

1. To understand the concepts of Steel design.
2. To introduce the concept of limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
3. Design of structural systems such as Plate girders, gantry girders as per provisions of current code of practice.

UNIT I: INTRODUCTION

Introduction-advantages and disadvantages of steel structures-loads and load combinations-Structural steel connections-Various types of connections in steel: Bolted & welded. Design code and considerations-Limit state method (LSM) of Design-Failure criteria for steel- Structural steel connections-Various types of connections in steel: Bolted & welded and applications. **(9)**

UNIT II: DESIGN OF TENSION MEMBERS, PLASTIC ANALYSIS, BEAMS

Types of tension members-modes of failure- Net sectional area-Design of Lug Angles-Tension Splices-gussets. Theorems of plastic collapse-methods of plastic analysis-plastic designs of portal frames. Types and classification-Lateral stability of beams-shear strength-web buckling and crippling. Introduction to castellated beams. **(9)**

UNIT III: DESIGN OF COMPRESSION MEMBERS

Behaviour of compression members- possible failure modes-single angle struts-design-built-up compression members-Lacings and Battens- column bases. **(9)**

UNIT IV: DESIGN OF PLATE GIRDERS

Design of web-flanges-curtailment of flanges-stiffeners- web and flange splices-economic depth of plate girders-example problem. **(9)**

UNIT V: DESIGN OF GANTRY GIRDERS

DESIGN OF GANTRY GIRDERS: Load and fatigue effects, selection and design of gantry girder-example problem. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Apply and use the concepts related to the concepts of limit state design, basics of structural steel design and analysis and design of connection.
2. Analyse and Design of members (Lug angles, tension splices, portal frames and beams)
3. Analyse and Design of compression members (Columns, Struts, built-up sections, column bases and caps)
4. Explain the concept and design of plate girder.
5. Explain the concept and design of gantry girder.

Text Books

1. Duggal, S.K., Limit State Design of Steel Structures, TMH, 2011. 3rd Edition

References

1. Subramanian, N., Steel Structures Design and Practice, Oxford University Press, 2010.
2. IS 800:2007, Code of practice for General construction in steel, B.I.S.
3. IS 875:1987, Code of practice for design Loads.
4. IS 808:1989 Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections, Bureau of Indian Standards.
5. Ramachandra, Design of Steel structures, Sai Ram Prints hall publications.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE115 QUANTITY SURVEYING AND CONSTRUCTION MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE105, 18CE201, 18CE206

Course Description

Standard units; detailed and abstract estimates of buildings, roads and canals; rate analysis; reinforcement bar bending schedule; contracts and tenders; building valuation; specifications.

Course Objectives

1. To provide the student with the ability to estimate the quantities of item of works involved in buildings, water supply and sanitary works, road works and irrigation works,
2. To equip the student with the ability to use construction technology and carryout the preparatory work and implementation.

UNIT I: INTRODUCTION TO ESTIMATION OF BUILDINGS

Different items of works in building - Principles of taking out quantities - Detailed measurement form - Estimate of RCC building - Long walls - Short wall method and Centre line method. **(9)**

UNIT II: REINFORCEMENT ESTIMATION

Reinforcement bar bending and bar requirement schedules.
EARTH WORK ESTIMATION: Roads: Estimate of bituminous and cement Concrete-Estimate of earthwork - Estimate of pitching of slopes - Estimate of earthwork of road from longitudinal sections - Estimate of earthwork in hill roads; Earthwork in canals - Different cases - Estimate of earthwork in irrigation channels. **(9)**

UNIT III: RATE ANALYSIS

Schedule of Rates - Preparing analysis of rates for the following items of work: Concrete, RCC Works, Brick work in foundation and super structure, plastering, CC flooring, whitewashing.
VALUATION: Necessity-Different terms used in valuation and their Meaning-Different methods of building valuation and rent fixation - Outgoings - Depreciation - Methods for estimating cost depreciation - Escalation. **(9)**

UNIT IV: FUNDAMENTALS OF CONSTRUCTION MANAGEMENT

Definitions and Discussion - Construction Activities - Construction Processes - Construction Works - Construction Estimating - Construction Schedule - Construction Documents - Construction Records - Quality - Safety. **(9)**

UNIT V: PREPARATORY WORK AND IMPLEMENTATION

Site layout - Infrastructure Development - Construction Methods - Construction Materials - Deployment of Construction Equipment - Prefabrication in Construction - False-work and Temporary Works. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Analyze and assess the quantity of different items of works in building
2. Estimate reinforcement and earthwork required for various structures
3. Prepare a detailed rate analysis for various items of work and valuation and rent fixation of different building structures
4. Understand fundamentals of construction technology
5. Carry out the preparatory work and implementation for construction work.

Text Books

1. Dutta, B.N., Estimating and Costing, UBS publishers, 2016.
2. Birdie, G.S., Text Book of Estimating and Costing 6^{th} Edition, Dhanpat Rai Publishing Company (P) Ltd
3. Patil, B.S., Contracts and estimations, Univ.Press, New Delhi.
4. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2005.

Reference Books

1. Standard Schedule of rates and standard data book by public works department.
2. IS. 1200 (Parts I to XXV - 1974/ method of measurement of building and Civil Engineering works - B.I.S.)
3. Estimation, Costing and Specifications by M. Chakraborthi, Laxmi publications.
4. National Building Code.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE210 STRUCTURES LABORATORY

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

Course Prerequisites: 18CE107, 18CE112

Course Description

The course covers structural analysis, design and drawings using commercial software's for concrete and steel structures normally encountered in civil engineering practice

Course Objectives

To acquire hands on experience in design and preparation of structural drawings for concrete and steel structures normally encountered in civil engineering practice

SOFTWARE

1. STAAD PRO
2. ETABS
3. AutoCAD

EXCERCISIES

1. 2-D Frame Analysis and Design
2. Steel Tubular Truss Analysis and Design
3. 3-D Frame Analysis and Design
4. Retaining Wall Analysis and Design
5. Simple tower Analysis and Design
6. One Way Slab Analysis & Design
7. Two Way Slab Analysis & Design
8. Column Analysis & Design
9. Structural detailing using CADD

Course Outcomes

The students after completing the course will be able to:

1. Apply the principles of structural analysis and design in an industry setting
2. Apply the different code provisions through a commercial software.
3. Make the design of structures from a holistic stand point
4. Use modern software in the design of structures.
5. Acquire hands on experience in design and preparation of structural drawings for concrete and steel structures normally encountered in civil engineering practice.

Text Books

1. Dr. Sesha, M.N, Prakash and Dr. Suresh, C.S., Computer Aided Design Lab Manual.

References

1. SP 32
2. IS 456-2000

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

18CE211 INSTRUMENTATION AND SENSOR TECHNOLOGY LABORATORY

L	T	P	C
0	0	2	1

Course Prerequisites: None

Course Description

The course includes transducer characteristics for acoustic, current, temperature, pressure, electric, magnetic, gravity, salinity, concentration of contaminants, velocity, heat flow, and optical devices; limitations on these devices imposed by building/structure/pavement environments; and signal conditioning and recording; noise, sensitivity, and sampling limitation

Course Objectives

1. The objective of this laboratory is to understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decision making.
2. This laboratory introduces practical principles of design of sensor systems.
3. To Use Different Sensor instruments for field measurements and apply knowledge to resolve various field challenges through suitable techniques

LIST OF EXPERIMENTS (any 8)

1. Determination of height of the remote object using total station.
2. Determination of coordinate point using total station.
3. Determination of compressive strength of concrete structure using rebound hammer
4. Determination of strength and quality of concrete using ultrasonic testing equipment
5. Estimation of depth of cracks using ultrasonic testing equipment
6. Estimation of load on structure using load cell
7. Determination of Safe bearing capacity of soil using standard penteration test rig.
8. Determination of indoor noise quality
9. Determination of nitrates in water
10. Estimation of intensity of light
11. Determination of dissolved oxygen in water

LIST OF EQUIPMENT

1. Total station
2. Rebound hammer
3. Ultrasonic testing equipment
4. Load cell
5. Standard Penteration test rig
6. Noise dosi meter
7. Spectrophoto meter
8. Lux meter
9. Disolved Oxygen meter

Course Outcomes

The students after completing the course will be able to:

1. Calcuate the geometric parameters of remote objects using total station.
2. Evaluate the compressive strength of concrete structures using rebound hammer.
3. Estimate crack width and strength of concrete using ultrasonic testing equipment.
4. Compute the loads on the concrete structures using load cell.
5. Estimate the quality of light, noise using Lux meter and Noise dosi meter.

Text Books

1. Vidivelli, B., Rehabilitation of concrete structures. Standard Publishers Distributors.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

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OPEN ELECTIVES-II

18MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Course Description

This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis. The students use MATLAB as the computer language to obtain solutions to a few assigned problems.

Course Objectives

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To avail the basics of numerical techniques for solving the system of linear equations.
3. To familiarize the knowledge of interpolation and numerical calculus.
4. To use numerical calculus for solving ordinary differential equations.
5. To introduce the computational techniques for solving partial differential equations.

UNIT-I: Solutions of algebraic and Transcendental Equations

Introduction to MATLAB, errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial.
Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.
Exercises of Bisection method and Newton's method through MATLAB

(9)

UNIT-II: Solutions of system of Algebraic Equations

Gaussian Elimination, LU decomposition, Thomas algorithm for the tridiagonal systems, Norms-Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.
Exercises of Gaussian Elimination and Gauss-Seidel method through MATLAB

(9)

UNIT-III: Interpolation & Numerical Calculus

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature.
Exercises of Divided differences and Simpson's rule through MATLAB

(9)

UNIT-IV: Numerical Solutions to Ordinary Differential Equations

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.
Exercises of Runge-kutta method and Shooting method through MATLAB

(9)

UNIT-V: Numerical Solution to Partial Differential Equations
Finite difference methods for one-dimensional Wave and Heat equations; Laplace and Poisson equations (five-point formula).
Exercises of Finite difference method (forward, central and backward differentiation) and Crank-Nicolson method through MATLAB

(9)

Course Outcomes

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

1. Solve the system of algebraic and transcendental equations.
2. Apply the numerical techniques to find the solution to system of equations.
3. Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.
4. Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.
5. Compute the solutions for engineering problems represented by partial differential equations.

Text Books

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
2. Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.
3. Advanced Engineering Mathematics by E. Kreyszig, 10th ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Course prerequisite:18MAT101,18MAT106, 18MAT104, 18MAT108, 18MAT109.

Course description: Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course objectives:

1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to solvedynamic programming problem using recursive relations.
5. Analyze the techniques of project management and queuing models.

Unit 1: Classical optimization. (9)
Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

Unit 2: Linear programming problem. (9)
Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method.Duality, dual Simplex method.

Unit 3: Transportation problem and assignment problem. (9)
Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

Unit 4: Dynamic programming. (9)
Introduction, developing optimal decision policy, Dynamic Programming Problem (DPP) under certainty, DPP approach for solving LPP.

Unit 5: Projectmanagementand Queuingmodels. (9)
Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT). Introduction to queuing system, single server queuing models (M/M/1) :(∞/FCFS), (M/M/1): (N/FCFS).

Course outcomes:
At the end of the course the students should able to
1. Understood the importance of unconstrained and constrained optimization to solve engineering problems.
2. Get an idea about the linear programming techniques.
3. Solve transportation andassignment problems in engineering situations.
4. Applythe Bellman principle of optimality to solvedynamic programming problem.
5. Analyze the problems of network analysis for project management and Queuing systems engineering & industry.

Text Books:
1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.
2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

References:
1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.
2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.
3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.
4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2ndedition.

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

18PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:

The course will cover Geometrical optics, Aberrations, Physical Optics, Diffraction and Optical fibers.

Course Objectives:

1. Knowledge of basic principles and concepts in optics and the techniques used to deal with them.
2. Explain the limitations associated with spherical and chromatic aberration
3. Describe optical systems such as microscopes and telescopes with reference to parameters such as angular magnification and depth of field
4. Provide students with a working knowledge of optical physics, including interference, diffraction and physical optics.
5. Introduce construction and concepts of basic fiber optic communication system and to make the students learn about its important applications for societal needs.

UNIT I: INTRODUCTION

Corpuscular and wave theory, Fermat's principle, Matrices for translation, refraction and reflection, Unit and nodal planes, Eigenvalues and Eigenvectors.

(9)

UNIT II: ABERRATIONS AND OPTICAL INSTRUMENTS

Types of aberrations, Chromatic and monochromatic aberrations. Different types of monochromatic aberrations. Simple and Compound microscopes, Astronomical and Terrestrial telescopes. Ramsden's and Huygens' eye pieces.

(9)

UNIT III: WAVE OPTICS & INTERFERENCE

Huygens's principle, Superposition of waves, Fourier transforms, representation of slits and apertures, Two beam interference by Division of wave front. Applications of Interference, Nonlinear interaction of light with matter (self-study).

(9)

UNIT IV: DIFFRACTION & POLARISATION

Fraunhoffer diffraction, Diffraction from single slit, double slit & multiple slits, Fresnel half-period zones, Zone plate, Applications of diffraction, Polarization, Malus' law, double refraction. Applications of polarization.

(9)

UNIT V: FIBER OPTICS

Construction and working principle of optical fibers, Numerical aperture and acceptance angle, Types of optical fibers. Attenuation and losses in optical fibers, Analog and Digital optical fiber communication system. Applications of optical fibers in communications, sensors and medicine.

(9)

Course Outcomes:

Upon completion of this course the students shall be able to:

1. Recollect the fundamental characteristics of light and their mathematical principles.
2. Learn the principles of superposition, Interference and Diffraction
3. Understand nonlinear optics and photonics phenomena.
4. Be exposed to the application of optical techniques in cutting edge research areas.
5. Describe the basic laser physics, working of lasers and principle of propagation of light in optical fibers.

Text Book:

1. Optics by Ghatak, 4th Edition, Tata McGraw Hill (2011).

Reference Books:

1. Optics by Lipson, Lipson & Lipson, 4th Edition, Cambridge Univ Press (2010).
2. Optics by Hecht, 4th Edition, Addison-Wesley (2002).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Course Prerequisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:
Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:

1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I: INTRODUCTION TO LASER TECHNOLOGY
Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

(9)

UNIT II: GASES AND LIQUIDS LASING MEDIUM
Energy levels & Radiative properties of Atoms and molecules**;** *Atomic lasers*: He-Ne laser, Argon Ion laser**;** *Molecular Lasers*: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

(9)

UNIT III: SOLID STATE LASERS
Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)
Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only);

(9)

UNIT IV: PULSED OPERATION OF LASERS
Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.
Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-

locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

(9)

UNIT V: LASER APPLICATIONS

Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology-Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering

(9)

Course Outcomes

Upon completion of this course the students shall be able to:

1. Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.
2. Estimate stability requirements in producing laser light by different types of sources
3. Differentiate or list the various types of lasers and their means of excitation.
4. Assess (Identify) which laser would best meet the need for a particular industrial or research task.
5. Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Text books:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.
2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer

Reference books:

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.
2. Ultrafast Optics, Andrew M. Weiner
3. Laser spectroscopy: Demtroder
4. Laser Applications: Monte Ross
5. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
6. Principles of Laser: O. Svelto
7. Laser Physics: Peter W Miloni, Joseph H Eberly.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

L	T	P	C
3	0	0	3

Course Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:
It deals with basic principles of petroleum engineering and the processes involved in petroleum industry.

Course Objective:
1. To get exposure to the basic concepts of petroleum refining.
2. To understand the basic properties of various fuels, additives and their importance.
3. To introduce the basic concepts of refining processes and technologies.
4. To familiarize the basic concepts of catalysis and various catalysts used in the refinery.
5. To understand the safety and environmental issues in petroleum industry

UNIT I: BASIC PROCESSES IN PETROLEUM REFINING AND FUEL TESTING
Source of Crude oils and types, Overview of refinery process, Atmospheric Distillation, Vacuum distillation, Desalter, Desulphurization, Cracking, catalysis, Effluent treatment plant(ETP). Properties and quality control of fuel: Density, Viscosity, Pour Point, Flashpoint, Fire Point, Octane Number, Cetane Number, Ductility, Water Content, Sulphur Analysis, Micro Carbon Residue Test(MCRT), Saturate, Aromatic, Resin and Asphaltene(SARA), High Frequency Reciprocating Rig(HFRR), Calorific Value.

(9)

UNIT II: CHEMICAL ADDITVES IN PETROLEUM INDUSTRY
Types of products in the refinery and their structural properties, Neutralizing amines, Corrosion inhibitors, Multifunctional additives, viscosity modifiers, drag reducing agents, antioxidants, Lubrication modifiers, Antifoam agents, Oil spill absorbers, Dispersants, Chemicals used for ETP plant.

(9)

UNIT III: ROLE OF HYDROPROCESSING AND FLUID CATALYTIC CRACKING IN PETROLEUM INDUSTRY
Hydrocracking reactions, Hydrocracking feedstock's, Modes of Hydrocracking, Effects of process variables, Hydro treating process and catalysts, Resid hydro processing, FCC Cracking, Catalyst coking and regeneration, Design for Fluidized-Bed Catalytic Cracking Units

(9)

UNIT IV: ROLE OF CATALYSTS AND BIOPROCESSES IN PETROLEUM INDUSTRY
Types of catalyst and their importance, Design and selection of catalyst. Catalytic processes. Bioprocesses: Introduction, Refining of petroleum using biodesulphurisation, Bioremediation, commercial processes for bioethanol, isopropanol.

(9)

UNIT V: SAFETY AND MANAGEMENT IN PETROLEUM INDUSTRY
Safety policy, Personal protective equipment, Different type of extinguishers, Types of gloves and their application, Hydrants and their role, Safety indicators, Safety contact, Environmental

pollution, precaution and first aid, safety measures, Different elements and their role in Occupational safety and Management.

(9)

Course Outcomes:

At the end of the course, the students will

1. Be able to understand the overview of petroleum industry
2. Be able to understand the concepts of crude oil, types of crude oils, properties of fuels such as octane number, cetane number, viscosity, density etc. Instruments.
3. Be familiarized with importance and their use of chemicals involved in the petroleum industry.
4. Be familiarized with the processes involved in hydroprocessing and fluid catalytic cracking.
5. Be familiarized the types of catalysts and bioprocesses in the petroleum industry.
6. Understanding the PPE, different types of extinguishers, First aid, process safety and management in the petroleum industry.

TEXT BOOKS

1. Mohamed A. Fahim, Taher A. Al-Sahhaf and Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier,2009

2. David T Day, Handbook of the Petroleum Industry, Volume 1, ISBN: 137595962X, Chizine Publ., 2017

REFERENCE BOOKS:

1. Sankara Papavinasam, Corrosion Control in the Oil and Gas Industry, Elsevier, 2013

2. Petroleum Engineering Handbook (Vol. 1 - VIII). Editor in Chief: Larry W. Lake, Society of Petroleum Engineers.

3. Srinivasan Chandrasekaran. Health, Safety and Environmental Management for offshore and Petroleum Engineers, John Wiley and Sons, U.K., ISBN: 978-11-192-2184-5, 2016.

4. S. P. Srivastava and Jenő Hancsók, Fuels and fuel additives, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.

5. Robert O. Anderson, Fundamentals of the Petroleum Industry–University of Oklahoma Pres, 1987.

6. James G. Speight, Handbook of Petroleum Product Analysis, John Wiley & Sons, Inc, 2015

7. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company), 2004

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Basic Engineering Chemistry or equivalent level

Course Description:
This course aims to introduce the interdisciplinary concept for engineering's to enhance their knowledge that they need to contribute with relevance and confidence in developing green technologies.
This course covers feedstocks, green metrics and the design of safer, more efficient processes, as well as the role catalysts, solvents and green processes for nanoscience.

Course Objectives:

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing nanoscience.

UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, Elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

(9)

UNIT 2: CATALYSIS AND GREEN CHEMISTRY

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using Wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide. Recycling of catalyst.

(9)

UNIT 3: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: carbondioxide, water - water as a reaction solvent, water based coatings, Ionic liquids as solvent.

(9)

UNIT 4: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell, SOFC and PEMFC), Photochemical Reactions: Advantages and Challenges of Photochemical Processes, Example-Caprolactum, chemistry Using Microwaves: heating, assisted Reactions, Sonochemistry.

(9)

UNIT 5: GREEN PROCESSES FOR NANOSCIENCE

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

(9)

Course Outcomes:
Upon completion of this course the students should

1. Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
2. Understand and apply catalysis for developing eco friendly processes.
3. Be in a position to use environmental benign solvents where ever possible.
4. Have knowledge of current trends in alternative energy sources.
5. Apply green chemistry principles in practicing green Nanoscience.

Text Books :

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA 2005.

Reference Books :

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Nanoscience, wiley-VCH
2. V.K. Ahluwalia , M. Kidwai, New trends in Green chemistry, 2004, Springer.
3. Benny Joseph, Environmental Science and Engineering, TATA Mc Graw Hill, New Delhi 2006.
4. Albert Matlack, Introduction to Green Chemistry, Second Edition CRC press, 2010

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18HUM301 INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	**0**	**0**	**3**

Course Description: Intellectual property (IP) is a legal term that refers to creations of the mind. Examples of intellectual property include music, literature, and other artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Under intellectual property laws, owners of intellectual property are granted certain exclusive rights. Some common types of intellectual property rights (IPR) are copyright, patents, and industrial design rights; and the rights that protect trademarks, trade dress, and in some jurisdictions trade secrets. Intellectual property rights are themselves a form of property, called intangible property.

Course Objectives: The course is intended to:

1. Explain the importance of Intellectual Property Rights, its protection and management;
2. Explain the types/tools of IPR;
3. Make aware the students to understand the commercialization of IPR;
4. Know the filing of patent rights, acts, rules & portfolio analysis, management, patent strategy; and
5. Create awareness about Right to Information Act (RTI), its powers, functions, penalties and appeal.

UNIT I: INTRODUCTION:

Intellectual property and its protection, WTO, TRIPS Agreement& its Protection

(9)

UNIT II: INTRODUCTION TO COPYRIGHTS

Copyright Principles – Copyright Law - Copyright ownership - Right to prepare derivative works – Rights of Distribution - Copyright Formalities and Registrations - Copyright disputes - International Copyright Law – Patent Trademark – Geographical indications

(9)

UNIT III: COMMERCIALIZATION OF IP ASSETS:

Contracting, Licensing, Assignment and technology transfer; Drawing up a business strategy IP rights in export markets; Ownership of rights by employees; Valuation of intellectual property rights.

(9)

UNIT IV: PROCEDURE FOR FILING PATENT IN INDIA AND OTHER COUNTRIES,

PCT filing, Patent Search, Patent Acts & Rules, Patent Infringement, Patent Portfolio analysis and management, Patent Strategy.

(9)

UNIT V: RTI

Introduction – Objectives – Obligation of Public Authorities – The Central & State information commission – Powers & Functions – Penalties & Appeal.

(9)

Course Outcomes:

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

1. Understand the importance of Intellectual Property Rights, its protection and management.
2. Analyze and apply the types/tools of IPR.
3. Identify the process of commercialization of IPR.
4. Understand the procedure of filing of patent, acts, rules and portfolio analysis, management, patent strategy.
5. Apply the Right to Information Act (RTI) in real life situation.

Text Book:

1. Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 4th Edition (2013) By **Deborah E. Bouchoux, Cengage Learning**

References:

1. Latest Research Papers

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18HUM302 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
3	0	0	3

Course Description: The course content includes: Introduction to HRM, strategic human resource challenges, work flows, job analysis, managing diversity, concepts, goals, mechanism and system of HRD, recruitment and selection, downsizing and outplacement, appraising and managing employee performance, training, career development, managing compensation, rewarding performance, designing benefit plans, employee relation and employee discipline, and workplace safety and health.

Course Objectives: The course is intended to:

1. Explain the nature and scope of HRM, its functions, policies and strategies;
2. Describe the human resource planning, work analysis and importance in designing jobs;
3. Know the recruitment, selection and the process of performance appraisal;
4. Make the student to learn about training and development; and
5. Explain the industrial relations, trade unions, Ethics and fair treatment at work.

UNIT I: INTRODUCTION

Understanding the nature and scope of Human Resource Management- Definition, Functions / objectives, organization of department.

(9)

UNIT II: HUMAN RESOURCE PLANNING

Human Resource Planning- Factors affecting HRP, the planning process, managerial succession planning. Job Analysis, Methods of collecting job data, Competency based Job Analysis, Job design approach, contemporary issues in Job Description.

(9)

UNIT III: RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL

Recruiting and selecting employees-, Selection process, Barriers, selection in India. Performance Management, Process of Performance Appraisal, Methods of Performance Appraisal - Errors in Performance Appraisal.

(9)

UNIT IV: TRAINING AND DEVELOPMENT

Training v/s development – Training Methods - challenges in training - Career development – Reward Management – Performance Appraisal – Compensation Management.

(9)

UNIT V: INDUSTRIAL RELATIONS, TRADE UNIONS

Industrial Relations, Trade unions, resolving dispute- Labor Movement - Trade Union in India, Collective Bargaining: Process and Methods, Grievance: Sources and process of Redressal, Managing Ethical issues in Human Resource Management- Ethics and fair treatment at work.

(9)

Course Outcomes:

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

1. Understand the concept of HRM, its nature, scope, functions, policies and strategies;
2. Analyse human resource planning and apply in designing jobs;
3. Evaluate the recruitment, selection and the process of performance appraisal;
4. Understand the importance of training and development activities; and
5. Examine the industrial relations, trade unions, employee safety and health measures.

Text Books:

1. Aswathappa K., Human Resource Management- Text and Cases, Tata McGraw Hill, 6th Edition, 2010
2. Gomez-Mejia, L.R., Balkin, D.B., &Cardy, R.L. Managing Human Resource Management 6th edition, Pearson Edu. 2007.

References:

1. Garry Dessler, BijuVarkkey , Human Resource Management ,11th Edition, Pearson Education, 2009.
2. R. Wayne Mondy, Human Resource Management, 10th Edition, 2010

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18ME301 MATERIAL SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
The purpose of this course is to introduce the student to enrich their knowledge on the materials science field. Begin with the microscopic level the structure at the atomic and their impact on the material properties are discussed. Electronic and related conductivity of materials and respective origins are studied. Substantial part of this course is dedicated in study of magnetism and its origin in the materials along with suitable applications. Last unit is dedicated towards photonic materials.

Course Objectives:
1. To understand the relation between structure and properties of metallic materials.
2. To understand the strengthening mechanism of metals
3. To comprehend the various electrical and electronic properties of materials.
4. To understand origins and various types of magnetism and its applications.
5. To comprehend the transmission of light in various solids and study of photonic behavior.

UNIT I: STRUCTURE OF MATERIALS
Introduction: Historical prospective - importance of materials - Classification of Materials and its Properties. Bonding in solids: bonding forces and energies - primary and secondary bonding. Crystallography and Metallic structures: Unit cell - Crystallographic directions and planes, FCC, BCC, HCP, SC and other structure – miller indices, Linear and planar densities - close-packed crystal structures. Packing of atoms in solids. Packing factor

(8)

UNIT II: CRYSTAL IMPERFECTIONS AND DIFFUSION.
Crystal Imperfections: Types, Vacancies and interstitials, Dislocations and grain boundaries. Diffusion: Fick's Law of diffusion – Diffusion mechanism – Steady state and non-steady state, factors affecting diffusion.

(7)

UNIT III: ELECTRICAL PROPERTIES OF MATERIALS
Introduction and Electrical Conduction: Ohm's Law, Electrical Conductivity, Electronic and Ionic Conduction, Energy Band Structures in Solids, Electron Mobility, Electrical Resistivity of Metals
Semiconductivity: Intrinsic and Extrinsic Semiconduction, Temperature Dependence of Carrier Concentration, Factors that Affect Carrier Mobility, The Hall Effect, Semiconductor Devices. Conduction in Ionic Materials, Electrical Properties of Polymers.

Dielectric Materials: Capacitance, Ferroelectric Materials, Piezoelectric Materials.

(9)

UNIT IV: MAGNETIC PROPERTIES OF MATERIALS
Introduction and Basic Concepts, Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism, Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Magnetic Anisotropy, Soft and Hard Magnetic Materials, Magnetic Storage, Superconductivity.

(8)

UNIT V: PHOTONIC MATERIALS

Introduction, Electronic Radiation in Vacuum; Reflection, Refraction and absorption in materials; Absorption and Chemical Bonding: Color, X-Ray absorption, Photon absorption Devices.

Photon Emission: X-Ray Emission, Emission of electromagnetic radiation and devices: LED's, OLEDs and LASERs. Optical Fibers in communication

(7)

Course Outcomes:

At the end of the course students will be able:

1. To develop deep knowledge of crystal structure and effect of structure on the properties of the materials.
2. To demonstrate knowledge of various imperfections in crystal, and diffusion mechanism in materials.
3. To explain the origins of various electronic and electrical properties in the materials.
4. To understand the concept of magnetism, its origin and types, while choosing the right material for the given application.
5. To summarize various optical properties of the material and light's transmission behavior.

Text Books:

1. W. Callister, "Materials Science and Engineering", Wiley, 7th Edition, 2007.
2. Charles M. Gilmore, "Materials Science and Engineering Properties", Cengage Learning, SI Edition, 2016.

References:

1. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", Cengage Learning, 5th Edition, 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisite: None

Course Description:

Course Objectives:

Students belonging to all branches of Engineering are made to learn following fundamental topics related to mechanical engineering

1. To teach students the basic concepts of Thermodynamics.
2. To teach students the basic Classification and working principles of boilers and turbines.
3. To teach students about IC engines, Refrigeration, and Air-Conditioning systems.
4. To teach students about engineering materials and casting manufacturing processes.
5. To teach students and machines tools and manufacturing systems.

UNIT I:

Basic concepts of Thermodynamics: Introduction, Important terminologies used in thermodynamics, Specific heat capacity, First law of thermodynamics, Second law of thermodynamics, Reversible and irreversible processes, the Carnot cycle and the Clausius inequality.

(7)

UNIT II:

Boilers: Introduction to boilers, Classification of boilers, requirements of a good boiler, Cochran, Babcock, Locomotive, and Lancashire boilers.

Turbines: Hydraulic Turbines-Classification and specification, Principles and operation of Pelton wheel turbine, Francis turbine, and Kaplan turbine (elementary treatment only).

Hydraulic Pumps: Introduction, Classification, and specification of pumps, reciprocating pump, and centrifugal pump.

(8)

UNIT III:

Internal Combustion Engines

Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines, Working principle of IC engines, Valve timing diagrams, Otto cycle, Diesel cycle, and Dual cycle.

Refrigeration and Air conditioning Refrigeration – Introduction, Refrigerator, and Heat pump, Components of refrigeration system, Types of refrigeration system, and Type of refrigerants.

(7)

UNIT IV:

Engineering Materials: Introduction, mechanical properties of engineering materials, mechanical testing of engineering materials, Impact test, and Classification of engineering materials.

Casting: Introduction to casting processes, Classification of casting processes, Sand casting, and special casting methods.

Power Transmission Devices: Introduction, belt drive, rope drive, Chain drive, Gear drive, Classification of gears.

(8)

UNIT V:

Machine Tools: Introduction, Mechanism of metal cutting, Geometry of single point cutting tool, Orthogonal and oblique metal cutting, Lathe, and Milling machines.

Manufacturing Systems Introduction, Computer Integrated Manufacturing, CAD/CAM, Numerical Control (NC), Computer Numerical Control, and Dynamics Numerical Control. **(7)**

Course Outcomes:

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

1. State first, second and third law of thermodynamics.
2. Sketch components of boilers and turbines.
3. State working principle of IC engines and R& AC systems.
4. Fair understanding of application and usage of various engineering materials, Casting process, and different types of drives with applications.
5. Explain the role of Computers in manufacturing systems.

Text Book:

1. "Basic Mechanical Engineering" by Pravin Kumar, Pearson Edition ISBN: 9789332505759, 9789332505759.

References:

1. George E Dieter, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 2017.
2. S. Kalpakjian and S. R. Schmid, "Manufacturing Engg, and Technology", 7th Edition, Pearson, 2018.
3. P K Nag, "Engineering Thermodynamics", 6th Edition, McGraw Hill, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18ME303 BASIC THERMODYNAMICS

L	T	P	C
3	0	0	3

Course Prerequisite: Differential Equations

Course Description:
Thermodynamics is one of the fundamental courses in the study of mechanical engineering. The principles of thermodynamics are applicable to a wide range of problems encountered in all branches of engineering. Also thermodynamics is an essential pre-requisite for subsequent courses in mechanical engineering like fluid mechanics, applied thermodynamics, heat transfer, gas dynamics, refrigeration and air conditioning, etc. This course is designed to equip the students with a thorough understanding of basic concepts of thermodynamics and with necessary skills and techniques to solve problems in thermodynamics through a systematic analysis using fundamental principles. The specific topics to be covered in the course include concepts of system and surroundings, energy, energy transfer by work and heat, properties of substances and property changes, first and second laws of thermodynamics.

Course Objectives:
1. To introduce the concepts of system, surroundings, energy interactions, thermodynamics properties of substances and to teach different techniques used for estimating the properties like gas laws and property tables
2. To explain the principles of work and energy.
3. To introduce the fundamentals of thermodynamic laws, concepts and principles.
4. To teach the systematic approach to be employed for effectively solving the problems in thermodynamics.
5. To explain the principles of various cycles and to apply the thermodynamic concepts in various applications like IC engines and Refrigeration and Air conditioning systems.

UNIT 1: THERMODYNAMIC BASICS
Macroscopic versus Microscopic viewpoint, Thermodynamic system and control volume, Thermodynamic properties, processes and cycles, Homogeneous and heterogeneous systems, Thermodynamic equilibrium, Quasi-static process, Concept of continuum, Zeroth law of thermodynamics, temperature scale, Ideal gas, Work Transfer, Heat transfer, First law of thermodynamics, Specific heat, Enthalpy, Internal Energy, Steady flow energy equation and application, PMM1 and Steady flow energy equation.

UNIT 2: PROPERTIES OF PURE SUBSTANCES
Pure substance, Vapor-Liquid-Solid-Phase equilibrium in a pure substance, Independent properties of a pure substance, Phase boundaries, tables of thermodynamic properties, Thermodynamic Surfaces, p-v and p-T diagram for a pure substance, p-v-T surface, T-s and h-s or Mollier diagram for a pure substance, dryness fraction, Steam Tables, Charts of Thermodynamic properties, Measurement of steam quality.

UNIT 3: SECOND LAW OF THERMODYNAMICS AND ENTROPY
Qualitative difference between heat and work, cyclic heat engine, Kelvin-Planck statement of second law, Clausius' statement of second law, Refrigerator and heat pump, Equivalence of

Kelvin-Planck and Clausius statement, Reversibility and Irreversibility, Carnot cycle, Reversed heat engine, Carnot's Theorem, Corollary of Carnot's theorem, absolute thermodynamic temperature scale and Efficiency of heat engine, Entropy, Inequality of Clausius, Temperature-Entropy plot, Entropy generation in an open and closed system and Entropy change in an Irreversible process.

UNIT 4: THERMODYNAMIC PROPERTY RELATIONS AND GAS MIXTURES
Equation of state, Ideal gas, Real gas, Compressibility chart, Internal energy, enthalpy, entropy, specific heats and Gibbs free energy of gas mixture, Maxwell's Equations, TdS equation, Difference in heat capacities, Ratio of heat capacities, Joule-Kelvin Effect, Clausius-Clapeyron equation, Properties of atmospheric air, Psychrometric chart and Psychrometric process.

UNIT 5: THERMODYNAMIC CYCLES
Rankine cycle, Actual vapour cycle processes, Comparison of Rankine and Carnot cycles, Air standard cycles - Otto, Diesel, dual and Brayton cycles, Reversed heat engine cycle, Vapour compression refrigeration cycles.

Course Outcomes:
On successful completion of the course, the student will be able to:
1. Define the fundamentals of the zeroth and first laws of thermodynamics and explain their application to a wide range of systems.
2. Apply the properties of steam to design steam systems.
3. Apply the second law of thermodynamics for the design of heat engine, heat pump and refrigerators. The student will also be able to Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
4. Explain the cycles on which IC engines, Gas turbines and refrigerator works.
5. Explain the importance of Tds relations and be able to use psychometric charts for the design of air conditioning systems.

Text Books:

1. Cengel, Y.A and Boles, M.A, Thermodynamics: An Engineering Approach, 5th ed., McGraw-Hill, 2006.

References:

1. Sonntag, R.E., Borgnakke, C., and Van Wylen, G.J., Fundamentals of Thermodynamics, 6th ed., John Wiley, 2003.
2. Nag, P.K., Engineering Thermodynamics, 3rd ed., Tata McGraw-Hill, 2005.

Mode of Evaluation: Assignment, Mid Examination, End Examination

18EEE301 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course deals with basics of electrical wiring systems for residential, commercial and industrial consumers, and its representation with standard symbols and drawings, various components of industrial electrical systems and its sizing and control aspects of industrial electrical system using PLC and SCADA.

Course Objectives:
1. To understand the electrical wiring systems for residential, commercial and industrial consumers.
2. To learn the representation of systems with standard symbols and drawings.
3. To understand the various components of industrial electrical systems.
4. To analyze and select the proper size of several electrical system components.
5. To study the control aspects of industrial electrical system using PLC and SCADA

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

(9)

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

(8)

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

(8)

UNIT IV: INDUSTRIAL SUBSTATION SYSTEMS
HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

(8)

UNIT V: INDUSTRIAL SYSTEM AUTOMATION
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.
Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

(12)

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Discuss the various component representation involved in the design of electrical wiring for Low Tension.
2. Understand the guidelines for wiring of household and commercial buildings.
3. Understand the various components of illumination in industrial electrical systems.
4. Select the proper size of various electrical system components required for designing different electrical wiring systems.
5. Understand the control aspects of industrial electrical system using PLC and SCADA.

Text Books:
1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

Reference:
1. Web site for IS Standards.
2. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 1997.
3. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Course Prerequisite: 18EEE101

Course Description:
This course describes about manufacturing, modeling and applications of MEMS.

Course Objectives:
1. To know the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices
2. To know various MEMS microfabrication technologies.
3. To provide various MEMS technology for mechanical, optical, and chemical sensors and actuator

UNIT I: INTRODUCTION
Overview – History and industry perspectives – Working principles – Mechanics and dynamics — Scaling law

(9)

UNIT II: MICRO SENSORS & ACTUATORS
Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems

(9)

UNIT III: MICRO MANUFACTURING
Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

(9)

UNIT IV: MODELING IN MEMS
Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

(9)

UNIT V: MEMS APPLICATIONS
Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

(9)

Course Outcomes:
At the end of the course, students will able to
1. Explain the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices
2. Analyze the Micro sensors and actuators and its fabrication
3. Explain the materials for MEMS and Microsystems
4. Design MEMS using microfabrication techniques
5. Explain the advantages of MEMS technology for mechanical, optical, and chemical sensors and actuator

Text Books:
1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006
2. G.K. Ananthsuresh et al ,'Micro and Smart Systems', Wiley, India, 2010

References:
1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000
3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005
4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:
This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids.

UNIT I: Human Physiology and Biomedical Transducers
Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.
(9)

UNIT II: Bio-Electrodes and Amplifiers
Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.
(9)

UNIT III: Biomedical Measuring Instruments
Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.
(9)

UNIT IV: Medical Imaging
X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.
(9)

UNIT V: Prostheses and Aids
Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects.
(**9)**

Course Outcomes:

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

1. Understand the applications of biological transducers in medical field.
2. Analyze the design of bio-electrodes and bio-amplifiers.
3. Apply suitable measuring instruments to measure various medical parameters.
4. Understand and test various imaging techniques used in bio-medical diagnosis.
5. Analyze the applications of artificial medical aids.

Text Books

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.
2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009.

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014.
2. R.S.Khandpur, "Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw-Hill, New Delhi, 2005.
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18ECE302 VLSI DESIGN

	L	T	P	C
Course Prerequisite: None	**3**	**0**	**0**	**3**

Course Description

This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET, CMOS processing technology, circuit characterization and performance estimation, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives

This course enables students to

1. Know the different VLSI Design Methodologies
2. Understand the characteristics of CMOS device
3. Study CMOS design rules
4. Designing of CMOS by considering the low power
5. Understand different types of CMOS circuit families

UNIT I: Introduction to VLSI design methodologies

Introduction to VLSI Design Methodologies, Scaling, CMOS Logic: Inverter, NAND Gate, NOR Gate, Combinational Logic, Compound Gates, Pass Transistors and Transmission Gates, CMOS Inverter Cross-section, Stick Diagrams. VLSI Design Flow, Complementary CMOS Inverter DC Characteristics, Beta Ratio Effects, Noise Margin.

(9)

UNIT II: MOS transistor theory

MOS Ideal I-V Characteristics, C-V Characteristics, MOS Small-signal Model, MOS Capacitance Models, MOS Gate Capacitance Model, MOSFET as a Switch, non-ideal I-V Effects: Velocity Saturation and Mobility Degradation, Channel Length Modulation, Body Effect, Sub-threshold Conduction, Junction Leakage, Tunneling.

(9)

UNIT III: CMOS technologies

CMOS Technologies: Background, Wafer Formation, Photolithography, Well and Channel Formation, Isolation, Gate Oxide, Gate and Source/Drain Formation, Contacts and Metallization, Passivation, Metrology. Scribe Line and Other Structures, MOSIS Scalable CMOS Design Rules, Micron Design Rules.

(9)

UNIT IV: Low power design

Delay Estimation using RC Delay Model and Linear Delay Model, Logical Effort, Parasitic Delay. Logical Effort and Transistor Sizing: Delay in a Logic Gate, Delay in Multistage Logic Networks, choosing the Best Number of Stages. Power Dissipation: Static Dissipation, Dynamic Dissipation, Low-Power Design. Interconnect: Resistance, Capacitance, Delay, and Crosstalk.

(9)

UNIT V: Circuit families
Circuit Families: Static CMOS, Ratioed Circuits, Cascade Voltage Switch Logic, Dynamic Circuits, Sense Amplifier Circuits, Bi-CMOS Circuits, Multiplexers, Sequential Static Circuits, Design of Latches and Flip-Flops.

(9)

Course Outcomes
Upon successful completion of the course, students will be able to
1. Explain the VLSI design methodologies and basic CMOS circuits used in modern Integrated circuits applications.
2. Discuss the fundamentals of MOS transistor theory.
3. Discuss about the CMOS processing technology.
4. Discuss about the integrated circuit characterization and performance estimation.
5. Describe the different types of circuit families.

Text Books
1. J. P. Uyemura: Introduction to VLSI Circuits and Systems, Wiley.
2. Neil H.E. Weste, David Harris, Ayan Banerjee: CMOS VLSI Design, Third Edition, Pearson Education.

Reference Books
1. Philip E. Allen and Douglas R Holberg: CMOS Analog Circuit Design, Oxford.
2. Carver Mead and Lynn Conway: Introduction to VLSI systems, BS Publication.
3. Plummer: Silicon VLSI Technology, Pearson Education.
4. J. P. Uyemura: Chip Design for Submicron VLSI, Cengage Learning.
5. Neil H.E. Weste, Kamran Eshraghian: Principle of CMOS VLSI Design, Pearson Education.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18CSE301 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Prerequisite: Nil

Course Description:

This course will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Course Objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To give introduction to shell programming.
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5. To know the components and management aspects of concurrency management

UNIT I: INTRODUCTION
Concept of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Case study on UNIX and WINDOWS Operating System. KORN SHELL PROGRAMMING:Basic Script Concepts,Expressions, Decisions: Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts.

(9)

UNIT II: PROCESS CONCEPTS
Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling.

(9)

UNIT III: PROCESS SYNCHRONIZATION AND DEADLOCKS
Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

(9)

UNIT IV: MEMORY MANAGEMENT STRATEGIES

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

(9)

UNIT V: FILE SYSTEM:

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

(9)

Course Outcomes:

At the completion of the course the students will be able to:

1. Write shell scripts using korn shell.
2. Create processes & threads and implement the various process scheduling techniques.
3. Analyse the concurrent processing and deadlock situations.
4. Design algorithmic solutions to solve memory management problems.
5. Implement the different types of file management techniques.

Text Books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

References:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18CSE302 E-LEARNING TECHNOLOGIES

	L	T	P	C
Course Prerequisite: Nil	**3**	**0**	**0**	**3**

Course Description:

The course provides a comprehensive understanding of the fundamental theory of E-learning and the Strategies of E-Learning .The relation between Models of E-Learning and Multi/Hyper Media for E-learning has been explained across various stages of learning techniques.

Course Objectives:

1. To enable the students to understand the concept of e-learning and integrating the technology.
2. To inculcate knowledge in planning the role of information technology in virtual classroom and university.
3. To make the students to understand the technology mediated communication and its applications.
4. To include knowledge in planning models of E-learning in in virtual classroom and university.
5. To make the students to understand the future of E-learning technology and its development.

UNIT I: CONCEPT OF E-LEARNING

Meaning, Evolution of E-Learning – Components of E-Learning – Virtual classroom: Teleconferencing, Audio and Video conferencing.

(9)

UNIT II: STRATEGIES OF E-LEARNING

Process of E-Learning: Knowledge Acquisition and Creation, Sharing of Knowledge, Utilization of Knowledge – E-Learning Instructional Grounds: Behaviourism, Cognitivism and Constructivism.

(9)

UNIT III: MODELS OF E-LEARNING

Role of Web-Based Instruction in Learning – Models of WBI: Instructional Design Model (ISD) & Hyper Media Design Model (HMD) – Computer Languages for Designing WBI – Future of E-Learning.

(9)

UNIT IV: MULTI/HYPER MEDIA FOR E-LEARNING

Concept, Meaning, Characteristics and Applications – Teaching Techniques through Multi/Hyper Media – Multimedia & Learning – Multimedia for Co-operative and Collaborative Learning Strategies – General Guidelines for Multi/Hyper Media Applications – Advantages & Disadvantages of Multi/Hyper Media.

(9)

UNIT V: FUTURE OF E-LEARNING TECHNOLOGY

21stCentury Education – Challenges of Distance Education – Electronic Media in Distance Education – Open Educational Resources / Open Learning – Internet in Distance Education – Virtual University System.E-Patashala, Indian Institutes Developing E-Content.

(9)

Course Outcomes:

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

1. Understand the concept of e-learning and integrating the technology.
2. Make the students to understand the technology mediated communication and its applications.
3. Understand the technology mediated communication and its applications.
4. Include knowledge in planning models of E-learning in in virtual classroom and university.
5. Make the students to understand the future of E-learning technology and its development.

Text Books:

1. Badrul Khan and Mohamed Ally(Edited), 2015, International Hand book of E-Learning:Volume-1 Theoretical Perspectives and Research, Routledge,.
2. Robyler , 2007, Integrating Educational Technology into Teaching, 4th Edition, Pearson Education India .
3. Richard Andrews and Caroline Heythornthwaite (Edited), 2007, The SAGE Hand Book of E-Learning Research, SAGE,Delhi.

References:

1. Bryn Holmes and John Gardiner, 2006,E-Learning Concepts and Practice, ,Pine Forge Press.
2. Y.R. Ramaiah , 2002,Distance Education and Open Learning, , Mittal Publications.
3. PradeepMandav, 2001, Visual Media Communication, Authorspress.
4. Michael D.Wiliams, Prentice Hall, 2000,Integrating Technology into Teaching and Learning: Concepts and Applications,.
5. Laura Parker Roerden, O'Reilly, 1997,Net Lessons: Web-based Projects for Your Classroom, Volume 1.
6. Paul F. Merrill, Allyn and Bacon, 1996,Computers in Education, 3rd Edition.
7. Joan Riedl, Allyn and Bacon, 1995,The Integrated Technology Classroom.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

18CSE303 AI TOOLS, TECHNIQUES AND APPLICATIONS

Course Prerequisite: None

L	T	P	C
3	0	0	3

Course Description:
To understand the importance of AI and its applications, Machine learning and Deep Learning algorithms and smart solutions for various domains.

Course Objectives:
The objectives of this course are to
1. Expose fundamental concepts in AI
2. Demonstrate the capability to create simple AI applications using Natural Language Processing, Speech Recognition, Computer Vision, Pattern recognition.
3. Present various modeling and formulation techniques to solve problems using AI techniques.
4. Introduce state-of-art AI tools and techniques to solve various problems faced by Engineers in design and analysis.

UNIT I: FUNDAMENTALS OF AI
AI-Definition, Applications of AI, Search Strategies – BFS, DFS, Knowledge representation and reasoning – Knowledge based Agent, Wumpus World Environment, Logics.**Machine Learning:** Supervised Learning - Linear Regression, Logistic Regression, Unsupervised Learning – K-means clustering, Anamoly Detection, Reinforcement Learning.
(9)

UNIT II: NLP AND BOT TECHNOLOGIES
Natural Language Processing: Natural language Understanding, Sentiment Analysis, Segmentation and recognition, Speech Recognition, Text-to-Speech, NLP in the cloud, NL Interface, **Chatbots:** Chatbot definition, Build a Chatbot, How has chatbot transformed user experience, Designing elements, best practices for chatbot development, **Virtual Assistants:** What is a Virtual Assistant?
(9)

UNIT III: IMAGE PROCESSING &APPLICATIONS
What is Image processing?, Image Noise, Removal of Noise from Images, Color Enhancement,Fourier transforms, Feature detection and matching, Segmentation**,** Object detection, Face recognition, Recognition Databases and test sets. Application: Optical Character Recognition.
(9)

UNIT IV: DEEP LEARNING
Introduction - Neural Networks, Deep Learning, Different types of Deep Neural Networks - CNN,RNN, forward propagation, Cost function, backpropagation.APIs using Softwares Tensorflow and Keras. **(9)**

UNIT V: SMART APPLICATIONS

Smart Agriculture, Smart Transportation and Autonomous Vehicles, Smart Homes, Smart Cities.

(9)

Course Outcomes:

Upon the completion of the course, students able to

1. Understand the basic concepts and applications of Artificial Intelligence.
2. Design Chatbots based on the user requirements
3. Identify the features of digital images for analysis.
4. Implement the deep learning techniques using software tools.
5. Develop smart applications for various domains

Textbooks:

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
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer 2010
4. Ian Goodfellow, Yoshua Bengio, Aaron Courvill, Deep Learning

Reference Books:

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. A classical approach to Artificial Intelligence, Munesh Chandra Trivedi, Khanna Publications
3. Artificial Intelligence and Machine Learning, Chandra S.S. & H.S. Anand, PHI Publications
4. Machine Learning, Rajiv Chopra, Khanna Publishing House

Mode of evaluation: Assignments, Mid Term Tests, End Semester Examinatio

OPEN ELECTIVES-IV

18ENG301 CREATIVE WRITING

L	T	P	C
3	0	0	3

Course Description: The course functions as a broad-based introduction to various forms of creative writing, such as short fiction, poetry and drama. Short story writing is geared towards creative writing so that students learn about character, dialogue, voice, style and description in fiction. The course provides them with the opportunity to delve deeper into the analysis of selected short fiction and to work on stories of their own. Students explore the genre of poetry in-depth through their own writing and that of published poets. The study of playwriting involves many of the same focuses as short story writing, such as dialogue, character and plot. Students also experiment with writing these genres. The class is usually comprised of technique and style discussions, reading assignments and writing exercises.

Course Objectives:
This course enables the students to –
1. familiarize with different forms of writing: poetry, scene writing, vignette and feature writing.
2. To encourage reading and acquainting, appreciating and responding to different genres of writing.

UNIT I: Introduction to creative writing and reading. Poetry, Short Story, Drama, Fiction, Non Fiction, Feature Writing, etc. **(9)**

UNIT II: Poetry, Scenario writing, feature and vignette writing. Haiku, Object Poem, List Poem, Visual Poem, Nature Poem. Scanning a poem and understanding its meaning. **(9)**

UNIT III: Writing a scene, finding sources from which to draw ideas to write scenes, creating an effective setting for a scene to take place; creating strong, believable characters in a scene **(9)**

UNIT IV: Learning how a scene can drive the plot of a story, how to effectively use point of view to enhance a scene, how to write interesting and useful dialogue, self-editing own writing. **(9)**

UNIT V: Writing a vignette, finding sources from which to draw ideas to write a vignette, organizing one's time and ideas to produce a longer piece of writing. **(9)**

Course Outcomes:
At the end of the course, students will be able to:
1. Develop skills in reading, writing, and editing various literary genres.
2. Obtain an awareness of the role of analysis to inform appreciation and understanding of poetry.
3. Demonstrate the ability to read and respond thoughtfully.
4. Develop plot of the story and sketch characters with relevant dialogues
5. Obtain effective writing skills such as good essays and projecting scholarly ideas.

Text Book:

1. Tondeur, Louise. 2017. How to Think Like a Writer: A Short Book for Creative Writing Students and Their Tutors. Louise Tondeur

Reference Books:

1. Middleton, Daniel. 2012. The 7 Points of Write: An Essential Guide to Mastering the Art of Storytelling, Developing Strong Characters, and Setting Memorable Scenes. 711 Press

2. Kumar, Amrita. 2017. Kissing the Demon: The Creative Writer's Handbook. Harper Collins
3. Mastering Creative Writing: A Writer's Guide by Dahveed Bar-Daniel (kindle book) published :12 April 2017

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

18HUM303 ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

Course Description: The objective of this course is to inculcate in students the skills necessary to craft strategies and initiatives which can enable growth and sustainability in an entrepreneurial venture, to include the effective management of inventory, receivables, production, human resources, financial resources, and risk. Students will develop higher-level critical thinking skills, evidenced by analysis, evaluation, and synthesis.

Course Objectives: The course is intended to:

1. Explain the basic concepts of entrepreneurship and its role in Indian Economy;
2. Describe the SWOT analysis, promotional and financial aspects of entrepreneurship
3. Explain project planning and feasibility studies;
4. Make the students acquire knowledge about women entrepreneurship; and
5. Explain the rural entrepreneurship and role of NGOs and EDPs in India.

UNIT I: INTRODUCTION

Entrepreneurial competencies, attitudes, qualities, functions - Forms of Entrepreneurship - Types of ownership - sole trading, partnership and corporation – Role of Government in Entrepreneurship Development. **(9)**

UNIT II: PROMOTIONAL & FINANCIAL ASPECTS OF ENTREPRENEURSHIP

Idea generation– opportunities - SWOT Analysis - patents and trademarks, Intellectual Property Rights. Financial Aspects of the Entrepreneurship: Source of Capital, Debt capital, seed capital, venture capital - Informal Agencies in financing entrepreneurs, Government Grants and Subsidies, Types of Investors and Private Offerings. **(9)**

UNIT III: PROJECT PLANNING AND FEASIBILITY STUDIES

Concept of Project, Project Life Cycle -Project Planning, Feasibility Report – Project proposal & report preparation. Technical Feasibility and Economic Viability – sources of New Ideas. **(9)**

UNIT IV: WOMEN ENTREPRENEURSHIP

Scope of entrepreneurship among women – Promotional effects – Institutional framework - Successful cases of women entrepreneurs. **(9)**

UNIT V: RURAL ENTREPRENEURSHIP AND EDPS

Role of NGO's– Organizing EDPs – Social Entrepreneurship – startups – Entrepreneurship development among target groups of society. **(9)**

Course Outcomes:

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

1. Understand the concepts of entrepreneurship and its role in Indian Economy;
2. Compare and apply sources of different promotional and financial aspects;
3. Understand and analyze the feasibility study in project planning;
4. Find the women entrepreneurship development in India; and
5. Assess the rural entrepreneurship and strengthen the role of NGOs and EDPs.

References:

1. Entrepreneurial Development, S. Chand and Company Limited, S.S. Khanka, New Delhi, 2009.
2. Fundamentals of Entrepreneurship, H. Nandan, PHI, First/e, New Delhi, 2009.
3. Entrepreneurship, 6/e, Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH,2009.
4. The Dynamics of Entrepreneurial Development and Management, Vasanth
5. Desai, Himalaya,2009
6. Entrepreneurship Management – text and cases, Bholanath Dutta, Excel Books, 2009
7. Entrepreneurship – New venture Creation, Holt, PHI, 2009

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

18MAT303 GRAPH THEORY

	L	T	P	C
Course Prerequisite: Modern Algebra, Linear algebra	**3**	**0**	**0**	**3**

Course Description:

Graph theory is the core content of Discrete Mathematics. This course introduces in an elementary way some basic knowledge and the primary methods in Graph Theory also it is important in regarding to find out the mathematical structures from graph theory in concrete examples.

Course Objectives

1. To understand the fundamental definitions and properties of graphs.
2. To know the concepts of trees and spanning trees.
3. To learn about the matching and factors, connectivity.
4. To study the concepts of coloring of graphs, Planer graphs.
5. To introduce about the edges and cycles.

UNIT I: FUNDAMENTAL CONCEPTS
Graphs, path, cycles and trails, vertex degree and counting, directed graphs **(9)**

UNIT II: TREES AND DISTANCE
Basic properties, spanning trees, optimization and trees. **(9)**

UNIT III: MATCHING AND CONNECTIVITY
Matching and covers, algorithm and applications, Cuts and Connectivity, k-connetced graphs. **(9)**

UNIT IV: COLOURING OF GRAPHS AND PLANER GRAPHS
Vertex coloring, structure of k-chromatic graphs, Euler's formula, characterization of planar graphs. **(9)**

UNIT V: EDGES AND CYCLES
Line graphs and edge coloring, Hamiltonian cycles, planarity, coloring and cycles. **(9)**

Course Outcomes:

At the completion of the course the students will be able to:

1. Understand the basic terminology of graphs.
2. Determine the number of trees and spanning trees in a graph.
3. Find the matching and connectivity in graphs.
4. Learn about the concepts of coloring of graphs and Planer graphs.
5. Determine the number of edges and cycles of a graph.

Text Book:

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India 2014.

References

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.
2. Frank Harary, Graph Theory, Narosa.
3. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall.

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Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

18MAT304 MATHEMATICAL MODELING AND NUMERICAL SIMULATION

L	T	P	C
3	0	0	3

Course Description:
This course introduces mathematical modeling and numerical simulation as tools for analyzing and solving real world problems. Here, data assimilation (DA) technique has been discussed to find the best estimate of the state by combining available information including model forecasts, observations and their respective errors. The accurate initial condition obtained by DA is used as input to numerical weather prediction (NWP) modules to improve the model forecast. Data visualization techniques allow engineering students to use their perception to better understanding of the implications of the data and their importance in many different fields.

Course Objectives:

1. To understand the overview of dynamic model system with dynamical and thermo-dynamical equations
2. To understand the basic concept and classification of partial differential equations and importance of initial and boundary value problem.
3. To introduce the development and use of modeling system in terms of scale and physical process.
4. To provide a conceptual and mathematical overview of the data assimilation.
5. To develop the skills for design and a comparative study between observed and modeled data.

UNIT I: BASIC CONSERVATION LAWS AND APPLICATIONS OF BASIC EQUATIONS

Total differentiation, Vectorial form of the momentum equation in rotating coordinates, Component equations in spherical coordinates, The continuity equation, The thermodynamic energy equation, Basic equations in isobaric coordinates, Balanced flow, Trajectories and streamlines, Thermal wind, Vertical motion **(9)**

UNIT II: NUMERICAL DISCRETIZATION OF EQUATIONS

Classification of partial differential equations (PDEs), Initial value problems, Finite difference method for space discretization, Boundary value problems: Heat, Wave and Laplace equations **(9)**

UNIT III: NUMERICAL MODELS AND PHYSICAL PROCESSES

Numerical models: Global, Regional, Mesoscale models, Parameterization of sub-grid scale physical processes: Planetary boundary layer, Moist microphysics physics, Cumulus convection, Radiation, Air-sea interaction processes, and Land-surface processes, Overview of interactions and parameterizations of these processes **(9)**

UNIT IV: DATA ASSIMILATION

Data assimilation: Empirical analysis schemes, Objective analysis schemes, Variational data assimilation techniques (unsteady three dimensional); Forecast error covariance; Dynamical and physical balance in the initial conditions; Quality control of observations; Atmospheric predictability; Concepts of chaotic systems and ensemble forecasting. **(9)**

UNIT V: DATA ANALYSIS AND VISUALIZATION

Introduction of WRF model and its Applications; Analysis of simulated and observed data sets through Grid Analysis and Display System (GrADS), MATLAB, and Excel software. **(9)**

Course outcomes

At the end of the course students are able to

1. Understand overview of dynamic model system and solve a set of dynamical and thermo-dynamical equations governing the state of the atmosphere.
2. Find accurate results through simulations by using proper and suitable representation of dynamical processes
3. Gain the knowledge of how and where to use the mathematical models in regional, mesoscale and global scales and develop an understanding of the physical processes
4. Compute the best estimate of the state by statistically combining model forecasts, observations, and their respective errors by using data assimilation technique.
5. Prepare the data for visualization and compare the results with observations.

Text books:

1. An Introduction to Dynamic Meteorology, Fourth Edition, by James R. Holtan, Elsevier Academic Press
2. Atmospheric Modeling, Data Assimilation, and Predictability, by Eugenia Kalnay (Cambridge University Press, 2003)
3. A description of the advanced research WRF version 3. Tech. Note, by Skamarock, W.C (2008).

References:

1. Dynamics, Volume 101, Second Edition: Physical and Numerical Aspects. Academic Press
2. Mark Z Jacobson. Fundamentals of Atmospheric Modeling, Cambridge University Press
3. James C. McWilliams. Fundamentals of Geophysical Fluid Dynamics, Cambridge University Press
4. Introduction to Grid Analysis and Display System (GrADS), by Guilherme Martins (2014), DOI:10.13140/RG.2.1.2594.2249.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations.

18PHY303 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:
1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I: PHYSICS OF THIN FILMS
Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation. **(9)**

UNIT II: THIN FILM DEPOSITION TECHNIQUES
Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating. **(9)**

UNIT III: PROPERTIES OF THIN FILMS
Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films. **(9)**

UNIT IV: CHARACTERIZATION OF THIN FILMS
Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry). **(9)**

UNIT V: APPLICATIONS OF THIN FILMS
Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors. **(9)**

Course Outcomes:
After a successfully completed course the students will be able to:

1. Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.
2. Asses the relation between deposition technique, film structure, and film properties.
3. Know the typical thin film applications.
4. Motivate selection of deposition techniques for various applications.

Text books:

1. Thin Film Deposition: Principles and Practice, *Donald L. Smith*, McGraw Hill, Singapore, 2001.
2. Maissel, L.I and Glang. R, "Handbook of thin film technology", McGraw Hill, 1970.

References:

1. Thin film phenomena / *Kasturi L. Chopra,* New York: McGraw-Hill, c1969.
2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
3. An introduction to physics and technology of thin films / *Alfred Wagendristel, Yuming Wang*, Singapore: World Scientific, c1994.
4. Thin film processes, *John L Vossen, Werner Kehn* editors, Academic Press, New York, 1978.
5. Thin film physics / *O.S. Heavens*, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18CHE303 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

Course Description

This is primarily a lecture course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology.

Objectives

1. To understand the emergence of nanoscience and technology through history.
2. The various process techniques available for nanostructured materials.
3. The role of nanotechnology in electronics how basic nano-systems work
4. To use physical reasoning to develop simple nanoscale models to interpret the behaviour of such physical systems

UNIT I: MOLECULE TO MATERIALS: BASICS OF NANOTECHNOLOGY

History & emergence (Feynman to present) of Nanoscience and Nanotechnology, Challenges in Nanotechnology. Atomic Structures: Rutherford and Bohr's model of atom. Bohr's model to Quantum: Wave function, Uncertainty principle, Orbital quantum numbers, Shape of the orbitals. Types of simple crystal structures, defects in crystals. **(9)**

UNIT II: TYPES AND SYNTHESIS OF NANOSTRUCTURES

Definition of a Nano system - Zero Dimensional (OD), One Dimensional (1D) - Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials. Nanoscale building blocks, Top-down and Bottom-up approaches. Synthesis of Nanomaterials – Physical & Chemical methods: Chemical Vapour Deposition (CVD), Atomic Layer Deposition (ALD), Chemical Reduction, Co-precipitation, Emulsion Polymerization (Polymer and Organic NPs), Sol-Gel, Green synthesis of Nanoparticle (NP). **(9)**

UNIT III: PROPERTIES OF NANOMATERIAL

Thermal, Mechanical, Optical, Electrical and Magnetic properties of nanomaterials (Metal oxides, Ceramics, Nanocomposites, Semiconductors). Carbon age materials: CNTs, and other Carbon-based materials). Effect of size and shape on the properties of nanomaterials. **(9)**

UNIT IV: CHARACTERIZATION OF NANOMATERIALS

Structure: Powder XRD (SAXS); Composition: XPS; Thermal: TG-DTA; Optical & Electron microscopes: Atomic force microscopes (AFM), Scanning electron microscope (SEM), Transmission electron microscope (TEM); Magnetic characterization (SQUID). **(9)**

UNIT V: APPLICATIONS OF NANOMATERIALS

Molecular electronics and nano-electronics – LED applications, Quantum electronic devices - CNT based transistor and Field Emission Display – Biological (anti-bacterial, anti-fungal, anti-microbial) applications - Biochemical sensor - Membrane based water purification, Target based drug delivery system. **(9)**

Course Outcomes:

Upon completion of this course the students will be able to:

1. Understand the correlation between atomic, molecular structures and nanomaterials
2. Classify the types and synthesis the nanomaterials based on the needs of the society and environment.
3. Infer and interpret the properties of nanomaterials
4. Apply the knowledge of characterization tools towards making the sustainable engineering products.
5. Illustrate the application of various nanomaterials in daily life, industry towards the sustainable development.

Text Books:

1. M. Wilson, K. Kannangara, G. Smith, M. Simmons, and B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C. N. R. Rao, A. Muller, and A. K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
3. Kenneth J. Klabunde (Eds), Nanoscale Materials Science, John Wiley & Sons, InC, 2001.
4. C. S. S. R. Kumar, J. Hormes, and C. Leuschner, Nanofabrication towards biomedical applications, Wiley - VCH Verlag GmbH & Co, Weinheim, 2004.
5. T. Pradeep, Nano: The Essentials, Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

References:

1. W. Rainer, *Nano Electronics and information Technology*, Wiley, 2003.
2. K. E. Drexler, *Nano systems*, Wiley, 1992.
3. G. Cao, *Nanostructures and Nanomaterials: Synthesis, properties and applications*, Imperical College Press, 2004.
4. P. Yang, Chemistry of Nanostructured Materials, World Scientific Publishers, 2005.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18CHE304 COMPUTATIONAL METHODS IN MATERIALS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisite:

Exposure to Introductory engineering mathematics, introductory materials science and introductory programming courses is preferred.

Course Description:

This course deals with various computational approach and mathematical methods to understanding and apply different concepts in materials science and engineering.

Course Objectives:

1. To get exposed to the basic concepts in Materials Science and Engineering.
2. To understand the basic concepts of Programming and Graphical plotting.
3. To introduce the basic concepts of Data types and handling of various data.
4. To familiarize the basic concepts of modelling and simulation.
5. To acquire and apply the current knowledge and trends in the field of Computational Materials Science.

UNIT I: INTRODUCTION TO COMPUTATIONAL MATERIALS SCIENCE AND ENGINEERING

Concepts in materials science and engineering; use of computers and freely available open source software to: data handling; understand concepts and solve problems of engineering interest. **(9)**

UNIT II: PROGRAMMING AND PLOTTING

Introductions to the advanced concept C programming language; open source software for numerical computations and visualization (gnuplot, GNU Octave, Scilab); introduction to the LaTeX software for report preparation along with other miscellaneous software and programs. **(9)**

UNIT III: DATA TYPES AND HANDLING TECHNIQUES

Classification, and understanding of data properties, data handling - plotting, fitting, functional forms, interpolation, and integration. **(9)**

UNIT IV: COMPUTATIONAL MODELING AND SIMULATIONS

Understanding the materials properties; atomistic and electronic modelling of materials; concepts in molecular dynamics and its application using Quantum ESPRESSO. **(9)**

UNIT V: CURRENT TRENDS IN COMPUTATIONAL MATERIALS SCIENCE

Applied materials for various engineering field; research literature exploration; real-time application of computational methods in materials science and engineering, mini-project. **(9)**

Course Outcomes:

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

1. Understand the importance and applications of computational methods in Materials Science and Engineering.
2. Be familiarized with the tools of the trade, namely programming and graphical plotting.
3. Be able to understand and access the various types of data sets and appropriately handle it to productively work with it.
4. Get the knowledge about handling various open source computational tools and their effective usage to do computational modeling and simulations.
5. Be familiarized with up to date trends in computational materials science by taking up real time research problems and provide solutions.

Text Books:

1. Computational Materials Science: An Introduction, Second Edition 2nd Edition, by June Gunn Lee, 2014
2. Materials science and engineering: an introduction, William D Callister, Sixth edition, John Wiley & Sons, 2013.
3. The C programming language, Brian W Kernighan and Dennis M Ritchie, Second edition, PHI Learning Private Limited, 2010.
4. Materials science and engineering: a first course, V Raghavan, Fifth edition, PHI Private Limited, 2008.
5. Physical metallurgy principles, Robert E. Reed-Hill, Second edition, Affiliated East-West Press Pvt. Limited, 2008.
6. An introduction to materials science and engineering, Kenneth M Ralls, Thomas H Courtney, and John Wulff, Wiley India Pvt. Ltd., 2011.

References:

1. Materials Science and Engineering,V Raghavan,Prentice-Hall India, 2004
2. Advanced Engineering Mathematics, E Kreyzig, Wiley-India,1999.
3. A Review of Computational Methods in Materials Science, International Journal of Molecular Sciences 10(12):5135-216

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18ME304 INTERNET OF MANUFACTURING THINGS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
The manufacturing industries are the significant sustainable sources for the modern society. Traditional manufacturing systems and relative management approaches need constant review and upgrade to meet the demands of modern complex products. Internet of Things (IoT), has potential to collect, process, analyze and communicate real time data, while enhancing overall productivity within given time frame with higher flexibility and transparency. This course tries to provide the essential knowledge to bridge the IoT and Manufacturing systems.

Course Objectives:

1. To provide the basic knowledge and importance of IoT and its logic and applications in Manufacturing Industry.
2. To provide the basic knowledge of real time information sensing and cloud computing in manufacturing system.
3. To understand the concepts of IoT enabled smart trolleys and assembly systems.
4. To provide basic understanding of real-time production performance analysis methods. and scheduling system.
5. To provide basic understanding of real-time, information driven production scheduling system.

UNIT I:
Introduction- Concept of IoT, Existing manufacturing paradigms and their limitations, Applications of IoT in Manufacturing System (MS), The Concept of IoT-MS and its limitations.

Overview of IoT-Enabled Manufacturing System- Overall architecture of IoT-MS, Integration framework of real-time manufacturing information, The work logic of IoT-MS, Core technologies in IoT-MS. **(9)**

UNIT II:

Real-Time(RT) Multisource Manufacturing Information Sensing System - Introduction, Overall Architecture of RT and multisource RMMISS, Deployment of multi-sensors, Multiple sensors manager, Multiple source manufacturing Information Capturing and Sharing, Case studies.

Cloud Computing-Based Manufacturing – Introduction, Overall architecture, Cloud Machine Model, MS-UDDI, Task driven manufacturing service method. **(9)**

UNIT III:
IoT-Enabled Smart Assembly Station- Introduction, RFID based applications and assistant services in assembly line, Overall architecture, Real-time: Status Monitoring, Production Guiding, Data Sharing, Production Requeuing.

IoT Enabled Smart Trolley– Material handling and real time strategy, RT-data capturing in manufacturing field, overall architecture, Real-time: Information capturing, Encapsulation, Exchange, Workflow based guidance. Two stage combination optimization method. **(9)**

UNIT IV:
Real-Time (RT) Production Performances Analysis Method- Real-time: Production monitoring technique, KPI analysis, Anomaly analysis. Overall architecture, Even hierarchy of critical event, HTCPN analysis. Real time production anomaly diagnosis. **(9)**

UNIT V:
Real-Time Information Driven Production Scheduling System – Introduction, RT production scheduling, Agent technology, Manufacturing information monitor technology, Overall architecture, Equipment agent, Capability evaluation agent model, RT- scheduling agent model, Production execution monitor agent model. **(9)**

Course Outcomes:
The focus of this course is to study the inculcation of IoT in manufacturing systems and how the system turns smart. By the end of the course student should:

1. Be able to understand the fundamentals of IoT and its application in manufacturing systems.
2. Have a clear overall picture of multisource manufacturing information sensing system and cloud manufacturing.
3. Outline various methods of IoT enabled smart assembly systems and summarize the usage of smart trolleys
4. Make use of various RT- production performance analysis methods for test its applicability to real life problems.
5. Make use of various RT- information driven production scheduling system for test its applicability to real life problems.

Text Book:

1. Fei Tao, Y. Zhang, "Optimization of Manufacturing Systems Using the Internet of Things", 1st Edition, 2017, Academic Press, Elsevier.

Reference Book:

1. A. Gilchrist, "Industry 4.0: The Industry Internet of Things", 1st Edition, 2016, Apress.
2. M. Dastbaz, P. Cochrane, "Industry 4.0 and Engineering for a Sustainable Future", 1st Edition, 2019, Springer.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18ME305 ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course is designed to ignite the entrepreneurship idea into the young minds of engineers. Gives the complete details to setup an enterprise which includes the generating the business ideas, writing a business plan executing the plan successfully.

Course Objectives:

1. Understand the requirements of entrepreneurship as a profession.
2. Understand and develop the business plan.
3. Identify the various financial terms and conditions of new business venture.
4. Selection of plant location and choosing layout.
5. Analyse the market research for new ventures and small businesses.

UNIT I: INTRODUCTION
Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision processes. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. Case studies about successful Entrepreneur. **(9)**

UNIT II : CREATING AND STARTING THE VENTURE
Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities. Develop the business plan and evaluate with team. **(9)**

UNIT III: FINANCING AND MANAGING THE NEW VENTURE
Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising. New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Case studies about entrepreneur who success or failure in their business based on the financial control. **(9)**

UNIT IV: PLANT LAYOUT
Choosing location and layout, Issues related to Selection of layout. Production and Marketing Management, Selection of production Techniques, plant utilization and maintenance. Case study about selection of site and plant layout for new business venture. **(9)**

UNIT V: MARKET ANALYSIS
Designing the workplace, Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Case studies on market analysis on entrepreneur perspective. **(9)**

Course Outcomes:

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

1. Describes the sources of new business ideas, methods to develop new ideas and use the problem solving techniques
2. Able to Write a business plan which includes Financial plan, Organizational Plan and Marketing Plan
3. Able to identify the financial sources for new business ventures
4. Able to select a plant layout and draw a plant layout
5. Design a work place and Analyze the market research for new business.

Text Books:

1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

References:

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publ. House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18ME306 TOTAL QUALITY MANAGEMENT

	L	T	P	C
Course Prerequisite: None	**3**	**0**	**0**	**3**

Course Description

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees for the improvement of processes and products. It helps to reduce costs, exceed needs and expectations of customers and other stakeholders of an organization. TQM encompasses the concepts of business and social excellence that is sustainable approach to organization's competition, efficiency improvement, leadership and partnership.

Course Objectives:

The students will be able to:

1. Study comprehensive knowledge about the principles, practices, tools and techniques of total quality management.
2. Gain knowledge on leadership, customer satisfaction, addressing customer complaints, team work, employee involvement, related to customer and supplier partnership.
3. Gather information on various tools and techniques, concept on Six Sigma, bench marking and Failure Mode Effective Analysis (FMEA).
4. Know the importance of Quality circle, Quality Function Deployment, Taguchi design and case studies related to TQM.
5. To be aware of international/national Quality awards.

UNIT I: INTRODUCTION

Introduction - Need for quality - Evolution of quality - Definition of quality – Quality control, Quality management and Quality Assurance - Definition of TQM – Basic concepts of TQM - TQM Framework - Contributions by Deming, Juran and Crosby – Dimensions of quality – Benefits of quality and Barriers. **(9)**

UNIT II: TQM PRINCIPLES

TQM principles - Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection, Supplier Rating. **(9)**

UNIT III: TOOLS AND TECHNQUES I

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA. **(9)**

UNIT IV: TQM TECHNIQUES

Quality circles – Quality Function Deployment (QFD) – Design of Experiments-Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures. **(9)**

UNIT V: IMPELMENTATION OF TQM
Steps for Implementation of TQM, KAIZEN, 5S, JIT, POKAYOKE, I - Introduction to Robust Design, ISO Standards, Need for ISO 9000 and 14000 series, Quality Systems and Case studies. **(9)**

Course Outcomes:
Upon successful completion of this course, the student will be able to:
1. Understand the various principles and practices of TQM to achieve quality.
2. Identify the various statistical approaches for Total Quality Control.
3. Demonstrate the TQM tools for continuous process improvement.
4. Adopt the importance of ISO and Quality systems.
5. Make use of the concepts of TQM to solve case studies

Text Book:

1. Dale H. BesterField, et al., Total Quality Management, Pearson Education Asia, Third Edition, Indian Reprint (2003).

References:

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd. (2006) Model.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18EEE303 ROBOTICS

L	T	P	C
3	0	0	3

Course Prerequisite: Control Systems

Course Description:
Robotics is an interdisciplinary area ranging from mechanical & electrical component design to advanced sensor technology, incorporating computer systems and Artificial Intelligence (AI). With advances in AI-techniques & computational power in recent years, it has become one of the most interesting area for multidisciplinary research, with lots of commercial applications already in market.

Course Objectives:
1. To know the fundamentals of Robotics & its Applications.
2. To make students capable of handling robot manipulator tasks in real, as well as in simulation environment.
3. To know about kinetic and Jacobian modeling
4. To know about sensors and actuators.

UNIT I: INTRODUCTION & TRANSFORMATION AND MAPPING
Evolution of Robots and Robotics, Laws of Robotics, Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Robotic Programming and Future Prospects. Coordinate Frames, Object Description in Space, Transformation of Vectors, Inverting a homogenous transform, Fundamental Rotation Matrices. **(9)**

UNIT II: KINEMATIC MODELS
Direct Kinematic Model- Mechanical Structure and Notations, Description of links and joints, Kinematic modelling of the Manipulator, Denavit - Hartenberg notation, Kinematic relationship between Adjacent Links, Manipulator Transformation Matrix. Inverse Kinematic Model- Manipulator workspace, Solvability of Inverse Kinematic model, Solution Techniques, Closed form solution. **(9)**

UNIT III: JACOBIAN AND DYNAMIC MODELLING
Differential motion and statics- Linear and Angular Velocity of a Rigid Body, Relationship between Transformation, Mapping Velocity Vector, Velocity propogation along links, Manipulator Jacobian, Jacobian Inverse, Jacobian Singularities, Static Analysis. Dynamic modelling- Lagrangian mechanics, Lagrange-Euler formulation, Newton-Euler formulation, Comparison of Langrange-Euler and Newton-Euler formulation, Inverse Dynamics**.** **(9)**

UNIT IV: ROBOT MANIPULATOR CONTROL AND PATH PLANNING (9)
Robot manipulator control- Introduction, Control of Puma Robot Arm, Computed Torque Technique, near minimum time control, Variable structure control, Non linear decoupled feedback control, Resolved motion control, Adaptive ControlPath/Trajectory Planning-Introduction, Joint space techniques, Cartesian space techniques, State space search, Problem reduction and use of predicate logic, Means-Ends analysis, Problem solving and robot learning, Robot Task Planning and Basic problems. **(9)**

UNIT V: SENSORS AND ACTUATORS
Range sensing, Proximity sensing, Touch sensors, Force and Torque sensing, Artificial Intelligence techniques using Neural Networks and Fuzzy control. **(9)**

Course Outcomes:
At the end of the course, students will able to
1. Understand the fundamentals of Robotics.
2. Analyze the mechanical structure and notations kinematic model.
3. Analyze the jacobian and dynamic modeling.
4. Explain the robot manipulator control and path planning.
5. Describe the various sensors and actuators.

Text Book:

1. Mittal, R.K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.

References:

1. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, 1988.
2. Craig, J.J., Introduction to Robotics: Mechanism & Control. Addison Wesley, 1986.
3. Paul, R.P., Robot Manipulator: Mathematics Programming & Control. MIT Press, 1981.
4. Pugh,A., RobotSensors, Vision Vol.-I.Springer Verlag, 1986.
5. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill, 1986.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18EEE304 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Course Prerequisite: BEE

Course Description:
To provide a comprehensive exposure to electrical hazards, various grounding techniques, safety procedures and various electrical maintenance techniques.

Course Objectives:
1. To impart knowledge on electrical hazards and safety equipment.
2. To analyze and apply various grounding and bonding techniques.
3. To select appropriate safety method for low, medium and high voltage equipment.
4. To understand how to participate in a safety team.
5. To carry out proper maintenance of electrical equipment by understanding various standards.

UNIT I: ELECTRICAL HAZARDS
Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, locking devices- voltage measuring instruments-proximity and contact testers-safety electrical one line diagram- electrician's safety kit. **(9)**

UNIT II: GROUNDING AND BONDING
General requirements for grounding and bonding- definitions- grounding of electrical equipment- bonding of electrically conducting materials and other equipment- connection of grounding and bonding equipment- system grounding- purpose of system grounding-grounding electrode system- grounding conductor connection to electrodes-use of grounded circuit conductor for grounding equipment- grounding of low voltage and high voltage systems. **(9)**

UNIT III: SAFETY METHODS
The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system- lockout-tag out- flash hazard calculation and approach distances- calculating the required level of arc protection-safety equipment , procedure for low, medium and high voltage systems- the one minute safety audit. **(9)**

UNIT IV: SAFETY TEAM
Electrical safety programme structure, development- company safety team- safety policy-programme implementation- employee electrical safety teams- safety meetings- safety audit-accident prevention- first aid- rescue techniques-accident investigation. **(9)**

UNIT V: MAINTENANCE OF ELECTRICAL EQUIPMENT
Safety related case for electrical maintenance- reliability centered maintenance (RCM) - eight step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- standard for electrical safety in work place- occupational safety and health administration standards.
(9)

Course Outcomes:
At the end of the course, students will able to
1. Describe electrical hazards and safety equipment.
2. Analyze and apply various grounding and bonding techniques.
3. Select appropriate safety method for low, medium and high voltage equipment.
4. Participate in a safety team.
5. Carry out proper maintenance of electrical equipment by understanding various standards**.**

Text Book:

1. Dennis Neitzel, Al Winfield,'Electrical Safety Handbook', McGraw-Hill Education , 4th Edition,2012.

References:

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.
2. Maxwell Adams.J, "Electrical safety- a guide to the causes and prevention of electric hazards",The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18ECE303 NANO ELECTRONICS

L	T	P	C
3	0	0	3

Course Prerequisite: CMOS VLSI Design, Electronic Devices

Course Description:
This course provides an overview of Semiconductor Physics and carrier transport phenomenon. It illustrates Quantum Mechanics, & Nano-materials, Nanoscale MOSFET Transistors and their characteristics.

Course Objectives:
1. Apply the knowledge of Quantum physics to illustrate energy band structure.
2. Understand the basic physics of Kronig Penny Model.
3. Understand the fundamentals of operation of the main semiconductor electronic devices.
4. Understand and utilize the mathematical models and characteristics of MOS transistors for circuits and systems.
5. Understand and appreciate the nano-materials process.

UNIT I: INTRODUCTION TO NANOTECHNOLOGY
Introduction to nanotechnology, meso-structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. **(9)**

UNIT II:
Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones. **(9)**

UNIT III:
Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.). **(9)**

UNIT IV:
Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics. **(9)**

UNIT V:
Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation. **(9)**

Course Outcomes:

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

1. Understand various aspects of nano-technology and the processes involved in makingnano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and theprocessesinvolved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Text / Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson,2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH,2003.
3. K.E. Drexler, Nanosystems, Wiley,1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press,1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley,2003

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18ECE304 WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

Course Prerequisite: None

Course Description:
This course introduces the concept of Wireless Sensor Network (WSN) to the students. It articulates the classification of WSN and related issues & challenges. It also describes different types of routing, MAC, dissemination protocols and explains design principles of wireless sensor networks.

Course Objectives:
1. Understand the concept of WSN, issues and challenges, classification of WSN.
2. Analyze and learn the classification of routing and MAC protocols.
3. Understand Dissemination protocol for large sensor network.
4. Design principles of WSNs.
5. Learn the hardware components & design constraints and Operating systems used in WSNs.

UNIT I
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks. **(9)**

UNIT II
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee. **(9)**

UNIT III
Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. **(9)**

UNIT IV
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. **(9)**

UNIT V
Single-node architecture, Hardware components& design constraints. Operating systems and execution environments, introduction to TinyOS and nesC. **(9)**

Course Outcomes:
At the end of the course the students will be able to
1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

Text/Reference Books:

1. WaltenegusDargie , Christian Poellabauer, " Fundamentals Of Wireless Sensor Networks Theory And Practice" , By John Wiley & Sons Publications ,2011
2. SabrieSoloman, " Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Networks", Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, " Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science.
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18CSE304 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Java Programming and Basics of XML

Course Description:
This course is concerned with the development of applications on Android platform. Android is used as a basis for the development of mobile applications. This course starts with the basic concepts of Java, history of android and architecture. It introduces the major building blocks that are used to develop an android application with examples. It also covers the development of applications using widgets, events, networking. It provides ideas on sensors, their types and writing programs based on sensor classes for application development.

Course Objectives:
While studying this course student will be able to
1. Understand Android history and its fundamentals and know the building blocks of android
2. Get idea on the creation of android user interface and its testing mechanisms
3. Identify the usage of threads, broadcast receivers, indents, services and their working methodology
4. Know about the storage mechanism in android using SQLite and the usage of content providers
5. Recognize the usage of android widgets and sensors in android based applications

UNIT- I INTRODUCTION AND INSTALLATION OF ANDROID TOOLS
Android Overview – History – Android Versions - Android Flavors. **Android Stack**: Linux, Native Layer and Hardware Abstraction Layer (HAL) – ART - Application Framework: Native C++ Library – Applications: System and User Applications - **Installation and Use of Android Tools:** Installing the Android SDK - Anatomy of an Android Project - Drawable Resources – XML Introduction - Creating user interface using XML – Overview of Android Building Blocks – Logging Messages in Android . **(9)**

UNIT- II USER INTERACTION
Example. Input Components – Text View – Image View – List View and Alert Dialogues – Menus: Popup, Options and Context Menus – Screen Navigation through App Bar – Recycler View – Material Design – Testing the User Interface: Expresso – Screen Navigation using Intents: Definition – Usage of Intends – Creation of Indents with example program – Lists and Adapters–Types of Adapters – Examples using Adapters. **(9)**

UNIT- III THREADS, LOADERS AND ASYNCTASK LOADER, BROADCAST RECEIVERS, SERVICES
Threading in Android – AsyncTask – Loaders – AsyncTask Loader – Connecting to Internet: JSON - HTTP API, Apache HTTP Client, HTTP URL Connection - Broadcast Receivers: Custom Broadcasts – Broadcasting Intends and their related API - Boot Receiver - Alarms and system services – Examples on alarms and services – Services: Services Life Cycle – Intent Service – Implementing Intent Service – Notifications: Managing Notifications. **(9)**

UNIT IV: SAVING, RETRIEVING AND LOADING DATA:
Android File systems and Files - Action Bar: Preferences and Action Bar - Shared Preferences – App Settings - Databases on Android - SQLite - Status Contract Class, Update Refresh Service – Cursors – Backups - Content Providers: Overview – Role of Content Providers - - Content Provider Example Program – Content Resolver **(9)**

UNIT-V APPLICATIONS WIDGETS, INTERACTION AND SENSORS
App Widgets: Creation of Application Widgets - Interaction and Animation: Live Wallpaper and Handlers - Sensors: Sensor API in Android - Motion Sensor, Position Sensor, Environmental Sensor, Sensor Values, Sensor Manager Class, Sensor Class, Sensor Event class, Sensor Event Listener interface, Compass Accelerometer and orientation Sensors, Sensor Examples **(9)**

Course Outcomes:
Upon successful completion of this course, students can able to:
1. Work on android basic components and Install android
2. Create User Interfaces with various Layouts and views using android building blocks
3. Work with Broadcast Receivers and Services
4. Create Database in Android, Store and Retrieve data using SQLite and Content Providers
5. Develop widgets, Wall papers for an android application and write programs based on Sensors

Text Books:

1. Android Programming-The Big Nerd Ranch Guide, Bill Philips, Christ Stewart, Kristin Mariscano, Big Nerd Ranch publishers, 3rd Edition
2. Android Programming for Beginners, John Horton, PACKT publishers
3. Learning Android , By Marko Gargenta& Masumi Nakamura, O'Reilly, II Edition
4. Android Application Development All in One for Dummies, Barry Burd, Wiley, 2nd Edition

Reference Books:

1. Android application Development-Black Book, Pradeep Kothari, dreamtech
2. Android Programming - Unleashed, B.M.Harwani, Pearson Education, 2013
3. Head First Android Development: A Brain-Friendly Guide, Dawn Griffiths and David Griffiths, O'Reilly, 2nd Edition
4. Android System Programming, Roger Ye, PACKT publishers
5. Programming Android,ByZigurdMednieks,LairdDornin,G.BlakeMeike& Masumi Nakamura, O'Reilly

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18CSE305 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisite: Nil

Course Description:
Software Project Management is generally seen as a key component of successful software projects. Together with software techniques it can produce software of high quality. This course deals with the decisions and actions related to planning, organizing, leading, and controlling programs and projects. Students are expected to gain a comprehensive understanding of Strategy, organization and leadership in managing projects and understanding of Processes, methods and systems used to plan, schedule and monitor projects.

Course Objectives:

1. To understand the basic concepts and issues of software project management.

2. To understand successful software projects that support organization's strategic goals.

3. Develop the skills for tracking and controlling software deliverables.

4. Match organizational needs to the most effective software development model.

5. Create project plans that address real-world management challenges.

UNIT I SPM CONCEPTS
Definition – components of SPM – challenges and opportunities – tools and techniques – managing human resource and technical resource – costing and pricing of projects – training and development – project management techniques. **(9)**

UNIT II SOFTWARE MEASUREMENTS
Monitoring & measurement of SW development – cost, size and time metrics – methods and tools for metrics – issues of metrics in multiple projects. **(9)**

UNIT III SOFTWARE QUALITY
Quality in SW development – quality assurance – quality standards and certifications – the process and issues in obtaining certifications – the benefits and implications for the organization and its customers – change management. **(9)**

UNIT IV RISK ISSUES
The risk issues in SW development and implementation – identification of risks – resolving and avoiding risks – tools and methods for identifying risk management. **(9)**

UNIT V SPM TOOLS
Software project management using Primavera & Redmine and case study on SPM tools. **(9)**

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Maintain software projects and monitor software project process
2. Design and develop project modules and assign resources
3. Understand software quality and project management techniques
4. Comprehend, assess, and calculates the cost of risk involved in a project management
5. Use Primavera &Redmine software management tools.

Text Books:

1. Richard H. Thayer, “Software Engineering Project Management”, John Wiley & Sons, 2nd edition, 2001
2. Royce, Walker, “Software Project Management”, Pearson Education, 2002
3. Kelker, S. A., “Software Project Management”, Prentice Hall, 2003

References:

1. Software Project Management, Bob huges, Mike cotterell, Tata McGraw Hill, New Delhi,2002.
2. Software Project Management: A Concise Study, S. A. Kelkar, PHI.
3. Software Project Management, Joel Henry, Pearson Education.
4. Software Project Management in practice, PankajJalote, Pearson Education.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

18CSE306 SOFTWARE TESTING

L	T	P	C
3	0	0	3

Course Prerequisite: 20CSE112

Course Description:
This course aims to introduce the students to different methodologies in testing a program and its usage in building the testing tools. This course covers introduction to principles of software testing, path testing, transaction testing, dataflow testing, domain testing, path, path product, regular expressions with node reduction algorithm, functional testing, and logic based testing, state graph and its applications, graph matrices and its applications and case study of testing tools.

Course Objectives:
1. To study the Basic software debugging methods.
2. To enable the Students to understand various testing methodologies.
3. To study the procedure for designing test cases.
4. To enable the Students about the significance of software testing.

Unit I: Principles of Software Testing and Path Testing
Concepts and principles of software testing: Introduction: Purpose of Testing, Dichotomies, model for Testing, Consequences of Bugs, and taxonomy of Bugs. Structural Testing: Flow graphs and Path testing, Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing. **(9)**

Unit II: Transaction Flow Testing and Dataflow Testing
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing. **(9)**

Unit III: Domain Testing, Paths, Path Products and Regular Expressions
Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interface Testing, Domains and Testability Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. **(9)**

Unit IV: Functional Testing, State, State Graphs and Transition Testing
Functional Testing: Logic Predicates and Clauses, Logic Based Testing, Logic Expression Coverage Criteria, Active Clause Coverage, Inactive Clause Coverage, Infeasibility and Subsumption, Making a Clause Determine a Predicate, Structural Logic Coverage of Programs, Decision Tables, Path Expressions, KV Charts, and Specifications. State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips. **(9)**

Unit V: Applications of Test Case Design
TestingObject-Oriented Software, Unique Issues with Testing OO Software, Types of Object-Oriented Faults , Testing Web Applications and Web Services, Testing Static Hyper Text Web Sites, Testing Dynamic Web Applications, Testing Web Services, symbolic testing, Concolic testing, Conclusions. **(9)**

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand the basic principles of testing, path testing and compare different path testing strategies.
2. Explain different transaction flow and data flow testing techniques.
3. Understand and identify various Domains testing strategies, methods and defining the method to find the regular expression used to find the testing paths.
4. Test the functions and state of the applications manually and by automation using different testing methods.
5. Apply and use software testing methods and various test tools.

Text Books:

1. Software testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing- Yogesh Singh, Camebridge.
3. Introduction to Software Testing, Paul Ammann and Jeff Offutt, Cambridge University Press, 2nd edition, 2016.

References:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3rd edition,P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
3. Software Testing, N.Chauhan, Oxford University Press.
4. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
6. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press.

Mode of Evaluation: Assignments, Mid Term Test, End Semester Examinations

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DISCIPLINE ELECTIVES-I

18CE401 ENGINEERING GEOLOGY

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18PHY101

Course Description

This course explores the fundamentals of geology applied to civil engineering problems. Topics include rock and mineral types, soil properties, rock mechanics, geologic structures, active tectonics and earthquake hazards, slope stability and landslides, groundwater, rivers and flood hazards.

Course Objectives

1. To understand the internal structure and composition of the earth.
2. To comprehend the properties, occurrence and uses of minerals in various industries.
3. To learn about geo-morphological altering agents such as river, wind, sea waves, and their implications in implementing civil engineering projects.
4. To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways

UNIT I: INTRODUCTION AND MINERALOGY

Introduction-Branches of geology useful to civil engineering- scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI- Granite Dimension Stone Cell-NIRM. Mineralogy-Mineral properties- composition and their use in the manufacture of construction materials. **(9)**

UNIT II: PETROLOGY

Rock Formation, Classification and Engineering Properties. Specific gravity of rocks. Deformation of rocks- Development of Joints-Folds- Faults and Unconformities. Classification of Igneous rocks on the basis of Chemical composition. Igneous Rocks -Sedimentary rocks Metamorphic rocks. **(9)**

UNIT III: PHYSICAL GEOLOGY

Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Rock weathering- types and its effects on Civil Engineering Projects. Origin of soils; Properties of Soil - Soil Classification- Geotechnical importance. **(9)**

UNIT IV: ROCK INSTABILITY AND SLOPE MOVEMENT

Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Hydrological cycle, Occurrence of Groundwater in different terrains -Weathered, Hard and Stratified rocks; Determination of Quality aspects - SAR, RSC and TH of Groundwater. Groundwater Pollution, Groundwater Exploration- Electrical Resistivity and Seismic methods. **(9)**

UNIT V: STRENGTH BEHAVIOR OF ROCKS AND BASICS OF EARTHQUAKES

Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Earthquake - Causes and Effects, Seismic waves, engineering problems related to Earthquakes, Earthquake intensity, Richter scale, Seismograph, Seismic zones- World and India, Tsunami - causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides - causes and their control. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Explain the importance of geological studies in civil engineering
2. Analyze Rock Formation and Engineering Properties
3. Analyze Weathering civil engineering practices.
4. Analyze the natural disasters and their mitigation.
5. Assess various strength behavior of rocks and Seimic effects for solving civil engineering problems.

Text Books

1. Parbin Singh, "Engineering and General Geology", 8th Edition, S K Kataria & Sons
2. P. K. Mukerjee, "A Text Book of Geology", World Press Pvt., Ltd. Kolkata.

Reference Books

1. Engineering Geology by N. Chennkesavulu, Mac-Millan, Publishers 2nd Edition India Ltd. 2010.
2. S.K Duggal, H.K Pandey and N Rawal, "Engineering Geology", McGraw Hill Education (India) Pvt, Ltd. New Delhi.
3. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
4. Dimitri P Krynine and William R Judd, "Principles of Engineering Geology and Geotechnics", CBS Publishers and Distributors, New Delhi.
5. K V G K Gokhale, "Principles of Engineering Geology", BS Publications, Hyderabad.
6. M Anji Reddy, "Text book of Remote Sensing and Geographical Information System", BS Publications, Hyderabad.
7. D. Venkata Reddy, "Engineering Geology", New Age International Publications, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE402 CONSTRUCTION PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course covers fundamentals of construction technology, different construction equipment, project management, Time estimates and computations, CPM, PERT and network analysis

Course Objectives

1. To make the students to learn about planning of construction projects, scheduling procedures and techniques, cost and quality control projects and use of project information as decision making tool.

UNIT I: CONSTRUCTION PLANNING

Basic concepts in the development of construction plans-choice of Technology and Construction Method -Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems. **(9)**

UNIT II: SCHEDULING PROCEDURES AND TECHNIQUES

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling; Use of PERT - Time estimates -Mean, variance and standard deviation - Probability distribution - Expected time Problems - Earliest expected time -Combined tabular computations for TE and TL problems. **(9)**

UNIT III: IT IN CIVIL ENGINEERING PROJECT MANAGEMENT

IT in Construction -Database management systems - spatial data management - Communication and Computer network. **(9)**

UNIT IV: QUALITY CONTROL AND SAFETY DURING CONSTRUCTION

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality Control - Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables. **(9)**

UNIT V: ORGANIZATION AND USE OF PROJECT INFORMATION

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data Bases-Other Conceptual Models of Databases-Centralized Database Management systems-Databases and application programs-Information transfer and Flow. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Plan construction projects, schedule the activities using network drawing and coding
2. Design the construction schedules using CPM and PERT methods.
3. Explain the use of information technology in project management.
4. Identify the quality control and safety measures during construction.
5. Identify and use project data information for successful project management.

Text Books

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2005.
2. Srinath,L.S., "PERT and CPM Principles and Applications", Affiliated East West Press, 2001.

Reference Books

1. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
2. Moder.J., Phillips. C. and Davis E, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3rd Edition, 1985.
3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.
4. Halpin,D.W., "Financial and Cost Concepts for Construction Management", John Wiley and Sons, New York, 1985.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE403 REMOTE SENSING AND GIS

L	T	P	C
3	0	0	3

Course Prerequisites: 18PHY101

Course Description

The topic covers Aerial photogrammetric; remote sensing: GPS; geographic information system: data representation, spatial analysis; computational algorithms, Strategies for development and implementation-applications of GIS

Course Objectives

1. The main objective of the course is to promote a good foundation in GIS and working knowledge of fields strongly related to GIS in the computing perspective.
2. To discuss different algorithms for spatial analysis illustrated with case studies.
3. The course will also guide the students through projects and to apply concepts and ideas in various application areas and to establish a motivation towards research in thrust areas related to GIS.

UNIT I: INTRODUCTION TO GIS

Introduction to GIS - GIS-definition and terminology - GIS categories - Components of GIS - fundamental operations of GIS - Land surveying - Global positioning system - Introduction of GIS modules - GIS Functionality: Interfaces of different GIS software: ArcGIS - QGIS - Map Window GIS. **(9)**

UNIT II: TYPES OF DATA REPRESENTATION

Introduction to different Co-ordinate System: Geographic Coordinate System - Projected Coordinate System. Introduction to Data Model: Raster Data Models - Vector Data Models - Different Types of Resolution for data models: Spatial - Temporal - Spectral - and Radiometric. Image Digitalization: Geo-referencing - Map Projection - Digitization - Encoding - and Structuring of data. **(9)**

UNIT III: COMPUTATIONAL ALGORITHMS

Triangulation - DEM - TIN - terrain mapping and Network analysis - Geocoding - Path analysis and network applications - Basics of spatial database- Deterministic and Statistical spatial interpolation. **(9)**

UNIT IV: REMOTE SENSING

Principle of Remote Sensing: Introduction - concept of remote sensing - definition - element of remote sensing - types of remote sensing: active and passive - electromagnetic radiation: Plank's - Stephen Boltzsmann and Wein's displacement law - electromagnetic spectrum - Atmospheric window - spectral signature.
Data Acquisition: Introduction to Different Types of remote Sensors: Landsat - MODIS - Cartosat - Sentinel etc - Flight planning and UAVs - Basics of Global Positioning System (GPS)- RADAR - TM and Multispectral Sensing - Radar - Sonar: basics and application. **(9)**

UNIT V: APPLICATION AND CASE STUDIES

Catchment area delineation, Computation of Morphometric Parameters - GIS application for Surveying: traversing - Cut and Fill (volume of earth work Computation) - Calculation of different indices: NDVI - EVI - SVI - SWVI - Calculation of radiance and reflectance from DN (digital Number) - Calculation of Land surface temperature (LST). **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Apply the GIS Plate forms for surveying and mapping
2. Analyze the types of data and data models
3. Evaluate the suitability of different vector and raster data interpolation method.
4. Analyze the capacity of different remote sensing data acquisition systems.
5. Derive the different indices for water-environment management.

Text Books

1. Qihao Weng, Remote Sensing and GIS IntegrationTheories, Methods, and Applications, McGraw Hill, 2010,

Reference Books

1. Rajiv Gupta & Mukesh Kumar Rohil, Computing Aspects of Geographical Information Systems, EDD Notes, BITS Pilani, 2001, 1st. Ed.
2. Kang-tsung Chang; "Introduction to Geographic Information Systems", Tata McGraw-Hill, 4^{th} Ed.
3. Thomas M Lillesand, and Ralph W Kiefer; "Remote sensing and Image Interpretation", John Wiley & Sons, 1994, 3rded.
4. Michael F. Worboys, "GIS: A Computing Perspective", Taylor & Francis Ltd; 1995.
5. Thomas et al., Remote Sensing and Image Interpretation, Wiley Publication 2004 (4^{th} Edition)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE404 GREEN BUILDINGS AND ENERGY CONSERVATION

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: None

Course Description

The course covers various aspects of bioclimatic architecture like climate sensitive design, passive solar architecture, Water management, green building materials and construction techniques.

Course Objectives

1. The course introduces concepts of sustainability and bioclimatic design in planning, construction and life of buildings.
2. This course intends to equip students with technical knowledge of energy-efficient green buildings
3. This course guide students, through projects, to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.
4. This course also initiates students in basics of functional design and drawing of the various buildings using the above concepts.

UNIT I : GREEN BUILDING CONCEPTS

Introduction to bioclimatic architecture - Sustainability in building science and Functional planning - Orientation - Elements of building design and drawing - Building regulations and bylaws - Traditional and VernacularArchitecture - Climate zones - Design Charts - sun path diagram - Solar angles - Indices of thermal comfort - Vernacular buildings in different climate zones. **(9)**

UNIT II : CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN

Introduction - various steps in Site planning - Plan form Building envelope Land form -Topography - vegetation - water bodies; Orientation - S/V ratio - P/A ratio - Walls, Fenestration - Roof and floors - Active and passive solar strategies - Passive solar architecture. **(9)**

UNIT III : THERMAL FLOW IN BUILDINGS

Calculation of thermal conductance - Heat flow through different building elements - Ventilation and day lighting- Design and placement of openings- Water management in buildings- Techniques to recycle, reuse and harvest water. **(9)**

UNIT IV : GREEN BUILDING MATERIALS AND CONSTRUCTION

Material properties - Energy efficiency using various materials - emerging new materials Construction techniques- Techniques for roof, wall and foundations. **(9)**

UNIT V : ECONOMY OF GREEN BUILDING

Cost of building - operation and maintenance - Green building rating system - Evaluation criteria of LEED - TERI GRIHA case studies - Case studies in different climate zones. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Use various regulations and by laws for green building construction0.
2. Do site planning for Green Building.
3. Compute thermal flow through different building elements
4. Identify energy efficient building materials
5. Compute cost of building/operation and maintenance

Text Books

1. Krishnan, A., Baker, N., Yannas, S., & Szokolay, S. (Eds.). (2001). Climate responsive architecture, a design handbook for energy efficient buildings. New Delhi: Tata McGraw-Hill Publishing Company.
2. TERI & ICAEN (InstitutCatalad'Energia). (2004). Sustainable building design manual (Vol. II). New Delhi: The Energy and Resources Institute(TERI) Press.

Reference Books

1. Bureau of Indian Standards. (1995). SP:41, Handbook on functional requirements of buildings (other than industrial buildings) (First reprint ed.). New Delhi: Bureau of Indian Standards.
2. Indian Green Building Council, LEED-India. (2011). LEED 2011 for India- Green building rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council.
3. Koenigsberger, O., ingersoll, T. G., Mayhew, A., & Skozolay, S. V. (2011). Manual of Tropical Housing and Building. Hyderabad: Universities Press.
4. Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan. Building Design and Drawing. Calicut: Spades Publishers, 2008.
5. Szokolay, S. V. (2008). Introduction to Architectural Science - The Basis of sustainable Design (Second ed.). Architectural Press/Elsevier.
6. The Energy and Resources Institute (TERI). (2011). Green Rating for Integrated Habitat Assessment (GRIHA) manual. New Delhi: TERI press.
7. Journals: Energy and Buildings, Building and Environment, Other relevant publications.
8. National Building Code, Bureau of Indian Standards: New Delhi. 2005; Building Bye laws and building rules of selected Indian urban and rural areas
9. Swamy, N. K., & Rao, A. K. (2013). Building planning and Drawing,New Delhi, CharotharPublishing House

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE405 AIR POLLUTION AND SOLID WASTE MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course covers various air pollution impacts, legislation and control techniques. Also, it discusses about municipal solid waste, hazardous waste, electronic waste and construction and demolition waste management.

Course Objectives

1. To explain the various air pollutants, their impact and control legislations.
2. To describe various air pollution control equipment and design of dust control equipment
3. To discuss about the quantity and characteristics of municipal solid waste and various treatment and disposal techniques.
4. To explain hazardous waste characteristics and management methods.
5. To discuss about generation and management of construction and demolition waste and electronic waste.

UNIT I: URBAN AIR POLLUTION AND LEGISLATION

Air - Composition and properties of air, source and impacts of air pollution-on human, vegetation and strucutres, types of air pollutants various air pollution control laws, National Ambient Air Quality Standards, Air Quality Index, Air pollution meteorology and dispersion. **(9)**

UNIT II :AIR POLLUTION CONTROL TECHNIQUES

Measures for air pollution control policies, Principles and working of various air pollution control equipments - PM and gaseous pollutant, design of PM control equipment- gravity settling chamber, cyclone separators, fabric filters and electrostatic precipitators. **(9)**

UNIT III: MUNICIPAL SOLID WASTE MANAGEMENT

Municipal Solid Waste-Characteristics and Quantities, MSW Rules, Municipal Solid Waste Collection, Transportation, Segregation and Processing, Energy Recovery from Municipal Solid Waste, recycling, disposal- landfilling and incineration. **(9)**

UNIT IV: HAZARDOUS WASTE MANAGEMENT

Hazardous Waste- definition, sources and characterisation, Hazardous Waste Rules, Storage and Transport, various Hazardous Waste disposal techniques. . **(9)**

UNIT V: Construction and Demolition Waste and Electronic Waste Management

C&D Waste - Regulation, Beneficial Reuse of C&D Waste Materials; E-Waste Generation, E-Waste Rules, Techniques for Recycling and Recovery - glass, plastics, ferrous and non-ferrious materials. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Explain the impacts of air pollution and various legislations related to air pollution control
2. Plan strategies and design equipment to control air pollution.
3. Select the most appropriate technique for the management of solid waste
4. Discuss about various sources of hazardous waste and its management processes
5. Explain the impacts and beneficial reuse of construction and demolition waste and electronic waste

Text Books

1. Rao M and Rao H.V.N. Air Pollution, McGraw Hill Education, 2017.
2. Sudha Goel, Advances in Solid and Hazardous Waste Management, Springer International Publishing

Reference Books

1. Peavy, H., Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985
2. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
3. M.N. Rao, Razia Sultana, Sri Harsha Kota, Solid And Hazardous Waste Management, BS Publications
4. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE406 BUILDING MATERIALS AND CONSTRUCTION

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

This course is designed to introduce various materials such as stones, wood, lime, cement and finishes used in civil engineering construction. Further the course includes different components of buildings and their construction planning also.

Course Objectives

1. To introduce various materials commonly used in Civil Engineering construction and their properties.
2. To introduce the different components involved in building and their construction.
3. To study the NBC Code practice need for better planning

UNIT I : REQUIREMENTS OF BUILDINGS AND ITS COMPONENTS

Introduction to building and its components, strength, dimensional stability, damp prevention, fire protection, lighting and ventilation. Properties of materials: physical and mechanical properties. **(9)**

UNIT II : STONES AND BRICKS, TILES

Building Stones - Classification and quarrying - properties - structural requirements - dressing Bricks - Composition of Brick earth - Manufacture and Structural requirements. Wood, aluminium, glass and paints-Wood - Structure - Types and Properties - Seasoning - defects; alternate materials for wood - GI/fiber - reinforced glass bricks, steel and aluminum. **(9)**

UNIT III: LIME, CEMENT AND FINISHES

Various ingredients of lime - Constituents of lime stone - classification of lime - various methods of manufacture of lime.Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of Cement concrete and their importance Proofing Damp and water proofing- materials used. Plastering, pointing, white washing and distempering - Painting - Constituents of a paint - Types of paints - Painting of new/old Wood -Varnish - Form work and scaffolding. **(9)**

UNIT IV: BUILDING CONSTRUCTION

Site investigation and sub-soil exploration, Foundations-functions and types of foundations. Stone Masonry- Rubble and Ashlar masonry. Brick masonry - basic terminology, types of bonds, walls load bearing, cavity and partition walls. Doors and windows. **(9)**

UNIT V:BUILDING PLANNING

Principles of Building Planning, Classification of buildings and Building by laws. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. To be familiarized with various building parts and components
2. To introduce various materials commonly used in Building Construction along with their tests and properties
3. To know various methods of manufacturing Lime, Metals and Finishes along with their properties and uses
4. To understand the basic terminologies used in building construction, like Site investigation, Sub-soil exploration, Types of Foundations, Masonry work, Walls, Doors and windows
5. To introduce building planning and bye laws.

Text Books

1. Duggal, S.K., Building material, New Age International Publishers, Second Edition
2. Punmia, B.C, Ashok Kumar Jain and Arun Kumar Jain., Building Construction - Laxmi Publications (P) ltd., New Delhi.

Reference Books

1. Varghese, P.C, Building Construction, Prentice-Hall of India private Ltd, New Delhi.
2. Arora, S.P. and Bindra, S.P., Building Construction, Dhanpath Rai Publications

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

DISCIPLINE ELECTIVES-III

18CE407 ADVANCED STRENGTH OF MATERIAL

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE107

Course Description

The course covers the concepts of shear stress and shear centre - unsymmetrical bending - Bending stress and deflection in Curved Beams - Theories of failure - Contact stresses - Cyclic loading

Course Objectives

1. To study effect of the shear stress and shear center on various unsymmetrical sections.
2. To analyse the stresses in the members under unsymmetrical bending.
3. To analyse the stresses in curved beams using different available methods.
4. To investigate the different theories of failures.
5. To evaluate contact stresses, fatigue, cycling loading, stress concentration etc.,

UNIT I :SHEAR CENTRE

Concepts - definitions - shear stress in thin walled sections - sections not symmetrical about one axis - shear centre - significance of shear centre - Various unsymmetrical sections. **(9)**

UNIT II :UNSYMMETRICAL BENDING

Introduction - Principal axes of inertia - Product of inertia - assumptions made in the determination of stresses in members subjected to unsymmetrical bending - bending stress and deflections - neutral axis - bending stresses in beams subjected to unsymmetrical bending. **(9)**

UNIT III :CURVED BEAMS

Introduction - Winkler Bach formula - Stresses in curved beams - Bending stress equation by Seely and Smith method - Finding Z for a rectangle, circular section, triangular section and for a trapezium - Application of Winkler Bach formula - closed Rings. **(9)**

UNIT IV : THEORIES OF FAILURE

Introduction - uni axial tension - different theories of failure - Factor of safety- Comparison of failure theories. **(9)**

UNIT V : SPECIAL TOPICS

Contact stresses - evaluating contact stresses - fatigue - cycling loading - fatigue tests - S-N curves - Goodman diagram -fracture - stress concentration - Griffiths theory - Limitations. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Investigate the shear stresses and shear centre in thin walled open sections and unsymmetrical sections.
2. Analysis of stresses and deflections due to unsymmetrical bending.
3. Analyse the location and magnitude of maximum stresses in curved beams.
4. Determine the safe dimensions of structural components under combined stresses due to various loads and their investigation.
5. Investigate contact stresses and stress concentration of different sections under different loading conditions.

Text Books

1. Popov E.P, Engineering Mechanics of Solids, prentice. Hall of India, New Delhi, Fourth Edition, 1998.
2. Vaidyanathan R., Perumal P. and Lingeswari S., Mechanics of Solids and Structures, Volume II, Laxmi Publications (P) Ltd., New Delhic

Reference Books

1. Srinath L.S, Advanced Mechanics of Solids, MC Graw Hill Education India (Pvt) Ltd, New Delhi, Third Edition, 2016.
2. Willian Nash, Theory and problems of strength of materials, Schaum's outline series,McGrowHill International Edition, Delhi, 1987
3. Rajput R.K., Strength of materials, S.Chand & company Ltd, New Delhi,2007

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE408 ADVANCED GEOTECHNICAL ENGINEERING - FOUNDATIONS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE107, 18CE109

Course Description

The main goal of this course is to provide an in-depth understanding regarding different types of foundation systems for buildings, bridges substructure, industrial complexes, ports, harbors, water tanks, and big storage tanks of industrial structure, transmission line towers, and machines subjected to static and dynamic loads. Complete analysis of foundation systems (spread footing, combined footing, raft foundation, ring foundation, pile foundations, machine foundations, retaining structures etc.) considering all geotechnical aspects will be covered

Course Objectives

1. Understand the fundamental principles and procedures of foundation analysis and design;
2. Students learn to apply the principles of foundation engineering to real world problems
3. Prepare students for entry level geotechnical engineering employment

UNIT I

SUB SURFACE INVESTIGATION: Introduction- scope - drilling bore holes -sampling - plate load test - standard penetration - cone penetration tests. Preparation of soil investigation report.
EARTH SLOPE STABILITY: Infinite and finite earth slopes - types of failures - factor of safety of infinite slopes - Stability analysis - Stability of slopes of earth dams under different conditions. **(9)**

UNIT II: EARTH PRESSURE THEORIES

Introduction- Rankine's theory of earth pressure -earth pressures in layered soils - Coulomb's earth pressure theory -Rebhann's and Culmann's graphical method. Types of retaining walls - stability of retaining walls. **(9)**

UNIT III: SHALLOW FOUNDATIONS

Types - choice of foundation - Location of depth - Safe Bearing Capacity - Terzaghi's, Meyerhoff's and Skempton's Methods. Safe bearing pressure based on N- value - allowable bearing pressure; safe bearing capacity and settlement from plate load test - allowable settlements of structures - Settlement Analysis. **(9)**

UNIT IV: DEEP FOUNDATIONS

Introduction - types of piles - dynamic and static formulae- load capacity of piles in sands and clays - pile load test - negative skin friction. **(9)**

UNIT V: WELL FOUNDATIONS

Introduction -Types - Different shapes of wells - Components of wells - functions and Design Criteria - Sinking of wells - Tilts and shifts. Machine foundations: General requirements and design criteria - Stiffness and damping parameters. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Select suitable site investigation methods andAnalyze the stability of slopes.
2. Calculte the earth pressures
3. Design shallow foundations using different methods.
4. Analyse different types deep foundations under different soil conditions.
5. Apply the design criteria of well foundation systems.

Text Books

1. Murthy, V. N. S. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, CRC Press, Taylor & Francis Group, New Delhi, 2010
2. Punmia B. C., Ashok Kumar and Arun Kumar., Soil Mechanics and Foundation. Laxmi Publications, 17^{th} Ed.

Reference Books

1. Principles of Geotechnical Engineering, by Braja M. Das, 6^{th} Edition, Cengage Learning
2. Principles of Foundation Engineering, by Braja M. Das, 7^{th} Edition ,Cengage Learning
3. Relevant BIS, IRC codes and International code of practice

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE409 RIVER HYDRAULICS AND SEDIMENT TRANSPORT

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE101, 18CE103, 18CE104

Course Description

This course provides the basic knowledge necessary for planning and designing the structural measures for river hydraulics. The course first describes the river administration and planning for application. Especially the methodology of comprehensive river management will be emphasized that includes planning of river hydraulics and sediment movement to river channels and dam reservoirs. This will be followed by specific technologies of channel control and channel improvement.

Course Objectives

1. To get knowledge of fluvial geomorphology
2. To understand concept of analysis of river flow hydraulics
3. To be able to analyse hydraulic geometry and to design stable alluvial channels
4. To be able to do fluvial design for river bank protection
5. To understand the sediment properties and sediment transport in river flow.

UNIT I: FLUVIAL GEOMORPHOLOGY

Fluvial system- variables for alluvial rivers- regime concept- river classifications- thresholds of river morphology- hydraulic geometry- meander platform- geomorphic analysis of river channel responses. **(9)**

UNIT II: FOUNDATION OF FLUVIAL PROCESS

Hydraulics of flow in river channel- physical properties of sediments- scour criteria and scour-related problems- alluvial bed forms and flow resistance- sediment movements in Rivers-flow in curved channels- Stabilization and rectification of rivers, Dredging- Inland navigation-Canalization- Diversion and cofferdams- Levees and associated flood control works. **(9)**

UNIT III: REGIME RIVERS AND RESPONSES

Analytical basis for hydraulic geometry- design of stable alluvial channel- analytical river morphology- plan geometry and processes of river meanders Interlinking of rivers: Case studies. **(9)**

UNIT IV: MODELLING OF RIVER CHANNEL CHANGES

Mathematical model for erodible channels- gradual breach morphology tidal responses of river and delta system- fluvial design of river bank protection- River model- Channel control and Transitions-Discharge measurement methods- Flow resistance- Composite roughness and compound channels-Continuity and dynamic equations of unsteady flow- Method of characteristics- Dam-break problem- Density current- Flow in channel bends- Tides and surges in rivers, etc. **(9)**

UNIT V: SEDIMENT TRANSPORT

Sediment transport- Measurement of stream flow and sediment- Sediment properties- Universal soil loss equation- Initiation of motion - Shields' diagram- Regime concept- Modes of sediment transport- Bed load- Bed form mechanics- Effective bed roughness- Armouring- Suspended load- Total load- Transport of sediment due to unsteady flow- Meandering of rivers- Braided river- Local scour at different structures- Sediment sampling- Design of stable channels- Seepage effects- Mathematical models of sediment transport, etc. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Describe about fluvial geomorphology
2. Apply the concepts for analysis of river flow hydraulics
3. Analyse hydraulic geometry and design stable alluvial channels
4. Design and modeling of river channel changes
5. Describe the sediment properties and sediment transport in river flow

Text Books

1. John Fenton, River Engineering, Institute of Hydraulic and Water Resources Engineering, Vienna University of Technology
2. K.D. Gupta, River Engineering, Vayu Education of India; First edition (2014)

Reference Books

1. Chang H. Howard, Fluvial Processes in River Engineering, John Wiley & Sons1988
2. Rozovskii L.I., Flow of Water in Bends of Open Channels, Academy of Sciences of the Ukraine, 1957
3. River Engineering: Margaret S. Petersen, Prentice Hall of India
4. Fundamentals of Fluvial Geomorphology: Ro Charlton, Routledge, Taylor and Francis Group
5. Loose Boundary Hydraulics: Arved. J. Raudkivi, Netherland: Balkema, 1998. ISBN: 90-5410-448-1
6. Fluvial Processes in River Engineering: H. H. Chnag, John Wiley and Sons
7. River Mechanics: Pierre Y. Julien, Cambridge University Press
8. Hydraulics in Civil and Environmental Engineering: Andrew Chadwick, John Morfett and Martin Borthwick, Allen and Unwin, Spon Press London and New York
9. Sediment Transport (Theory and Practice): C. T. Yang, McGraw Hill. International Edition

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE410 FINITE ELEMENT ANALYSIS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE107, 18CE108, 18CE111

Course Description

Principles of Analysis of Stress and Strain - Finite Element Method for the analysis of one and two dimensional problems - stress and strain parameters and their inter relations of the continuum.

Course Objectives

1. To provide an overview and basic fundamentals of Finite Element Analysis.
2. To introduce basic aspects of finite element theory, including domain discretization, interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
3. To explain the underlying concepts behind variational methods and weighted residual methods in FEM.
4. Formulate simple structural problems in to finite elements.

UNIT I: BASICS OF THEORY OF ELASTICITY

Basic principles of structural mechanics - equations of equilibrium -strain displacement relations -stress strain relations - plane stress and plane strain problems - virtual work - principles of minimum potential energy -basic steps of finite element analysis - discretization - basic element shapes - displacement function - element properties - node numbering procedure - stiffness matrix - Nodal load vector - assemblage -boundary conditions -primary unknowns - secondary unknowns - convergence requirements. **(9)**

UNIT II

ONE DIMENSIONAL ELEMENTS: Shape functions for one dimensional structures - formulation of element stiffness matrix - formulation of element nodal load vector .
TWO DIMENSIONAL ELEMENTS: Plane stress - plane strain - 3,6 noded triangular elements - rectangular elements -Lagrange and Serendipity elements - Isoparametric elements - shape functions, element stiffness matrix - load vector formulations - gauss quadrature rule. **(9)**

UNIT III

INTRODUCTION TO ISOPARAMETRIC ELEMENTS: Concept of sub - iso - super parametric elements - gauss quadrature - Isoparametric Formulation of the Bar Element Stiffness Matrix – Isoparametric Formulation of the Plane Element Stiffness Matrix **(9)**

UNIT IV: AXISYMMETRIC ELEMENTS

Introduction to Axisymmetric Elements – Derivation of the Stiffness Matrix **(9)**

UNIT V: THREE DIMENSIONAL FEM

Different 3-D elements, 3D strain - displacement relationship - Formulation of hexahedral and Isoparametric solid elements. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Solve the problems using the principles of elasticity.
2. Perform one dimensional and two dimensional analysis.
3. Solve the problems using Isoparamteric Elements.
4. Solve the problems using Axisymmetric Elements.
5. Analyse and solve various 3D problems using Finite Element Method.

Text Books

1. T.N. Seshu," Finite element analysis - Theory and programming", Second edition, Tata McGraw Hill publishing co.,1994.
2. Tirupati.R, Chandrupatla and Ashok DBelgundu.," Introductionto finite elements in engineering", Thirdedition, 2005.
3. Bhavikatti S.S, Finite Element Analysis, New Age International Publishers New Delhi, Third Edition, 2018.

Reference Books

1. Cook Robert D., Concept and Application of Finite Element Analysis, John Wiley and Sons INC, 1995.
2. Rajasekaran S., Finite Element Analysis in Engineering Design, S. Chand and Co. Ltd.,2008.
3. Desai C.S and Abel J.F. Introduction to the Finite Element Method, Affiliated East West Press, 1972.
4. Krishnamoorthy C.S, Finite Element Analysis, Tata MC Graw -Hill, NewDelhi, Second Edition, 2011
5. Rao S.S., The Finite Element Methods in Engineering, Pergaman press Edition, 2003.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE411 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course will focus on Basic concept of Environmental Impact Assessment (EIA), EIA Methodologies, Impactof Developmental Activities and Land use in soil, water, and vegetation, Environmental Audit, Post Audit activities, The Environmental pollution Acts.

Course Objectives

1. To impart knowledge on Environmental management and Environmental Impact Assessment.
2. To give the student the brief knowledge about various legislations and audit protocols.
3. To give student knowledge about the framing of environmental audit through case studies.

UNIT I: CONCEPTS AND METHODOLOGIES IN EIA

Introduction - Elements of EIA - Factor affecting EIA -Impact evaluation and analysis - Preparation of Environmental Base map - Classification of environmental parameters. Criteria for the selection of EIA Methodology - EIA methods: Ad-hoc methods - matrix methods - Network method - Environmental Media Quality Index Method -overlay methods - cost/benefit Analysis. **(9)**

UNIT II: IMPACT OF DEVELOPMENTAL ACTIVITIES

Introduction and Methodology for the assessment of soil and ground water - Delineation of study area - Identification of actives.Procurement of relevant soil quality - Impact prediction - Assessment of Impact significance -Identification and Incorporation of mitigation measures. EIA in surface water - Air and Biologicalenvironment. **(9)**

UNIT III: IMPACT ON VEGETATION AND WILD LIFE

Assessment of Impact of development Activities on Vegetation and wildlife - environmental Impact ofDeforestation - Causes and effects of deforestation. **(9)**

UNIT IV: ENVIRONMENTAL AUDIT

Environmental Audit & Environmental legislation objectives of Environmental Audit - Types of environmental Audit - Audit protocol - stages of Environmental Audit - onsite activities - evaluation of audit data and preparation of audit report - Post Audit activities. **(9)**

UNIT V: ENVIRONMENTAL POLLUTION ACTS

The water Act-1974 - The Air Act-1981 (Prevention & Controlof pollution Act.) - Wild life Act-1972 - Indian Forest Conservation Act-1980 -National Green Tribunal Act –2010 - Biological Diversity Act-2002. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Utilize the various methods used in predicting environmental impacts.
2. Utilize site information to interpret impacts on land and groundwater.
3. Outline the environmental impacts of various development activities on existing ecosystem.
4. Utilize the procedures and various protocols involved in preparation of environmental audit report.
5. Utilize the implications of environmental prevention and protection acts in relation to environmental impact assessment.

Text Books

1. Anjaneyulu, Y., Environmental Impact Assessment Methodologies, B.S. Publication, Sultan Bazar,Kakinada.

Reference Books

1. Glynn, J. and Gary W. Hein Ke., Environmental Science and Engineering, Prentice Hall Publishers
2. Suresh K. Dhaneja Environmental Science and Engineering, S.K., Katania& Sons Publication,New Delhi.
3. Dr. Bhatia, H.S., Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

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DISCIPLINE ELECTIVES-IV

18CE412 HYDRAULIC ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE103

Course Description

In this course open channel flow and pipe flows are covered. Students will gather the idea of uniform flow, gradually varied flow, rapidly varied flow. They will be able to understand the depth-energy relationship of any flow. At the end, students will get preliminary idea of computational fluid dynamics.

Course Objectives

1. To understand different types of flows
2. To understand the concepts of specific energy.
3. To identify uniform flow, gradually varied flow and rapidly varied.
4. To calculate various losses that occur in pipe flow.

UNIT I

OPEN CHANNEL HYDRAULICS: Introduction- Types of Channels- Classification of Flows- Velocity Distribution- One-Dimensional Method of Flow Analysis- Pressure Distribution- Pressure Distribution in Curvilinear Flows- Flows with Small Water-Surface Curvature- Equation of Continuity- Energy Equation- Momentum Equation. **(9)**

UNIT II

DEPTH-ENERGY RELATIONSHIP: Specific Energy- Critical Depth- Calculation of the Critical Depth- Section Factor Z- First Hydraulic Exponent M- Computations. **(9)**

UNIT III

UNIFORM FLOW: Introduction- Chezy Equation- Darcy-Weisbach Friction Factor f- Manning's Formula- Other Resistance Formulae- Velocity Distribution- Shear Stress Distribution- Resistance Formula for Practical Use- Manning's Roughness Coefficient- Equivalent Roughness- Uniform Flow Computations- Standard Lined Canal Sections- Maximum Discharge of a Channel of the Second Kind- Hydraulically Efficient Channel Section- The Second Hydraulic Exponent N- Compound Channels- Critical Slope- Generalized Flow Relation. **(9)**

UNIT III

GRADUALLY VARIED FLOW: Differential Equation of GVF- Classification of Flow Profiles- Some Features of Flow Profiles- Control Sections- Analysis of Flow Profile.
RAPIDLY VARIED FLOW: The Momentum Equation Formulation for the Jump- Hydraulic Jump in a Horizontal Rectangular Channel- Jumps in Horizontal Non-Rectangular Channels- Jumps on a Sloping Floor- Use of the Jump as an Energy Dissipator- Location of the Jump. **(9)**

UNIT IV

FLOW THROUGH PIPES: Loss of energy in Pipes- Minor Energy (Head) loss- Hydraulic Gradient and Total Energy line- Flow through Syphon- Parallel Pipes- Branched Pipes- Flow through Nozzles- Water Hammer in Pipes- Pipe Network. Power transmission in Pipes. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Identify type of channels and flows
2. Calculate specific energy and establish depth-energy relationship for open channel flow.
3. Compute uniform flow discharge and their profiles.
4. Identify gradually varied flow and rapidly varied flow and compute their profiles.
5. Calculate head losses in pipe flow.

Text Books

1. K. Subramanya, "Flow in Open Channels", Tata McGraw Hill.

Reference Books

1. R. K. Bansal, "A Textbook of Fluid Mechanics", Laxmi Publications.
2. Charles Hirsch "Numerical Computation of Internal and External Flows. Volume 1: Fundamentals of Computational Fluid Dynamics, Second edition"

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE413 ADVANCED STRUCTURAL ANALYSIS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE107, 18CE108, 18CE111

Course Description

This course Includes the analysis of structures like indeterminate beams, frames, Arches and trusses. Strain energy method and computer methods will be employed in the analysis.

Course Objectives

1. To make the Students aware of the analysis of indeterminate Structures.
2. To Teach the Students aware of influence lines for of indeterminate Structures.
3. To analyse multi-storey frames subjected to lateral and vertical loads using approximate methods like portal method, cantilever method and by using substitute frames.
4. To analyse the indeterminate trusses using stiffness and flexibility methods.
5. To make the Students familiar with the computer methods of Structural Analysis.

UNIT I: REDUNDANT FRAMES

Frames - Redundancy - Methods of solving redundant frames - Lack of fit - Temperature stresses -Trussed beams. two hinged arches-Determination horizontal thrust, Bending moment and Radial shear-Introduction to fixed arches. **(9)**

UNIT II: INFLUENCE LINES FOR INDETERMINATE STRUCTURES

Introduction - Muller Breslau principle - Influence lines for propped cantilevers and continuous beams. **(9)**

UNIT III: APPROXIMATE METHODS OF ANALYSIS OF MULTI-STOREY FRAMES

Analysis for vertical load - substitute frames - loading condition for maximum positive and negative bending moment in beams and maximum bending moment in columns - analysis for lateral load - portal method - cantilever method. **(9)**

UNIT IV: STIFFNESS AND FLEXIBILITY ANALYSIS OF TRUSSES

Introduction - Analysis of indeterminate trusses using stiffness and flexibility methods. **(9)**

UNIT V: INTRODUCTION TO FINITE ELEMENT ANALYSIS

Introduction - Structural mechanics - concepts - Basic steps of the finite element method - Advantages and Disadvantages - various elements shapes -Displacement model- formation of stiffness matrix for truss and beam elements-Element nodal load vector. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Understanding the concept of Redundant Frames and Analysing.
2. Analyze the Indeterminate Structures using Influence Line.
3. Learning the Approximate methods for Multi-Storey Frames.
4. Analyze the Indeterminate Structures using Stiffness and Flexibility method.
5. Learning the basic concepts of Finite Element Analysis

Text Books

1. Bhavikatti S.S., Structural Analysis, Vikas publishing house, New Delhi, 2014.
2. Vaidyanathan R and Perumal P., Structural Analysis, Volumes I & II Laxmi Publications New Delhi, 2016.

Reference Books

1. Reddy C.S., Basic structural Analysis, McGraw Hill Education, New Delhi, 2017.
2. Megre A.S, and Deshmukh S.K, Matrix Methods of structural Analysis, Charotar publishing house Gujarat Second Edition 2015.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE414 GEOTECHNICAL EXPLORATION

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE109

Course Description

This course covers importance of soil exploration, methods of subsurface exploration, different drilling techniques, borings, and sampling. Further the course also covers various field test.

Course Objectives

1. To provide a basic understanding the importance of soil exploration
2. To provide students with exposure to the different techniques like sampling, boring and drilling etc.
3. To build the necessary field background for selection of soil to design and construction of civil engineering structures

UNIT I: INTRODUCTION OF SOIL EXPLORATION

Necessity and Importance of soil exploration-method of sub surface exploration Test pits- Wash boring- Percussion drilling- Rotary drilling. Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes- Spacing and depth of various Civil engineering structures. **(9)**

UNIT II: INDIRECT METHODS OF EXPLORATION

Indirect method of exploration: Seismic method- Electrical resistivity,-Resistivity sounding and profiling-, Qualitative and quantitative interpretation of test results- Comparison of resistivity and seismic surveys. **(9)**

UNIT III: STABILIZATION OF BORE HOLES AND GROUND WATER OBSERVATION

Stabilization of bore holes: Different method of stabilization of the bore holes- their relative merits and demerits. Ground water Observation: Different method of ground water observation: Time lag in observation- sampling of ground water. **(9)**

UNIT IV: SOIL SAMPLING

Source of disturbance and their influence. Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils. Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log. **(9)**

UNIT V: FIELD TESTS

Penetration tests, Standard penetration tests, Dynamic cone penetration tests with and without bentonite slurry, Static cone penetration tests, factor affecting the penetration tests. Various corrections in the test results. Interpretation of test result for design and determination of modulus of deformation. Small size penetrometers. Correlation among various test results. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Know the Importance of soil exploration.
2. Get the knowledge about soil sampling from field.
3. apply the concepts to prevent the collapse of bore holes
4. Prepare Soil investigation report.
5. Do various field tests.

Text Books

1. Punmia B. C, Ashok Kumar Jain, and Arun Kumar Jain. Soil Mechanics and Foundations, 16th Edition, Laxmi Publications
2. Arora, K.R., Soil Mechanics and Foundation Engg, Standard Publishers and Distributors, Delhi.

Reference Books

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
4. Principles of Geotechnical Engineering, by Braja M. Das, 6th Edition,Cengage Learning
5. Principles of Foundation Engineering, by Braja M. Das, 7th Edition,Cengage Learning

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE415 ESTIMATING AND COSTING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE206, 18CE113

Course Description

Standard units; detailed and abstract estimates of buildings, roads and canals; rate analysis; reinforcement bar bending schedule; contracts and tenders; building valuation; specifications.

Course Objectives

Standard units; detailed and abstract estimates of buildings, roads and canals; rate analysis; reinforcement bar bending schedule; contracts and tenders; building valuation; specifications.

UNIT I: INTRODUCTION

Different types of activities in irrigation structure - cross drainage work - terminal building and Specification. **(9)**

UNIT II: IRRIGATION STRUCTURES ESTIMATION

Estimation of head regulator work, Estimation of syphon aqueduct work. **(9)**

UNIT III: COMMERCIAL STRUCTURE ESTIMATION

Estimation of Terminal Building- Detailed Estimates of Terminal Building, reinforcement estimation of bridge-Reinforcement bar bending and bar requirement schedules. **(9)**

UNIT IV: COST CONTROL MONITORING AND ACCOUNTING

The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget Updates-Relating cost and schedule information. **(9)**

UNIT V: PROJECT TIME CONTROL

Time progress monitoring methodology - What-if analysis - Time Reduction Techniques - Work Progress reviewing procedure. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Learn standard units for different items of work in building.
2. Calculate various Special Works materials required for a structure.
3. Estimate the cost of materials and labour required for a construction.
4. Prepare agreements, tenders for building construction and valuation and rent fixation of different Special structures.
5. Write specification of different material required for different infrastructures and Special works.

Text Books

1. Dutta, B.N., Estimating and Costing, UBS publishers, 2016.
2. Chitkara K K., Construction Project Management, TATA McGRAW HILL, 2014.
3. Birdie, G.S., Text Book of Estimating and Costing 6^{th} Edition, Dhanpat Rai Publishing Company (P) Ltd
4. Patil, B.S., Contracts and estimations, Univ.Press, New Delhi.

References

1. Standard Schedule of rates and standard data book by public works department.
2. IS. 1200 (Parts I to XXV - 1974/ method of measurement of building and Civil Engineering works - B.I.S.)
3. Estimation, Costing and Specifications by Chakraborthi .M, Laxmi publications.
4. National Building Code.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE416 TRAFFIC ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE112

Course Description

The course introduces the concepts of characterizing traffic, various modeling approaches, and design of facilities to control and manage traffic.

Course Objectives

To give an overview of traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well

UNIT I

Urban Transportation and Systems: Role of transportation in urban development. Transportation problems and solutions. Transportation planning purposes. pro ess and factors of transportation planning and designing. Travel demand and Transport forcasting . **(9)**

UNIT II

Transportation Surveys: Selection of study area and zoaning. Various types of transportation study. Inventory gor existing transportation surveys. . **(9)**

UNIT III

Traffic Signal. Fixed and vehicle actuated signals - Optimum cycle length - Warrants for signals - Saturation flow - Signal co-ordination - Area traffic control - Design of signalized and un-signalized intersections. Design of interchanges- Design of roundabouts. Road signs- test of the sign. Lettering and placement of signals. **(9)**

UNIT IV

Traffic Regulation and Safety: Regulation of speed - Vehicle and road users- Parking regulations - Parking and Traffic Control : Parking studies - Design of parking lots - Traffic signs - Road markings at different locations - Speed breaker Accident investigation - Accident data analysis. **(9)**

UNIT V

Traffic Management: Legislation enforcement and education for traffic safety- Cost of road accidents- Measures for accident reduction Segregation of traffic- Tidal flow operation- Exclusive bus lane- one-way streets- Street lighting- Noise barrier. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Know the fundamentals of urban transportation system.
2. Decide the type of data requirment for the transportation related studes.
3. Design and analyze Intersections and Interchanges
4. Understand traffic regulations and safety
5. Acknowledge Traffic Management Systems

Text Books

1. Kadiyali,L.R., Traffic and Transportation Engineering, Khanna Technical Publications, Delhi, 2003.
2. Khanna, K and Jussto C.E.G., Highway Engineering, Khanna Publishers,Roorkee , 2006.

Reference Books

1. Worfgang.S., Hamburger, Transportation and Traffic Engineering Hand Book,Prentice-Hallo,New Jersey, 2002.
2. Louis, J Pignataro, Traffic Engineering - Theory and Practice, Prentice-Hall Inc., New Jersey, 2003.
3. James.L. Pline, Traffic Engineering Hand Book, Prentice Hall, New Jersey, 2002
4. Salter. S. A. Highway Traffic analysis and design, Prentice Hall, New Jersey,2003
5. Partha Chakroborthy and Animesh Das, "Principles of Transportation Engineering", Prentice Hall of India Pvt. Ltd., New Delhi - 110001, 2003 Publishers, New Delhi, 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

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DISCIPLINE ELECTIVES-V

18CE417 WATERSHED MANAGEMENT

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

Topic covers basic concepts of watershed, sustainable watershed management approached and practices, integrated watershed management and modelling, social aspect inwatershed management, quantification of water quality and quantity at the catchment outlet using modern techniques, drought, flood and storm management at catchment scale.

Course Objectives

1. To discuss various aspects of water resources development and management on watershed basis.
2. To proliferate the sustainable use and development of natural resources.
3. To enrich the students for change in the hydrological fluxes due altered physiographic condition (land use or elevation) on a watershed scale.
4. To improve the quantitative problem solving skills of the students for natural resources management.

UNIT I

CONCEPT OF WATERSHED: Concept of watershed - classification of watershed - introduction to watershed management - objective of watershed development - Hydrological cycle - water balance equation - different stakeholders and their relative importance - watershed management policies and decision making.
FACTOR AFFECTING WATERSHED DEVELOPMENT: Morphological characteristics: linear - Arial and Relief aspect - land use - vegetation - soil and geological characteristics - Hydrology and geology and socio-economic characteristics. **(9)**

UNIT II

WATERSHED MODELING: Watershed delineation - modelling of rainfall - runoff process - Concept of integrated watershed management conjunctive use of water resources - Integrated water resources management. PRA - Private sector participation - Institutional issues - Socio-economy issues - Integrated development - Water legislation and implementations - Tools and emerging technologies for watershed management and planning. **(9)**

UNIT III

EROSION AND SEDIMENTATION: Types of erosion - factor affecting erosion - effect of erosion on land fertility and capacity - estimation of soil loss due to erosion: universal soil loss equation.
PREVENTION AND CONTROL TO EROSION: contour techniques - ploughing - furrowing - trenching - bunding - terracing - gully control - rockfill dams - check dams - brushwood dam - Gabion structure. **(9)**

UNIT IV

WATER HARVESTING: Rain water harvesting - catchment harvesting - harvesting structures - soil moisture conservation - check dams - artificial recharge from pond - percolation tanks.
FLOOD AND DROUGHT MANAGEMENT: Definition of flood - Flood frequency analysis: Weibul - Gumbel - and log Pearson methods.Definition and classification of drought - drought analysis techniques - drought mitigation planning. **(9)**

UNIT V

COVER MANAGEMENT: Land use land cover change estimation through satellite imageries - land capability classification - management of forest - agricultural - grassland and wild land - Reclamation of saline and alkaline soil. Classification of columns based on slenderness ratio - reinforcement & loading - Design of rectangular and circular columns subjected to axial load - (axial load + uni-axial bending) and (axial load + bi-axial bending). Different Types of Footings - Design of isolated - square - rectangular and circular footings.
INTEGRATED CROPPING SYSTEM FOR WATERSHEDS: Intercropping - mix cropping - strip and terrace cropping - sustainable agriculture - cover cropping (biomass conservation) - horticulture - dryland agriculture and afforestation. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Classify watershed and Identify factors to consider for watershed Development.
2. Apply the concepts of watershed development and planning
3. Evaluate the erosion rate and total amount of soil loss from a watershed
4. Select the flood and drought mitigation measures
5. Quantify the change in land use land/cover and its impact on hydrological processes.

Text Books

1. Kenneth N. Brooks Peter F. Ffolliott Joseph A. Magner. Hydrology and the Management of Watersheds. A John Wiley & Sons, Inc., Publication (4^{th} Edition)
2. VVN, Murthy. Land and Water Management- Kalyani Pblication

Reference Books

1. JVS Murthy. Watershed Management. New Age International publisher.
2. A.M. Michel and T.P. Ojha. Hand Book on Agricultural Engineering, Volume 2.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE418 RAILWAYS ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE109, 18CE112

Course Description

This course covers importance of railway engineering, design concepts of geometric of railway tracks and critical crossing components, interlocking methods and advance train control systems. Design factors of track drainage system and railway track maintenance.

Course Objectives

1. To explain about the railway engineering and its importance.
2. To understand the design concepts of permanent way and track drainage system.
3. To understand about critical crossing and points components of railway track.
4. To explain about importance of interlocking functions and advance traffic and train control system.

UNIT I: Introduction to Railway Engineering

Historical Development of Railways in India – Advantages of Railways – Classification of Indian Railways – Permanent Way – Components and their Functions – Rail Joints – Welding of Rails – Creep of Rails – Rail Fixtures and Fastenings. **(9)**

UNIT II: Geometric design of railway track

Necessity of Good Geometric Design, Causes of Derailment, Gradients and Types of Gradients, Grade Compensation on Curves, Degree of a Curve, Super elevation on Curves or Cant, Equilibrium Super elevation for different Gauges, Safe speed on Curves, Negative Super elevation, Transition Curve and its Objectives of Providing Transition Curve, Shift, Length of Vertical Curves, Widening of Gauges on Curves. **(9)**

UNIT III: Points & Crossings

Necessity of point and crossings, turnout, left hand turnouts and right hand turnouts, point of switches and its component parts, crossings and its component parts, number of crossing and angle of crossing. **(9)**

UNIT IV: Signalling and inter locking

Objects of signalling, classification and types of signals, centralized traffic control system (CTC), automatic train control system (ATC), track circuiting. Necessity and functions of interlocking, methods of interlocking, mechanical device for interlocking **(9)**

UNIT V: Track drainage and safety

Sources of Moisture in Railway Track, Significance & Requirements of Track Drainage, Drainage Systems, Cross Drainage. Railway Accidents & Derailments- Classification, Causes & Prevention, Duties of Railway Staff In Serious Accidents, Emergency Restoration Of Railway Traffic. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Explain about the Indian railway network and permanent way components.
2. Analyse the design concepts of permanent way.
3. Explain and analyse the critical crossing points of permanent way.
4. Explain the signalling and interlocking system.
5. Understand the importance of track drainage and safety.

Text Books

1. "A Text book of Railway Engineering" by S.C. Saxena and S.P. Arora, Dhanpat Rai Publications, New Delhi.
2. Railway Engineering by Rangwala Chrotar Publisihing House, Anand, Gujarat
3. Railway Engineering – A text book Transportation Engineering by S.P.Chandola , S. Chand and Co Ltd.

Reference Books

1. “Railway Engineering" by Satish Chandra and M.M. Agarwal, Oxford University Press, New Delhi.
2. "Railway Engineering" by B.L. Gupta and Amit Gupta, Standard Publishers and Distributors, New Delhi.
3. “Indian Railway Track" by M.M. Agarwal, Standard Publishers and Distributors, New Delhi.
4. "Railway Engineering" by S.C. Rangwala, Charotar Publishing House Pvt. Ltd., Anand,Gujarat

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE419 BRIDGE ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE101, 18CE103, 18CE107, 18CE108, 18CE109, 18CE111

Course Description

This course includes introduction to bridge engineering. Design concepts of different bridge types like box culvert, deck Slab Bridge, T-beam Bridge, and plate Girder Bridge, composite bridges will be discussed. Bridge bearings, pears and abutments will also be explained.

Course Objectives

1. To make the student to know about various bridge structures, selection of appropriate bridge structures and design it for given site conditions.

UNIT I

INTRODUCTION: Importance of site investigation in Bridge design. Highway Bridge loading standards.Impact factor.Railway Bridge loading standards (B.G. ML Bridge) various loads in bridges.

BOX CULVERT: General aspects. Design loads, Design of Box culvert subjected to RC class AA tracked vehicle only. **(9)**

UNIT II

DECK SLAB BRIDGE: Introduction - Effective width -method of Analysis Design of deck slab Bridge (Simply supported) subjected to class AA Tracked Vehicle only.

BEAM & SLAB BRIDGE (T-BEAM BRIDGE): General features - Design of interior panel of slab - Pigeaud's Method -Design of a T-beam bridge subjected to class AA tracked vehicle only. **(9)**

UNIT III

PLATE GIRDER BRIDGE: Introduction - elements of a plate girder and their design. Design of a deck type welded plate girder - Bridge of single line B.G. **(9)**

UNIT IV

BRIDGE BEARINGS: General features - Types of Bearings - Design principles of steel Rocker & Roller Bearings - Steel rocker bearing - Elastometric pad Bearing. **(9)**

UNIT V

PIERS & ABUTMENTS: General features - Bed Block - Materials piers & Abutments Types of piers - Forces acting on piers - Stability analysis of piers - General features of Abutments - forces acting on abutments - Stability analysis of abutments - Types of wing walls - Approaches - Types of Bridge Foundations (excluding Design). . **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Design a box culvert subjected to IRC class AA loading.
2. Design of deck slab bridge and beam slab bridge.
3. Design of plate girder bridge.
4. Differentiate between usage of types of bearings for different types of bridges.
5. Differentiate between piers, abutments and their types including forces and stability analysis of abutments.

Text Books

1. Victor, D. Johnson, Elements of Bridge Engineering, Oxford and IBH Publishers, New Delhi(2009)
2. Vazirani & Ratwani, Design of Concrete Bridges, Khanna Publishers, New Delhi(2010)

Reference Books

1. Raina, V.K., Analysis, Design and Construction of Bridges, Tata McGraw Hill (2010)
2. Raju, N. Krishna, Design of Bridges, Oxford and IBH (2004).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE420 OPTIMIZATION IN STRUCTURAL DESIGN

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18MAT101, 18MAT102, 18CE101, 18CE107, 18CE113

Course Description

Optimization methods; linear programming, non-linear programming - geometric programming, dynamic programming - integer programming, quadratic programming, engineering applications

Course Objectives

1. To understand basic theoretical principles and algorithms developed for solving various types of optimization problems.
2. To get a broad picture of the various applications of optimization viz linear and non-linear programming methods used in engineering.
3. To develop formulation and solution methods in optimization.
4. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.
5. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.

UNIT I: INTRODUCTION AND OPTIMIZATION TECHNIQUES

Introduction - Statement of optimization problem - Classification of optimization problems - Optimization techniques - Single variable optimization - Multivariable optimization with no constraints - Multivariable optimization with equality constraints - Multivariable optimization with inequality constraints. **(9)**

UNIT II: LINEAR PROGRAMMING - SIMPLEX METHOD

Introduction - standard form of a linear programming problems - geometry of linear programming problems - Definitions and theorem - Motivation to the simplex method - simplex algorithm. **(9)**

UNIT III: NON-LINEAR PROGRAMMING: ONE DIMENSIONAL MINIMIZATION

Introduction - unimodel function - Elimination method - Unrestricted search - Exhaustive search - Dichotomous search - Fibonacci method - Golden section method - Interpolation method. **(9)**

UNIT IV: GEOMETRIC PROGRAMMING

Introduction - Posynomial- Unconstrained minimization problem. dynamic programming: Introduction - Multi stage decision processes - Concept of sub optimization and the principle of optimality - Computational in procedure in dynamic programming. **(9)**

UNIT V: FURTHER TOPICS

Integer programming - Stochastic programming - Quadratic programming - Game theory -Decision Theory. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Identify the basic theoretical principles and algorithms developed for solving various types of optimization problems.
2. Implementing the various applications of optimization viz linear programming methods in engineering problems.
3. the problem of nonlinear progarmming by using different optimization methods.
4. Implemneting the mathematical results and numerical techniques of optimization theory to Engineering problems.
5. Acquaint students with advanced approaches for optimization including decision theory and game theory.

Text Books

1. Rao S.S., Engineering optimization Theory and Practice, New Age International Publishers, New Delhi, Third Edition ,2016.
2. Gupta P. K and Hira D.S., Operations Research, S. Chand and Company Ltd.,2016.

Reference Books

1. Ravindran A, Ragsdell K.M, Reklaitis G.V, Enginnering Optimization Methods and Application, Wiley India Edition, New Delhi, Second Edition 2012.
2. Sharma S.D, Operations Research, Kedar Nath Ram Nath, Mecrut, Revised Edition, 2015.
3. Srinivasan G, Operations Research: Principles and Applications, PHI Learning Private Limited, New Delhi, Third Edition,2017
4. Kalavathy S, Operations Research, Vikas Publishing House Pvt. Ltd., New Delhi, Fourth Edition ,2014.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE421 OFFSHORE STRUCTURES

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE103

Course Description

The course is proposed for civil engineering and who need to understand the concepts behind the behaviour of offshore structure and system at sea The course is designed in such a way that at the end of the lectures, the students will have a very broad understanding of the elements and behaviour of offshore structures under a variety of loading and operating conditions, Break waters and Berthing structures, types of offshore structures, and foundations in offshore structure.

Course Objectives

The overall objective of this course is to provide an in-depth understanding of offshore structural elements and its behaviour under various load considerations for design of offshore structure, Types of offshore structures, foundation of offshore structure, construction and risk based maintenance for offshore platforms.

UNIT I

INTRODUCTION Introduction to constructability, Construction stages for offshore structure. Principle of constructability, Facilities and methods for fabrication, Launching, Assembly and Jointing Afloat, Material Selection and procedures, Access, Tolerances, Survey control, Quality control and assurance, safety, Control of construction: Feedback and Modification, Contingency Planning, Manuals, On-site Instruction Sheets, Risk and reliability Evaluation. **(9)**

UNIT II

LOADS CONSIDERATION Environmental loads on offshore structures due to a) Wind b) Wave c) Current d) Ice, and e) Earth quake. Functional loads; III. Buoyant Forces; IV. Installation forces, Soil structure interaction. **(9)**

UNIT III

BREAK WATERS Break waters: Types – Selection – Forces and – Design principles of break waters. **(9)**

UNIT IV

TYPES OF OFFSHORE STRUCTURES Selection – function - Physical, environmental and geotechnical aspects of offshore construction – Concrete Gravity Platform Offshore Structures, Floating Production, Storage, and Offloading Offshore Structures, and Tension-Leg Platform Offshore Structures. **(9)**

UNIT V

FOUNDATIONS FOR OFFSHORE STRUCTURES Introduction to design and installation of offshore piled platforms, concrete offshore platforms, Moored floating structures and Submarine pipelines. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Analyse the basic elements and risk evaluation on offshore structures
2. Calculate the various loads acting on offshore structures
3. Load calcualtion and design of Break waters
4. Estimate of geotechnical parameters involved in offshore structures
5. Analyse and design of foundations for offshore structures

Text Books

1. API recommended practice 2A-WSD, "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms" - Working Stress Design
2. B.C Gerwick, "Construction of Marine and Offshore Structures", CRC Press, Florida, 2000.
3. Hydrodynamics of Offshore Structures by S.K. Chakrabarti, SpringerVerlag
4. Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.
5. Offshore Structural Engineering by: Thomas H Dawson, 1983.

Reference Books

1. Libros y Manuales de Ingenieria, "Construction of Marine and Offshore Structures", 3rd Edition, CRC Press.
2. McClelland, B & Reifel, M.D., "Planning & Design of fixed Offshore Platforms", Van Nostrand, 1986
3. Graff, W.J., "Introduction to Offshore Structures", Gulf Publ. Co. 198

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE422 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geosynthetics; improvement of expansive soils.

Course Objectives

1. To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques.
2. To bring out concepts of reinforced earth.
3. Applications of geotextiles in various civil engineering projects.

UNIT I: DEWATERING & GROUTINHG

Introduction- Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique. Methods of de-watering- sumps and interceptor ditches- wells- drains- Electro- osmosis. Objectives of grouting- grouts and their properties-grouting methods. **(9)**

UNIT II: DENSIFICATION

In - situ densification methods in cohesion less Soils: - Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth. In - situ densification methods in cohesive soils: - preloading or dewatering, Vertical drains - Sand Drains- Sand wick geo-drains - Stone and lime columns - thermal methods. **(9)**

UNIT III: STABILIZATION

Methods of stabilization-mechanical-cement- lime-bituminous-chemical stabilization with calcium chloride- sodium silicate and gypsum. **(9)**

UNIT IV: REINFORCED EARTH & GEOSYNTHETICS

Principles - Components of reinforced earth - factors governing design of reinforced earth walls design principles of reinforced earth walls. Geotextiles- Types, Functions and applications - geo-grids and geo-membranes - functions and applications. **(9)**

UNIT V: EXPANSIVE SOILS

Problems of expansive soils - tests for identification - methods of determination of swell pressure. Improvement of expansive soils - Foundation techniques in expansive soils - under reamed piles. **(9)**

Course Outcomes

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

1. Identify basic deficiencies of various soil deposits and able to decide various dewatering methods to improve the soil.
2. Implement different techniques of soil densification.
3. Use different admixtures in stabilizing the soil.
4. Use geo-synthetics materials in engineering applications.
5. Suggest different types of foundation techniques and methods to control swelling of soil

Text Books

1. Dr. Purushotham Raj, P., Ground Improvement Techniques, Laxmi Publications, New Delhi.
2. Dr. Sivakumar Babu, GL, An Introduction to Soil Reinforcement & Geosynthetics, Universities Press

Reference Books

1. Hausmann M.R., Engineering Principles of Ground Modification, McGraw-Hill International Edition, 1990.
2. Moseley M.P., Ground Improvement, Blackie Academic and Professional, Boca Taton, Florida, USA, 1993.
3. Xanthakos P.P., Abramson, L.W and Brucwe, D.A., Ground Control and Improvement, John Wiley and Sons, New York, USA, 1994.
4. Robert M. Koerner, Designing with Geosynthetics, Prentice Hall New Jercy, USA.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE423 PAVEMENT DESIGN AND ANALYSIS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE107, 18CE112

Course Description

Course covers various theoretical and practical aspects of design of pavements. This course includes pavement analysis; stresses in flexible and rigid pavements; analysis and design of flexible and rigid pavements; pavement maintenance and evaluation of pavement condition.

Course Objectives

1. To understand the principles and design of pavements.
2. To introduce the students the basic knowledge on various IRC guidelines for designing rigid and flexible pavements.
3. To understand the pavement maintenance and evaluation of pavement condition.

UNIT I

PAVEMENT ANALYSIS: Types of pavements - Basic difference between flexible and rigid pavements - Factors affecting design of pavements - Elastic modulus - Poisson's ratio - wheel load - equivalent single wheel load - repetition of loads - wheel configuration and tyre pressure - ESWL Concept - Tyre pressure - Contact pressure - Material characteristics - Environmental and other factors. **(9)**

UNIT II

STRESSES IN FLEXIBLE PAVEMENTS: Stress inducing factors in flexible pavements - stresses in flexible pavement - Layered systems concept - One layer system - Boussinesq Two layer system - Burmister theory for pavement design.
STRESSES IN RIGID PAVEMENTS: Types of stresses and causes - Introduction to Westergaard's equation for calculation of stresses in rigid pavements due to wheel loads and temperature - Considerations in rigid pavement analysis - wheel load stresses - warping stresses - frictional stresses - combined stresses. **(9)**

UNIT III

DESIGN OF FLEXIBLE PAVEMENT: Theoretical - empirical and semi - empirical methods - Group index method - Burmister - CBR Method - AASHTO Method - IRC and Asphalt Institute method. **(9)**

UNIT IV

DESIGN OF RIGID PAVEMENT: Radius of relative stiffness - critical load positions - Westergaard's stress equation - Bradley's stress coefficients - design charts. PCA method - AASHTO - IRC method - Design of cement concrete pavements for highways - Design of joints - reinforcements - tie bars - dowel bars and slab thickness as per IRC guidelines. **(9)**

UNIT V

PAVEMENT MAINTENANCE AND EVALUATION OF PAVEMENT CONDITION: Need for highway maintenance - Failures and their causes in flexible pavements and rigid pavements - Pavement evaluation - Evaluation based on Surface Appearance - Cracks - Patches and Pot Holes - Undulations - Raveling - Roughness - Skid Resistance. Environmental influence and effects - Structural Evaluation by Deflection Measurements - Benkleman beam method - Pavement Serviceability index - Pavement maintenance (IRC Recommendations only) - Strengthening of existing pavements - Overlays. **(9)**

Course Outcomes

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

1. Provide the material characterization affected by tyre characteristics, tyre pressure and wheel load.
2. Identify the process of collecting information necessary for successful design of flexible and rigid pavements and their analysis.
3. Understand the need for highway maintenance and failures and their causes in flexible pavements and rigid pavements
4. Understand the procedure of evaluation of pavement.

Text Books

1. Bindra B.S, Highway Engineering, Danpat Rai and Sons.
2. R. Srinivas Kumar, Pavement Design, Universities Press, 2013.
3. R. Srinivasa Kumar, "Pavement Evaluation and Maintenance Management System", Universities Press, 2014.
4. S. K. Sharma, Principles, practice and design of Highway Engineering including Air Port pavements, S. Chand publications.
5. S. K. Khanna & C. E. G. Justo, Highway Engineering, Nem Chand Publishers

References

1. Yang H Huang "Pavement Analysis and Design", Prentice Hall.
2. E. J. Yoder and M. W. Witczak, "Principles of Pavement Design", John Wiley & Sons.
3. IRC Standard specifications for Construction of Flexible and rigid pavements

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

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DISCIPLINE ELECTIVES-VI

18CE424 PORT ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE112

Course Objectives

1. To have an overall knowledge of the design and construction of airport, docks, harbours and ports as a whole.
2. To understand the function of different components of airports, docks and harbours.

AIRPORTS

UNIT I

GENERAL
History - development - policy of air transport - aircrafts - aerodromes - airtransport authorities - air transport activities - aircrafts and its characteristics - airport classifications.
AIRPORT PLANNING
Regional planning - concepts and advantages - location and planning of airport elements - airfield - terminal area - obstructions - approach zone - zoning laws - airport capacity - airport size and site selection - estimation of future air traffic - development of new airport - requirements of an ideal airport layout. **(9)**

UNIT II

RUNWAY DESIGN
Wind rose and orientation of runway - factors affecting runway length - basic runway length - and corrections to runway length - runway geometrics and runway patterns (configurations).
TAXIWAY DESIGN
Controlling factors - taxiway geometric elements - layout - exit taxiway - location and geometrics - holding apron - turnaround facility. Aprons - locations - size - gate positions - aircraft parking configurations and parking systems - hanger - site selection - planning and design considerations. **(9)**

UNIT III

TERMINAL DESIGN AREA
Terminal area elements and requirements - terminal building functions - space requirements - location planning concepts - vehicular parking area and circulation network.
AIR TRAFFIC CONTROL AND VISUAL AIDS
Air traffic control - objectives - control system - control network - visual aids - landing information system - airport markings and lighting. **(9)**

SEAPORTS

UNIT IV

Introduction - Definition of the terms associated with docks and harbour - Requirements of harbour and port - classification of harbours with examples. Factors affecting Factors affecting growth of port - Major Ports in India and abroad - Planning a Port - Selection of ideal location of harbour - Introduction to dredging. **(9)**

UNIT V

Breakwater and materials of construction for breakwater - Introduction to design of break waters - Dock - Bulkhead and Sea Walls - Design Considerations and Construction Materials - Revetments - Water front structures - Wharves - Jetty - Dolphins - Different types of dock fenders - Uses of wet docks and Dry/ Repair docks. Port facilities - Transit sheds and warehouses. **(9)**

Course Outcomes

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

1. Identify requirements of airport pavement.
2. Design airport runway and taxiway
3. Introduce terminal design area, traffic control and visual aids
4. Use basic terminologies for operation of docks and harbours
5. Design various components of dock and harbour

Text Books/Reference Books

1. Ashport and Wright, “Airport Engineering”, 3rd edition,1992, Willey-Interscience.
2. Khanna and Arora, Airport Planning & Design, Nemchand Bros, Roorkee.
3. Bindra S. P., “Dock and Harbour Engineering”, Dhanpat Rai Publications, 1979, 1st Edition.
4. Oza H. P. and Oza G.H., “Dock and Harbour Engineering”, Charotar Publishing House, 1999, 4th Edition.
5. Quinn, “Planning and construction of Docks and Harbours”, Tata McGraw Hill, Latest Edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE425 EARTHQUAKE ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: 18PHY101, 18CE101, 18CE107, 18CE109, 18CE113

Course Description

This course provides an overview of Earthquake engineering and further discusses the technical aspects pertaining to its applicability in Civil Engineering. Single and multiple degree of freedom system are discussed. Elements of seismology and Indian codal provisions pertaining to earthquake engineering is also presented.

Course Objectives

1. To understand the fundamental principles and procedures of Earthquake engineering
2. To apply the principles of Earthquake engineering to real world problems; and
3. Prepare students for entry level structural engineering employment.

UNIT I: THEORY OF VIBRATIONS

Concept of inertia and damping - Types of Damping - Difference between static forces and dynamic excitation - Degrees of freedom - SDOF idealization - Equations of motion of SDOF system for mass as well as base excitation - Free vibration of SDOF system - Response to harmonic excitation - Impulse and response to unit impulse - Duhamel integral. **(9)**

UNIT II: MULTIPLE DEGREE OF FREEDOM SYSTEM

Two degree of freedom system - Normal modes of vibration - Natural frequencies - Mode shapes - Introduction to MDOF systems - Decoupling of equations of motion - Concept of mode superposition (No derivations). . **(9)**

UNIT III: ELEMENTS OF SEISMOLOGY

Causes of Earthquake - Geological faults - Tectonic plate theory - Elastic rebound - Epicentre - Hypocentre - Primary, shear and Raleigh waves - Seismogram - Magnitude and intensity of earthquakes - Magnitude and Intensity scales - Spectral Acceleration - Information on some disastrous earthquakes. **(9)**

UNIT IV: RESPONSE OF STRUCTURES TO EARTHQUAKE

Response and design spectra - Design earthquake - concept of peak acceleration - Site specific response spectrum - Effect of soil properties and damping - Liquefaction of soils - Importance of ductility - Methods of introducing ductility into RC structures. **(9)**

UNIT V: DESIGN METHODOLOGY

IS 1893, IS 13920 and IS 4326 - Codal provisions - Design as per the codes - Base isolation techniques - Vibration control measures - Important points in mitigating effects of earthquake on structures. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Identify the underlying theories behind the dynamic system under investigation
2. Calculate different degrees of freedom.
3. Identify the reasons and the consequences of the estimates of seismic hazard at a national scale.
4. Carry out response spectra analysis for structures.
5. Apply relevant IS 1893, IS 13920 and IS 4326 Codal provisions to ensure safety and serviceability of structural elements.

Text Books

1. Chopra, A. K., Dynamics of Structures, Prentice-hall, New Delhi, 2008.

References

1. IS: 1893-2002, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part 1 to 5, BIS, New Delhi
2. IS:1893-1984, Indian Standard Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi
3. IS: 4326-1993, Indian Standard Code of practice for Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi, 1993
4. SP:22-1982, Explanatory Hand Book on Codes of Earthquake Engineering, BIS, New Delhi, 1982.
5. IS:13920-1993, Indian Standard Ductile Detailing of RCC Structures subjected to seismic forces - Code of practice, 1993
6. Pankaj Agarwal and Manish Shirkhande, Earthquake Resistant Design of structures, Prentice-Hall of India, 2006
7. Duggal, S. K., Earthquake Resistant Design of structures, Oxford University Press, 2007

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE426 PRESTRESSED CONCRETE STRUCTURES

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE105, 18CE111, 18CE113

Course Description

This course includes Historic development of prestressing, methods of prestressing, losses of prestress. Further, in this course, analysis of sections for flexure, design of sections for flexure, design of section for shear will be explained. Composite section and deflections of prestressed concrete beams will also be explained.

Course Objectives

1. To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students.
2. Students will be introduced to the design of prestressed concrete structures subjected to flexure and shear.
3. To explain analysis of composite sections, deflection of pre stressed concrete beams.

UNIT I: INTRODUCTION

Historic development–General principles of pre-stressing, pre-tensioning and post tensioning, Advantages and limitations of prestressed concrete – Materials – High strength concrete and high tensile steel their characteristics, Methods and Systems of Pre-stressing **(9)**

UNIT II: LOSSES OF PRESTRESS

Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of stress in steel, slip in anchorage ,bending of member and wobble frictional losses. **(9)**

UNIT III: PRESTRESSED MEMBERS- FLEXURE & SHEAR

Elastic analysis of concrete beams prestressed with straight, concentric, eccentric, bent and parabolic tendons, Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure – Kern – lines, cable profile. Shear and Principal Stresses – Design for Shear in beams **(9)**

UNIT IV: COMPOSITE PRESTRESSED CONCRETE BEAMS

Types of composite construction - Transformation of composite sections - flexural analysis of composite simply supported beams - calculation of stresses. **(9)**

UNIT V: DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS

Importance of control of deflections – factors influencing deflections –short term deflections of uncracked members prediction of long term deflections. **(9)**

Expected Outcomes

After the completion of the course students will be able to-3

1. Explain the basic principle of pre-stressing and post tensioning concrete structure and its limitations.
2. Evaluate the losees in prestressed concrete members.
3. Analyze and design of prestressed section for flexure & Shear.
4. Analyze and design of composite prestressed concrete beam.
5. Identify the factors influencing the deflection of pre-stressed concrete beams.

Text Books

1. KrishnarajuN., Prestressed concrete, Tata McGraw Hill Publishing company Ltd, New Delhi, Fifth Edition 2017.
2. Sinha N.C and Roy S.K.,Fundamentals of prestressed concrete S.Chand and Co Ltd 1985.

Reference Books

1. Lin T.Y., and Ned H. Burns., Design of prestressed concrete structures., John Wiley & Sons, InternationalEdition, New York, Third Edition 2015.
2. DayaratnamP., PrestressedConcrete Structures, Oxford and IBH Publishing Company pvt. Ltd, NewDelhi, 1982.
3. Ramamrutham S.,Prestressed concrete,Dhanpat Rai Publishing Company (P) Ltd .,New Delhi, Fifth Edition ,2016.

Codes

1. BIS code on prestressed concrete, IS 1343 to be permitted into the Examination Hall.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE427 SOIL RETAINING WALLS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE103, 18CE107, 18CE109, 18CE113

Course Description

This course covers importance of Earth pressures, stability consideration, and sheet pile walls. Further the course also covers basics about geo-synthetics and design of reinforced earth wall.

Course Objectives

1. Understand the fundamental principles and procedures of earth pressure and earth retaining structures.
2. Understand the design procedures of retaining walls
3. Understand the fundamental principles and design procedures of reinforced soil walls.

UNIT I:EARTH PRESSURE THEORIES

Introduction - State of stress in retained soil mass - Earth pressure theories - Classical and Graphical techniques - Active and passive cases - Earth pressure due to external loads, empirical methods. Wall movement and complex geometry. **(9)**

UNIT II:DRAINAGE AND STABILITY CONSIDERATIONS

Lateral pressure due to compaction- wall flexibility- influence of drainage. Each pressure due to earthquake forces - Stability of retaining structure. **(9)**

UNIT III: SHEET PILE WALLS

Selection of soil parameters - Analysis and design of cantilever and anchored sheet pile walls. Diaphragm and bored pile walls - Design requirements. **(9)**

UNIT IV: GEOSYNHETICS

Introduction, Historical Development - Types of Geosynthetics - Geotextiles - Geogrids- Geonets - Geomembranes - Geocomposites - Functions - Reinforcement - Separation - Filtration - Drainage - Barrier Functions. **(9)**

UNIT V: DESIGN OF REINFORCED EARTH WALL

Reinforced earth wall - principles, Concepts and mechanism of reinforced Earth - Design consideration of reinforced earth. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Calculate different types of earth pressures acting on retaining walls.
2. Design retaining walls
3. Design sheet pile walls
4. Suggest geo- synthatics for different geosynthatics for civil engineerign applications
5. Design reinforced earth walls

Text Books

1. Chris R.I. Clayton, Rick I. Woods, Andrew J. Bond, Jarbas Milititsky - Earth Pressure and Earth-Retaining Structures, Third Edition (2014, CRC Press)
2. Koerner, R.M., Design with Geosynthetics (Third Edition), Prentice Hall, 1997

Reference Books

1. Hugh, B, Basics of Retaining Wall Design. HBA Publications Incorporated; 10th edition.
2. Das, B.M., Principles of Geotechnical Engineering (Fourth Edition). The PWS series in Civil Engineering, 1998

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18CE428 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE103

Course Description

This course deals with basics of Computational Fluid Dynamics. The governing equations and numerical schemes used to solve the CFD problems is covered in this course content.

Course Objectives

1. To introduce Governing Equations of viscous fluid flows
2. To introduce numerical modeling and its role in the field of fluid flow and heat transfer
3. To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
4. To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

UNIT I: GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD – Elliptic, Parabolic and Hyperbolic equations. **(9)**

UNIT II: One-dimensional Euler's equation

Conservative, Non-conservative form and primitive variable forms of Governing equations. Flux Jacobian Is there a systematic way to diagonalise Eigenvalues and Eigenvectors of Flux Jacobian. Decoupling of Governing equations, introduction of characteristic variables. Relation between the two non-conservative forms. Conditions for genuinely nonlinear characteristics of the flux Jacobian. Introduction to Turbulence Modeling: Derivation of RANS equations and k-epsilon model. **(9)**

UNIT III: Finite difference method

Applied to Linear Convection equation, Laplace Equations, Convection Diffusion equations, Burgers equations, modified equations - Explicit methods and Implicit methods – as applied to applied to linear convection equation, Laplace equations, convectiondiffusion equation- FTCS, FTFS,FTBS,CTCS - Jacobi Method, Gauss-Siedel, Successive Over Relaxation Method, TDMA.- VonNaumann stability (linear stability) analysis. Upwind Method in Finite Difference method. **(9)**

UNIT IV: FLOW FIELD ANALYSIS

9 Finite volume methods - Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms. **(9)**

UNIT V: TURBULENCE MODELS AND MESH GENERATION

Turbulence models, mixing length model, Two equation (K-Epsilon) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Deriving the basic govering euations of Comptational fluid dynamics
2. Solving the 1D Euler's equation for various CFD Problems.
3. Analyzing the CFD problems using Finite difference method.
4. Solving the flow field analysis problems.
5. Analysing the problems incorporating the turbulence modelling.

Text Books

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd.Second Edition, 2007.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

Reference Books

1. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004.
2. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
5. ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.
6. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Mandatory Non-Credit Courses

18CHE901 ENVIRONMENTAL SCIENCES

L	T	P	C
2	0	0	0

Course Prerequisites: Basic knowledge about sciences up to intermediate or equivalent level.

Course Description: The course deals with basic concepts of environment, its impact on human, universe, consumption of energy sources, effects, controlling methods for pollution and the environmental ethics to be followed by human beings.

Course Objectives:

1. To make the students aware about the environment and its inter-disciplinary nature and to emphasize the importance of the renewable energy sources.
2. To familiarize the concept of Ecosystem and their importance.
3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.
4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
5. To introduce the environmental ethics and emphasize the urgency of rain water harvesting along with water shed management.

UNIT I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance – Need for Public Awareness. Renewable energy Resources: Solar energy - solar cells, wind energy, tidal energy. Non-renewable energy resources: LPG, water gas, producer gas. Overgrazing, effects of modern agriculture – fertilizer and pesticides.

(6)

UNIT II: ECOSYSTEMS

Concept of an ecosystem. Structure – functions – Producers, Consumers and Decomposers – Ecological succession – Food chains, Food webs and Ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystems: Forest, Desert and Lake.

(6)

UNIT III: BIODIVERSITY AND ITS CONSERVATION

Introduction, Definition: Value of biodiversity: consumptive use, productive use, social, ethical and aesthetic values. Biogeographical zones of India. Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and Endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

(6)

UNIT IV: ENVIRONMENTAL POLLUTION

Definition, Cause, effects and control measures of pollution – Air, Water, Soil and Noise. Solid Waste Management: Effects and control measures of urban and industrial wastes. **(6)**

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT

Urban problems related to Water conservation, rain water harvesting and watershed management; Climate changes: global warming, acid rain, ozone layer depletion, nuclear accidents. Case Studies: Population growth, variation among nations and population explosion.

(6)

Course Outcomes:

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

1. Ability to understand the natural environment, its relationship with human activities and need of the day to realize the importance of the renewable energy sources.
2. The knowledge of various ecosystems and their importance along with the concepts of food chains, food webs and ecological pyramids.
3. Familiarity with biodiversity, its importance and the measures for the conservation of biodiversity.
4. The knowledge about the causes, effects and controlling methods for environmental pollution, along with disaster management and solid waste management.
5. Awareness about the sustainable development, environmental ethics, social issues arising due to the environmental disorders.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press, 2005.
2. Environmental Studies by R. J. Ranjith Daniels and Jagdish Krishnaswamy, (Wiley Re-print version 2014).
3. Chemistry for Environmental Engineering/C.N. Sawyer, P.L. McCarty, G.F. Parkin (TataMcGraw Hill, Fifth Edition, 2003).
4. Environmental Chemistry by B.K. Sharma, (Goel Publishing House, 2014).
5. Environmental Studies by Benny Joseph (TataMcGraw Hill, Second Edition, 2009).

Reference Books:

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2. Perspectives in Environmental Studies, Second edition, Anubha Koushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.

Mode of Evaluation: Assignments and Mid Term Tests

18HUM902 INDIAN CONSTITUTION

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

Course Prerequisites:

Course Objectives:

The course is intended to:

1. To know about Indian constitution;
2. To know about central and state government functionalities in India; and
3. To know about Indian society.

UNIT I: INTRODUCTION

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

(6)

UNIT II: STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

(6)

UNIT III: STRUCTURE AND FUNCTION OF STATE GOVERNMENT

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

(6)

UNIT IV CONSTITUTION FUNCTIONS

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

(6)

UNIT V INDIAN SOCIETY

Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

(6)

Course Outcomes:

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

1. Understand the functions of the Indian government; and
2. Understand and abide the rules of the Indian constitution.

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
3. Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
4. K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

References:

1. Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments and Mid Term Tests

18HUM903 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L	T	P	C
2	0	0	0

Course Prerequisite:

Basic understanding on Indian culture, traditions, and beliefs. Logistic approach towards learning.

Course Description:

This course deals with introducing and elaborating the importance and capabilities of the ancient, Indian Traditional Knowledge System in achieving heights of success and well-being towards humanity.

Course Objectives:

1. To get exposed to the basics of ITKS;
2. To understand the types and techniques used in Traditional Indian Medicine;
3. To introduce and elaborate the kind of art, architecture along with Vaastu Shashtra knowledge systems. To elucidate the product and construction technologies;
4. To familiarize the basic knowledge in ancient and traditional Astronomy and astrology along with aviation technologies in traditional knowledge systems; and
5. To acquire the knowledge on ancient contemporary world and IT revolution.

UNIT I: Indian Traditional Knowledge Systems (TKS) – Indian monuments; British Impact; Basics sciences - Philosophy and physical science; Indian physics; story of Kanada; Indian Chemistry; Indian Mathematics.

(6)

UNIT II: (Traditional Medicine)

Ayurveda – origin, texts, the three greater classics, three lesser classics, concepts; manifestation of creation; mental constitution; three Doshas; individual constitution, clinical process and proceedings; sushruta Samhita and its contents; shastrakarma; Yoga; and siddha.

(6)

UNIT III: Production and construction Technology; Art, Architecture and VastuShashtra; crafts and trade – Impact of Technology on society

(6)

UNIT IV: Astronomy and Astrology; Aviation technology in Ancient India - Vedic Astronomy; Eclipses, calculations using earths circumferences; Heliocentric theory of Gravitaton; vedic Astrology; Vaimanika Sastra and its ancient notes.

(6)

UNIT V: Information Technology in India – trends – Contemporary issues of IT Industry – Impact of IT on Indian society

(6)

Course Outcomes:

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

1. Understand the basics of Indian Traditional Knowledge System and the origin of basic science and Mathematics,
2. Get familiarized with various traditional medical methods and their implications in the human betterment,
3. Understand various production and construction technologies along with art and architectural implications in TKS,
4. Get the knowledge Vedic astronomy and astrology and get to know the ancient aviation technologies, and
5. Understand the outreach of the TKS to the contemporary world and gain the Indian action in protecting the TKS along with IT revolution.

Text Books:

1. Traditional Knowledge System in India, Amit Jha, Atlantic publishers, 2009. ISBN: 978-81-269-1223-0.
2. Traditional Knowledge System & Technology In India, Basanta Kumar Mohantra, Pratibha Prakashan (2012), ISBN-10: 8177023101

References:

1. Online Materials

Mode of Evaluation: Assignments and Mid Term Tests

18CE904 DISASTER MANAGEMENT

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

Course Prerequisite: None

Course Description:

The goal of this course is to expose the under graduate students regarding different types of disasters and preparedness needed to mitigate their effects. The course matrix will cover various natural, biological, chemical and emerging hazards and risks that may cause property, loss of lives, and livestock's. Thus, the future engineers will understand the social responsibility for the preparedness and mitigation of the damages caused by the disasters.

Course Objectives:

1. To make aware the students about disasters and their impact on living beings.
2. To ensure the students for the understanding on vulnerability, disasters, disaster prevention and risk reduction.
3. To gain a preliminary understanding of approaches for the Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes available in the country for the disaster risk mitigation.
5. To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I: INTRODUCTION

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention and mitigation.

(6)

UNIT II: TYPES OF DISASTERS

Types of Disaster; natural disasters (earthquakes, volcanoes, forest fires and explosions, heat and cold waves, floods, draught, cyclones, tsunami, landslides, soil erosion); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.), hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

(6)

UNIT III: DISASTER IMPACTS

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

(6)

UNIT IV: DISASTER RISK MITIGATION MEASURES

Disaster Risk Reduction (DRR) - Disaster management- four phase approach; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications), DRR programmers in India and the activities of National Disaster Management Authority. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction,

(6)

UNIT V: IMPACT OF DEVELOPMENTAL ACTIVITIES

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

(6)

Course Outcomes:

The student will develop competencies in:

1. Understanding on the nature of disasters
2. Application of Disaster Concepts to Management
3. Analyzing Relationship between Development and Disasters.
4. Ability to understand Categories of Disasters
5. Realization of the responsibilities to society

Text

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)

2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003

6. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments and Mid Term Tests

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Honors in Civil Engineering

18HDCE101 ADVANCED SURVEYING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE102

Course Description

A Civil Engineer has to be conversant with all the measurement techniques to know the ground topography and he should be able to use the modern survey equipments and be able to use different software applications in surveying.

Course Objectives

Students should be able to use advance surveying equipment's and methods through this subject.

Unit - I

Tacheometric Surveying Introduction- purpose- principle- instruments- stadia constants- methods of tacheometry- anallatic lens- subtense bar- field work in tacheometry- reduction of readings- errors and precisions. Geodetic Surveying Principle and Classification of triangulation system- Selection of base line and stations- Orders of triangulation- Triangulation figures- Station marks and signals- marking signals- Extension of base- Reduction of Centre- Selection and marking of stations **(9)**

Unit - II

Theory of Errors Introduction -types of errors-definitions- laws of accidental errors- laws of weights- theory of least squares- rules for giving weights and distribution of errors to the field observations- determination of the most probable values of quantities. **(9)**

Unit - III

Field Astronomy Introduction- purposes- astronomical terms- determination of azimuth- latitude- longitude and time corrections to the observations. **(9)**

Unit - IV

Aerial photogrammetry Introduction- Principle- Uses- Aerial camera- Aerial photographs- Definitions- Scale of vertical and tilted photograph– Ground Co-ordinates- Displacements and errors- Ground control- Procedure of aerial survey- Photomaps and mosaics- Stereoscopes- Parallax bar. **(9)**

Unit - V

Modern Surveying Instruments Introduction- Electromagnetic spectrum- Electromagnetic distance measurement- Total station- Digital self-levelling levels- and scanners for topographical survey. **(9)**

Course Outcomes

The students after completing the course will be able to do:

1. Conduct tacheometry and geodetic survey.
2. Apply principles of theory of errors for correction of measurements.
3. Apply knowledge of astronomy for solving civil engineering problems.
4. Explain use of aerial camera- aerial photographs and procedure of aerial survey.
5. Utilize stereoscope and parallax bars.

Text Books

1. Surveying Vol. I, II and III by Dr. B.C. Punamia, Laxmi Publishers. New Delhi
2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni, Pune Vidhyarthi Gruh
3. Surveying Vol. I, II and III by Dr. K.R. Arora, Standard Book House. New Delhi
4. Surveying Vol. I and II by S. K. Duggal, Tata Mcgraw Hill, New Delhi
5. Surveying and Levelling by N.N. Basak, Tata Mcgraw Hill, New Delhi

Reference Books

1. Surveying and Levelling by R. Agor, Khanna Publishers, New Delhi
2. Advanced Surveying by R. Agor, Khanna Publishers, New Delhi
3. Fundamentals of Surveying by Roy, S.K., Prentice Hall India, New Delhi
4. Surveying and Leveling by Subramanian, R., Oxford University Press, New Delhi

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE102 ENVIRONMENTAL GEOTECHNIQUES

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE109, 18CE106

Course Description

Geotechnical aspects of waste and waste containment. Nature of soils, contaminants and contaminant transport processes in the subsurface. Saturated and unsaturated flow in soils and performance of natural and geosynthetic base barrier, drainage and cover systems. Mechanical aspects and stability of waste containment facilities. Analytical tools and their role in design of containment systems. Key design elements and case studies of municipal, mining and industrial wastes.

Course Objectives

1. Provide an understanding of the use of geotechnical concepts in the analysis and design of environmental systems.
2. Focus will be placed on the evaluation of waste containment facilities.
3. The course will also cover relevant aspects of remediation technologies of contaminated sites.
4. The course will cover demonstrating the selection, design and performance of various waste containment facilities.

UNIT 1

Fundamentals of Geoenviromental Engineering: Scope of Geoenviromental engineering Three phase soil system - role of soil in geoenvironmental applications - importance of soil physics, soil chemistry, hydrogeology, biological process - sources and type of ground contamination - impact of ground contamination on geoenvironment **(9)**

UNIT 2

Soil-Water-Contaminant Interaction: Soil mineralogy characterization and its significance in determining soil behaviour - soil-water interaction and concepts of double layer - forces of interaction between soil particles, factors effecting retention and transport of contaminants. **(9)**

UNIT 3

Waste Containment System: Different components of waste containment system and its stability issues - property evaluation for checking soil suitability for waste containment - design of waste containment facilities. **(9)**

UNIT 4

Contaminant Site Remediation: Site characterization - risk assessment of contaminated site - remediation methods for soil and groundwater - selection and planning of remediation methods - some examples of in-situ remediation. **(9)**

UNIT 5

Geomembranes for landfills and ponds: Geosynthetics clay liner, designing with GCL's, Filtration, Erosion control, slope protection. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Understand the regulatory framework related to safe containment of wastes.
2. Evaluate the soil contaminant interaction forces.
3. Quantify the mechanical and hydraulic properties needed to satisfy design criteria of projects involving clay barriers.
4. Select, justify the selection, and design base liner systems, final cover systems, and liquid collection systems for municipal and hazardous waste as well as mining disposal sites.
5. Evaluate the mechanical and hydraulic properties of soil, solid waste, and geosynthetics.

Text Books

1. David, D. E. and Koerner, R. M., Waste Containment Facilities, ASCE Press, Allied Pub. Pvt. Ltd., 2007
2. S.K.Gulhati and Manoj data, "Geotechnical Engineering", The Mc-Graw-Hill publications, 2006.

Reference Books

1. Mitchell, J. K., "Fundamentals of Soil Behavior" Wiley, 2005.
2. Koerner, R. M., Designing with Geosynthetics, Pearson Education Inc., 2005
3. Ramanatha Ayyar, T. S., Soil Engineering in Relation to Environment, LBS Centre for Science and Technology, Thiruvananthapuram, 2000.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE103 APPLIED HYDRAULICS

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101

Unit-I (Introduction)

Introduction, engineered and natural open channel flows, review of conservation laws, Definition of specific energy, specific energy diagrams, flows over variable bathymetry, flows through contractions and expansions

Unit-II (Uniform flow)

Uniform flow force balance, normal depth calculations, flows in composite channels, Uniform flow - efficient channel design, Hydraulic jumps, momentum and energy analyses, stilling basin design.

Unit-III (Non-Uniform flow)

Gradually varied flow, basic equation and profile classifications, Gradually varied flow, numerical methods, Unsteady flow, routing introduction, Unsteady flow, kinematic and dynamic methods

Unit-IV (Hydraulic Structures in Channels)

Hydraulic structures - weirs and flumes, Hydraulic structures - culverts (HY8 introduction / demo) Stream gaging techniques, shear stress estimates, Sediment motion - Turbulent boundary layers, Shields parameter, Sediment transport - bedload and suspended load

Unit-V (Flow Modelling)

No-Class (field demonstration of stream gaging), HEC-RAS and HEC-GEORAS Introduction / demo **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Differentiate the types of open channel flow.
2. Estimate and design the depth of flow in uniform composite open channels.
3. Apply the un-steady flow routing methods for open channels flow.
4. Design the culvert in an open channel.
5. Evaluate and estimate the rating curve and flow velocities in an open channel section.

Text Books

1. Open Channel Hydraulics, Terry Sturm (2005), McGraw Hill Publication

Reference Books

1. Open Channel Hydraulics, Ven Te Chow, McGraw Hill Publication
2. Hydraulics of Open channel flow, Hubert Chanson (2004), Elsevier

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE104 ADVANCED CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE105

Course Description

This course covers ingredients of concrete and admixtures, properties of fresh concrete and hardened concrete, testing of hardened concrete and mix design. The course further covers special concretes used in construction industry.

Course Objectives

1. To explain properties of ingredients of concrete and procedures for testing concrete ingredients.
2. To recognizes the reasons for the use of Chemical and mineral admixtures.
3. To study the behavior of fresh and hardened concrete and also impart the methods of proportioning of concrete mixtures.
4. To make aware of factors affecting the durability of concrete.
5. To explains the characteristics of special concrete and its use.

UNIT-I : Concrete Material Properties:

Cement, grade of Cement, chemical composition, Hydration of Cement, Structure of hydrated Cement, Special Cement, properties and tests, Aggregates classification- Testing Aggregates, fibres, Water. **(9)**

UNIT-II :Admixtures

Chemical: Types and classification; actions and interactions; usage; effects on properties of concrete. Mineral : Flyash, ground granulated blast furnace slag, rice-husk ash and silica fume; chemical composition; physical characteristics; effects on properties of concrete; advantages and disadvantages. **(9)**

UNIT-III : Fresh and Hardened Concrete:

Rheological behaviour of fresh Concrete- Properties of fresh and hardened concrete- Strength, Elastic properties, Creep and Shrinkage, Maturity concept, Methods of Mix Design, Non Destructive Testing of Concrete. **(9)**

UNIT-IV : Durability of concrete:

Durability concept; factors affecting, reinforcement corrosion; fire resistance; frost damage; sulfate attack; alkali silica reaction; concrete in sea water, statistical quality control, acceptance criteria as per code. **(9)**

UNIT-V : Special Concretes:

Light weight Concrete, Fly-ash Concrete- Fibre reinforced Concrete, Polymer Concrete, Self Compacting concrete, Air entrained concrete, Polymer Concrete, Recycled aggregate concrete-properties and application. **(9)**

Course Outcomes

The students after completing the course will be able to do:

1. Identify properties and Quality Control tests on concrete ingredient as per IS cOde.
2. Determine the consequences of using admixtures in concrete.
3. Design the concrete mix and determine the properties of fresh and hardened of concrete.
4. Analyze the factors affecting the durability of concrete.
5. Update the knowledge on recent advances in special concretes.

Text Books

1. Neville, A.M., Properties of Concrete, Low priced Edition, 4th edition.
2. Shetty, M.S., Concrete Technology, S.Chand & Co, 2009.

Reference Books

1. Special Structural concretes by Rafat Siddique, Galgotia Publications 2000.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications, 2000.
3. Concrete: Micro Structure by P.K.Mehta, ICI, Chennai.
4. Concrete Technology by A.R. Santha kumar, Oxford University Press Oct 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE105 DESIGN OF HYDRAULIC STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisites: 18CE101, 18CE103, 18CE107, 18CE110, 18CE113

Course Description

Structures that are constructed for the purpose of the utilisation of water or to contai n the damages caused by water, occupy a position of special importance in human society. Although an introduction to this unique class of structure is available through the course on Water Resources Engineering, the present course plans to discuss each of these structures in detail, with ample worked examples. Special reference would be made, wherever possible, to relevant national and international standards and norms. The course would cover the design aspects of the hydraulic structures meant for storage, diversion, conveyance and distribution of water apart from structures for river flow modification and control. Preliminary design aspects of hydropower structures would also be included. Foundation considerations in the design of the structures would be discussed for each structure.

Course Objectives

1. To understand the design of various hydraulic structures
2. To determine the design flood for dams

UNIT I: STORAGE, DIVERSION, CONVEYANCE & DISTRIBUTION STRUCTURES

An Introduction- Reservoirs behind dams and pond area behind barrages: determination of capacities (influence of sedimentation) - Dead and Live storages - Design of storage structures: Gravity dam: Spillway and Non-overflow sections and their design - Concrete dam details: joints - water-seals - galleries and adits - instrumentation: purpose and techniques - sluices - Foundation treatment for concrete dams (curtain and consolidation grouting) - Other types of concrete dams (Arch, Buttress, Hollow, etc.) **(9)**

UNIT II: DAMS, SPILLWAYS, GATES

Design flood for dams (according to the size of dams and reservoir capacities) - PMF, SPF, Return Period - Backwater curve analysis for reservoirs - Typical sections of earth and rockfill dams (homogeneous / zoned) - Analysis and design of embankment dams - Types of gates for dams and barrages (radial and vertical lift types).
Types of spillways (adaptations for concrete and embankment dams) - Flow characteristics of gated/ungated spillways / breast-walled gates - Types of energy dissipators (Hydraulic Jump / Ski-Jump / Rollerbucket) - Influence of tail water rating curve on choice of energy Dissipater. **(9)**

UNIT III: DIVERSION STRUCTURES

Barrages and weirs on permeable foundations - Design consideration of barrages for surface and sub - surface flows (raft foundation on alluvial rivers) - Retrogression and flow concentration effects on barrage design - Design consideration of barrages (gravity design on boulder bed rivers)

- Sedimentation characteristics for barrage ponds and its influence by gate operation - management of sedimentation in barrage ponds - Barrage components: Glacis - Rigid apron - Flexible (concrete block) apron - End - sill arrangements for energy dissipation for weir and under - sluice sections of a barrage - Pier - Divide wall - Sheet Piles. **(9)**

UNIT IV: CANAL STRUCTURES

Head regulator - Cross regulator and Falls - Canal section design (unlined and lined) - in cutting and filling - Aqueducts - Superpassage - Syphon Aqueducts - Distribution structures for conveying water from canals to irrigation fields - Canal capacity determination from field water requirements - Guide bunds for flow control of rivers (for barrages and bridges)- its design features. **(9)**

UNIT V: HYDROPOWER

Principal components of a hydropower station: Intakes and Trash racks - Water conductor system - Tunnels - Surge tanks - Penstocks - Anchor blocks - Turbine foundation - Structures for prevention of riverbank and coastal erosion (considerations for toe scour - provision of filter to prevent subsidence). **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Identify hydraulic structures required to control and convey water
2. Compute the design flood for dams,
3. Design basic components of various hydraulic structures

Text Books

1. Hydraulic Structures, P. Novak, A. I. B. Moffat,, Nalluri .C and Narayanan .R,Taylor and Francis, U. K.
2. Garg S.K Irrigation and Hydraulic Structures, Khanna Publisher

Reference Books

1. Hydraulics of Spillways and Energy Dissipators, R. M. Khatsuria, Marcel Dekker Publishing, New York.
2. Manual on Barrages and Weirs on Permeable Foundation, Publication 179, (Volumes I and II), Central Board of Irrigation and Power, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE106 TRANSPORTATION INFRASTRUCTURE AND MANAGEMENT

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE112

Course Description

The course is intended to provide an overview of infrastructure planning and management approaches for building an efficient transport system by bringing out a holistic understanding of safe, accessible and sustainable components.

Course Objectives

1. To study various parameters of traffic flow and its concepts in urban contexts.
2. To know the economics of transport system and application of a range of techniques.
3. To study social, economic and environmental implications of various modes of transportation.
4. To provide knowledge of barrier-free design and planning as deemed necessary for a transportation system.
5. To improve the knowledge of transportation safety issues.

UNIT I: TRAFFIC ENGINEERING

Traffic characteristics-various traffic studies and their applications, Basic Parameters of Traffic Volume, Speed and Density; Parking Studies and Parking characteristics; Traffic control devices-Traffic signs- markings- traffic signals and traffic islands; Principles of highway lighting; Design of Traffic Signals. **(9)**

UNIT II: TRANSPORT ECONOMICS

Dynamics of Transport Market; Transport costing; Pricing policy; Cost/Benefit Analysis and Passenger Transport Subsidies; Road Investment; Competition, Regulation and Integration in Public Transport. **(9)**

UNIT-III: MULTIMODEL TRANSPORT INTEGRATION

Contemporary issues in transportation; Transportation, landuse and urban form; Travel pattern and Behaviour; Multimodal planning concepts and process; Transit and landuse; Freight and goods movement; Motorised and Non-motorised transportation. **(9)**

UNIT-IV: BARRIER-FREE TRANSPORTATION

Introduction to Transport Accessibility; Elements of road infrastructure - Pedestrian, cycle, junctions, vehicle lane, etc.; Design Standards and public policies for Barrier Free Transport; Universal Design Theory; Barrier Free Public Transportation; Access Audit for Barrier-free transport environment; Introduction to Intelligent Transportation Systems (ITS). **(9)**

UNIT-V: TRANSPORTATION SAFETY

Road and Transport Safety - factors for improving safety on roads, causes of accidents due to drivers and pedestrians, preventive maintenance- Vehicle act ; Vehicle and driver safety - Driver safety programme, driver's responsibility, accident reporting and investigation procedures; Transportation of Hazardous Goods - driver training-parking of tankers on the highways speed of the vehicle , warning symbols, inspection and maintenance of vehicles-check list - decanting procedures; Transportation and construction safety - Transport precautions, safety on manual mechanical handling equipment operations, safe driving, movement of cranes conveyors etc. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Determine the planning and management aspects of various transportation systems.
2. Identify and analyse various aspects of economics involved in transportation.
3. Understand the role of multimodal integration in the improvement of level of transportation services.
4. Identify the accessibility requirements for transport infrastructure to improve the quality of mobility and to create barrier-free environment for all.
5. Understand the safety issues in transportation and evaluate the risks involved.

Text and Reference Books

1. Khanna, S.K. & Justo E.G., Highway Engineering, Nem Chand & Bros., 2000
2. Kadiyali, L. R., Principles of Highway Engineering, Khanna Publishers, 2001
3. Bednar, M. J., "Barrier Free Environments", Dowden, Hutchinson & Ross, Inc., Community Development Series, Volume 33, Pennsylvania.
4. Cole, S. "Applied Transport Economics", Kogan page Limited., 1987.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE107 PROJECT PLANNING AND IMPLEMENTATION

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

A Civil Engineer has to be able to manage the modern construction project and he/she should be able to use different construction methods and techniques.

Course Objectives

To study and understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.

UNIT I CONSTRUCTION PLANNING

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities - Coding Systems. **(9)**

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES

Construction Schedules - Critical Path Method - Scheduling Calculations - Float - Presenting Project Schedules - Scheduling for Activity-on-Node and with Leads, Lags, and Windows Scheduling with Resource Constraints and Precedences - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Improving the Scheduling Process. **(9)**

UNIT III COST CONTROL, MONITORING AND ACCOUNTING

The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows -Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information. **(9)**

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION

Quality and Safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality Control by Statistical Methods Statistical Quality Control with Sampling by Attributes - Statistical Quality Control with Sampling by Variables - Safety. **(9)**

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION

Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow. **(9)**

Course Outcomes

The students after completing the course will be able to do:

1. The development of construction planning
2. The development of scheduling procedures and techniques
3. The cost control, monitoring and accounting
4. The quality control and safety during construction
5. The organization and use of project information

Text Books

1. Calin M. Popescu, Chotchai Charoenngam, "Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications", Wiley, New York, 1995.
2. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", McGraw-Hill Publishing Company, New Delhi, 1998.

Reference Books

1. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamental Concepts for Owners, Engineers", Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Halpin, D. W., "Financial and Cost Concepts for Construction Management", John Wiley & Sons, New York, 1985.
3. Willis, E. M., "Scheduling Construction Projects", John Wiley & Sons, 1986.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE108 BASIC STRUCTURAL DYNAMICS

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE101

Course Objectives

1. To acquaint with basic principles relating to Dynamics of structures under both damped and undamped condition.
2. To understand Impact of degree of freedom on vibration of structures
3. To make students learn about mathematical treatment of dynamics of structural Problems both single degree and multi degree of freedom system.
4. To train students in dealing with behaviour of structure subjected vibration and dynamic forces.

UNIT I

INTRODUCTION
Basic concepts of structural dynamics: degree of freedom system - force displacement relationship damping force - equation of motion - mass-spring-damper system - methods of Solution of differential equation.

UNIT II

SINGLE DEGREE OF FREEDOM SYSTEM- FREE VIBRATION
Solution to single degree of freedom systems subjected to free vibrations - undamped and damped,logarithmic decrement and numerical problems.

UNIT III

SINGLE DEGREE OF FREEDOM SYSTEM-FORCED VIBRATION
Solution to single degree of freedom systems subjected to forced vibrations - undamped and damped,resonance, dynamic load factor, half power band width, transmissibility ratio, response to impulsive loading, Duhamel’s Integral.

UNIT IV

MULTI DEGREE OF FREEDOM SYSTEM
Equation of motion and solution to MDOF system subjected to free vibration, Eigen value and Eigen vectors, Mode shapes, Normalization of modes, response of MDOF systems subjected to forced vibration.

UNIT V

DYANMICS OF CONTINUOUS SYSTEM
Approximate methods of analysis,Flexural vibrations of beams- Elementary case-Equation of motion -Analysis of undamped free shapes of simple beams with different end conditions-principles of application to continuous beams.

Course Outcomes

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

1. Identify different types of degree of freedom system conditions and other dynamic parameter.
2. Study the response of Free vibrations on undamped and damped SDOF system.
3. Compute impact of Forced vibrations on undamped and damped SDOF system.
4. Evaluate dynamic response of MDOF system by Modal analysis.
5. Interpret the behaviour of continuous system of structures subjected to different loading conditions.

Text Books

1. A.K.Chopra, "Structural Dynamics for Earthquake Engineering",Prentice Hall,1994
2. S.R Damodarasamy & S.Kavitha,“Basics of Structural Dynamics and a Seismic Design”, PHI Pvt. Ltd., 2009

Reference Books

1. Clough & Penziem, Dynamics of structures, Mc Graw Hill Publications
2. Mario Paz, Structural dynamics, CBS Publications.
3. I.S:1893(latest) “code of practice for earthquakes resistant design of structures”

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18HDCE109 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: None

Course Description

This course covers various deterioration mechanisms or damage mechanisms in structures, scientific aspects and its use while practicing repair works at site, selecting measurable parameters that are useful in deciding the further repair and maintenance practices.

Course Objectives

1. To understand the importance of performance of construction materials and its components
2. To provide a comprehensive knowledge on the diagnosis the damage, condition assessment of structures.
3. To learn various repair techniques of damaged structures, corroded structures
4. To study the various types and properties of repair materials
5. To learn the importance and methods of strengthening of structures.

UNIT I : Construction Materials

Performance of construction materials and components in services for strength, permeability, thermal properties and cracking effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, Effects of cover thickness **(9)**

UNIT II : Maintenance and Diagnosis

Maintenance, Repair and rehabilitation, Facets of Maintenance, Importance of Maintenance, Preventive measures based on various aspects of inspection- Condition assessment and rating procedure for evaluating a damaged structure. Diagnosis of construction failures. **(9)**

UNIT III : Corrosion Damages and Protection

Corrosion damage of reinforced concrete, methods of corrosion protection, Corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, rust eliminators. Causes of deterioration of concrete, steel, masonry and timber structures, surface deterioration, efflorescence, causes, prevention and protection. **(9)**

UNIT IV : Materials and Techniques

Special concrete and mortar, concrete chemicals, expansive cement, polymer concrete sulphur infiltrated concrete, Ferro cement, fiber reinforced concrete. Methods of repair in concrete, steel and masonry structures. Gunite and shotcrete, epoxy injection. **(9)**

UNIT V: Strengthening and Demolition

Strengthening of existing structures - repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure, coatings for set concrete and steel reinforcement. Demolition techniques of structures - case studies. **(9)**

Course Outcomes

The students after completing the course will be able to do:

1. Recognize the performance of construction materials and components.
2. Diagnosis the damage of distress structures.
3. Investigate the condition assessment of structures against corrosion damage.
4. Select the proper repair materials and its application.
5. Select the method to strengthen the distressed structures.

Text Books

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991
2. Allen .R.T, and Edwards .S.C, Shaw D.N, "Repair of Concrete Structures",Chapman and Hall, 2005.

Reference Books

1. Raiker .R.N, "Learning from Failures, Deficiencies in Design, Construction and Service", R&D Centre (SDCPL), Raikar Bhavan, Bombay 1987.
2. "Repair & Rehabilitation", Compilation from The Indian Concrete Journal,- ACC - RCD Publication 2001.
3. VK Raina, Concrete Bridge Practice Construction, Maintenance and Rehabilitation, 2nd Edition, Shroff Publishers and Distributors, August, 2010.
4. WH Ransom, Building Failures, Diagnosis and Avoidance, 2nd Edition, E and F.N. Spon Publishers, December 1987.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

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Minor in Civil Engineering

Stream: Civil Engineering-I

18MDCE101 SURVEYING AND BUILDING TECHNOLOGY

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: None

Course Description

The course will focus on basic concepts of Surveying and Building Technology. The student will have the knowledge of fundamentals of surveying and can apply the general principles of building construction to practical examples of constructional work throughout some parts of simple domestic buildings.

Course Objectives

1. To impart basic concepts of Surveying & Building Technology.
2. To make the student familiar with Chain Survey.
3. To make the students aware Compass Survey.
4. To make the student familiar with the general principles of building construction.
5. To make the students aware with the different types of foundations used in the construction.

UNIT I: BASIC CONCEPTS OF SURVEYING

Surveying - History; Definition; primary divisions, Classification, Principles of surveying Plan and map; Basic Measurements; Instruments and Basic methods; units of measurement, Scales used for Maps and plans, Duties of a surveyor. Errors: Accuracy and Precision Sources and types of errors, theory of Probability, Rounding of numbers. Minor instruments- uses and working of the minor instruments: Hand level, Line ranger, Optical square, Abney level, Clinometers, Pantograph, Box Sextant and Planimeter. **(9)**

UNIT II: CHAIN SURVEYING:

Instruments for chaining, Ranging out, chaining a line on a flat ground; Chaining on an uneven or a sloping ground; Chain & Tape corrections; Degree of accuracy. Principles of chain surveying; Basic definitions; Well-Conditioned Triangle, Field book, Field work; Offsets, Cross Staff survey; obstacles in chain survey-problems, Conventional signs. **(9)**

UNIT III: COMPASS SURVEY:

Introduction, Bearings and angles, Designation of bearings, Conversion of bearings from one system to the other, fore bearing and back bearing, , Calculation of bearing from angles, Theory of Magnetic compass (i.e. Prismatic compass), Temporary adjustments of compass-Magnetic Declination, Local attraction-Related Problems-Errors in compass survey. **(9)**

UNIT IV: THE BUILDING PROCESS, SITEWORKS AND DRAWINGS

Choice of site; site investigation; groundwater drainage; setting out; control of building work; sequence of building operations; problems in design and construction of buildings.

BUILDING DRAWING

Drawing instruments and materials; layout and presentation of drawings; sketches; working drawings. **(9)**

UNIT V: FOUNDATIONS

Identification and characteristics of soils; design of foundations; foundation types and their selection; excavation and trench timbering; concrete; cements; aggregates; site testing of materials; concrete mixes; concreting operations; reinforced concrete; prestressed concrete; basement construction. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Outline the basic concepts of surveying
2. Use the chain and its accessories to measure the distances.
3. Use the prismatic compass to measure the horizontal angles.
4. Outline the different building process, siteworks and drawings.
5. Utilize site information to interpret the type of foundation necessary at the site.

Text Books

1. Arora K.R, Surveying (In SI Unit), Standard Publishers, 2002.
2. Bhavikatti, S.S, Surveying and Leveling Vol. I, I.K. International Pvt Ltd, 2008.
3. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications; Eleventh edition (2016).
4. Sushil Kumar, Building Construction, Standard Publisher Distributors.(2010).

Reference Books

1. Ivor H. Seeley, Building Technology, Red Globe Press, 1st edition, Macmillan International Higher Education
2. Venkataramaiah, C, Surveying , Universities Press, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE102 BASIC SOIL MECHANICS AND FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The main goal of this course is to provide an basic understanding regarding different types of soils for foundation systems like buildings, bridges substructure, industrial complexes, ports, harbors, water tanks, and big storage tanks of industrial structure, transmission line towers, and machines.

Course Objectives

1. Understand the fundamental principles of Soil Mechanics;
2. Students learn to apply the principles of foundation engineering to real world problems
3. Prepare students for entry level geotechnical engineering employment

UNIT I

SOIL MECHANICS -INTRODUCTION: Origin of Soils- Three-phase System and Phase Relationships -Index Properties -Unified and Indian standard soil classification system. **(9)**

UNIT II: Soil Mechanics - Compaction & Consolidation of soil

Definitions - Differentiate between compaction and consolidation - Compaction mechanism and proctor tests- field compactions methods- factors affecting compaction -Consolidation mechanism through spring analogy -fundamental definitions - Terzaghi's one dimensional consolidation theory (only formula) -consolidation settlement. **(9)**

UNIT III: Soil Mechanics - Shear Strength of Soil

Types - choice of foundation - Location of depth - Safe Bearing Capacity - Terzaghi's, Meyerhoff's and Skempton's Methods. Safe bearing pressure based on N- value - allowable bearing pressure; safe bearing capacity and settlement from plate load test - allowable settlements of structures - Settlement Analysis. **(9)**

UNIT IV: Earth Pressure and Stability of Slopes

Types of lateral earth pressure - Rankine's and Coulomb's earth pressure- Infinite and finite slopes - Factor of safety -Type of slope failure -Limit equilibrium method- Taylors stability number - Numericals˙ **(9)**

UNIT V: Introduction to Foundations and Bearing Capacity

Shallow Foundations; Types, Basic terms, SBC computation using IS and Terzaghi methods. Deep Foundations; Pile and Pile capacity, Numericals. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Student will Classify the type of soil.
2. Student will Analyze the compaction and consolidation behavior of different soils.
3. Student will calculte the shear strength of soil.
4. Student will Calculte earth pressure for different soils.
5. Student will Analyse different types deep foundations under different soil conditions.

Text Books

1. Arora K. R. Geotechnical Engineering: Soil Mechanics & Foundation Engineering. Standard Publications, 17^{th} Ed.

Reference Books

1. Soil Mechanics & Foundation Engineering, by Murthy V. N. S, 6^{th} Edition, Dhanpat Rai
2. Principles of Foundation Engineering, by Braja M. Das, 7^{th} Edition ,Cengage Learning
3. Relevant BIS, IRC codes and International code of practice

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE103 STRUCTURAL ENGINEERING

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: 18CE101

Course Description

This course is designed to know how to analyse & design the basic civil engineering structural components in terms of both concrete and steel such as beams, frames, trusses, slabs, column and footings as per the International Codes. This also covers the fundamental properties of concrete and steel.

Course Objectives

1. To provide a coherent development to the students for the courses in sector of structural engineering.
2. To understand the fundamental principles and procedures of reinforced concrete and steel design;
3. To present the foundations of many basic engineering concepts related designing of structures.
4. To give an experience in the implementation of designing concepts which are applied in field of structural engineering
5. Prepare students for entry level structural engineering employment.

UNIT I: STRUCTURAL MATERIALS

Rheological behaviour of fresh Concrete- Properties of fresh and hardened concrete- Strength, Elastic properties, Creep and Shrinkage, Maturity concept, Methods of Mix Design, Non Destructive Testing of Concrete. Properties of Steel - Structural Steel sections – loads on structures - Structural steel connections and its applications- Rivet, welding and bolting. **(9)**

UNIT II: ANALYSIS OF INDETERMINATE STRUCTURES

Analysis of fixed and continuous beams - Analysis of Single Bay Single storey portal frame using Slope deflection and Moment distribution method - Analysis of Two bay Two storey portal frame using Kani's method.

UNIT III: MATRIX METHODS OF ANALYSIS

Analysis of continuous beams, frames and trusses using flexibility and stiffness methods **(9)**

UNIT IV: DESIGN OF CONCRETE STRUCTURAL ELEMENTS

Design Philosophy- Design of singly and doubly reinforced beams- Design of one way and two way slabs- Design of columns and footings. **(9)**

UNIT V: DESIGN OF STEEL STRUCTURAL ELEMENTS

Design Philosophy- Design of Tension and Compression member- Design of Plate girders and Gantry girders. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Investigate the properties of concrete and steel
2. Analyse the beams and portal frames using displacement methods
3. Analyse the beams and portal frames and trusses using matrix methods
4. Design and analyse the concrete structural elements.
5. Design and analyse the Steel structural elements.

Text Books

1. Shetty, M.S., Concrete Technology, S.Chand & Co, 2004.
2. Reddy, C.S., Basic Structural Analysis, Mc Graw Hill India, 2010
3. Subramanian, N., Design of Reinforced Concrete Structures, Oxford Publications, 2013
4. Bhavikatti, S. S., Design of Steel Structures, I.K. International Pvt Ltd, 2019
5. Subramanian, N., Steel Structures Design and Practice, Oxford University Press, 2010.

Reference Books

1. Gambhir, M.L., Concrete Technology, Tata Mc. Graw Hill Publishers, New Delhi.
2. Varghese, P. C., Limit State Design of Concrete, 2nd edition, PHI Pvt. Ltd., New Delhi, 2011.
3. Duggal, S.k., Limit State Design of Steel Structures, TMH, 2011.
4. IS 456:2000, Code of practice for Plain and Reinforced concrete, Bureau of Indian Standards, New Delhi
5. IS 800:2007, Code of practice for General construction in steel, B.I.S.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE104 WATER RESOURCES ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course will focus on basic concepts of Surveying and Building Technology. The student will have the knowledge of fundamentals of surveying and can apply the general principles of building construction to practical examples of constructional work throughout some parts of simple domestic buildings.

Course Objectives

1. To introduce the basics/fundamentals of hydrological cycle, precipitation, runoff, evaporation and other losses,
2. To measure and predict runoff and flood
3. To analyse & design of gravity dams and earth dams,
4. To estimate reservoir capacity
5. To familiarize with canal irrigation system

UNIT I: HYDROLOGIC CYCLE, PRECIPITATION AND LOSSES

Introduction - hydrologic cycle-world water balance - applications in engineering,
Precipitation - forms of precipitation - characteristics of precipitation in India - measurement of precipitation - rain gauge network - mean precipitation over an area - depth-area-duration relationships - maximum intensity/depth-duration-frequency relationship - Probable Maximum Precipitation (PMP) - rainfall data in India.
Eaporation process - evaporimeters - evapotranspiration - measurement of evapotranspiration - evapotranspiration equations - potential evapotranspiration over India - actual evapotranspiration - interception - depression storage - infiltration - infiltration capacity - measurement of infiltration - modelling infiltration capacity - classification of infiltration capacities - infiltration indices. **(9)**

UNIT II: FLOODS

FLOOD ESTIMATION: Flood Estimation by Rational method - empirical method - Unit Hydrograph Method - Flood frequency studies: Gumbel's method - Log-Pearson Type III Distribution
FLOOD HYDRAULICS: Basic Equations - Flood Routing-Reservoir routing - Channel routing - Hydrologic Storage Routing - Attenuation - Hydrologic Channel Routing - Muskingum Method - Runge Kutta Method **(9)**

UNIT III: CANAL IRRIGATION SYSTEM

Canal Irrigation System - Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular, and modular outlets. Lining of canals, types

of lining.
Canal Regulation Works: Canal falls: Necessity and location of falls - Types of falls - Classification of falls, Canal regulators, off-take alignment - head regulators and cross-regulators - regulator, outlets and escapes **(9)**

UNIT IV: RESERVOIR PLANNING:

Investigations for reservoir planning - selection of site for a reservoir - Zones of storage in a reservoir - Storage capacity, Catchment Yield and Reservoir Yield - Mass inflow curve and demand curve - Calculation of reservoir capacity for a specified yield from the mass inflow curve - Determination of safe yield from a reservoir of a given capacity - Sediment flow in streams: Reservoir Sedimentation - Life of reservoir. Reservoir sediment control, Reservoir Losses, Economic height of a dam. **(9)**

UNIT V: DAMS

GRAVITY DAMS: Introduction - Forces acting on a gravity dam - Combination of loading for design, Modes of failure, stability requirements - principal and shear stresses - Stability analysis, Elementary Profile of a Gravity dam - Practical profile of a gravity dam - Limiting height of a gravity dam- High and low gravity dams - Galleries - Stability analysis of non - overflow section of Gravity dam.
EARTH DAMS: Introduction - Types of earth dams - Causes of failure of earth dams - Criteria for safe design of earth dams - Section of an earth dam
SPILLWAYS: Types of Spillways - Types of Energy Dissipators. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Estimate the areal average precipitation over the basin using the knowledge of hydrological cycle.
2. Estimate flood using flood routing techniques.
3. Plan and design canal irrigation system.
4. Plan and fix reservoir capacity.
5. Analyse stability of gravity and earth dams

Text Books

1. S. K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers
2. K Subramanya, Engineering Hydrology, Mc-Graw Hill.

Reference Books

1. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc- Graw Hill.
2. G L Asawa, Irrigation Engineering, Wiley Eastern
3. L W Mays, Water Resources Engineering, Wiley.
4. J D Zimmerman, Irrigation, John Wiley & Sons

5. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE201 CIVIL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

Course Prerequisites: None

Course Description

This course covers the different laboratory/field experiments in the area of Civil Engineering.

Course Objectives

1. To understand the behaviour of materials under different types of loading
2. To represent field measurements into document form
3. To demonstrate tests in the laboratory to obtain different soil properties
4. To provide an opportunity to learn how to measure the parameters wich governs the quality of the materials
5. To make the students to learn the principles and procedures of testing Highway materials and to get hands on experience by conducting the tests and evolving inferences

LIST OF EXPERIMENTS

1. Axial deformation
2. Deflections of structural elements
3. Non-destructive tests on structural elements
4. Utility of Total Station
5. Experiments using planimeter
6. Grain size distribution by Sieve Analysis
7. Determination of field density by core-cutter
8. To determine the compressive strength of Concrete.
9. To determine the compressive strength of Cement
10. Impact test
11. Crushing test
12. Shape test
13. Specific gravity and water absorption
14. Fineness modulus of aggregates

Course Outcomes

The students after completing the course will be able to:

1. Examine the compressive strength of cement and concrete
2. Use modern instruments for different surveying purposes
3. Do various tests to apply in practical problems
4. Implement good quality construction techniques
5. Select the appropriate materials for use in different road layers

Text Books

1. Laboratory Manual for Civil Engineering Second Edition, HS Moondra, Rajiv Gupta, CBS PUBLISHERS AND DISTRIBUTORS PVT LTD
2. IS 13311-1 (1992): Method of Non-destructive testing of concrete, Part 1: Ultrasonic pulse velocity [CED 2: Cement and Concrete]
3. Surveying (Volume I), Dr. B.C. Punmia, Er. Ashok Kumar Jain, Dr. Arun Kumar Jain, Sixteenth Edition, Laxmi Publications (P) Ltd.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

18MDCE105 ECONOMICS OF TRANSPORTATION SYSTEMS

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: None

Course Description

This course offers a multi-disciplinary approach to transportation systems and intends to bring an overall understanding of the concepts of transport engineering.

Course Objectives

1. To have an overall knowledge of the transportation engineering and its components.
2. To provide knowledge of the planning and management of different modules of transportation systems.
3. To cater to the need of understanding the economics of transport system and explain the application of a range of techniques.
4. To improve the knowledge of factors and measures of accident involved to understand the transportation safety issues.
5. To bring out an understanding of concepts of Barrier-free design and planning as deemed necessary for a transportation system.

UNIT-I: Basics of Transportation Engineering

Introduction to Transportation Engineering; Role of transport; Types of transport systems; Evolution of transport modes; Transport problems and mobility issues; Urban form and Transport patterns; land use transport - cycle; concept of accessibility, Classification of roads; Typical cross sections of roads in urban and rural area; Flexible and Rigid pavement; Road geometric design. **(9)**

UNIT-II: Transportation Systems

Urban transportation systems - Mass rapid transit system, Bus Rapid transit system, Light rail transit system, Personal rapid Planning of railway - layout, passenger facilities, traffic control. Airport Planning - requirements and components. Planning of Harbours and ports - Inland waterways; Pipeline transportation. **(9)**

UNIT-III: Transport Economics

Transportation costs; Supply and demand; Supply of transport services; Economics of traffic congestion; Vehicle operating costs; Fuel costs; Maintenance; Value of travel time savings; Accident costs. Economic analysis of projects; Methods of evaluation; Cost-benefit ratio; Financing of road projects; Private Public Partnership (PPP) **(9)**

UNIT-IV: Road Safety:

Road accidents - Causes, Scientific Investigations and Data Collection; Ensuring Traffic Safety in new design, reconstruction and operation; Road safety audit; Traffic management techniques. **(9)**

UNIT-V: Barrier Free Environment for Transportation Infrastructure:

Design Standards for Barrier Free Transport; Universal Design Theory; Barrier Free Public Transportation; Access Audit; Disability Models and Public Policies; Case studies **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Understand the basic concepts of transportation engineering in reference to their background
2. Determine the planning and management aspects of various transportation systems.
3. Understand and analyze the economics involved in the transportation.
4. Understand the safety issues in transportation and evaluate the risks involved.
5. Improve their multidisciplinary understanding of the barrier-free concept in transportation for making an accessible environment for all.

Text Books

1. Khanna, S.K. & Justo E.G., Highway Engineering, Nem Chand & Bros., 2000
2. Kadiyali, L. R., Principles of Highway Engineering, Khanna Publishers, 2001
3. Khanna, S. K. & Arora. M. G., Airport Planning and Design, Nemchand & Bros.

Reference Books

1. Horonjeff R. & McKelvy, F., Planning and Design of Airports, McGraw Hill, 5e, 2010
2. IRC: 37-2001, Guidelines for the Design of Flexible Pavements, IRC 2001, New Delhi'
3. IRC:37-2012, Tentative Guidelines for the Design of Flexible Pavements
4. O' Flaherty, C.A (Ed.)., Transport Planning and Traffic Engineering, Elsevier, 1997
5. Rangwala, S. C. , Airport Engg. Charotar Publishing Co., 16e, 2016
6. Yoder, E. J & Witezak, M. W, Principles of Pavement Design, John Wiley & Sons, 1991
7. Paquette, R.J., et al, Transportation Engineering Planning and Design, John Wiley & Sons, New York, 1982.
8. Alan Black, Urban Mass Transportation Planning, McGraw-Hill, 1995.
9. Winfrey, Economic analysis for Highways, International Textbook Company, Pennsylvania, 1969.
10. CRRI, Road User Cost Study in India, New Delhi, 1982
11. IRC, Manual on Economic Evaluation of Highway Projects in India, SP30, 2007

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor in Civil Engineering

Stream: Civil Engineering-II

18MDCE106 ENGINEERING MECHANICS AND MATERIALS

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: None

Course Description

This course covers study of forces and geometric properties of rigid bodies, simple stresses and strains, shear force and bending moment for determinate beams, flexural, shear stresses and deflection of beams.

Course Objectives

1. To Study the forces on rigid bodies
2. To study the geometric properties of different shapes
3. To understand the nature of stresses and strains developed in simple geometries
4. To understand the concepts of shear force and bending moment and deflections in beams
5. To understand concept of flexural and shear stresses

Unit-I

STATICS OF PARTICLES: Introduction to Mechanics - System of Units -Laws of mechanics -Lame's theorem - Parallelogram and triangular Law of forces -Resolution of coplanar forces - Free body diagram - Equilibrium of particles
STATICS OF RIGID BODY: Moment of a force - Varignon's theorem - Moments and Couples -Equivalent system of forces - Requirements of stable equilibrium - Equilibrium of Rigid bodies subjected to two, three and four force system. **(9)**

Unit-II

CENTROID, CENTER OF GRAVITY AND MOMENT OF INERTIA: Center of Gravity and Centroid - Area and polar moment of inertia - Radius of Gyration -Parallel and Perpendicular Axis Theorems -Mass Moment of inertia - Problems on centroid and area moment of inertia of plane figures and build-up sections. **(9)**

Unit-III

SIMPLE STRESSES AND STRAINS: Concept of stress and strain- Types of stresses and strains- St. Venant's principle, Elasticity and plasticity - Hooke's law - Stress - Strain diagram for mild steel - Working stress - Factor of safety - Lateral strain, Poisson's ratio and volumetric strain - Elastic moduli and the relationship between them - Bars of varying section - composite bars - Temperature stresses. Strain Energy - Resilience **(9)**

Unit-IV

SHEAR FORCE AND BENDING MOMENT Concept of Shear Force (SF) and Bending Moment (BM) - SF and BD diagrams for Cantilever and Simply supported and Overhanging beams under point load(s), part and whole Uniformly Distributed Load(s), Uniformly Varying Load(s) and moment(s) -Calculation of maximum value and its location of SF and BM for all above load cases

DEFLECTIONS OF BEAMS Slope and deflection- Relationship between moment, slope and deflection, determine slopes and deflections of the determinate beams (Simply supported and Cantilever) using Double integration method, Macaulay's method, Moment area method. **(9)**

Unit-V

BENDING STRESSES: Assumptions - Derivation of bending equation, Neutral axis - Determination of bending stresses - Section modulus of rectangular and circular sections, I & T sections and built-up sections
SHEAR STRESSES- Derivation of shear stress formula - Shear stress distribution across various beam sections like rectangular, circular, triangular, I & T sections, Built-up sections. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Analyse force systems for a particle and rigid body and resolving the force system under equilibrium conditions
2. Determine centroid, center of gravity and moment of inertia of various surfaces and solids.
3. Learn the concepts of stress and strain in mechanics of solids
4. Analyse the beams for shear force, bending moment and deflections
5. Analyse bending and shear stresses for different types of beam sections

Text Books

1. R K Rajput, Strength of Material, S Chand Publications
2. Ferdinand P. Beer, E. Russell Johnston (2010), Vector Mechanics for Engineers: Statics and Dynamics (9th Edition), Tata McGraw-Hill International Edition.

Reference Books

1. S. S. Bhavikatti, (2008), Engineering Mechanics, New Age International.
2. Irving H. Shames, (2003), Engineering Mechanics - Statics and Dynamics, PrenticeHall of India Private limited.
3. S. Timoshenko D.H. Young J.V. Rao, SukumarPati, Engineering Mechanics, McGraw HillEducation; 5th edition
4. S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Company

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE101 SURVEYING AND BUILDING TECHNOLOGY

L	T	P	C
3	**0**	**0**	**3**

Course Prerequisites: None

Course Description

The course will focus on basic concepts of Surveying and Building Technology. The student will have the knowledge of fundamentals of surveying and can apply the general principles of building construction to practical examples of constructional work throughout some parts of simple domestic buildings.

Course Objectives

1. To impart basic concepts of Surveying & Building Technology.
2. To make the student familiar with Chain Survey.
3. To make the students aware Compass Survey.
4. To make the student familiar with the general principles of building construction.
5. To make the students aware with the different types of foundations used in the construction.

UNIT I: BASIC CONCEPTS OF SURVEYING

Surveying - History; Definition; primary divisions, Classification, Principles of surveying Plan and map; Basic Measurements; Instruments and Basic methods; units of measurement, Scales used for Maps and plans, Duties of a surveyor. Errors: Accuracy and Precision Sources and types of errors, theory of Probability, Rounding of numbers. Minor instruments- uses and working of the minor instruments: Hand level, Line ranger, Optical square, Abney level, Clinometers, Pantograph, Box Sextant and Planimeter. **(9)**

UNIT II: CHAIN SURVEYING:

Instruments for chaining, Ranging out, chaining a line on a flat ground; Chaining on an uneven or a sloping ground; Chain & Tape corrections; Degree of accuracy. Principles of chain surveying; Basic definitions; Well-Conditioned Triangle, Field book, Field work; Offsets, Cross Staff survey; obstacles in chain survey-problems, Conventional signs. **(9)**

UNIT III: COMPASS SURVEY:

Introduction, Bearings and angles, Designation of bearings, Conversion of bearings from one system to the other, fore bearing and back bearing, , Calculation of bearing from angles, Theory of Magnetic compass (i.e. Prismatic compass), Temporary adjustments of compass-Magnetic Declination, Local attraction-Related Problems-Errors in compass survey. **(9)**

UNIT IV: THE BUILDING PROCESS, SITEWORKS AND DRAWINGS

Choice of site; site investigation; groundwater drainage; setting out; control of building work; sequence of building operations; problems in design and construction of buildings.

BUILDING DRAWING

Drawing instruments and materials; layout and presentation of drawings; sketches; working drawings. **(9)**

UNIT V: FOUNDATIONS

Identification and characteristics of soils; design of foundations; foundation types and their selection; excavation and trench timbering; concrete; cements; aggregates; site testing of materials; concrete mixes; concreting operations; reinforced concrete; prestressed concrete; basement construction. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Outline the basic concepts of surveying
2. Use the chain and its accessories to measure the distances.
3. Use the prismatic compass to measure the horizontal angles.
4. Outline the different building process, siteworks and drawings.
5. Utilize site information to interpret the type of foundation necessary at the site.

Text Books

1. Arora K.R, Surveying (In SI Unit), Standard Publishers, 2002.
2. Bhavikatti, S.S, Surveying and Leveling Vol. I, I.K. International Pvt Ltd, 2008.
3. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications; Eleventh edition (2016).
4. Sushil Kumar, Building Construction, Standard Publisher Distributors.(2010).

Reference Books

1. Ivor H. Seeley, Building Technology, Red Globe Press, 1st edition, Macmillan International Higher Education
2. Venkataramaiah, C, Surveying , Universities Press, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE102 BASIC SOIL MECHANICS AND FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The main goal of this course is to provide an basic understanding regarding different types of soils for foundation systems like buildings, bridges substructure, industrial complexes, ports, harbors, water tanks, and big storage tanks of industrial structure, transmission line towers, and machines.

Course Objectives

1. Understand the fundamental principles of Soil Mechanics;
2. Students learn to apply the principles of foundation engineering to real world problems
3. Prepare students for entry level geotechnical engineering employment

UNIT I

SOIL MECHANICS -INTRODUCTION: Origin of Soils- Three-phase System and Phase Relationships -Index Properties -Unified and Indian standard soil classification system. **(9)**

UNIT II: Soil Mechanics - Compaction & Consolidation of soil

Definitions - Differentiate between compaction and consolidation - Compaction mechanism and proctor tests- field compactions methods- factors affecting compaction -Consolidation mechanism through spring analogy -fundamental definitions - Terzaghi's one dimensional consolidation theory (only formula) -consolidation settlement. **(9)**

UNIT III: Soil Mechanics - Shear Strength of Soil

Types - choice of foundation - Location of depth - Safe Bearing Capacity - Terzaghi's, Meyerhoff's and Skempton's Methods. Safe bearing pressure based on N- value - allowable bearing pressure; safe bearing capacity and settlement from plate load test - allowable settlements of structures - Settlement Analysis. **(9)**

UNIT IV: Earth Pressure and Stability of Slopes

Types of lateral earth pressure - Rankine's and Coulomb's earth pressure- Infinite and finite slopes - Factor of safety -Type of slope failure -Limit equilibrium method- Taylors stability number - Numericals. **(9)**

UNIT V: Introduction to Foundations and Bearing Capacity

Shallow Foundations; Types, Basic terms, SBC computation using IS and Terzaghi methods. Deep Foundations; Pile and Pile capacity, Numericals. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Student will Classify the type of soil.
2. Student will Analyze the compaction and consolidation behavior of different soils.
3. Student will calculte the shear strength of soil.
4. Student will Calculte earth pressure for different soils.
5. Student will Analyse different types deep foundations under different soil conditions.

Text Books

1. Arora K. R. Geotechnical Engineering: Soil Mechanics & Foundation Engineering. Standard Publications, 17^{th} Ed.

Reference Books

1. Soil Mechanics & Foundation Engineering, by Murthy V. N. S, 6^{th} Edition, Dhanpat Rai
2. Principles of Foundation Engineering, by Braja M. Das, 7^{th} Edition ,Cengage Learning
3. Relevant BIS, IRC codes and International code of practice

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE104 WATER RESOURCES ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course will focus on basic concepts of Surveying and Building Technology. The student will have the knowledge of fundamentals of surveying and can apply the general principles of building construction to practical examples of constructional work throughout some parts of simple domestic buildings.

Course Objectives

1. To introduce the basics/fundamentals of hydrological cycle, precipitation, runoff, evaporation and other losses,
2. To measure and predict runoff and flood
3. To analyse & design of gravity dams and earth dams,
4. To estimate reservoir capacity
5. To familiarize with canal irrigation system

UNIT I: HYDROLOGIC CYCLE, PRECIPITATION AND LOSSES

Introduction - hydrologic cycle-world water balance - applications in engineering,
Precipitation - forms of precipitation - characteristics of precipitation in India - measurement of precipitation - rain gauge network - mean precipitation over an area - depth-area-duration relationships - maximum intensity/depth-duration-frequency relationship - Probable Maximum Precipitation (PMP) - rainfall data in India.
Eaporation process - evaporimeters - evapotranspiration - measurement of evapotranspiration - evapotranspiration equations - potential evapotranspiration over India - actual evapotranspiration - interception - depression storage - infiltration - infiltration capacity - measurement of infiltration - modelling infiltration capacity - classification of infiltration capacities - infiltration indices. **(9)**

UNIT II: FLOODS

FLOOD ESTIMATION: Flood Estimation by Rational method - empirical method - Unit Hydrograph Method - Flood frequency studies: Gumbel's method - Log-Pearson Type III Distribution
FLOOD HYDRAULICS: Basic Equations - Flood Routing-Reservoir routing - Channel routing - Hydrologic Storage Routing - Attenuation - Hydrologic Channel Routing - Muskingum Method - Runge Kutta Method **(9)**

UNIT III: CANAL IRRIGATION SYSTEM

Canal Irrigation System - Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular, and modular outlets. Lining of canals, types

of lining.
Canal Regulation Works: Canal falls: Necessity and location of falls - Types of falls - Classification of falls, Canal regulators, off-take alignment - head regulators and cross-regulators - regulator, outlets and escapes **(9)**

UNIT IV: RESERVOIR PLANNING:

Investigations for reservoir planning - selection of site for a reservoir - Zones of storage in a reservoir - Storage capacity, Catchment Yield and Reservoir Yield - Mass inflow curve and demand curve - Calculation of reservoir capacity for a specified yield from the mass inflow curve - Determination of safe yield from a reservoir of a given capacity - Sediment flow in streams: Reservoir Sedimentation - Life of reservoir. Reservoir sediment control, Reservoir Losses, Economic height of a dam. **(9)**

UNIT V: DAMS

GRAVITY DAMS: Introduction - Forces acting on a gravity dam - Combination of loading for design, Modes of failure, stability requirements - principal and shear stresses - Stability analysis, Elementary Profile of a Gravity dam - Practical profile of a gravity dam - Limiting height of a gravity dam- High and low gravity dams - Galleries - Stability analysis of non - overflow section of Gravity dam.
EARTH DAMS: Introduction - Types of earth dams - Causes of failure of earth dams - Criteria for safe design of earth dams - Section of an earth dam
SPILLWAYS: Types of Spillways - Types of Energy Dissipators. **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Estimate the areal average precipitation over the basin using the knowledge of hydrological cycle.
2. Estimate flood using flood routing techniques.
3. Plan and design canal irrigation system.
4. Plan and fix reservoir capacity.
5. Analyse stability of gravity and earth dams

Text Books

1. S. K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers
2. K Subramanya, Engineering Hydrology, Mc-Graw Hill.

Reference Books

1. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc- Graw Hill.
2. G L Asawa, Irrigation Engineering, Wiley Eastern
3. L W Mays, Water Resources Engineering, Wiley.
4. J D Zimmerman, Irrigation, John Wiley & Sons

5. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

18MDCE201 CIVIL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

Course Prerequisites: None

Course Description

This course covers the different laboratory/field experiments in the area of Civil Engineering.

Course Objectives

1. To understand the behaviour of materials under different types of loading
2. To represent field measurements into document form
3. To demonstrate tests in the laboratory to obtain different soil properties
4. To provide an opportunity to learn how to measure the parameters wich governs the quality of the materials
5. To make the students to learn the principles and procedures of testing Highway materials and to get hands on experience by conducting the tests and evolving inferences

LIST OF EXPERIMENTS

1. Axial deformation
2. Deflections of structural elements
3. Non-destructive tests on structural elements
4. Utility of Total Station
5. Experiments using planimeter
6. Grain size distribution by Sieve Analysis
7. Determination of field density by core-cutter
8. To determine the compressive strength of Concrete.
9. To determine the compressive strength of Cement
10. Impact test
11. Crushing test
12. Shape test
13. Specific gravity and water absorption
14. Fineness modulus of aggregates

Course Outcomes

The students after completing the course will be able to:

1. Examine the compressive strength of cement and concrete
2. Use modern instruments for different surveying purposes
3. Do various tests to apply in practical problems
4. Implement good quality construction techniques
5. Select the appropriate materials for use in different road layers

Text Books

1. Laboratory Manual for Civil Engineering Second Edition, HS Moondra, Rajiv Gupta, CBS PUBLISHERS AND DISTRIBUTORS PVT LTD
2. IS 13311-1 (1992): Method of Non-destructive testing of concrete, Part 1: Ultrasonic pulse velocity [CED 2: Cement and Concrete]
3. Surveying (Volume I), Dr. B.C. Punmia, Er. Ashok Kumar Jain, Dr. Arun Kumar Jain, Sixteenth Edition, Laxmi Publications (P) Ltd.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

18MDCE107 TRAFFIC AND ROAD SAFETY ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description

The course intends to bring out a holistic understanding of concepts of traffic engineering and safety as deemed necessary for a multidisciplinary approach in transportation system.

Course Objectives

1. To have an overall knowledge of the traffic components and assess the traffic characteristics and related problems.
2. To develop a strong knowledge base of traffic planning and its management in any transportation area.
3. To provide knowledge of traffic control devices and its techniques in transportation interaction for the management of different modules of urban transportation system.
4. To improve the knowledge of factors and measures of accident involved to understand the transportation safety issues.
5. To bring out an understanding of concepts of Barrier-free design and planning as deemed necessary for a transportation system.

UNIT-I: Basics of Traffic Engineering:

Aim of traffic engineering; traffic stream components and characteristics - road user characteristics, vehicle characteristics; Basic Parameters of Traffic Volume; Speed and Density- Traffic Volume Studies, speed studies; Parking Studies and Parking characteristics. **(9)**

UNIT-II: Intelligent Transportation Systems:

Introduction to Intelligent Transportation Systems (ITS) - Definition of ITS and Identification of ITS Objectives, ITS applications, Benefits of ITS, ITS Data collection; Telecommunications in ITS; ITS functional areas; ITS user needs and services; case studies. **(9)**

UNIT-III: Traffic Control, Design and Regulation

Traffic control types and methods; Intersections; Traffic signs; road markings; traffic signals; traffic islands. **(9)**

UNIT-IV: Road Safety:

Road accidents - Causes, Scientific Investigations and Data Collection; Ensuring Traffic Safety in new design, reconstruction and operation; Road safety audit; Traffic management techniques. **(9)**

UNIT-V: Barrier Free Environment for Transportation Infrastructure:

Design Standards for Barrier Free Transport; Universal Design Theory; Barrier Free Public Transportation; Access Audit; Disability Models and Public Policies; Case studies **(9)**

Course Outcomes

The students after completing the course will be able to:

1. Understand the basic concepts of traffic engineering in reference to their background
2. Determine the planning and management aspects of urban traffic systems.
3. Understand the different methods involved in traffic control, operations and management.
4. Understand the safety issues in transportation and evaluate the risks involved.
5. Improve their multidisciplinary understanding of the barrier-free concept in transportation for making an accessible environment for all.

Text Books

1. Khanna, S.K. & Justo E.G., Highway Engineering, Nem Chand & Bros., 2000
2. Kadiyali, L. R., Principles of Highway Engineering, Khanna Publishers, 2001
3. Khanna, S. K. & Arora. M. G., Airport Planning and Design, Nemchand & Bros.
4. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

Reference Books

1. Bednar, M. J., "Barrier Free Environments", Dowden, Hutchinson & Ross, Inc., Community Development Series, Volume 33, Pennsylvania.
2. Disability Standards for Accessible Public Transport, Australia.
3. Steinfeld, E. and Danford, G. (Eds.), "Enabling Environments - Measuring the Impact of environment on disability and rehabilitation"
4. Preiser, W.F.E., "Universal Design Handbook", Ostroff, E.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination