Dr. MAHALINGAM
MCET
COLLEGE OF ENGINEERING AND TECHNOLOGY
Enlightening Technical Minds

An Autonomous Institution Since 2011.
Approved by AICTE / Affiliated to Anna University.
Accredited by NAAC with 'A++' Grade.
Tier-1* - Accredited by NBA.
Part of NIA Educational Institution

Curriculum and Syllabi

B.E CIVIL ENGINEERING

Semesters I to VIII

Regulations 2019

(2021 Batch Onwards)

Programme: B.E. Civil Engineering
Curriculum and Syllabi: Semesters I to VIII
Recommended by Board of Studies on 21.04.2023
Approved by Academic Council on 19.06.2023

Action	**Responsibility**	**Signature of Authorized Signatory**
Designed and Developed by	BoS Civil Engineering	
Compiled by	Office of the Controller of Examinations	
Approved by	Principal	

Dr. Mahalingam College of Engineering and Technology
Department of Civil Engineering

Vision

To develop Competent Civil Engineers to meet the infrastructure challenges of India and the world.

Mission

- To become one of the reputed departments offering Civil Engineering Program in the country.
- To produce excellent engineers to cope up with the changes through dynamic, innovative, and flexible curriculum.
- To provide a conducive environment for teaching & learning and to develop leaders with effective communication skills.
- To conduct quality research driven by industry & societal needs and provide affordable engineering solutions in an ethical way.

Programme: B.E. – Civil Engineering

Programme Educational Objectives (PEOs) - Regulation 2019

B.E Civil Engineering graduates will:

PEO.1 Graduates who effectively demonstrate engineering knowledge, problem solving skill, design capabilities and entrepreneurial skills by providing practical solutions.

PEO.2 Graduates who effectively demonstrate professionalism in multi-disciplinary engineering environment, leadership quality, teamwork and engage in life-long learning.

PEO.3 Graduates who demonstrate an ethical commitment to the community and the profession through involvement with professional societies.

PEO.4 Graduates who make contributions to knowledge and establish best engineering practice through research and development.

Programme outcomes (Pos) – Regulations 2019

PO.1 **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO.2 **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO.3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO.4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO.5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO.6 **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO.7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO.8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO.9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO.10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO.11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO.12 **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs) - Regulations 2019

PSO.1 **Problem Analysis:** Able to arrive solutions to real time problems related to various domains of civil engineering through problem solving skills.

PSO2. **Design and Management:** Able to design systems, components and processes considering safety, quality and cost consideration and able to prepare project documents, engineering drawings and construction schedules.

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COLLEGE OF ENGINEERING AND TECHNOLOGY
Affiliated to Anna University, Chennai; Approved by AICTE ; Accredited by NAAC with Grade 'A++'
Accredited by NBA - Tier1 (Mech, Auto, Civil, EEE, ECE, E&I and CSE)
Udumalai Road, Pollachi - 642 003. Tel: 04259-236030/40/50 Fax: 04259-236070 www.mcet.in

Programme: B.E Civil Engineering
2019 Regulations (2021 batch onwards)
Curriculum for Semesters I to VIII

Course Code	Course Title	Duration	Credits	Marks
19SHMG6101	Induction Program	3 Weeks	-	100

Semester I

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19ENHG2101	Communication Skills – I	2	0	2	3	100	All
19MABC1101	Matrices and Calculus	3	1	0	4	100	AU, CE, EC, EI, EE, ME
19PHBN2101	Physics for Civil Engineering	3	0	2	4	100	-
19EESN2101	Basics of Electrical and Mechanical Engineering	3	0	2	4	100	-
19CESN3101	Engineering Drawing for Civil Engineering	0	0	4	2	100	-
19PSHG6001	Wellness for Students	0	0	2	1	100	All
Total		**11**	**1**	**12**	**18**	**600**	

Semester II

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19ENHG2201	Communication Skills – II	2	0	2	3	100	All
19MABC1201	Ordinary Differential Equations and Complex Variables	3	1	0	4	100	AU, CE, EC, EI, EE, ME
19CHBN2201	Chemistry for Civil Engineering	3	0	2	4	100	-
19CESN1201	Engineering Mechanics	3	1	0	4	100	-
19CSSC2001	C Programming	3	0	2	4	100	AU, CE, EC, EI, EE, ME
19CECN3201	Computer Aided Building Drawing Laboratory	0	0	4	2	100	-
19CHMG6201	Environmental Sciences	1	0	0	-	-	All
19PSHG6003	தமிழர்மரபு /Heritage of Tamils*	1	0	0	1	100	All
Total		**16**	**2**	**12**	**22**	**800**	

* Applicable only for 2022 Batch

Semester III

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABN1301	Transforms and Partial Differential Equations	3	1	0	4	100	All
19CECN1301	Construction Materials and Practices	3	0	0	3	100	-
19CECN1302	Transportation Engineering	3	0	0	3	100	-
19CECN1303	Surveying	4	0	0	4	100	-
19CESN1301	Solid Mechanics	3	1	0	4	100	-
19CECN3301	Surveying Practice Laboratory	0	0	3	1.5	100	-
19CECN3302	Materials Laboratory	0	0	3	1.5	100	-
XXXXXXXXXX	One Credit Course	0	0	2	1	100	-
19PSHG6004	தமிழரும்தொழில்நுட்பமும் / Tamils and Technology*	2	0	0	1	100	All
Total		**18**	**2**	**8**	**23**	**800**	

*Applicable only for 2022 Batch

Semester IV

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABG1401	Probability and Statistics	3	1	0	4	100	All
19CECN1401	Hydraulics Engineering	3	1	0	4	100	-
19CECN1402	Concrete Technology	3	0	0	3	100	-
19CECN1403	Structural Analysis	3	1	0	4	100	-
19CECN3401	Hydraulics Engineering Laboratory	0	0	3	1.5	100	-
19CECN3402	Concrete and Transportation Engineering Laboratory	0	0	3	1.5	100	-
19PSHG6002	Universal Human Values 2: Understanding Harmony	2	1	0	3	100	All
XXXXXXXXXX	One Credit Course	0	0	2	1	100	-
19CEPN6401	Mini – Project	0	0	4	2	100	-
Total		**14**	**4**	**12**	**24**	**900**	

Course Code	Course Title	Duration	Credits	Marks
XXXXXXXXXX	Internship or Skill Development**	2 Weeks	1	100

**Refer to clause: 4.8 in UG academic regulations 2019

Semester V

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19CESN1501	Geology and Soil Mechanics	3	1	0	4	100	-
19CECN1502	Design of RC Structures	3	1	0	4	100	-
19CECN1503	Environmental Engineering	4	0	0	4	100	-
XXXXXXXXXX	Professional Elective – I	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective – II	3	0	0	3	100	-
XXXXXXXXXX	Open Elective – I	3	0	0	3	100	-
19CECN3501	Soil Mechanics Laboratory	0	0	3	1.5	100	-
19CECN3502	Environmental Engineering Laboratory	0	0	3	1.5	100	-
19PSHG6501	Employability Skills 1: Teamness and Interpersonal Skills	0	0	2	1	100	All
Total		**19**	**2**	**8**	**25**	**900**	**-**

Semester VI

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19CECN1601	Foundation Engineering	3	1	0	4	100	-
19CECN1602	Design of Steel Structures	3	1	0	4	100	-
19CEEN10XX	Professional Elective – III	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective – IV	3	0	0	3	100	-
XXXXXXXXXX	Open Elective – II	3	0	0	3	100	-
19CECN3601	Building Drawing Laboratory	0	0	3	1.5	100	-
19CECN3602	Computer Aided Design and Drafting Laboratory	0	0	3	1.5	100	-
19PSHG6601	Employability Skills 2: Campus to Corporate	0	0	2	1	100	All
19CEPN6601	Innovative and Creative Project	0	0	4	2	100	-
Total		**15**	**2**	**12**	**23**	**900**	

Course Code	Course Title	Duration	Credits	Marks
XXXXXXXXXX	Internship or Skill Development**	2/4 Weeks	1	100

**Refer to clause: 4.8 in UG academic regulations 2019

Semester VII

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19CECN1701	Water Resources and Irrigation Engineering	4	0	0	4	100	-
19CECN1702	Construction Project Management	4	0	0	4	100	-
XXXXXXXXXX	Professional Elective – V	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective – VI	3	0	0	3	100	-
XXXXXXXXXX	Open Elective – III	3	0	0	3	100	-
19CECN3701	Quantity Surveying and Estimation Laboratory	0	0	4	2	100	-
Total		**17**	**0**	**4**	**19**	**600**	

Semester VIII

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19SHVG6001/ 19SHVG6002	Entrepreneurship Development/*தமிழர் மரபும் பண்பாடும்* / Culture and Heritage of Tamils	1	0	0	1	100	All
19CEPN6801	Project	0	0	16	8	200	-
Total		**0**	**0**	**16**	**8**	**200**	

Course Code	Course Title	Duration	Credits	Marks
XXXXXXX	Internship or Skill Development**	8/16 weeks	4	100

**Refer to clause: 4.8 in UG academic regulations 2019

Total Credits (2021 batch): 167

Total Credits (2022 batch): 169

VERTICAL WISE ELECTIVES

Structural Engineering Electives							
Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19CEEN1002	Advanced Concrete Structures	3	0	0	3	100	-
19CEEN1008	Maintenance and Rehabilitation of Structures	3	0	0	3	100	-
19CEEN1011	Prefabricated Structures	3	0	0	3	100	-
19CEEN1012	Prestressed Concrete Structures	3	0	0	3	100	-
19CEEN1019	Seismic Design of Structures	3	0	0	3	100	-
19CEEN1020	Smart Materials and Structures	3	0	0	3	100	-
19CEEN1024	Experimental Techniques	3	0	0	3	100	-

Environmental Engineering Electives							
Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19CEEN1003	Air Pollution Management	3	0	0	3	100	-
19CEEN1007	Industrial Waste Management	3	0	0	3	100	-
19CEEN1009	Municipal Solid Waste Management	3	0	0	3	100	-
19CEEN1025	Environmental Impact and Risk Assessment	3	0	0	3	100	-
19CEEN1026	Climatic Change and Adaption	3	0	0	3	100	-
19CEEN1027	Disaster Mitigation and Management	3	0	0	3	100	-
19CEEN1028	Sustainable Engineering and Technology	3	0	0	3	100	-

Geotechnical Engineering Electives							
Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19CEEN1006	Ground Improvement Techniques	3	0	0	3	100	-

19CEEN1029	Subsurface Investigation and Instrumentation	3	0	0	3	100	-
19CEEN1030	Engineering behavior of Soil	3	0	0	3	100	-
19CEEN1031	Shallow Foundation	3	0	0	3	100	-
19CEEN1032	Deep Foundation	3	0	0	3	100	-
19CEEN1033	Soil Dynamics and Machine Foundation	3	0	0	3	100	-
19CEEN1034	Reinforced Soil Structure	3	0	0	3	100	

Water Resources Engineering Electives							
Course Code	**Course Title**	**Hours/Week**			**Credits**	**Marks**	**Common to Programmes**
		L	**T**	**P**			
19CEEN1023	Hydrology	3	0	0	3	100	-
19CEEN1035	Groundwater Engineering	3	0	0	3	100	-
19CEEN1036	Irrigation Management	3	0	0	3	100	-
19CEEN1037	Irrigation Water Quality	3	0	0	3	100	-
19CEEN1038	Watershed Conservation and Management	3	0	0	3	100	-
19CEEN1040	Remote Sensing and GIS applications in Water Resources	3	0	0	3	100	-
19CEEN3001	Irrigation and Environmental Engineering Drawing	0	0	3	1.5	100	-

Construction Engineering and Management Electives							
Course Code	**Course Title**	**Hours/Week**			**Credits**	**Marks**	**Common to Programmes**
		L	**T**	**P**			
19CEEN1001	Advanced Construction Techniques	3	0	0	3	100	-
19CEEN1004	Building Services	3	0	0	3	100	-
19CEEN1015	Quality Control and Assurance	3	0	0	3	100	-
19CEEN1018	Safety in Construction	3	0	0	3	100	-
19CEEN1041	Construction Personnel Management	3	0	0	3	100	-
19CEEN1042	Alternative Building Materials	3	0	0	3	100	-

19CEEN1043	Economics and financial Management in Construction	3	0	0	3	100	-

Transportation and Urban Planning Electives							
Course Code	**Course Title**	**Hours/Week**			**Credits**	**Marks**	**Common to Programmes**
		L	**T**	**P**			
19CEEN1016	Railways, Airports and Harbour Engineering	3	0	0	3	100	-
19CEEN1021	Architecture and Town Planning	3	0	0	3	100	-
19CEEN1044	Pavement Engineering	3	0	0	3	100	-
19CEEN1045	Traffic Engineering and Management	3	0	0	3	100	-
19CEEN1046	Housing Planning and Management	3	0	0	3	100	-
19CEEN1047	Introduction to Intelligent Transport Systems	3	0	0	3	100	-
19CEEN1048	Urban Planning and Development	3	0	0	3	100	-

Diversified Electives

Course Code	**Course Title**	**Hours/Week**			**Credits**	**Marks**	**Common to Programmes**
		L	**T**	**P**			
19SCEC2001	Cyber Security	2	0	2	3	100	All
19MEEC1025	Fundamentals of Entrepreneurship	3	0	0	3	100	All
19MEEC1026	Design Thinking and Innovation	3	0	0	3	100	All
19ITEN1029	Intellectual Property Rights	3	0	0	3	100	All

Open Electives

Course Code	**Course Title**	**Hours/Week**			**Credits**	**Marks**
		L	**T**	**P**		
19CEOC1001	Environmental Impact Assessment	3	0	0	3	100
19CEOC1002	Safety Engineering	3	0	0	3	100
19CEOC1003	Geographical Information System	3	0	0	3	100
19CEOC1004	Applied Design thinking concepts	3	0	0	3	100
19CEOC1005	Startup Fundamentals for Engineers	3	0	0	3	100

Regulations 2019

Detailed Syllabi for

Semesters I to VIII

Course Code: 19SHMG6101	Course Title: Induction Program (common to all B.E/B.Tech programmes)
Course Category: Mandatory Non-Credit Course	Course Level: Introductory
Duration: 3 Weeks	Max. Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain various sources available to meet the needs of self, such as personal items and learning resources.
2. Explain various career opportunities, opportunity for growth of self and avenues available in the campus.
3. Explain the opportunity available for professional development.
4. Build universal human values and bonding amongst all the inmates of the campus and society.

List of Activities:

1. History of Institution and Management: Overview on NIA Education Institutions-Growth of MCET – Examination Process-OBE Practices – Code of Conduct – Centre of Excellence
2. Lectures by Eminent People, Motivational Talk – Alumni, Employer
3. Familiarization to Dept./Branch: HoD Interaction – Senior Interaction – Department Association
4. Universal Human Value Modules: Module 1, Module 2, Module 3 and Module 4
5. Orientation on “Professional Skill Courses”
6. Proficiency Modules – Mathematics, English, Physics and Chemistry
7. Introduction to various Chapters, Cell, Clubs and its events
8. Creative Arts: Painting, Music and Dance
9. Physical Activity: Games and Sports, Yoga and Gardening
10. Group Visits: Visit to Local areas and Campus Tour

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain various sources available to meet the needs of self, such as personal items and learning resources through visit to local areas and campus	Understand
CO2: Explain various career opportunities and avenues available in the campus through orientation sessions	Understand
CO3: Explain the opportunity available for professional development through professional skills, curricular, co–curricular and extracurricular activities	Understand
CO4: Build universal human values and bonding amongst all the inmates of the campus and society for having a better life	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO2	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO3	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO4	2	-	-	-	-	-	-	2	1	2	-	-	-	-

High–3; Medium–2; Low–1

SEMESTER I

Course Code: 19ENHG2101		Course Title: COMMUNICATION SKILLS – I (Common to all B.E/B.Tech Programmes)	
Course Category: Humanities		Course Level: Introductory	
L:T:P (Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Pre–requisites

- The student should have undergone English as his/her first or second language in school.

Course Objectives

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with B1 of CEFR level.
2. Speak in simple sentences to convey their opinions and ideas on par with B1 of CEFR level.
3. Read and infer a given text on par with B1 of CEFR level.
4. Draft basic formal written communication on par with B1 of CEFR level.

UNIT I – LISTENING **15 Hours**

Importance of active listening –Physical condition needed for active listening –Identifying relevant points while taking notes – Framing questions at different linguistic contexts – Listening for specific details of concrete monologues and dialogues –Listening to organize ideas – Developing ideas –Listening to compose paragraphs – Paraphrasing the aural input.

UNIT II – SPEAKING **15 Hours**

Importance of note making to practice speaking – Traditional note making, developing Mind map – Collecting points from various sources – Identifying relevant ideas needed for the speech –Using mind–map to organize thought processing – Prioritizing the ideas – Types of sentences –Frequently used words (Institution, home and leisure) – Mother Tongue Influence – Expressing the thoughts in simple sentences – Tenses & Voices (Active & Passive) – Postures, gestures and eye contact – Intonation and Sentence stress – Express one's thoughts coherently.

UNIT III – READING **15 Hours**

Reading strategies – Skimming –Scanning – Interpretation of visual data – Factual texts on subjects of relevance – Inferring texts – Reading to write a review –Checking the accuracy of reading while presenting the interpreted data – Reading to comprehend.

UNIT IV – WRITING **15 Hours**

Writing Simple and short sentences **–** Writing E–mail, Memo, Note and Message – Letter Writing – Importance of punctuations – Identifying the main points – Organising the main ideas – Writing a draft.

LABORATORY COMPONENT

LIST OF TASKS:

1. BEC Preliminary Listening Test–I & Speaking Test–1.
2. BEC Preliminary Listening Test–2 &Speaking Test–2.
3. BEC Preliminary Listening Test–3 &Speaking Test–3.
4. BEC Preliminary Listening Test–4 &Speaking Test–4.
5. BEC Preliminary Listening Test–5 &Speaking Test–5.
6. BEC Preliminary Listening Test–6 &Speaking Test–6.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Listen actively and paraphrase simple messages and specific details of concrete monologues and dialogues	Apply
CO.2 Express one's views coherently in a simple manner	Apply
CO.3 Read and comprehend factual texts on subjects of relevance	Understand
CO.4 Write texts bearing direct meanings for different contexts maintaining an appropriate style	Apply

Text Book(s):

T 1. Whitby Norman, Business Benchmark Pre–intermediate to Intermediate Students' Book CUP Publications, 2nd Edition, 2014.

T 2. Wood Ian, Williams Anne, Cowper Anna, Pass Cambridge BEC Preliminary, Cengage Learning,2nd edition, 2015.

T 3. Learners Book prepared by the faculty members of Department of English.

Reference Book(s):

R 1. BEC - Preliminary – Cambridge Handbook for Language Teachers, 2nd Edition, CUP 2000.

R 2. Hewings Martin – Advanced Grammar in use – Upper–intermediate Proficiency, CUP, Third Edition, 2013.

Web References:

1. http://www.grammarinenglish.com –Jan 23,2018
2. https://www.northshore.edu/support_centre /pdf/listen–notes.pdf
3. http://www.examenglish.com/BEC/BEC_Vantage.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	1	2	1	3	-	1	-	1
CO2	-	-	-	-	-	1	1	2	1	3	-	1	-	1
CO3	-	-	-	-	-	1	1	2	1	3	-	1	-	1
CO4	-	-	-	-	-	1	1	2	1	3	-	1	-	1

High–3; Medium–2; Low–1

Course Code: 19MABC1101		Course Title: MATRICES AND CALCULUS (Common to AU, CE, MC, ME, EC, EI & EE)	
Course Category: Basic Science		Course Level: Introductory	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Determine the canonical form of a Quadratic form using Orthogonal transformation
2. Use different testing methods to check the convergence of infinite series.
3. Apply differential and integral calculus to determine the evolutes of a curve and improper integrals.
4. Apply partial derivatives to find extreme values of functions of two variables.
5. Apply multiple integrals to find area of plane curves and volume of solids.

UNIT I – MATRICES **9+3 Hours**

Rank of a matrix – System of linear equations – Symmetric – Skew symmetric and orthogonal matrices – (Definitions and examples only) – Eigenvalues and Eigenvectors – Diagonalization of symmetric matrices through orthogonal transformation – Cayley – Hamilton Theorem – Transformation of quadratic forms to canonical forms through orthogonal transformation.

UNIT II – SEQUENCES AND SERIES **9+3 Hours**

Sequences – Definition and Examples – Series – Tests for convergence– Power series – series for exponential, trigonometric and logarithm functions – Comparison Test – Integral Test – Cauchy's root test – D Alembert's ratio test – Alternating series – Leibnitz's test.

UNIT III – DIFFERENTIAL AND INTEGRAL CALCULUS **9+3 Hours**

Reading strategies – Skimming –Scanning – Interpretation of visual data – Factual texts on subjects of relevance – Inferring texts – Reading to write a review –Checking the accuracy of reading while presenting the interpreted data – Reading to comprehend.

UNIT IV – MULTIVARIABLE DIFFERENTIATION **9+3 Hours**

Writing Simple and short sentences **–** Writing E-mail, Memo, Note and Message – Letter Writing – Importance of punctuations – Identifying the main points – Organising the main ideas – Writing a draft.

UNIT V – MULTIVARIABLE INTEGRATION **9+3 Hours**

Multiple Integration: Double integrals – Change of order of integration in double integrals – Change of variables (cartesian to polar, cartesian to spherical and cartesian to cylindrical) – Triple integrals – Applications: areas and volumes.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Determine the canonical form of a Quadratic form using Orthogonal transformation	Apply
CO.2 Use different testing methods to check the convergence of infinite series.	Apply
CO.3 Determine the evolute of a curve and evaluate improper integrals using beta gamma functions	Apply
CO.4 Apply partial derivatives to find extreme values of functions of two variables.	Apply
CO.5 Apply multiple integrals to find area of plane curves and volume of solids	Apply

Text Book(s):

T1. Erwin kreyzig, “Advanced Engineering Mathematics”, 10th edition, John Wiley & Sons, 2015.

T2. Veerarajan T., “Engineering Mathematics for First Year” , Tata McGraw-Hill, New Delhi, 2011.

T3. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 1st edition, 2017.

Reference Book(s):

R 1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2010.

R 2. N.P.Bali and Manish Goyel, “A Text book of Engineering Mathematics”, Laxmi Publication, 9th edition, 2010.

R 3. B.S.Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 43rd Edition, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO2	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO3	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO4	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO5	3	2	1	1	-	-	1	1	-	1	-	1	-	-

High–3; Medium–2; Low–1

Course Code: 19PHBN2101		Course Title: PHYSICS FOR CIVIL ENGINEERING	
Course Category: Basic Science		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Determine the equilibrium condition of particles and rigid bodies.
2. Inculcate the knowledge of elastic properties of materials.
3. Calculate geometric properties like centre of gravity, moment of inertia and mass moment of inertia for various sections.
4. Explain the principles of waves and acoustics for civil engineering applications.
5. Determine the quality of materials through Non-Destructive Testing (NDT).

UNIT I – BASICS OF MECHANICS **9 Hours**

Review of fundamental laws of mechanics – scalars, vectors – Newton's law of mechanics, Gravitational law. Particles and rigid body, Concept of force and its effect on rigid body system of forces–Free body diagram–principle of transmissibility–equilibrium conditions–equilibrium of particles subjected to coplanar and non–coplanar force system – equilibrium of particles subjected to coplanar Triangle law, Parallelogram law and Lami's theorem.

UNIT II – PROPERTIES OF MATTER **9 Hours**

Elasticity – Stress strain diagram and its uses – Elastic constants – Factors affecting elastic modulus and tensile strength – Twisting couple – Torsion stress and deformations – Torsion pendulum: Theory and experiment – Bending of beams – Bending moment – Cantilever: Theory and experiment – I shaped girders – Stress due to bending in beams.
Viscosity: Coefficient of viscosity, streamline and turbulent flow, Reynold's number, Experimental determination of low and high viscous liquids: *Poiseuille's and* Stoke's method.

UNIT III – PROPERTIES OF SURFACES AND SOLIDS **9 Hours**

Centroid and centre of mass– Centroid of lines and areas – Area moments of inertia of plane areas –Theorems of Pappus – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia–Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle.

UNIT IV – WAVES AND ACOUSTICS **9 Hours**

Introduction to waves–Longitudinal and transverse waves, speed of wave motion. Seismic waves: P waves, S waves, Surface waves, Love waves, Rayleigh waves– isolation of structures against seismic waves.
Classification of sound – decibel– Weber–Fechner law – Sabine's formula– derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting

acoustics of buildings and their remedies. Methods of sound absorptions – absorbing materials – noise and its measurements, sound insulation and its measurements, impact of noise in multi–storeyed buildings.

UNIT V – NON-DESTRUCTIVE TESTING (NDT) 9 Hours

Liquid Penetrant Method – Characteristics of Liquid Penetrant Testing materials, X–Ray Radiographic testing: Tube shift method – Exposure factor – Attenuation –Principle of Ultrasonic testing: Ultrasonic transducer – Couplant – Ultrasonic flaw detector: Pulse echo system, transmission, A, B & C scan displays - Inspection standards.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO.1	Determine the equilibrium condition of particles and rigid bodies using the law of mechanics	Understand
CO.2	Explain the elastic properties of materials.	Understand
CO.3	Calculate geometric properties like centre of gravity, moment of inertia and mass moment of inertia for various sections.	Understand
CO.4	Explain the principles of waves and the factors affecting acoustics of buildings and their remedies.	Understand
CO.5	Describe the Non-Destructive Testing (NDT) methods to inspect the quality of materials.	Understand

Text Book(s):

T 1. F. P. Beer, E. R. Johnston Jr, “Vector Mechanics for Engineers (in SI Units): Statics and Dynamics”, 8th Edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2005.

T 2. M.N. Avadhanulu, P.G. Kshirsagar, “A Textbook of Engineering Physics”, S. Chand & Co., New Delhi, 2011.

Reference Book(s):

R 1. D.S. Mathur, “Properties of Matter”, S. Chand & Co., New Delhi, 2012.

R 2. V. Rajendran, “Engineering Physics”, Tata McGraw–Hill Publishing Co. Ltd., New Delhi 2017.

R 3. R. C. Hibbeller, “Engineering Mechanics: Combined static and dynamics”, Prentice Hall, 2010.

Web References:

1. http://www.physicsclassroom.com/
2. http://nptel.ac.in/course.php?disciplineId=115

LIST OF EXPERIMENTS (ANY FIVE):

ENGINEERING PHYSICS LABORATORY

1. Determination of Young’s Modulus of the material – Cantilever bending method.
2. Determination of Moment of inertia of the metallic disc – Torsional Pendulum method.
3. Determination of Rigidity modulus of the metallic wire – Torsional Pendulum method.
4. Determination of Viscosity of less viscous liquid –*Poiseuille’s method.*
5. Determination of Viscosity of high viscous liquid –*Stoke’s method.*

6. Determination of velocity and compressibility of ultrasonics in given liquid.
7. Verification of Lami's Theorem

Course Articulation Matrix*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	1	1	-	1	-	1	-	-
CO2	2	1	-	-	-	-	1	1	-	1	-	1	-	-
CO3	2	1	-	-	-	-	1	1	-	1	-	1	-	-
CO4	2	1	-	-	-	-	1	1	-	1	-	1	-	-
CO5	2	1	-	-	-	-	1	1	-	1	-	1	-	-

High–3; Medium–2; Low–1

Course Code: 19EESN2101		Course Title: BASICS OF ELECTRICAL AND MECHANICAL ENGINEERING	
Course Category: Engineering Science		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the basic concepts and laws of electrical engineering
2. Describe the basics of wiring
3. Explain the basic concepts of electronics engineering
4. Explain the concepts of Conventional and Non–conventional power sources
5. Explain the concepts of Refrigeration and Air conditioning systems

UNIT I – INTRODUCTION TO ELECTRICAL ENGINEERING 9 Hours

DEFINITION – symbol and units of electrical quantities–Active and passive elements –ohms law statement illustration, and limitation – Kirchhoff's law statement and illustration – Resistance in series and voltage division technique – Resistance in parallel and current division technique – Method of solving a circuit by Kirchhoff's law – Star to delta and delta to star transformation

UNIT II – INTRODUCTION TO AC MACHINES AND WIRING 9 Hours

Construction, Principle of Operation of Single phase and Three phase Induction machines – BASIC OF WIRING: Basic components of Wiring (Wires, Switches, Fuses, sockets, plug, lamps and lamp holders, rating of different accessories and its functions). TYPES OF CIRCUIT: Open circuit –Closed circuit –Short circuit. WIRING METHODS: Series circuit –Parallel circuit – Combination of series and parallel circuit. Illustration of House Wiring–Safety Precautions and measures

UNIT III – INTRODUCTION TO ELECTRONICS ENGINEERING 9 Hours

Intrinsic and extrinsic semiconductor, PN junction diode – construction – working, bipolar junction transistor – construction – working, static and dynamic characteristics of instruments – units and standards of measurements – general measurements systems – data acquisition systems – sensors in civil engineering – acoustic emission sensor – fibre optic sensor

UNIT IV – CONVENTIONAL AND NON–CONVENTIONAL POWER PLANTS 9 Hours

Power plant – Definition, Classifications – Layout of Steam power plant, hydroelectric power plant, Diesel power plant, nuclear power plant, Solar power plant, wind energy conversion system, Bio- gas power plant, Geothermal power plant, OTEC, MHD, and Tidal power plant.

UNIT V – REFRIGERATION AND AIR CONDITIONING SYSTEMS 9 Hours

Refrigeration – terminologies, COP, Refrigerant – types and properties, Classifications – Vapour compression refrigeration system, vapour absorption refrigeration system, Layout of a

typical domestic refrigerator. Air conditioning system – definition, classifications – working of the window, split and year–round air conditioning systems.

LIST OF EXERCISES:

1. Making of two-way staircase wiring for lamp and making of internal wiring of tube light and checking connection.
2. Making of a domestic wiring circuit to connect a light, a fan with a regulator and a socket
3. VI Characteristics of PN Diode and common emitter configuration of BJT.
4. Study of wind turbine power plant and solar power plant
5. Study and performance analysis of vapour compression refrigeration system
6. Study and performance analysis of Air Conditioning system.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the basic concepts and laws of electrical engineering.	Understand
CO.2 Describe the basics of wiring.	Understand
CO.3 Explain the basic concepts of electronics engineering.	Understand
CO.4 Explain the concepts of Conventional and Non–conventional power sources.	Understand
CO.5 Explain the concepts of Refrigeration and Air conditioning systems.	Understand

Text Book(s):

T1. S.C. Arora and S Domkundwar, “A course in Power Plant Engineering” Dhanpatrai & Sons, New Delhi, 2008.

T2. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).

T3. Kalsi .H.S, “Electronics Instrumentation”, 3rdEdition (copyright 2010, Second Reprint 2011) Tata McGraw Hill, New Delhi, 2010

Reference Book(s):

R 1. Manohara Prasad, “Refrigeration and Air conditioning”, New Age International, 2004.

R 2. Bhattacharya, ”Electrical Machines”, Tata McGraw Hill, Second Edition, 2008.

R 3. Ray C. Mullin, Phil Simmons, ”Electrical Wiring Commercial” Cengage learning, 2011

R 4. John Cadick, Mary Capelli–Schellpfeffer, Dennis Neitzel, ”Electrical Safety Handbook” Tata McGraw Hill third edition, 2005

R 5. Ming L. Wang, Jerome P. Lynch, HoonSohn “Sensor Technologies for Civil Infrastructures, Volume 1: Sensing Hardware and data collection methods and performance assessment”,Elsiver–2014

R 6. Millman J, Halkias .C andSatyabratajit, “Electronic Devices and Circuits”, Second Edition, Tata McGraw–Hill, New Delhi, 2007

R 7. Jeyachandran.K, Natarajan.S. & Balasubramanian.S, “A Primeron Engineering Practices Laboratory”, Anuradha Publications, 2007.

R 8. Electrical practices laboratory manual for civil engineers – MCET.

Web References:

1. https://www.jove.com/science–education/10114/electrical–safety–precautions–and–basic–equipment

Course Articulation Matrix*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	1	2	3	-	-	-	-
CO2	1	-	-	-	-	-	-	1	2	3	-	-	-	-
CO3	1	-	-	-	-	-	-	1	2	3	-	-	-	-
CO4	1	-	-	-	-	-	-	1	2	3	-	-	-	-
CO5	1	-	-	-	-	-	-	1	2	3	-	-	-	-

*Subject to change based on assessment.
High–3; Medium–2; Low–1

Course Code: 19CESN3101		Course Title: ENGINEERING DRAWING FOR CIVIL ENGINEERING	
Course Category: Engineering Science		Course Level: Introductory	
L:T:P (Hours/Week) 0: 0: 4	Credits:2	Total Contact Hours: 60	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

- Understand and develop the skill of drawing different symbols of civil engineering drawings, building components, orthographic projection, isometric views of simple objects and buildings, perspective view of simple building, plan and elevation residential buildings.

UNIT I – INTRODUCTION TO ENGINEERING DRAWING **3+9 Hours**

Importance of graphics in engineering applications – Size, layout and folding of drawing sheets – Lettering and dimensioning – Methods of Dimensioning – BIS standards and symbols in civil engineering drawing – building terminologies as per NBC – First angle projection – projection of points and lines.

UNIT II – ORTHOGRAPHIC PROJECTION **3+9 Hours**

Representation of Three-Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – layout of views –Orthographic projection of simple objects – drawing views of doors, windows, dog legged staircase.

UNIT III – ISOMETRIC PROJECTIONS **3+9 Hours**

Isometric Projection of solids – practices on simple solids like prisms, pyramids, cylinder& cone – practices on simple residential buildings.

UNIT IV –PERSPECTIVE PROJECTIONS **3+9 Hours**

Concepts of Perspective projection of simple solids like prisms, pyramids by Visual Ray Method – Concepts of Perspective projection of building by vanishing point method.

UNIT V – BUILDING DRAWING **3+9 Hours**

Introduction to types & Orientation of buildings – types of foundations – trusses. Drawing of different views of Isolated wall foundation – column footing (stepped footing, combined footing, trapezoidal footing) – drawing of plan and elevation view of two room building.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Draw the various symbols used in civil engineering drawings.	Apply
CO.2 Draw the orthographic views of building components.	Apply
CO.3 Draw the isometric views of simple objects and buildings.	Apply
CO.4 Draw the perspective view of residential building.	Apply
CO.5 Draft plan and elevation of residential buildings.	Apply

Text Book(s):

T 1. Rangawala, "A text book of Civil Engineering Drawing", Charotar publishers, 3rd edition, 2017.

T 2. N. Kumaraswamy& A. KameswaraRao, "Building Planning and Drawing", Charotar publishers, 8th edition, 2015

Reference Book(s):

R 1. Anurag A. Kandya, "Elements of Civil Engineering" Charotar publishers, 3rd edition, 2017 (Reprint)

R 2. 2. B.P. Verma, "Civil Engineering Drawing & House Planning", Khanna publishers, 12th edition, 2006

PUBLICATIONS OF BUREAU OF INDIAN STANDARDS

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods. The mode of delivery is like practical.
6. National building code of India (SP–7) Volume 1, Part 3 –"Development control rules and general building requirements", third revision 2016.

Web References:

1. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco–tutorial.html
2. http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf

List of Experiments:

1. Lettering, Dimensions & drawing of civil engineering drawing symbols.
2. Orthographic projection of simple solids
3. Drawing of elevation of doors & windows
4. Drawing of plan & elevation of dog legged staircase
5. Isometric projection of simple solids & buildings
6. Perspective projection of simple solids and buildings
7. Drawing of different views of foundation.
8. Drawing plan and elevation of two room building.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	3	3	-	-	-	3
CO2	3	2	-	-	-	-	-	-	3	3	-	-	-	3
CO3	3	2	-	-	-	-	-	-	3	3	-	-	-	3
CO4	3	2	-	-	-	-	-	-	3	3	-	-	-	3
CO5	3	2	-	-	-	-	-	-	3	3	-	-	-	3

High–3; Medium–2; Low–1

SEMESTER II

Course Code: 19ENHG2201		Course Title: COMMUNICATION SKILLS – II (Common to all B.E/B.Tech Programmes)	
Course Category: Humanities		Course Level: Introductory	
L:T:P (Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Communication Skills – I

Course Objectives

The course is intended to:

- Listen and understand monologues and dialogues of a native speaker on par with B2 of CEFR level.
- Speak in simple sentences to convey their opinion and ideas on par with B2 of CEFR level.
- Read and infer a given text on par with B2 of CEFR level.
- Draft basic formal written communication on par with B2 of CEFR level.

UNIT I – LISTENING **15 Hours**

Importance and purpose of extensive listening and intensive listening –Body Language – Listening tasks on complex and abstract themes – Correlating Ideas related to listening input – importance of empathetic – listening for main ideas – Paraphrasing– Listening to native speakers English – Compound and Complex sentences – Developing ideas – Listening to compose paragraphs.

UNIT II – SPEAKING **15 Hours**

Jotting down ideas collected from listening to speak – organising the ideas – Expressing one's view coherently – Understanding grammatical elements (Noun – Pronoun Antecedent) – Expressing ideas assertively – Answering questions during presentations – Understanding the use of discourse markers – word stress and sentence stress – voice modulation and pauses – Highlighting significant points – interpretation of visual data – Using verbal cues – Preparing simple hand – outs.

UNIT III – READING **15 Hours**

Reading strategies – Skimming &Scanning – Inferring meaning– Barriers to reading – sub vocalisation, Eye fixation, Regression – Speed Reading Techniques – Reading different types of texts and their contexts with speed – Note making – Reading a review – Paraphrasing – Reading to comprehend

UNIT IV – READING **15 Hours**

Reading strategies – Skimming &Scanning – Inferring meaning– Barriers to reading – sub vocalisation, Eye fixation, Regression – Speed Reading Techniques – Reading different types

of texts and their contexts with speed – Note making – Reading a review – Paraphrasing – Reading to comprehend.

UNIT V – WRITING **15 Hours**

Reported speech& Concord (Subject – verb Agreement) – Report writing – Different kinds of Report – Structure of the report – Writing Proposal – Plagiarism – References – Appendices – Techniques for Report writing – Registers.

LABORATORY COMPONENT

LIST OF TASKS:

1. BEC Vantage Listening Test-I & Speaking Test-1.
2. BEC Vantage Listening Test-2 & Speaking Test-2.
3. BEC Vantage Listening Test-3 & Speaking Test-3.
4. BEC Vantage Listening Test-4 & Speaking Test-4.
5. BEC Vantage Listening Test-5 & Speaking Test-5.
6. BEC Vantage Listening Test-6 & Speaking Test-6.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Listen actively and empathetically, and paraphrase discussions and presentations on complex and abstract themes and topics	Apply
CO.2 Express one's views coherently, fluently and confidently highlighting the significant points with supporting details	Apply
CO.3 Read and comprehend different types of texts and their contexts reasonably at moderate speed	Understand
CO.4 Write detailed reports on variety of subjects synthesizing information gathered during listening & reading citing appropriate references	Apply

Text Book(s):

T 1. Whitby Norman, Business Benchmark Upper Intermediate Students' Book CUP Publications, 2nd Edition, 2014.

T 2. Learners Book prepared by the faculty members of Department of English.

Reference Book(s):

R 1. Cambridge BEC Vantage - Practice Tests, Self-study Edition, Cambridge University Press, 2002

R 2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, Third Edition, 2013.

Web References:

1. http://www.grammarinenglish.com - Jan 23, 2018
2. https://www.northshore.edu/support_centre /pdf/listen-notes.pdf
3. http://www.examenglish.com/BEC/BEC_Vantage.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	1	3	-	1	-	1
CO2	-	-	-	-	-	-	-	2	1	3	-	1	-	1
CO3	-	-	-	-	-	-	-	2	1	3	-	1	-	1
CO4	-	-	-	-	-	-	-	2	1	3	-	1	-	1
CO5	-	-	-	-	-	-	-	2	1	3	-	1	-	1

High-3; Medium-2; Low-1

Course Code: 19MABC1201		**Course Title: ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES** (Common to AU, CE, MC, ME, EC, EI, EE)	
Course Category: Basic Science		**Course Level: Introductory**	
L:T:P (Hours/Week) 3: 1: 0	**Credits: 4**	**Total Contact Hours: 60**	**Max Marks:100**

Pre-requisites

- Matrices and Calculus

Course Objectives

The course is intended to:

1. Explain the concepts of vector differentiation and integration.
2. Determine the solution of second and higher order ordinary differential equations
3. Construct analytic functions
4. Use the concept of complex integration to evaluate definite integrals.
5. Apply Laplace transform techniques to solve ordinary differential equations

UNIT I - VECTOR CALCULUS **9+3 Hours**

Gradient – Divergence – Curl – Line integrals – Surface integrals – Volume integrals – Theorems of Green, Gauss and Stokes (without proof) and their applications.

UNIT II - COMPLEX VARIABLES (DIFFERENTIATION) **9+ 3 Hours**

Cauchy-Riemann equations – Analytic functions – Properties – Harmonic functions – Finding harmonic conjugate – Conformal mapping (w=z+a, w= az, w=1/z) – Mobius transformation and their properties.

UNIT III - COMPLEX VARIABLES (INTEGRATION) **9+3 Hours**

Contour integrals – Cauchy Integral formula (without proof) – Cauchy Integral theorem – Taylor's series – Singularities of analytic functions – Laurent's series–Residues – Cauchy Residue theorem (without proof) – Evaluation of real definite integrals around unit circle and semi circle (Excluding poles on the real axis).

UNIT IV - ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS **9+3 Hours**

Second and higher order linear differential equations with constant coefficients – Second order linear differential equations with variable coefficients (Cauchy - Euler equation– Legendre's equation) – Method of variation of parameters – Solution of first order simultaneous linear ordinary differential equations

Unit V - LAPLACE TRANSFORM **12 Hours**

Laplace Transform – Properties of Laplace Transform – Laplace transform of integrals – Laplace transform of periodic functions -Inverse Laplace transforms - Convolution theorem – Solution of ordinary differential equations by Laplace Transform method – Applications on engineering problems.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the concepts of vector differentiation and integration.	Apply
CO.2 Use the concept of complex variables to construct analytic functions	Apply
CO.3 Use the concept of complex integration to evaluate definite integrals	Apply
CO.4 Use the concept of complex integration to evaluate definite integrals	Apply
CO.5 Apply Laplace transform techniques to solve ordinary differential equations	Apply

Text Book(s):

T1. Erwin kreyzig, Advanced Engineering Mathematics, 9th edition, John Wiley & Sons, 2015.

T2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2011.

T3. Ramana B.V., higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2017.

Reference Book(s):

R.1 G.B. Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2010.

R.2 N.P. Bali and Manish Goyel, A text book of Engineering Mathematics, Laxmi Publication, Reprint, 2010.

R.3 B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2
3. https://nptel.ac.in/courses/111105035/22

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	1	-	1	-	-
CO2	3	2	1	1	-	-	-	1	-	1	-	1	-	-
CO3	3	2	1	1	-	-	-	1	-	1	-	1	-	-
CO4	3	2	1	1	-	-	-	1	-	1	-	1	-	-
CO5	3	2	1	1	-	-	-	1	-	1	-	1	-	-

High-3; Medium-2; Low-1

Course Code: 19CHBN2201		Course Title: CHEMISTRY FOR CIVIL ENGINEERING	
Course Category: Basic Science		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the chemistry of water and water conditioning methods.
2. Explain the mechanism of corrosion and corrosion control
3. Explain different renewable energy sources and storage devices.
4. Describe the preparation, properties and applications of engineering plastics
5. Describe the chemistry of building materials in modern construction.

UNIT I - WATER TECHNOLOGY **9 Hours**

. Water quality parameters–Types of water- Hardness of water – Types, expression, units, problems - determination of hardness by EDTA method – Boiler feed water - boiler troubles (scale, sludge, priming, foaming, caustic embrittlement, Boiler corrosion) - Water conditioning methods – Internal conditioning – phosphate, calgon and sodium aluminate conditioning, External conditioning – demineralization, Desalination of brackish water-reverse osmosis process

UNIT II - CORROSION AND CONTROL **9 Hours**

Corrosion- causes- consequences - types- chemical, electrochemical corrosion (galvanic, differential aeration-Pitting corrosion), factors influencing corrosion (Based on Metal and Environment)-corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints-constituents and function

UNIT III - ENERGY SOURCES AND STORAGE DEVICES **9 Hours**

Introduction – Nuclear energy - nuclear fission - nuclear fusion - nuclear chain reactions - nuclear reactor power generation - classification of nuclear reactor - solar energy conversion - solar cells - wind energy, Batteries - Types of batteries- alkaline battery - lead storage battery - lithium-ion battery.

UNIT IV - POLYMERS, PLASTICS AND COMPOSITES **9 Hours**

Polymers–definition-polymerization-types-addition and condensation polymerization-classification – Terminologies – Plastics – Classification, Engineering plastics
(PVC, Teflon, Polycarbonates, Polyurethanes, PET)– preparation, properties and uses, Compounding of plastics – Moulding technique – blow and extrusion. Polymer composites – FRP and ceramic matrix composites.

UNIT V - CHEMISTRY OF BUILDING MATERIALS **9 Hours**

Chemistry of lime and gypsum, Cement – chemical composition, classification, manufacture by wet and dry process, setting and hardening of cement, chemical reactions during the hydration of cement, waterproof and white cement–properties and uses, Chemistry and applications of ceramics, fly ash and glass in construction

LABORATORY COMPONENT

LIST OF EXPERIMENTS:

1. Estimation of hardness of water by EDTA method.
2. Determination of corrosion rate of mild steel by weight loss method.
3. Determination of molecular weight of polymer by viscometric method.
4. Determination of percentage of calcium oxide in cement by titrimetric method
5. Estimation of strength of hydrochloric acid by p^Hmetry.
6. Determination of iron in water by spectrophotometry.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Calculate hardness of water based on water quality parameters associated with water conditioning methods	Apply
CO.2 Explain the mechanism of corrosion and its control techniques.	Understand
CO.3 Explain different renewable energy sources and storage devices.	Understand
CO.4 Identify a suitable plastic for a specific engineering application.	Understand
CO.5 Describe the chemistry of building materials in modern construction.	Understand

Text Book(s):

T 1. Jain & Jain, Engineering Chemistry (All India),17th edition, Dhanpat Rai Publishing Company(P) Ltd, New Delhi, 2018

T 2. Wiley Engineering Chemistry, Second Edition, Wiley India Pvt Ltd, New Delhi, 2011

Reference Book(s):

R 1. Dara S.S., and Umare S.S.,A text book of Engineering Chemistry, S.Chand & Co Ltd,New Delhi, 2014

R 2. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, Polymer Science, New Age International(P) Ltd, Chennai, 2006

R 3. Renu Bapna and Renu Gupta, Engineering Chemistry, Macmillan India Publisher Ltd, 2010

R 4. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book of Quantitative Chemical Analysis, Oxford, ELBS, London, 2012

R 5. Shoemaker D.P. and C.W.Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co., Ltd., London, 2009

Web References:

1. http://nptel.ac.in/courses/122101001/downloads/lec.23.pdf
2. https://nptel.ac.in/courses/104106075/Week1/MODULE%201.pdf
3. https://nptel.ac.in/courses/103102015/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	1	1	-	3	3	-	3	-	-
CO2	2	1	-	-	-	1	1	-	3	3	-	3	-	-
CO3	2	1	-	-	-	1	1	-	3	3	-	3	-	-
CO4	2	1	-	-	-	1	1	-	3	3	-	3	-	-
CO5	2	1	-	-	-	1	1	-	3	3	-	3	-	-

High-3; Medium-2; Low-1

Course Code: 19CESN1201		Course Title: ENGINEERING MECHANICS	
Course Category: Engineering Science		Course Level: Introductory	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours: 60	Max Marks:100

Pre-requisites

- Physics for Civil Engineering

Course Objectives

The course is intended to:

1. Gain knowledge on Equilibrium of rigid bodies.
2. Gain knowledge on application of equilibrium.
3. Gain knowledge on Friction.
4. Gain knowledge on Dynamics of particles.
5. Gain knowledge on Dynamics of rigid bodies.

UNIT I - EQUILIBRIUM OF RIGID BODIES **9+3 Hours**

Types of supports - Types of beams and loads - Free body diagram - Action and reaction forces - stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Single equivalent force - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions.

UNIT II - APPLICATION OF EQUILIBRIUM **9+3 Hours**

Introduction to static determinacy and indeterminacy of beams and trusses - Types of trusses - Analysis for member forces by method of joints and method of sections - Shear force and bending moment diagram - simply supported, cantilever and overhanging beams - Relationship between load, bending moment and shear force - Theory of simple bending, analysis of beams for stresses - Stress distribution at a cross section due to bending moment and shear force for cantilever, simply supported and overhanging beams with different loading conditions - Flitched Beams.

UNIT III – FRICTION **9+3 Hours**

Frictional force - Laws of Coulomb friction - Coefficient of Static and Kinematic friction -Block Friction - Motion Impending (Static and Kinematic) - Coplanar systems with friction (Ladder, Wedges and Screw).

UNIT IV - DYNAMICS OF PARTICLES **9+3 Hours**

Kinematics of particles - Displacements, Velocity and acceleration, their relationship - Relative motion - Rectilinear and Curvilinear motions

UNIT V - DYNAMICS OF RIGID BODIES **9+3 Hours**

Kinetics of rigid bodies - Newton's law - D' Alembert's principle - Work, Energy equation of particles - Impulse and Momentum - Impact of elastic bodies - Natural Frequency - Time period - Mode shapes.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Calculate the forces and moments using equilibrium equations	Apply
CO.2 Compute the forces acting on trusses and to draw SF & BMD for various beams	Apply
CO.3 Calculate the friction of screws, belts, wedges, ladders of different machine components.	Apply
CO.4 Calculate relative velocities of particles based on kinematic principles.	Apply
CO.5 Apply the concepts of dynamics of rigid bodies to calculate momentum.	Apply

Text Book(s):

T 1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2012).

T 2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

T 3. Beer, F.P and Johnson Jr. E.R., "Mechanics of Materials", 7th Edition, McGraw-Hill Education, New york (2015)

Reference Book(s):

R 1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.

R 2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.

R 3. Raghu Ramakrishnan, Johannes Gehrke. "Database Management Systems", Third Edition, McGraw Hill International Edition, New Delhi 2013

R 4. Jefrey D.Ulman and Jenifer Widom, "A First Course in Database Systems", Third Edition, Prentice-Hall, New Delhi, 2012.

R 5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.

R 6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

Web References:

1. http://nptel.ac.in/courses/112103109/(updated 01-Mar-2019)
2. http://www.iitg.ac.in/ssg/me101.html(updated 31-Jan-2015)
3. https://www.coursera.org/learn/engineering-mechanics-statics(updated 01-Mar-2019)
4. http://www.vssut.ac.in/lecture_notes/lecture1423904717.pdf (updated 01-Aug-2014)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	3	2	-

High-3; Medium-2;Low-1

Course Code: 19CSSC2001	Course Title: C PROGRAMMING (Common to AU, CE, MC, ME, EC, EI, EE)		
Course Category: Engineering Science		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 2	Credits: 4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain about computer organization and problem solving techniques
2. Write programs using appropriate programming constructs
3. Develop programs using arrays, functions & strings
4. Implement programs using pointers, structures& unions
5. Write programs using files & preprocessor directives

UNIT I - INTRODUCTION **7 Hours**

Generation and Classification of Computers –Basic Organization of a Computer – Software development life cycle – Problem Solving Techniques :Algorithm,Pseudocode and Flow Chart.

UNIT II - C PROGRAMMING BASICS **10 Hours**

Introduction to C programming – Structure of a C program – Keywords – Identifiers-Constants– Variables – Data Types – Operators and Expressions –Formatted & Unformatted I/O functions– Decision statements – Loop control statements.

UNIT III - ARRAYS, FUNCTIONSAND STRINGS **10 Hours**

Arrays: Characteristics –One-dimensional and Two-dimensional arrays – Functions: Declaration & Definition of function –Built in function – User defined function –Types of functions – Call by value &reference – Strings: Formatting strings – String handling functions.

UNIT IV - POINTERS, STRUCTURES & UNION **9 Hours**

Pointers: Features and Types of pointers – Arithmetic operations with pointers–Pointers and Arrays –Structures: Features– Operations on Structures – Array of structures – Unions.

UNIT V - FILES & PRE-PROCESSOR DIRECTIVES **9 Hours**

Introduction to Files – Stream and File Types – File operations (Open, close, read, write) – Command line arguments – Pre-processor Directives: Macro Expansion, File Inclusion, Conditional Compilation.

LIST OF EXPERIMENTS **30**

1. Programs to process data types, operators and expression evaluation. (any 1)
    a. To find area of rectangle/circle/square.
    b. To find the simple interest and compound interest.
2. Programs using decision and looping statements. (any 2)
    a. To find the maximum number among 3 given numbers.
    b. To check whether given year is leap year or not.
    c. To display the Fibonacci series.
    d. To find the factorial of a number.
3. Programs using Arrays
    a. To search for particular number among N numbers. (1D array)
    b. To compute matrix addition. (2 D array)
4. Programs using Functions and Strings (any 2)
    a. To swap two numbers using call by reference.
    b. To find the cube of a number.
    c. To manipulate strings using string functions.
    d. To check whether the string is palindrome or not.
5. Programs using Pointer, Structure & Union
    a. To perform arithmetic operations using pointers.
    b. To display the information of N students using Structure.
    c. To display the employee details using Union.
6. Programs using Files (any 1)
    a. To read the contents of a text file.
    b. To copy the contents from one file into another.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain about computer organization and problem solving techniques	Understand
CO2: Write programs for the given scenario using appropriate programming Constructs	Apply
CO3: Develop programs using arrays, functions & strings for the given Scenario	Apply
CO4: Implement programs for given application using pointers, structures& unions	Apply
CO5: Write programs using files & preprocessor directives for simple problems	Apply

Text Book(s):

T1. Ashok N. Kamthane, Amit.N. Kamthane, “Programming in C”, Third Edition, Pearson Education, 2015.

Reference Book(s):

R 1. Ajay Mittal, “Programming in C-A Practical Approach”, Third Edition, Pearson Education, 2010.

R 2. Yashavant P. Kanetkar, “Let Us C”, Sixteenth Edition, BPB Publications,2018

R 3. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second edition, Oxford University Press, 2013

Web References:

1. http://www.cprogramming.com/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	-	-	-	-	-
CO2	3	2	1	2	2	-	-	-	2	-	-	-	-	-
CO3	3	2	1	2	2	-	-	-	2	-	-	-	-	-
CO4	3	2	1	2	2	-	-	-	2	-	-	-	-	-
CO5	3	2	1	2	2	-	-	-	2	-	-	-	-	-

High-3; Medium-2; Low-1

Course Code: 19CECN3201	Course Title: COMPUTER AIDED BUILDING DRAWING LABORATORY		
Course Category: Professional Core		Course Level: Introductory	
L:T:P (Hours/Week) 0: 0: 4	Credits: 2	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Engineering Drawing for Civil Engineering

Course Objectives

The course is intended to:

- Understand the principles of planning for various buildings by incorporating building bye laws and develop the skills of drawing the different components of buildings using CAD software.

List of Exercises

1. Introduction to CAD commands and drawing of simple objects.
2. Drawing of plan, elevation and section of types of foundations. (Wall foundation, Column footing – Stepped, Combined and Trapezoidal)
3. Drawing of plan, elevation of dog legged staircase and bifurcated staircase.
4. Drawing of section of King post & Queen Post wooden truss.
5. Drawing of plan, elevation & section of simple buildings.
6. Drawing of plan, elevation & section of one BHK residential building with RCC flat roof – single storey – load bearing structure
7. Drawing of plan, elevation & section of one BHK residential building with RCC flat roof – single storey – framed structure
8. Drawing of plan, elevation & section of two BHK residential building with RCC flat roof – single storey – load bearing structure
9. Drawing of plan, elevation & section of two BHK residential building with RCC flat roof – single storey – framed structure
10. Drawing of plan, elevation & section of Commercial building.
11. Drawing of perspective view of a single storied building.
12. Drawing of perspective view of a two storied building.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Draw plan, elevation and section of wall foundations and column footings (stepped, combined and trapezoidal) using CAD software	Apply
CO.2 Draw plan, elevation of dog legged and bifurcated staircase using CAD software.	Apply
CO.3 Draw the king post and Queen post wooden trusses using CAD software.	Apply
CO.4 Draw plan, elevation and sectional view of residential buildings using CAD software.	Apply
CO.5 Draw the perspective view of buildings using CAD software.	Apply

Reference Book(s):

R 1. Rangawala, “A text book of Civil Engineering Drawing (including computer aided

R 2. N. Kumaraswamy & A. Kameswara Rao, “Building Planning and Drawing”, Charotar publishers, 8th edition, 2015.

R 3. B.P. Verma, “Civil Engineering Drawing & House Planning”, Khanna publishers, 12th

R 4. 19CECN3201- Computer Aided Building Drawing Laboratory Manual - MCET

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	3	3	-	3	-	3
CO2	3	-	-	-	3	-	-	-	3	3	-	3	-	3
CO3	3	-	-	-	3	-	-	-	3	3	-	3	-	3
CO4	3	-	-	-	3	-	-	-	3	3	-	3	-	3
CO5	3	-	-	-	3	-	-	-	3	3	-	3	-	3

High-3; Medium-2; Low-1

Course Code: 19PSHG6001		Course Title: WELLNESS FOR STUDENTS (Common to all B.E/B.Tech Programmes) (2021 Batch onwards)	
Course Category: Humanities		Course Level: Introductory	
L:T:P (Hours/Week) 0: 0 :2	Credits: 1	Total Contact Hours: 30	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Set SMART goals for academic, career and life
2. Apply time management techniques
3. Articulate the importance of wellness for success in life.
4. Understand the dimensions of wellbeing and relevant practices

UNIT I – GOAL SETTING

Understanding Vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people. Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume. Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment.

UNIT II – TIME MANAGEMENT - TOOLS AND TECHNIQUES

Importance of planning and working to time. Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination

UNIT III – PRACTICES FOR PHYSICAL WELLNESS

Concept of wellness – impact of absence of wellness - Wellness as important component to achieve success. Wellbeing as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods.

Simplified Physical Exercises. Fitness as a subset of Wellness – health related physical fitness - skill related physical fitness. Joint movements, Warm up exercises, simple asanas, WCSC simplified exercises.

UNIT IV – PRACTICES FOR MENTAL WELLNESS

Meditation: Mind and its functions - mind wave frequency – Simple basic meditation – WCSC meditation and introspection tables. Greatness of friendship and social welfare – individual, family and world peace – blessings and benefits.

Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas

UNIT V – PUTTING INTO PRACTICE

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Set well-articulated goals for academics, career, and personal aspirations	Apply
CO.2 Apply time management techniques to complete planned tasks on time	Apply
CO.3 Explain the concept of wellness and its importance to be successful in career and life	Apply
CO.4 Explain the dimensions of wellness and practices that can promote wellness	Apply
CO.5 Demonstrate the practices that can promote wellness	Valuing

Text Book(s):

T 1. Reading material, workbook and journal prepared by PS team of the college

Reference Book(s):

R.1 Stephen R Covey, “First things first”, Simon & Schuster Uk, Aug 1997.

R.2 Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster Uk, 2004.

R.3 Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, “Value education for harmonious life (Manavalakalai Yoga)”, Vethathiri Publications, Erode, I Ed. (2010).

R.4 Dr. R. Nagarathna, Dr.H.R. Nagendra, “Integrated approach of yoga therapy for positive health”, Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.

R.5 Tony Buzan, Harper Collins, “The Power of Physical Intelligence English)”.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	1	-	1	-	-
CO2	-	-	-	-	-	-	-	-	1	-	1	1	-	-
CO3	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO4	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO5	-	-	-	-	-	1	1	-	1	-	-	1	-	-

High–3; Medium–2; Low–1

Course Code: 19CHMG6201	Course Title: ENVIRONMENTAL SCIENCES (Common to all B.E/B.Tech Programmes)		
Course Category: Mandatory Non-Credit Course		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0: 0	Credits: 0	Total Contact Hours:15	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Create awareness for conservation and equitable use of natural resources.
2. Impart knowledge on measures for prevention of pollution and disaster management.
3. Facilitate the understanding of environmental legislations in India.
4. Familiarize the environmental issues relevant to human health.
5. Know the innovative measures for day to day environmental issues.

UNIT I - NATURAL RESOURCES **2 Hours**

Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT II - ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT **2 Hours**

Role of an individual in prevention of pollution; Disaster management : floods, earthquake, cyclone and landslides.

UNIT III - ENVIRONMENTAL ETHICS AND LEGISLATIONS **2 Hours**

Environmental ethics : Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.

UNIT IV - ENVIRONMENTAL ISSUES AND PUBLIC AWARNESS **2 Hours**

Public awareness - Environment and human health

UNIT V - ENVIRONMENTAL ACTIVITIES **2 Hours**

(a) Awareness Activities*:*

i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
ii) Slogan making event
iii) Poster making event.

(b) Actual Activities:

i) Plantation
ii) Cleanliness drive
iii) Drive for segregation of waste
iv) To know about the different varieties of plants
v) Shutting down the fans and ACs of the campus for an hour or so

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Describe the role of individual in conservation of water resources and equitable use of natural resources for sustainability.	Understand
CO.2 Explain the role of individual in prevention of pollution and disaster management.	Understand
CO.3 Illustrate the importance of environmental legislations in India and the issues involved in its enforcement.	Understand
CO.4 Explain the general environmental issues relevant to human health.	Understand
CO.5 Demonstrate innovative measures for day to day environmental issues such as waste disposal and deforestation.	Understand

Text Book(s):

T 1. Benny Joseph, “Environmental Studies", Tata McGraw Hill, New Delhi, 2006.

T 2. Mackenzie Davis and Susan Masten, “Principles of environmental engineering and science”, Mc-Graw Hill, 3rd Edition, 2014.

Reference Book(s):

R 1. Trivedi R.K. “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, Enviro Media.

R 2. Cunningham, W.P.Cooper, T.H. Gorhani, “Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	3	3	-	-	-	-	2	3	-
CO2	2	1	-	-	-	3	3	-	-	-	-	2	3	-
CO3	2	1	-	-	-	3	3	-	-	-	-	2	3	-
CO4	2	1	-	-	-	3	3	-	-	-	-	2	3	-
CO5	2	1	-	-	-	3	3	-	-	-	-	2	3	-

High-3; Medium-2;Low-1

NON-LETTER GRADES

Marks Scored	**Performance Level**
70 & above	Good
30 – 69	Average
< 30	Fair

SEMESTER III

Course Code: 19MABN1301	Course Title: TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS		
Course Category: Basic Science		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours: 60	Max Marks:100

Pre-requisites

- Matrices and Calculus
- Ordinary Differential Equation and Complex variables

Course Objectives

The course is intended to:

- Determine the solution of first and higher order partial differential equations.
- Compute the Fourier series expansion
- Solve one dimensional wave equation.
- Solve one dimensional and two-dimensional heat flow equation.
- Calculate the Fourier transformation for a periodic function

UNIT I - PARTIAL DIFFERENTIAL EQUATIONS **9+3 Hours**

Formation of partial differential equations — Solutions of standard types of first order partial differential equations — Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II - FOURIER SERIES **9+3 Hours**

Dirichlet's conditions — General Fourier series — Odd and even functions — Half range sine series — Half range cosine series — Parseval's identity — Complex form of Fourier series — Harmonic analysis.

UNIT III - SOLUTION OF ONE-DIMENSIONAL WAVE EQUATION **9+3 Hours**

Method of separation of variables - Classification of second order linear partial differential equations, Solutions of one-dimensional wave equation by Fourier series method.

UNIT IV - SOLUTION OF ONE AND TWO-DIMENSIONAL HEAT FLOW EQUATION **9+3 Hours**

One dimensional equation of heat conduction - Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded), Solution by Fourier series method.

UNIT V - FOURIER TRANSFORMS **9+3 Hours**

Fourier transform pair — Fourier sine and cosine transforms — Properties — Transforms of simple functions — Convolution theorem — Parseval's identity.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Determine the solution of first and higher order partial differential equations.	Apply
CO.2 Compute the Fourier series expansion	Apply
CO.3 Solve one dimensional wave equation.	Apply
CO.4 Solve one dimensional and two-dimensional heat flow equation.	Apply
CO.5 Calculate the Fourier transformation for a periodic function	Apply

Text Book(s):

T 1. Erwin kreyzig, Advanced Engineering Mathematics, 10th edition, John Wiley& Sons, 2015.

T 2. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

T 3. Ramana B.V., higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11thReprint, 2010.

Reference Book(s):

R 1. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education (2007).

R 2. N.P.Bali and Manish Goyel, A text book of Engineering Mathematics, Laxmi Publication, Reprint, 2008.

R 3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Web References:

1. http://nptel.ac.in/courses/122107037/19 2

http://nptel.ac.in/video.php?subjectIId=108106075

https://nptel.ac.in/courses/111103021/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO2	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO3	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO4	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO5	3	2	1	1	-	-	1	1	-	1	-	1	-	-

High-3; Medium-2; Low-1

Course Code: 19CECN1301	Course Title: CONSTRUCTION MATERIALS AND PRACTICES		
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Acquire basic knowledge on various building materials used in construction.
- Discuss the importance of metals, timber and other materials.
- Study the specifications, details and sequence of sub structure construction activities.
- List the concepts and techniques used in super structure construction.
- Identify the equipment required in various levels of construction.

UNIT I - BASIC CONSTRUCTION MATERIALS **9 Hours**

Stones –Bricks – Classification – Manufacturing of Clay Bricks –Bricks for Special Use – Cement Concrete blocks – Considerations for use – Lime – Types – Properties and Uses – Cement: Manufacture – Types – Characteristics – Properties – Fly ash. Aggregates – Characteristics – Types – Mortar: Classification – Preparation – Selection.

UNIT II - METALS, TIMBER AND OTHER MATERIALS **9 Hours**

Steel – Types – Manufacturing process– Tests – Structural steel – Rebar – Alloy steels – Aluminium – Properties and Uses – Timber – Types –Characteristics – Seasoning – Defects – Timber products – Paints – Types– Glass – Characteristics – Selection – Ceramics – Composite materials – Geo-synthetics – properties and applications.

UNIT III - SUB STRUCTURE CONSTRUCTION PRACTICES **9 Hours**

Specifications, details and sequence of activities - Site Clearance - Marking - Earthwork - Excavation – Dewatering - Building foundations – Types of foundations - Plinth beam – Filling in foundation trenches– Anti-termite treatment – Damp-proofing and Waterproofing – Sand filling in basement.

UNIT IV - SUPER STRUCTURE CONSTRUCTION PRACTICES **9 Hours**

Masonry – Formwork - Scaffolding - Roofs and roof covering - Flooring - types of flooring - Joints in Concrete - Staircase: Types and Construction – Plastering – Plastering methods - Pointing – Types - Painting – Preparation and Process – Defects.

UNIT V - CONSTRUCTION EQUIPMENTS **9 Hours**

Earthwork equipments- tractors, motor graders, scraper, front end loader, earth mover - Concreting equipments - batching, mixing, transportation, concreting and compaction - Equipment for material handling and erection of structures - Dewatering and pumping equipments.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Identify the building materials used for construction based on its properties, characteristics, classification and manufacturing methods, also explain the selection and preparation process of mortar.	Understand
CO.2 Elucidate the manufacturing process, properties and tests to be performed for metals, timber and composite materials for various civil engineering applications.	Understand
CO.3 Explain the specifications, details and sequence of sub structure construction activities of civil engineering projects.	Understand
CO.4 Identify appropriate scaffoldings for super structure construction activities as well as various super structure construction processes.	Understand
CO.5 Identify and illustrate the construction equipment for various applications in construction project.	Understand

Text Book(s):

T 1. Punmia B.C., Ashok Kumar Jain, Arun Kumar Jain, "Building Construction", LaxmiPublications Pvt. Ltd., 2016

T 2. Bindra and Arora, "Building Materials and Construction", DhanpatRai& Sons, NewDelhi, 2015

T 3. Varghese. P.C, "Building Materials", 2nd Revised edition (2015)PHI Learning Pvt. Ltd, New Delhi.

Reference Book(s):

R 1. Roy Chudley, Roger Greeno, Advanced Construction Technology, Pearson Prentice Hall, 2006.

R 2. Rangwala S.C., "Engineering Materials" Charotar Publishing House, Anand, India, 2014

R 3. P.C. Varghese, "Building Construction", PHI Learning Private Limited, New Delhi, 2010.

R 4. M.S. Shetty, "Concrete Technology Theory and Practice", S. Chand and Company Ltd., 2008.

Web References:

1. www.understandconstruction.com
2. www.engineeringcivil.com

Course Articulation Matrix*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	2	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CECN1302		Course Title: TRANSPORTATION ENGINEERING	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Understand the concept of highway alignment.
- Comprehend the geometrics of highway.
- Gain knowledge on the various pavement materials and its properties.
- Understand the design procedure of the flexible and rigid pavement according to the IRC codes, specifications and methods.
- Comprehend the elements of highway construction.

UNIT I - HIGHWAY ALIGNMENT **9 Hours**

Different Modes of Transportation; Highway Development in India; Highway Alignment, Survey- Horizontal Profile, Vertical Profile, Factors Controlling the alignment, Survey for route location, and Detailed Project Report

UNIT II - GEOMETRIC DESIGN OF HIGHWAYS **9 Hours**

Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. introduction to Elements of Traffic Engineering

UNIT III - PAVEMENT MATERIALS **9 Hours**

Properties and testing of Sub grade soil, aggregates, bituminous binders

UNIT IV - PAVEMENT DESIGN **9 Hours**

Types of Pavements, Design factors, Design of bituminous paving mixes; Design of Flexible Pavement by CBR method (IRC : 37- Latest revision), Design of rigid pavement, Westerguard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2015)

UNIT V - ELEMENTS OF HIGHWAY CONSTRUCTION **9 Hours**

Embankment, subgrade, subbase and base courses, bituminous surface courses, concrete pavements, soil stabilization; Drainage; Evaluation and Maintenance of highways.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the concepts of highway planning as well as highway alignment for transportation infrastructural projects.	Understand
CO.2 Elucidate the geometrics of highway and calculate the super elevation, sight distance and widening of curves.	Apply
CO.3 Illustrate the various pavement materials for highway construction projects.	Understand
CO.4 Design the flexible and rigid pavement according to the IRC codes.	Apply
CO.5 Illustrate the various elements of highway construction as per the standards.	Understand

Text Book(s)

T 1. Khanna, S. K. and Justo, C.E.G., Highway Engineering, Nem Chand & Bros, 10th Edition 2015

T 2. Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Eighth edition,2013

T 3. Subhash C Saxena, Textbook of Highway and Traffic Engineering., CBS Publishers, 2014

Reference Book(s):

R 1. C. Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press (India) Private Limited, Hyderabad, 2015

R 2. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005

R 3. IRC: 37- Latest revision, “Tentative Guidelines for the design of Flexible Pavements” Indian Roads Congress, New Delhi

R 4. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) (with CD)

Web References:

1. https://www.vidyarthiplus.com/vp/attachment.php?aid=10395
2. https://www.scribd.com/doc/119865487/Pavement-Engineering

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-	3
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	3	-	-	-	-	-	2	-	3
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1.

Course Code: 19CECN1303		Course Title: SURVEYING	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 4: 0: 0	Credits: 4	Total Contact Hours: 60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Study the Conventional surveying techniques [Chain, Compass and Plane table], Levelling, Theodolite Surveying, Tacheometric Surveying, Curves and Modern Surveying.

UNIT I - BASICS OF SURVEYING **12 Hours**

Definition - Principles – Classification. Introduction to Chain, Compass, Plane table – Errors and corrections in Chain/Tape, Compass – bearing, meridian – Open and closed traverse – Closing errors

UNIT II - LEVELLING **12 Hours**

Principles and theory of levelling - Types of levels, levelling staff and their types - Effect of curvature and refraction - Longitudinal, cross-sectional and reciprocal levelling - Reducing levels by rise and fall and height of collimation methods and check. Definition - Contour interval and horizontal equivalent - Characteristics - Uses of contour maps - Computation of area and volume from contour map

UNIT III - THEODOLITE SURVEYING **12 Hours**

Theodolite - types, features and fundamental axes - Adjustments; horizontal angles - Vertical angles - Heights and distances of inaccessible points - Methods of traversing - Problems on omitted measurements – Gale's Traversing method for closing error correction.

UNIT IV - TACHEOMETRIC SURVEYING **12 Hours**

Methods - Determination of constants of the tacheometer - Use of anallactic lens - Distance and elevation formulae for inclined sights with vertical and normal holding staff - Movable hair method - principles of tangential tacheometry - Problems in tacheometry - Subtense bar method.

UNIT V - CURVES AND MODERN SURVEYING **12 Hours**

Elements of simple curve - Location of tangent points - Setting out of simple curve by offset and Rankine's methods. Vertical curves – Types – grades. Total Station – Electronic Theodolite – Laser alignment instrument – Global Positioning System. Introduction to remote sensing (RS) and Geographical Information System (GIS).

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO.1	Explain the concepts of surveying for linear and angular measurements through conventional techniques to arrive solutions to basic surveying problems.	Understand
CO.2	Illustrate the levelling methods, calculate reduce levels for the give area as well as compute the area and volume from contour map.	Apply
CO.3	Arrive solutions to find omitted measurements and closing error correction using traverse surveying.	Apply
CO.4	Calculate the elevation and distance using tacheometric principles.	Apply
CO.5	Calculate the important parameters of curves for setting out of alignments in transport planning using advanced equipments.	Apply

Text Book(s)

T 1. Punmia B C, "Surveying" - vol. 1, vol. 2 and vol 3, Laxmi Publications (P) Ltd., New Delhi, 2016.

T 2. Agor. R, "A Text Book of Surveying and Levelling", Khanna Publishers, 2009.

T 3. Duggal R K, "Surveying", Vol I & II, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.

Reference Book(s):

R 1. Kanetkar T P, "Surveying and Levelling", Part I and II, Pune Vidyarthi Griha Prakashan, 2006.

R 2. Bannister A and Raymond S, "Surveying", 7th Edition, Addison Wesley Longman ltd, England, 1998.

R 3. Gopi. S, Sathikumar. R, Madhu. N, "Advanced Surveying", Dorling Kindersley (India) Pvt. Ltd.., 2008.

R 4. Chandra. A.M., "Surveying", New Age International Private Ltd Publishers, 2015.

Web References:

1. http://www.aboutcivil.org/surveying-levelling%20II.html
2. http://civil.engineering.webservices.utoronto.ca/Assets/Civil+Engineering+Digital+Assets/
3. http://www.nptel.ac.in/courses/105107122/
4. http://www.vssut.ac.in/lecture_notes/lecture1428642587.pdf
5. www.scribd.com/doc/63716977/Surveying-1-Lecture-Notes

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	3	-	-	-	-	-	-	3	-	3

High-3; Medium-2; Low-1.

Course Code: 19CESN1301	Course Title: SOLID MECHANICS		
Course Category: Engineering Science		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Engineering Mechanics

Course Objectives

The course is intended to:

- Learn the concept of slope and deflection in determinate beams
- Understand the stresses in oblique plane and to study continuous beams.
- Study the energy theorems.
- Gain knowledge on columns and cylinders.
- Acquire the knowledge on shafts and springs

UNIT I – DEFLECTION OF STATICALLY DETERMINATE BEAMS 9+3 Hours

Deflection and slope of cantilever, simply supported and overhanging beams – Double integration method, Macaulay's method, Moment area method and Conjugate beam method.

UNIT II – PRINCIPAL STRESSES AND STATICALLY INDETERMINATE BEAMS 9+3 Hours

Biaxial state of stress – Stress at a point – Stress on inclined plane – Principal stresses and principal planes – Mohr's circle of stresses. Theorem of three Moments – Analysis of continuous beam (up to two spans)-Shear force and B.M diagrams for continuous beams.

UNIT III – ENERGY PRINCIPLES 9+3 Hours

Strain energy and Strain energy density - Strain energy in axial load, flexure, Shear and Torsion - Strain energy and complimentary energy - Castigliano's and Engessor's Energy theorems - Principle of virtual work - Application of Energy theorem for computing deflection - Simple beams, plane trusses and simple rigid plane frames - Maxwell's reciprocal theorem- Williot Mohr diagram.

UNIT IV – COLUMNS AND CYLINDERS 9+3 Hours

Type of columns, eccentrically loaded short columns, combined bending and direct stresses, crushing load – middle third rule – Euler's theory – Limitations of Euler's theory - critical loads for prismatic columns with different end conditions; Rankine's formula - Thin cylinders - Circumferential stress, longitudinal stress, volumetric strain under internal pressure – Thick cylinders.

UNIT V – TORSION OF SHAFTS AND SPRINGS 9+3 Hours

Elastic theory of torsion - Stresses and deformation in circular solid and hollow shafts - Combined bending moment and torsion of shafts - Strain energy due to torsion - Modulus of Rupture – Power transmitted to shaft – Shaft in series and parallel - Design of shafts - Closed coiled and open coiled helical springs subjected to axial load, leaf springs, deflection of springs.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Compute slope and deflection for different types of beams using appropriate method.	Apply
CO2 Calculate the stresses in oblique plane and to draw the shear force and bending moment for continuous beam for various support conditions.	Apply
CO3 Apply energy theorems to compute the deflection for beams, trusses and frames	Apply
CO4 Calculate the critical load for various end conditions of columns as well as the stresses in thin and thick cylinders.	Apply
CO5 Calculate the design parameters of shaft and springs for various applications.	Apply

Text Book(s)

T 1. R.K. Rajput, "Strength of Materials", Sixth Edition, S. Chand & Company Pvt. Ltd., New Delhi, 2015.

T 2. R.K. Bansal, "A Text Book of Strength of Materials", Sixth Edition, Laxmi Publications (P) Ltd., New Delhi, 2017.

T 3. Egor P Popov, Engineering Mechanics of Solids, Second Edition, Prentice Hall of India, New Delhi, 2005.

Reference Book(s):

R.1 Timoshenko. S.P. and Young D.H., "Elements of Strength of Materials", 5th edition (SI Units), Affiliated East-West Press Ltd., New Delhi, 2012

R.2 Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf and David F. Mazurek "Mechanics of Materials", Seventh Edition, McGraw Hill Education, New York, 2015.

R.3 R.C. Hibbeler, "Mechanics of Materials", Nineth Edition, Pearson-Prentice Hall, New Delhi, 2014.

Web References:

1. http://nptel.ac.in/courses/105106116
2. http://web.mit.edu/emech/dontindex-build/
3. http://www.aboutcivil.org/solid-mechanics.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-

High-3; Medium-2; Low-1.

Course Code: 19CECN3301		Course Title: SURVEYING PRACTICE LABORATORY	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Impart the field knowledge of surveying measurements and a broad overview of surveying instruments and their applications.

List of Experiments:

1. Study of Instruments – chains, compass, plane table and dumpy levels.
2. Determination of the area of a closed traverse after eliminating the closing error using Compass Surveying
3. Determination of RL of different points on the earth surface using dumpy level
4. Verifying the accuracy of levelling using method of Check Levelling
5. To plot the LS & CS of a given length of road using Profile levelling.
6. Determination of horizontal angles by Method of repetition and reiteration.
7. Determination of elevation of an object whose base is inaccessible by Single Plane method
8. Determination of elevation of an object whose base is inaccessible by Double Plane method
9. Determination of gradients between given points by stadia method
10. Set out a simple circular curve by Rankine's method.

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO.1	Survey the given plot using chain and compass to determine the area through linear and angular measurements.	Apply
CO.2	Record the levels using various methods of levelling to calculate the reduced levels of given points and plot the level profile as well as contour maps.	Apply
CO.3	Determine the elevation of an object by single and double plane methods.	Apply
CO.4	Set out the simple curves using Rankines method.	Apply
CO.5	Determine the measurements with the help of modern surveying instruments for real time applications.	Apply

Reference(s):

R 1. Punmia B C, “Surveying” - vol. 1, vol. 2 and vol 3, Laxmi Publications (P) Ltd., New Delhi, 2016.

R 2. Agor. R, “A Text Book of Surveying and Levelling”, Khanna Publishers, 2009.

R 3. Duggal R K, “Surveying”, Vol I & II, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.

R 4. Surveying Practice Laboratory Manual, Department of Civil Engineering, MCET, Pollachi.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO2	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO3	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO4	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO5	3	2	-	-	-	-	-	-	3	3	-	3	-	3

High-3; Medium-2; Low-1

Course Code: 19CECN3302	Course Title: MATERIALS LABORATORY		
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Provide an understanding of the basic properties of construction materials and presents current field and laboratory standards and testing requirements for these materials.

List of Exercises

1. Determination of modulus of elasticity for a given metal specimen
2. Determine the properties of bricks
3. Determine the properties of cement
4. Determine the properties of coarse aggregates
5. Determination of torsional strength and modulus of rigidity for a given metal specimen.
6. Verification of Maxwell reciprocal theorem
7. Determination of hardness and impact strength
8. Determination of spring constant on a given spring specimen
9. Determination of slope and deflection of a beam by moment area theorems
10. Determination of Flexural Rigidity (EI) for a given specimens
11. Determination of shear strength of metals (Double Shear test).
12. Determination of buckling load for a given end condition of a column.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Determine the important mechanical properties of materials.	Apply
CO.2 Demonstrate the different theorems of beam as well as column members.	Apply
CO.3 Calculate the hardness of various metals.	Apply
CO.4 Calculate the impact strength of various metals.	Apply
CO.5 Determine the Flexural Rigidity (EI), shear strength of a beam and buckling load for a given end condition of a column.	Apply

Reference Book(s):

R 1. Bansal, R.K., “A Text Book of Strength of Materials”, Laxmi Publications (P) Ltd., New Delhi 2010.

R 2. Timoshenko. S.P. and Young D.H., “Elements of Strength of Materials”, 5th edition (SI Units), Affiliated East-West Press Ltd., New Delhi, 2012.

R 3. 19CELN3302 - Materials Laboratory Manual

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	-	-	-	-	3	-	-	-	-	-
CO2	3	2	-	2	-	-	-	-	3	-	-	-	-	-
CO3	3	2	-	2	-	-	-	-	3	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	3	-	-	-	-	-
CO5	3	2	-	2	-	-	-	-	3	-	-	-	-	-

High-3; Medium-2; Low-1

SEMESTER IV

Course Code: 19MABG1401		Course Title: PROBABILITY AND STATISTICS (Common to EE,EC,AU,CS,ME,IT & CE)	
Course Category: Basic Science		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Calculate expectations and variances of random variables
- Apply the concepts of standard distributions to solve practical problems
- Calculate the correlation and regression for two variables
- Test the samples based on hypothesis
- Analyse the samples based on variance

UNIT I - PROBABILITY AND RANDOM VARIABLES **9+3 Hours**

Axioms of Probability- Conditional Probability- Total Probability -Baye's Theorem- Random Variables- Probability Mass Function- Probability Density Functions- Properties - Moments- Moment generating functions and their properties.

UNIT II - STANDARD DISTRIBUTIONS **9+3 Hours**

Binomial- Poisson- Uniform –Exponential- Normal Distributions and their properties-Functions of a random variable.

UNIT III - TWO DIMENSIONAL RANDOM VARIABLES **9+3 Hours**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables.

UNIT IV - TESTING OF HYPOTHESES **9+3 Hours**

Sampling Distributions- Testing of hypotheses for mean, variance, proportions and differences using Normal, t, Chi-Square and F distributions – Tests for independence of attributes and Goodness of fit.

UNIT V - DESIGN OF EXPERIMENTS **9+3 Hours**

Analysis of Variance (ANOVA)- One way Classification – Completely Randomized Design (CRD) – Two-way Classification – Randomized Block Design (RBD) – Latin square

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Calculate expectations and variances of random variables	Apply
CO.2 Apply the concepts of standard distributions to solve practical problems	Apply
CO.3 Calculate the correlation and regression for two variables	Apply
CO.4 Test the samples based on hypothesis	Apply
CO.5 Analyse the samples based on variance	Apply

Text Book(s):

T 1. Veerajan T, "Probability, Statistics and Random process", 4th Edition, Tata McGraw-Hill, New Delhi, 2013.

T 2. Dr.J.Ravichandran, "Probability and Statistics for Engineers", 1st Edition, Wiley India Pvt.Ltd.2010.

Reference Book(s):

R 1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", 9thEdition Pearson Education, Asia, 2016.

R 2. M.R. Spiegel,J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", 3rd Edition,Tata McGraw Hill edition, 2009.

R 3. Morris DeGroot, Mark Schervish, "Probability and Statistics", Pearson Educational Ltd, 4th Edition, 2014.

R 4. Johnson and C.B. Gupta, "Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.

Web References:

1. https://onlinecourses.nptel.ac.in/111105041/
2. https://nptel.ac.in/downloads/111105041/
3. https://nptel.ac.in/courses/111105090/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO2	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO3	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO4	3	2	1	1	-	-	1	1	-	1	-	1	-	-
CO5	3	2	1	1	-	-	1	1	-	1	-	1	-	-

High-3; Medium-2;Low-1

Course Code: 19CECN1401		Course Title: HYDRAULICS ENGINEERING	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Introduce the concepts of static pressure, buoyant force and metacentric height.
- Know the flow properties through velocity potential function and stream function and
- apply the Bernoulli's theorem for pipe flow.
- Understand the major and minor losses in pipe flow.
- Study the principles of most economical channel section.
- Impart knowledge on the performance of pumps and turbines.

UNIT I - FLUID PROPERTIES AND FLUID STATICS **12 Hours**

Fluid – definition, distinction between solid and fluid – Units and dimensions – Properties of fluid. Fluid statics – concepts of fluid static pressure, absolute and gauge pressure – Pressure measurements using manometers and pressure gauges – Forces on planes – centre of pressure – Buoyancy – Metacentric height - Floatation.

UNIT II - FLUID KINEMATICS AND DYNAMICS **12 Hours**

Fluid kinematics: Flow visualization – Lines of flow – Types of flow- Velocity field and acceleration – Continuity (one dimensional and three-dimensional form)- stream function – velocity potential function – flow net

Fluid dynamics: Euler's equation along a streamline – Bernoulli's equation – Applications – Venturimeter, orificemeter. Linear momentum equation and its applications. Boundary layer concept- displacement, energy and momentum thickness.

UNIT III - FLOW THROUGH PIPES **12 Hours**

Laminar flow through circular pipes(Hagen Poiseulle's equation)- Hydraulic and energy gradient – flow through pipes – Darcy Weisbach equation – friction factor – Moody's diagram – Major and minor losses of flow in pipes – Pipes in series and in parallel.

UNIT IV - FLOW THROUGH OPEN CHANNELS **12 Hours**

Definition - Differences between pipe flow and open channel flow –Types open channels - Types of Flow – Properties of open channel - Fundamental equations - Velocity distribution in open channel – Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT V - PUMPS AND TURBINES **12 Hours**

Centrifugal pump – components – working principle – priming of centrifugal pump – specific speed- reciprocating pump – components – working principles – single and double acting reciprocating pump – discharge through a pump- work done – pump efficiency – negative slip. Turbines – classification – impulse and reaction turbines – head and efficiencies of hydraulic turbines – components and functions of Pelton wheel turbine, Francis turbine, Kaplan turbine – Velocity triangle – specific speed.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Determine the fluid properties and its behaviour in static conditions.	Apply
CO.2 Apply the conservation laws for fluids in fluid kinematics and dynamics.	Apply
CO.3 Determine the major and minor losses in pipelines.	Apply
CO.4 Determine the most economical channel section for various conditions.	Apply
CO.5 Determine the performance of pumps and turbines.	Apply

Text Book(s):

T 1. R.K. Rajput, “A text book of fluid mechanics”, S. Chand Publishing, 2019

T 2. Subramanya, K., “Flow in open channels”, Tata McGraw Hill Publishing Company Ltd, New Delhi (2015)

T 3. Som S., Biswas G., and Chakraborty S., “Introduction to fluid mechanics and fluid machines”, Tata McGraw Hill Education private Ltd.,New Delhi, 2011.

T 4. R.K. Rajput,”A text book of hydraulic machines”, S. Chand Publishing, 2019.

Reference Book(s):

R 1. Chow VenTe, “Open Channel hydraulics”, Tata McGraw Hill Book company Ltd, New Delhi (2009)

R 2. Modi, P.N., and Seth, S.M., “Hydraulics and Fluid Mechanics”, Standard book house, New Delhi (2019)

R 3. Srivastava, R., “Flow through open channels”, Oxford University Press, New Delhi (2007)

R 4. Chanson, H., “The Hydraulics of open channel flow: An Introduction”, Elsevier (2013)

R 5. Frank M White, “Fluid mechanics”, Tata McGraw Hill, New Delhi, 2008.

R 6. John F Douglas, Janusz M, Gasiorek and John A. Swaffield. “Fluid mechanics”, Fourth edition, Pearson education limited, New Delhi, 2001.

Web References:

1. http://nptel.ac.in/courses/105103095
2. http://www.vidhyarthiplus.com/vp/Thread-ME2204-Fluid-Mechanics-and-Machinery-
3. http://www.et.byu.edu/~2014/che374/lectureNotes/lectureNotes.html
4. http://www.annaunivupdates.com/2015/01/ce6403-applied-hydraulic-engineering-ahe-
5. http://nptel.ac.in/courses/105106114/

6. http://web.itu.edu.tr/~bulu/hydraulics_files/lecture_notes_05.pdf

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-

High-3; Medium-2;Low-1

Course Code: 19CECN1402		Course Title: CONCRETE TECHNOLOGY	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Construction Materials and Practices
- Materials Laboratory

Course Objectives

The course is intended to:

- Understand the theoretical concept of concrete materials which includes Cement, Aggregate and Water.
- Study the different types of admixtures.
- Study the concrete mix design.
- Study the behavior of concrete at its fresh and hardened state.
- Know the different types of special concrete and its applications.

UNIT I - CONCRETE CONSTITUENTS **9 Hours**

Composition of cement - Hydration of cement - Structure of hydrated cement - Aggregate - Classification - Testing - Methods of combining aggregates - Grading requirements as per BIS - Quality of water.

UNIT II - ADMIXTURES **9 Hours**

Chemical admixture - Accelerators, Retarders, Plasticisers, Super plasticisers, Water proofers - Effects on fresh and hardened properties - Mineral admixture - Fly ash, Silica fume, Ground granulated blast furnace slag, Metakaoline - Effects on fresh and hardened properties.

UNIT III - CONCRETE MIX PROPORTIONING **9 Hours**

Basic considerations - Principles of mix proportioning – Quality control - Methods of mix proportioning - BIS and ACI mix design procedure - Mix design examples - Correction for moisture content and bulking.

UNIT IV - PROPERTIES OF CONCRETE **9 Hours**

Fresh concrete properties - Workability and factors affecting it - Segregation - Bleeding - Hardened concrete properties - Factors affecting strength - curing - methods of curing - Dimensional stability - Creep, Shrinkage, Permeability - Tests on permeability - RCPT, Half cell - Non Destructive Testing - Rebound hammer test, Ultrasonic pulse velocity method.

UNIT V - SPECIAL CONCRETES **9 Hours**

Light weight concrete - High strength concrete - High performance concrete - Fibre reinforced concrete - Ferrocement - Polymer Concrete - Ready mix concrete - Shotcrete - Self compacting concrete - their production, properties and application.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the properties of the constituent materials of concrete.	Understand
CO.2 Explain the effect of admixtures on fresh and hardened concrete.	Understand
CO.3 Calculate the mix proportions of concrete as per BIS and ACI standards	Apply
CO.4 Explain the properties of fresh and hardened concrete.	Understand
CO.5 Explain the properties of special concrete and their real time applications.	Understand

Text Book(s):

T 1. Shetty. M.S, “Concrete Technology”, S. Chand and Company Ltd., New Delhi, 2010.

T 2. Gambhir. M.L, “Concrete Technology”, Tata Mc-Graw Hill Company, New Delhi, 2013.

Reference Book(s):

R 1. Santhakumar. A.R, “Conrete Technology”, Oxford university press, New Delhi, 2007.

R 2. Neville A.M “Properties of Concrete”, Pearson Education Asia Pvt Ltd., New Delhi, 2012.

R 3. Povindar K. Mehta, Paulo J. M. Monteiro, “Concrete: Microstructure, Properties, and Materials”, Mc-Graw Hill Company, 2011.

Web References:

1. http://nptel.ac.in/courses/105102012/
2. http://freevideolectures.com/Course/3357/Concrete-Technology/1

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	3	3	3
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2;Low-1

Course Code: 19CECN1403		Course Title: STRUCTURAL ANALYSIS	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Solid Mechanics

Course Objectives

The course is intended to:

- Gain knowledge on Consistent deformation and flexibility matrix method.
- Understand the Moment distribution and stiffness matrix method.
- Know the Influence line diagrams.
- Know the Arches and cables.
- Understand the Plastic analysis

UNIT I - CONSISTENT DEFORMATION AND FLEXIBILITY MATRIX METHOD **9+3 Hours**

Analysis of statically indeterminate structures by the method of consistent deformations- analysis of rigid frames - Analysis of statically indeterminate trusses by the method of consistent deformations - Flexibility Matrix method Concept of flexibility matrix - analysis of continuous beams - plane frames and pin jointed plane trusses.

UNIT II - MOMENT DISTRIBUTIONAND STIFFNESS MATRIX METHODS **9+3 Hours**

Analysis of Statically indeterminate Structures; Distribution and carryover of moments - Stiffness and carry over factors - Analysis of continuous beams - Plane rigid frames with and without sway. Stiffness Matrix method Stiffness matrix for beam element - analysis of continuous beams - plane frames & pin jointed plane trusses.

UNIT III - INFLUENCE LINES FOR MOVING LOAD **9+3 Hours**

System of moving loads- Equivalent UDL – Influence lines for reactions, shear force and bending moment in statically determinate beams for concentrated and uniformly distributed moving loads – Influence lines for member forces in statically determinate pin-jointed plane frames – Influence lines for three hinged arches.

UNIT IV - ARCHES AND CABLE STRUCTURES **9+3 Hours**

Arches as structural forms - Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches - Settlement and temperature effects. Cables, Suspension bridges and Space frames: Suspension cables – Cables with two and three hinged stiffening girders.

UNIT V - PLASTIC ANALYSIS **9+3 Hours**

True and idealized stress - strain curve for mild steel in tension, stress distribution in elastic, elasto-plastic and plastic stage - Plastic moment of resistance — Plastic modulus — Shape factor — Load factor — Concept of plastic hinge and collapse mechanism - Static and kinematic methods - Upper bound, lower bound and uniqueness theorems - Plastic analysis of determinate and indeterminate beams, single bay single storied portal frames.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Determine the SFD and BMD for statically indeterminate structures using flexibility matrix method.	Apply
CO.2 Determine the SFD and BMD for statically indeterminate structures using stiffness matrix method.	Apply
CO.3 Determine the effect of moving loads acting on the beams, arches and frames using influence line diagrams.	Apply
CO.4 Calculate the internal forces, moments and displacement for various types of arches and cables.	Apply
CO.5 Calculate the plastic moments for determinate and indeterminate structures.	Apply

Text Book(s):

T 1. Vaidyanadhan, R and Perumal, "Comprehensive Structural Analysis - Vol. 1 & Vol. 2", P, Laxmi Publications, New Delhi, 2008

T 2. B. C. Punmia, Ashok Kumar Jain, Arun K. Jain, “Theory of Structures", Laxmi Publications Pvt. Ltd, 2003.

T 3. S.S. Bhavikatti, Structural Analysis, Vol I & II, Vikas Publishing House Pvt. Ltd, 2011.

Reference Book(s):

R 1. Wang, C.K., Intermediate Structural Analysis, McGraw Hill, 2017

R 2. Vazirani, V.N. and Ratwani, M.M., Analysis of Structures Vol-1, Vol-2, Khanna Publishers, 2009

R 3. Ramamrutham, S. and Narayan, R., Theory of Structures, Dhanpat Rai Publishing Co (P) Ltd, 2020

Web References:

1. https://nptel.ac.in/courses/105101085/
2. https://nptel.ac.in/courses/105105109/
3. http://www.iste.co.uk/book.php?id=1367

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	-

High-3; Medium-2;Low-1

Course Code: 19CECN3401		Course Title: HYDRAULICS ENGINEERING LABORATORY	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Provide hands-on experience of the application of flow measuring devices and performance characteristics of pumps and turbines.

List of Exercises

1. Determination of metacentric height of a floating body
2. Classification of flow based on Reynolds number
3. Verification of Bernoulli's theorem
4. Measurement of flow using venturi meter and orifice meter
5. Measurement of flow through orifice
6. Determination of friction factor of various pipe materials
7. Determination of losses of different pipe fittings
8. Measurement of flow through notches
9. Measure the performance of centrifugal pump
10. Measure the performance of reciprocating pump
11. Measure the performance of Kaplan turbine
12. Measure the performance of Pelton Wheel turbine

Experiments beyond syllabus

1. Measure the efficiency of a multistage centrifugal pump
2. Measure the performance of Francis turbine
3. Measure the efficiency of a submersible pump

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Determine the type of flow using Reynolds apparatus.	Apply
CO.2 Verify Bernoulli s Theorem principle.	Apply
CO.3 Determine the major and minor losses for pipes made of different materials.	Apply

CO.4	Determine the characteristics of flow through pipes and open channel.	Apply
CO.5	Calculate the efficiency and draw the characteristic curves of the hydraulic machines.	Apply

Reference Book(s):

R 1. R.K. Rajput., “A textbook of hydraulic machines”, S. Chand Publishing, New Delhi, 2019.

R 2. Bansal, R.K., “Fluid mechanics and hydraulic machines”, Laxmi Publications Ltd, New Delhi, 2010.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	3	-	-	-	-	-

High-3; Medium-2; Low-1

Course Code: 19CECN3402		Course Title: CONCRETE AND TRANSPORTATION ENGINEERING LABORATORY	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Construction Materials and Practices
- Transportation Engineering

The course is intended to:

- To gain hands on experience of the various tests to be conducted for fresh and hardened concrete as well as highway materials.

List of Exercises

1. Preparation of concrete mix design using IS code of practice.
2. Determination of workability of fresh concrete.
3. Determination of compressive, split tensile and flexural strength on hardened concrete.
4. Determination of modulus of elasticity of concrete.
5. Determination of strength & quality of concrete using NDT.
6. Determination of workability of self-compacting concrete.
7. Determination of specific gravity of bitumen.
8. Determination of softening point of bitumen.
9. Determination of ductility test on bitumen.
10. Determination of flash and fire point of bitumen.
11. Determination of binder content of bitumen using binder recovery extraction test.
12. Determination of optimum bitumen content using Marshall Stability test.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Calculate the concrete mix proportions as per IS method for different types of concrete.	Apply
CO.2 Determine the various fresh concrete properties as per IS standards	Apply
CO.3 Determine the various hardened concrete properties as per IS standards.	Apply
CO.4 Determine the basic properties of bitumen for highway projects.	Apply
CO.5 Determine optimum bitumen content as per IS standards.	Apply

Reference Book(s):

R 1. M. S. Shetty & A K Jain, “Concrete Technology: Theory and practice”, S. Chand publishers, 2018.

R 2. S.K.Khanna and C.E.G Justo, “Highway Engineering” Nem Chand & Brothers publishers, 2015.

R 3. Concrete and transportation engineering laboratory manual, MCET, Pollachi

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	3	3	-	-	3	-	3
CO2	3	2	-	-	-	-	-	3	3	-	-	3	-	3
CO3	3	2	-	-	-	-	-	3	3	-	-	3	-	3
CO4	3	2	-	-	-	-	-	3	3	-	-	3	-	3
CO5	3	2	-	-	-	-	-	3	3	-	-	3	-	3

High-3; Medium-2; Low-1

Course Code: 19PSHG6002		Course Title: Universal Human Values 2: Understanding Harmony	
Course Category: Humanities		Course Level: Practice	
L:T:P (Hours/Week) 2:1: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Induction Program (UHV 1)

Course Objectives

The course is intended to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Strengthening of self-reflection
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Development of commitment and courage to act
5. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

UNIT I - INTRODUCTION TO VALUE EDUCATION **9 Hours**

Need for the Value Education; Self -exploration as the process for value education; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding: Relationship and Physical Facilities; Happiness and Prosperity: current scenario; Method to fulfill the Basic human aspirations

UNIT II - HARMONY IN HUMAN BEING **9 Hours**

Human being as a co-existence of self (‘I’) and the material ‘Body’; needs of Self ('I') and 'Body'; The Body as an instrument of ‘I’; Harmony in the self (‘I’); Harmony of the self (‘I’) with body; Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

UNIT III - HARMONY IN THE FAMILY AND SOCIETY **9 Hours**

Harmony in the Family the basic unit of human interaction; Values in human to human relationship; Trust as the foundational values of relationship; Respect as the right evaluation ;Understanding harmony in the society (society being an extension of family); Vision for the universal human order.

UNIT IV - HARMONY IN THE NATURE **9 Hours**

Understanding the harmony in the Nature Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature; Existence as Co-existence at all levels; Holistic perception of harmony in existence.

UNIT V - HARMONY ON PROFESSIONAL ETHICS **9 Hours**

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case study: holistic technologies, management models and production systems; Strategy for transition towards value-based life and profession

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Reflect on values, aspiration, relationships and hence identify strengths and weaknesses.	Responding
CO.2 Appraise physical, mental and social wellbeing of self and practice techniques to promote wellbeing.	Responding
CO.3 Value human relationships in family and society and maintain harmonious relationships.	Valuing
CO.4 Respect nature and its existence for survival and sustainable of all life forms and hence practice conservation of nature	Valuing
CO.5 Appreciate ethical behaviour as a result of value system in personal and professional situations	Receiving

Text Book(s):

T 3. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

Reference Book(s):

R 1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
R 2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
R 3. The story of stuff, Annie Leonard, Free Press, New York 2010.

Web References:

1. https://aktu.ac.in/hvpe/ResourceVideo.aspx
2. http://hvpenotes.blogspot.com/
3. https://nptel.ac.in/courses/109/104/109104068/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	1	2	2	-	-	2	-	-
CO2	-	-	-	-	-	1	2	2	2	1	-	2	-	-
CO3	-	-	-	-	-	2	2	2	2	1	-	2	-	-
CO4	-	-	-	-	-	2	2	2	2	-	-	2	-	-
CO5	-	-	-	-	-	1	2	2	2	-	-	2	-	-

High-3; Medium-2;Low-1

Course Code: 19CEPN6401		Course Title: MINI-PROJECT	
Course Category: Project		Course Level: Practice	
L:T:P (Hours/Week) 0:0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Know how to prepare the layout of the buildings, which includes architectural drawing by using building by-laws.
- Provide opportunity for the students to demonstrate their independence, individuality and originality to plan and organize projects within a specified time frame by way of applying, and implementing the principles/techniques that they have learnt through the courses.

The student should plan a residential building by applying principles of planning, local building bye laws, vastu and draw the section as well as elevation. The mini project work shall be carried out individually by the student. The progress of the project is evaluated based on a minimum of three reviews by the project review committee. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Comprehend local building bye-laws and provisions of National Building Code in respect of building and town planning.	Apply
CO.2 Plan residential, commercial and public buildings.	Apply
CO.3 Prepare working drawings, foundation plans and other executable drawings with proper details for residential buildings.	Apply
CO.4 Present the report using multimedia tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	3	-	3	3	-	-	3	-	3
CO2	3	2	-	-	3	-	-	-	3	3	-	3	-	3
CO3	3	2	-	-	3	-	-	-	3	3	-	3	-	3
CO4	3	2	-	-	3	-	-	-	3	3	-	3	-	3

High-3; Medium-2;Low-1

V SEMESTER

Course Code: 19CESN1501		Course Title: GEOLOGY AND SOIL MECHANICS	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Understand the nature and origin of soil, petrology and structural geology in relevance to civil engineering applications.
- Understand the soil properties, classification of soil and soil compaction.
- Understand the concept of effective stress, permeability of soil and flownets.
- Understand the stress distribution and consolidation of soil.
- Understand the importance of shear strength of soil.

UNIT I – INTRODUCTION TO GEOLOGY **9 + 3 Hours**

Geology in Civil Engineering – Weathering of Rocks – Classification of rocks – Engineering properties of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering.

UNIT II – SOIL PROPERTIES, CLASSIFICATION AND COMPACTION **9 + 3 Hours**

Types of soil – Basic soil properties – Three phase system – Sieve Analysis including Hydrometer Analysis – Determination of consistency limits and their significance to the field behaviour of Soil – Unified Soil Classification System & IS Soil Classification system – Plasticity Charts

Soil compaction – Concept of OMC and dry density– Factors affecting compaction – Field compaction methods.

UNIT III – EFFECTIVE STRESS AND PERMEABILITY **9 + 3 Hours**

Soil water – Various forms – Capillary rise – Effective stress concepts in soil – Total, neutral and effective stress distribution in soil – Pressure diagrams.

Permeability – Darcy's Law – factors affecting permeability – Determination of Permeability– Liquefaction and Quicksand Condition – Seepage – Introduction to flow nets – properties and uses – Application to simple problems.

UNIT IV – STRESS DISTRIBUTION AND CONSOLIDATION **9 + 3 Hours**

Stress distribution in soil media – Boussinesq's theory (Point Load, UDL and Line Load) – Use of Newmark influence charts – Westergaard's equation for point load–pressure bulb.

Consolidation – Definition – Concepts of coefficient of compressibility –Terzaghi's theory of one–dimensional consolidation – Coefficient of volume change and compression index – e-log p curves – Determination of coefficient of consolidation by curve fitting methods – Calculation of Consolidation settlement – Pre-consolidation pressure.

UNIT V – SHEAR STRENGTH **9 + 3 Hours**

Shear strength of cohesive and cohesion less soils – Mohr–Coulomb theory – shear strength parameters and their measurements – Direct shear, Triaxial compression, Unconfined Compression and Vane shear tests – Types of shear tests based on drainage and their applicability – Factors influencing shear strength – pore pressure parameters.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1 Explain the different types of minerals, rocks, structure of rocks and geological investigations needed for construction of civil engineering structures	Understand
CO2 Calculate soil parameters through phase diagram and optimum moisture content of soil.	Apply
CO3 Determine the seepage of water in soil.	Apply
CO4 Solve problems related to stress distribution and consolidation settlement for design of foundation.	Apply
CO5 Calculate shear strength parameters for cohesive and non-cohesive soil.	Apply

Text Book(s):

T 1. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi,

T 2. Venkatramaiah. C, "Geotechnical Engineering", New Age International (P) Ltd. Publishers, New Delhi, 2019.

T 3. Dr. Arora. K.R, "Soil Mechanics and Foundation Engineering (Geotechnical Engineering)", Standard Publishers Distributors, Nai Sarak, New Delhi, 2020.

T 4. Parbin Singh "Engineering and General Geology" S.K Kataria & Sons, October 2013.

Reference Book(s):

R 1. Varghese P.C., "Foundation Engineering", PHI Learning Private Limited, New Delhi,2012.

R 2. GopalRanjan and Rao A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers, New Delhi, 2020.

R 3. Dr. B.C Punmia, Er. Ashok K Jain, Dr. Arun K Jain., "Soil Mechanics and Foundations", Laxmi Publications, 17th Edition, 2018.

R 4. N. Chenna Kesavulu, "Textbook of Engineering Geology", Laxmi Publication, January 2018.

IS Code Book:

1. IS: 2720– Part 1 to Part 40

Web References:

3. http://nptel.ac.in/courses/105103097/
4. http://home.iitk.ac.in/~pkbd/A%20preview%20of%20soil%20Behaviour.pdf
5. https://www.aboutcivil.org/soil–mechanics–html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Course Code: 19CECN1502		Course Title: DESIGN OF RC STRUCTURES	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Structural Analysis

Course Objectives

The course is intended to:

- Learn to design Reinforced Concrete beam.
- Learn to design Reinforced Concrete slabs and staircase
- Learn to design Reinforced Concrete columns.
- Learn to design Reinforced Concrete footings.
- Learn to design Reinforced Concrete water tanks

Unit I-INTRODUCTION AND DESIGN OF BEAMS 9+3 Hours

Objective of RC design - Code of practices and specifications-Properties of concrete and reinforcing steel - Design methodologies - Limit state method of design for singly and doubly reinforced rectangular and flanged sections - Design for shear, torsion, bond and anchorage of reinforcement

Unit II- DESIGN OF SLABS AND STAIRCASE 9+3 Hours

Design of One-way, two-way and flat slabs - Types of staircases - Design of dog-legged staircase.

Unit III - DESIGN OF COLUMNS 9+3 Hours

Design of columns for axial load with uniaxial bending-Design of short columns under axial compression, axial compression with uni-axial and bi-axial bending-Design of slender columns.

Unit IV - DESIGN OF FOOTINGS 9+3 Hours

Types of footings and foundation - Design of isolated and combined footings - Design of Raft foundation.

Unit V -DESIGN OF WATER TANKS 9+3 Hours

Types of water tanks - Design of ground and underground tanks (square, rectangular and circular)

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Analyse reinforced concrete beams as per BIS codal provisions.	Analyse
CO.2 Analyse different types of RC slabs and dog-legged staircase as per BIS codal provisions.	Analyse
CO.3 Analyse the columns for various loading conditions as per BIS codal provisions.	Analyse
CO.4 Analyse the different types of footings for load bearing and framed structure as per BIS codal provisions.	Analyse
CO.5 Analyse and design water tanks as per BIS codal provisions.	Analyse

Text Book(s):

T 1. S. Unnikrishna Pillai and Devdas Menon, Reinforced concrete design, Tata Mc-Graw HillPublication.,2019

T 2. P.C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt.Ltd., New Delhi, 2013

T 3. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, RCC Designs (Reinforced Concrete Structures), Laxmi Publications Pvt. Ltd., New Delhi, 2019

Reference Book(s):

R 1. M.L. Gambhir, Design of Reinforced Concrete structures, Prentice Hall of India Private limited, New Delhi, 2012

R 2. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, NewDelhi, 2014

Web References:

1. https://nptel.ac.in/courses/105/105/105105104/
2. https://nptel.ac.in/courses/105/105/105105105/

IS Code Book

1. IS 456:2000 Plain and Reinforced Concrete - Code of Practice.
2. SP 16:1980 Design Aids for Reinforced Concrete to IS 456:1978.
3. IS 875(1-5):1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.
4. IS 3370(Part 1-4): 1965 Code of Practice for Concrete Structures for the Storage of Liquids

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	3	-	-	-	3	3	3
CO2	3	3	2	-	-	-	-	3	-	-	-	3	3	3
CO3	3	3	2	-	-	-	-	3	-	-	-	3	3	3
CO4	3	3	2	-	-	-	-	3	-	-	-	3	3	3
CO5	3	3	2	-	-	-	-	3	-	-	-	3	3	3

High-3; Medium-2; Low-1

Course Code: 19CECN1503		Course Title: ENVIRONMENTAL ENGINEERING	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 4: 0: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Hydraulics Engineering

Course Objectives

The course is intended to:

- Study the public water supply schemes and sources of water.
- Study the quality and distribution of water.
- Understand the concept of water treatment.
- Study the quantity, collection and conveyance of wastewater.
- Understand the sewage treatment process.

UNIT I - PUBLIC WATER SUPPLY SCHEMES AND SOURCES OF WATER **12 Hours**

Necessary and objectives of water supply schemes. Quantity of water and its requirements - continuous and intermittent supply - Rate of demand and variations - effect on design period - population growth and forecast. Sources of water - infiltration galleries - storage reservoirs - storage capacity by mass curve methods. Types of wells - tests for yield of a well

UNIT II - QUALITY AND DISTRIBUTION OF WATER **12 Hours**

Definitions - quality of water - portable water, pure water, mineral water, etc. Physical, chemical, biological impurities in water- quality standards of water. Transportation of water - types of conduits - Hydraulics of pipe flow - design-materials of pressure pipes and pipe corrosion. Laying and testing of pipelines. Pumps - types, selection of pumps. Distribution of water - requirements of good distribution system - method of distribution - layout - pressure in the distribution system - Hardy cross method

UNIT III - TREATMENT OF WATER **12 Hours**

Water treatment - screening, plain sedimentation - coagulation sedimentation - filtration - disinfection - water softening - removal of colour, odour and taste - Removal of iron and manganese- Fluoridation and defluoridation(Only theoretical concepts will be covered, no design)

UNIT IV - QUANTITY, COLLECTION AND CONVEYANCE OF WASTEWATER **12 Hours**

Necessity and objectives of sanitary engineering projects - Definitions - Design period - Systems of sewerage - quantity of sewage - Fluctuation in the flow pattern- Estimation of storm runoff - Dry and Wet weather flow - Hydraulics of sewers - Self cleansing velocities - Full/partial flow conditions - Sewer appurtenances - Materials of sewers - sewer joints - sewer laying - sewer cleaning and maintenance

UNIT V - QUALITY OF SEWAGE AND TREATMENT **12 Hours**

Characteristics and composition of sewage - physical and chemical analysis - DO, BOD, COD and their significance - Objectives and basic principles of sewage treatment - primary treatment - screens - grit chamber - settling tank - principles of sedimentation. Principles and Functions of Aeration, Activated Sludge Process and Trickling filter, Other treatment methods - Oxidation ditches, UASB - Waste Stabilization Ponds
(Only theoretical concepts will be covered, no design)

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the concept of water supply system and source of water.	Understand
CO.2 Explain the requirements of an efficient water distribution system.	Understand
CO.3 Elucidate the fundamental scientific processes underlying for design of water treatment processes.	Understand
CO.4 Explain the different methods of sewage disposal.	Understand
CO.5 Elucidate the fundamental scientific processes underlying for design of waste water treatment processes.	Understand

Textbook(s):

T1. Garg, S.K., Environmental Engineering Vol. I and Vol.II, Khanna Publishers, NewDelhi, 2019.

T2. Mark J Hammer, Mark J. Hammer Jr., Water and wastewater technology, Prentice Hall of India, 2012.

Reference Book(s):

R.1 Birdie, G.S., Water supply and sanitary engineering, Dhanpat Rai and Sons, 2018.

R.2 Shah, C.S., Water supply and sanitation, Galgotia publishing company, New Delhi, 2016.

R.3 Manual on wastewater and treatment CPHEEC, Ministry of urban affairs and employment, Govt of India., New Delhi, 2013.

Web References:

1. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-85-water-and-wastewater-treatment-engineering-spring-2006/lecture-notes/
2. http://cpheeo.gov.in/cms/manual-on-sewerage-and-sewage-treatment.php

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	2	-	-	-
CO2	2	-	-	-	-	-	2	-	-	-	2	-	-	-
CO3	2	-	-	-	-	-	2	-	-	-	2	-	-	-
CO4	2	-	-	-	-	-	2	-	-	-	2	-	-	-
CO5	2	-	-	-	-	-	2	-	-	-	2	-	-	-

High-3; Medium-2; Low-1

Course Code:19CECN3501	Course Title: SOIL MECHANICS LABORATORY		
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- attain adequate knowledge in assessing both index and engineering properties of soils, through hands on experience.

List of Experiment

1. Determination of Water content and Specific Gravity of Soil Solids.
2. Determination of Grain Size distribution using Sieve Analysis and Hydrometer Analysis.
3. Determination of Liquid Limit, Plastic Limit and Shrinkage Limit using Casagrande Apparatus.
4. Determination of Field Density by Sand replacement method and core cutter method.
5. Determination of Moisture-density relationship using Standard Proctor compaction Test.
6. Determination of Relative density of Cohesion less soil.
7. Determination of soil permeability by Constant head and falling head methods.
8. Determination of Coefficient of Consolidation using One Dimensional Consolidation Test.
9. Determination of Shear strength using Direct Shear Test in Cohesion less soil.
10. Determination of Shear strength parameters by Unconfined compression test in cohesive soil.
11. Determination of Shear strength using Laboratory vane shear test in cohesive soil.
12. Determination of Shear strength and stiffness parameters of soil using Tri-axial compression test in cohesion-less soil (Demonstration only).
13. Determination of Soil strength by CBR test for roads and pavements.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Determine the properties of soil as per the IS codal provisions.	Apply
CO.2 Determine the index properties of for various types of soils.	Apply
CO.3 Determine the Insitu density and compaction characteristics of soils for pavement design.	Apply
CO.4 Determine the seepage characteristics of soils.	Apply
CO.5 Determine the shear strength parameters of soils.	Apply

Reference Book(s):

R 1. Soil Mechanics Laboratory Manual, Department of Civil Engineering, MCET,

R 2. Soil Mechanics Laboratory Manual, Braja M. Das, 8th Edition, Oxford University

R 3. Soil Mechanics Laboratory Manual, Michael E Kalinski, 2nd Edition.

R 4. I.S Code of Practice (2720) Relevant parts.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	2	-	-	-	3	3	-	-	3	-	-
CO2	3	-	-	2	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	2	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	2	-	-	-	-	3	-	-	-	-	-
CO5	3	-	-	2	-	-	-	-	3	-	-	-	-	-

High-3; Medium-2; Low-1

Course Code:19CECN3502		Course Title: ENVIRONMENTAL ENGINEERING LABORATORY	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- learn how the common environmental experiments relating to water and wastewater quality are performed.

List of Experiments

1. Determination of pH and Electrical Conductivity
2. Determination of Dissolved solids, Suspended Solids, Volatile Solids (VS), and Turbidity
3. Determination of Sulphates
4. Determination of Chlorides
5. Determination of Dissolved Oxygen
6. Determination of Chemical Oxygen Demand
7. Determination of Acidity
8. Determination of Alkalinity
9. Determination of Total Hardness
10. Determination of Available chlorine in Bleaching powder
11. Determination of Residual Chlorine, Chloride and Fluoride
12. Determination of Optimum amount of Coagulant
13. Determination of Biological Oxygen Demand (Demonstration)

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Determine physical and chemical characteristics of water.	Apply
CO.2 Determine physical and chemical characteristics of wastewater.	Apply
CO.3 Determine the optimum dosage of coagulant.	Apply
CO.4 Determine break-point chlorination.	Apply
CO.5 Determine the biological oxygen demand.	Apply

Reference Book(s):

R 1. Environmental engineering Laboratory manual of Civil Engineering Department, MCET, Pollachi.

R 2. Csuros Maria, Environmental sampling and analysis for technicians, Lab Manual, 1st edition, CRC Press, 1997.

Web References:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/index.html
2. https://vlab.amrita.edu/?sub=2&brch=193&sim=1548&cnt=6

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	3	-	-	2	-	-
CO2	3	-	-	3	-	-	-	-	3	-	-	2	-	-
CO3	3	-	-	3	-	-	-	-	3	-	-	2	-	-
CO4	3	-	-	3	-	-	-	-	3	-	-	2	-	-
CO5	3	-	-	3	-	-	-	-	3	-	-	2	-	-

High-3; Medium-2; Low-1

Course Code: 19PSHG6501	**Course Title: EMPLOYABILITY SKILLS 1: TEAMNESS AND INTERPERSONAL SKILLS** (Common to all B.E/B.Tech Programmes)		
Course Category: Humanities		**Course Level: Practice**	
L: T:P (Hours/Week): 0: 0: 2	**Credit :1**	**Total Contact Hours: 30**	**Total Marks: 100**

Pre-requisites:

- **NIL**

Course objectives:

The course is intended to

1. Enrich effective communicative attributes as part of the skills and Facilitate presentation and public speaking skills.
2. Handle negativities and explore the true self.
3. Inculcate interpersonal skills and to groom as a professional.
4. Educate the importance of Nonverbal skill set to attain perfection
5. Build teamness and its ethics to facilitate corporate working

UNIT I: EFFECTIVE COMMUNICATION & PRESENTATION SKILLS 6 Hours

Barriers of Communication -Fear Of English -Handling Social Factors - Handling Psychological Factors -Handling Practical Problems -Do's & Don'ts - Effective Presentation - Presentation - Importance of Presentation Slide orientation - Introduction in a presentation - Styles of a slide - Slide Templates- Font ,color, Background -Graph Diagrammatic representation - Delivery of presentation - Body Language &Gestures - Verbal Attributes - Communication -Handling stammers and breaks - Handling fear of stage - Maintaining Confidence - Content delivery methods- Do's and Don'ts in a presentation- Tips to handle it-Effective Conclusion

UNIT II: POSITIVE ATTTITUDE &HANDLING REJECTIONS 6 Hours

A,B,C's Of Attitude -Influencing Factors -Individual Factors -Character Comparison - Strategies to Handle ourselves-Benefits of Positive Attitude - Do's& Don'ts - Handling Rejections - Identifying Negativities -Nuances of handling it -Necessary changes -To do List -Creating One's self -Self Qualifiers

UNIT III - INTERPERSONAL SKILLS 6 hours

Life skills -Core IP Skills -Importance of IP Skills -Tips to improve IP Skills-Necessity of IP Skills

UNIT IV - BODY LANGUAGE, DRESSING & GROOMING 6 Hours

Unconscious Physical moments - Metrics of Body Language - Good Posture -Head Motion -Facial Expression - Eye contact -Gestures -Dressing -Grooming & Outlook - Necessity of good Body Language

UNIT V - TEAM ETHICS 6 Hours

Team Ethics-Necessity of Team Work- Teams Everywhere - Benefits of team culture - Reason for team failure -Conflicts -Handling Conflicts -Being a team player -Work difference from college

COURSE OUTCOMES:

Course Outcomes	Cognitive Level
CO.1 Demonstrate effective communicative attributes as part of their skills and facilitate presentation & public speaking skills	Apply
CO.2 Identify and explore the true self and handle negatives.	Apply
CO.3 Develop interpersonal skills and to groom as a professional.	Apply
CO.4 Explain the importance of Nonverbal skill set to attain perfection.	Understand
CO.5 Build teamness and its ethics to facilitate corporate working.	Apply

Textbook(s):

T 1. John C Maxwell, " The 17 Indisputable Laws of Teamwork: Embrace Them and Empower Your Team", Harper Collins Leadership Publishers, 2013

Reference Books

R 1. Patrick Lencioni, " The Five Dysfunctions of a Team: A Leadership Fable" Jossey Bass Publishers, 2006

R 2. Malcolm Gladwell, "Talking to Strangers: What We Should Know about the People We Don’t Know" Penguin Publishers, 2019

R 3. Harvey Segler, " Body Language: Discovering & Understanding the Psychological secrets behind reading & Benefiting from Body Language” Kindle Edition, 2016

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	-	-	2	-	-	1	-	-
CO3	-	-	-	-	-	-	-	-	2	-	1	1	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	1	-	-
CO5	-	-	-	-	-	-	-	2	1	-	-	1	-	-

High -3, Medium - 2, Low-1

VI SEMESTER

Course Code: 19CECN1601	Course Title: FOUNDATION ENGINEERING		
Course Category: Professional Core		Course Level: Practice	
L: T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Geology and Soil Mechanics

Course Objectives

The course is intended to:

- Gain knowledge on Site investigation methods for selection of suitable foundation.
- Gain Knowledge on Bearing capacity of soil and design of footings.
- Gain Knowledge on Load carrying capacity and settlement of pile foundation.
- Gain Knowledge on Earth pressure in retaining walls.
- Gain Knowledge on Stability of slopes.

UNIT I - SUBSURFACE EXPLORATION AND SITE INVESTIGATION 9 + 3 Hours

Objectives - Methods of exploration - Boring - Depth of boring - Spacing of bore hole - In-situ penetration tests - SPT - SCPT - Geophysical methods- Electrical Resistivity Method- Seismic Refraction Method- Soil Sampling techniques -Sample Disturbance - Rock sampling- RQD- Core Recovery Ratio-Bore log.

UNIT II - SHALLOW FOUNDATION 9 + 3 Hours

Types of Shallow Foundation – function – requirements - Location and depth of foundation – bearing capacity of Soils – factors affecting bearing capacity - Terzaghi and IS bearing capacity theories - Plate load test and its limitations- Allowable bearing pressure - Contact Pressure – proportioning of footings - design of footings (Rectangular, combined and strap footing)- Settlement and types.

UNIT III - DEEP FOUNDATION 9 + 3 Hours

Types of piles and their function - Factors influencing the selection of pile - Estimating Load Carrying capacity of piles by Static formula and Dynamic formulae - Pile load test - Negative skin friction - Use of Under reamed piles in Expansive Soils-Group capacity - Pile group efficiency by Feld's rule, Converse Labarra formula - Group Capacity- Settlement of pile groups.

UNIT IV - LATERAL EARTH PRESSURE AND RETAINING WALLS 9 + 3 Hours

Earth Pressure at rest - Active and Passive states - Rankine's theory for cohesionless and cohesive soil - Coloumb's wedge theory- Determination of Earth Pressure by Analytical methods - Culmann's Graphical method- Types of retaining walls - Design principles of Gravity and Cantilever retaining walls.

UNIT V - STABILITY OF SLOPES **9 + 3 Hours**

Types of Slope Failure - Different factors of Safety- Stability analysis of Infinite and Finite Slopes- Swedish Circle Method - φ=0 analysis and c= 0 analysis - Friction circle Method - Taylor's stability number- Stability Charts- Slope Protection measures.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the various site investigation methods for the selection of foundation.	Understand
CO.2 Calculate the bearing capacity of soil.	Apply
CO.3 Determine the load carrying capacity of pile foundation and efficiency of pile group.	Apply
CO4. Calculate earth pressure for different backfill conditions.	Apply
CO.5 Calculate the stability number for various soil types.	Apply

Textbook(s):

T 1. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New

T 2. Venkatramaiah. C, "Geotechnical Engineering", New Age International (P) Ltd. Publishers, New Delhi, 2019.

T 3. Dr. Arora. K.R, "Soil Mechanics and Foundation Engineering (Geotechnical Engineering)", Standard Publishers Distributors, Nai Sarak, New Delhi, 2019.

Reference Book(s):

R 3. Varghese P.C., "Foundation Engineering", PHI Learning Private Limited, New Delhi,2012.

R 4. Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers, New Delhi, 2020.

R 5. Dr. B.C Punmia, Er. Ashok K Jain, Dr. Arun K Jain., "Soil Mechanics and Foundations", Laxmi Publications, 17th Edition, 2018.

IS Code Book:

1. IS: 2720- Part 1 to Part 40

Web References:

1. http://nptel.ac.in/courses/105103097/
2. http://home.iitk.ac.in/~pkbd/A%20preview%20of%20soil%20Behaviour.pdf
3. https://www.aboutcivil.org/soil-mechanics-html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	-

High-3; Medium-2; Low-1

Course Code: 19CECN1602		Course Title: DESIGN OF STEEL STRUCTURES	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Mechanics of Solids

Course Objectives

The course is intended to:

- Gain knowledge on design of steel structure connections.
- Gain knowledge on design of tension member.
- Gain knowledge on design of Compression member.
- Gain knowledge on design of Flexure member.
- Gain knowledge on design of Roof trusses.

UNIT I - INTRODUCTION **9+3 Hours**

Steel structures- types - Properties of steel - Design philosophies - Analysis and Design Methods - Structural steel sections - Types of connections - Design of bolted and welded connections - Axial and Eccentric connections

UNIT II - TENSION MEMBERS **9+3 Hours**

Classification of Tension members - Net area - Net effective sections - Concept of shear lag - Design strength of simple and compound members - Use of lug angles - Design of tension splices.

UNIT III - COMPRESSION MEMBERS **9+3 Hours**

Classification of Compression members - Effective length of compression members - Slenderness ratio - Design strength of simple and compound members - Design of laced and battened columns - Design of column bases and column splicing.

UNIT IV - FLEXURAL MEMBERS **9+3 Hours**

Effective span of beams - Design strength in bending - Laterally supported and unsupported beams - Intermediate and bearing stiffeners- Flange web splices - Effective length for lateral torsional buckling - Web crippling and buckling.

UNIT V -ROOF TRUSSES **9+3 Hours**

Components of industrial structures - load specifications-calculation of dead, live and wind loads - Types of roof trusses - Design of purlins - need for bracings-design of bracings- Introduction to gantry girder.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Calculate the forces acting on bolted and welded connections to ensure efficiency of joints as per codal provisions.	Apply
CO.2 Design of tension members for various steel structures as per IS codal provisions.	Apply
CO.3 Design of steel columns and column bases as per IS standards.	Apply
CO.4 Design of laterally supported and unsupported beams under different loading conditions as per IS codal provisions.	Apply
CO.5 Design purlins as per IS standards and explain the design principles of gantry girder.	Apply

Textbook(s):

T1. N. Subramanian, Design of Steel Structures, Oxford University Press 2015.

T2. S.S.Bhavakatti, Design of Steel Structures, IK publications, New Delhi, Third Edition 2017.

Reference Book(s):

R 1. S. K. Duggal, Limit State Design of Steel Structures, Tata, Mc Graw Hill Education Pvt Ltd, New Delhi, 2014.

R 2. Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain, “Design of Steel Structures”, Vol. I and II, Arihant Publications, Mumbai, 2015.

R 3. Dayaratnam P., “Design of Steel Structures”, A.H. Wheeler & Co. Ltd., Allahabad, 2012.

IS Code Book

1. IS 800 - 2007, General Construction in Steel - Code of Practice, BIS, New Delhi
2. IS 875 (part 3) - 2015, Wind loads on Buildings and Structures, BIS, New Delhi
3. IS 808: 1989 - Steel Tables

Web References:

1. http://www.steel-insdag.org/TM_Contents.asp

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	3	-	-	-	2	2	3
CO2	3	2	-	-	-	-	-	3	-	-	-	2	2	3
CO3	3	2	-	-	-	-	-	3	-	-	-	2	2	3
CO4	3	2	-	-	-	-	-	3	-	-	-	2	2	3
CO5	3	2	-	-	-	-	-	3	-	-	-	2	2	3

High-3; Medium-2; Low-1

Course Code: 19CECN3601	Course Title: BUILDING DRAWING LABORATORY		
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Drawing for Civil Engineers
- Design of RC Structures

Course Objectives

The course is intended to:

- provide an understanding of plotting reinforcement details of various building components as well as other structures.

List of Experiments

1. Explain the requirements of a building along with minimum dimension as per NBC, requirement
2. Draft the section for foundation for load bearing structure
3. Draft the section for foundation and column of framed structure
4. Draft the Cross Section and Longitudinal Section of RCC roof slab (one way), and beam
5. Draft the Cross Section and Longitudinal Section of RCC roof slab (two way), and beam
6. Preparation of Cross Section and Longitudinal Section for Beam - column joints
7. Draft the Plan, Section, and elevation of dog legged staircase,
8. Draft the Plan, Section, and elevation of bifurcated staircase,
9. Draft the Plan, Section, and elevation of septic tank,
10. Draft the Plan, Section, and elevation Rainwater Harvesting Structure.
11. Prepare a scheme layout of a residential building section (G+1) for a load bearing Structure
12. Prepare a scheme layout of a residential building section (G+1) for a framed structure.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Draw the reinforcement details of basic components of buildings as per IS codal provisions.	Apply
CO.2 Draw the reinforcement details of staircases as per IS codal provisions.	Apply
CO.3 Design the septic tank and plot the plan, section and elevation.	Apply
CO.4 Draw the plan, section and elevation of a residential building (G+1) for load bearing and framed structures.	Apply

Reference Book(s):

R 1. Computer Aided Building Drawing Manual, Department of Civil Engineering, MCET, Pollachi

R 2. Civil Engineering Drawing and House Planning, B. P. Verma, Khanna Publishers, New Delhi, 2010.

R 3. Illustrated Design of Reinforced Concrete Buildings, V. L. Shah and S. R. Karve, Assorted Editorial; 8th edition, 2017.

R 4. IS 456-2000 (Reaffirmed 2016), Plain and Reinforced Concrete code of practice (Fourth Revision), Bureau of Indian Standards.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	3	3	-	-	-	-	3
CO2	3	-	-	-	-	-	-	3	3	-	-	-	-	3
CO3	3	-	-	-	-	-	-	-	3	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	3	-	-	-	-	3

High-3; Medium-2; Low-1

Course Code: 19CECN3602		Course Title: COMPUTER AIDED DESIGN AND DRAFTING LABORATORY	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Design of RC structures

Course Objectives

The course is intended to:

- Provide students with a solid background on the computer aided design and drafting of building elements.
- Acquire the knowledge of designing components of buildings, retaining walls, water tanks and steel structures using software.

List of Exercises

1. Design simply supported, cantilever and continuous beams
2. Design short and long columns
3. Design isolated and combined footing
4. Design retaining walls
5. Design underground and elevated water tanks
6. Design two storey RC space frame
7. Design steel beams for flexure
8. Design steel roof truss
9. Design gantry girder
10. Design bridge deck slab

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO.1	Design and illustrate the reinforcement detailing of various structural elements such as beams, columns, footing as well as the framed structures by a software.	Apply
CO.2	Design and draw the structural detailing of RCC water tanks using a software	Apply
CO.3	Design and demonstrate the structural detailing of RCC Retaining wall by a software	Apply
CO.4	Design and draw the structural drawing of steel beams and trusses by a software	Apply
CO.5	Design and detail the sectional view of bridge deck slab and gantry grider using a software	Apply

Reference Book(s):

R 1. Computer Aided Design and Drafting Laboratory manual of Civil Engineering Department, MCET, Pollachi.

R 2. S. Unnikrishna Pillai and Devdas Menon, Reinforced concrete design, Tata Mc-Graw Hill Publication., 2019

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	3	-	-	3	3	2	-	3	2	3
CO2	3	2	-	-	3	-	-	3	3	2	-	3	2	3
CO3	3	2	-	-	3	-	-	3	3	2	-	3	2	3
CO4	3	2	-	-	3	-	-	3	3	2	-	3	2	3
CO5	3	2	-	-	3	-	-	3	3	2	-	3	2	3

High-3; Medium-2;Low-1

Course Code: 19PSHG6601	Course Title: EMPLOYABILITY SKILLS 2: CAMPUS TO CORPORATE		
Course Category: Humanities	Course Level: Introductory		
L: T:P (Hours/Week): 0:0:2	Credit :1	Total Contact Hours: 30	Total Marks: 100

Pre-requisites:

- **NIL**

Course objectives:

The course is intended to:

1. Understand emotions and necessity to handle it to evolve as an effective social animal
2. Build effective resumes to project the positives to be employable
3. Facilitate working in a collaborative work environment and to engage in healthy agreements for building person's professional facet
4. Formulate the growth attribute to outperform, initiate and grow in professional arena
5. Explain time management and impart leadership skills.

UNIT I: EMOTIONAL INTELLIGENCE 6 Hours

Nature of Emotions - Importance of EI - EQ vs IQ - Behavioral difference between EQ & IQ - Acquiring Emotional Intelligence - Benefits of high EI - Steps to develop EI - Role of EI in Interviews

UNIT II: RESUME PREPARATION 6 Hours

Importance of Resume - Good Resume - Planning Resume -Organizing Resume -Spell check - Benefits of good resume - Resume Writing

UNIT III: GROUP DISCUSSION 6 Hours

Purpose of GD -Prerequisites of GD - Benefits of GD-Features of GD-Do's & Don'ts in GD-Accept Criticism & Feedback - Accepting Suggestions - GD Phrases - Effective Introduction& Conclusion - Preferred Etiquette of GD.

UNIT IV: INTERVIEW ETIQUETTE(NETIQUETTE) 6 Hours

Definition of Interview - Types of Interview - Prior interview - Know the Company -Employer's perspective in interview - Non-Verbal etiquette - Dressing - Verbal Communication in Interview - Facing Rejection in Interview - Do's & Don'ts in an Interview - Common Interview Questions - Handling Stress Questions - Handling Telephonic Interviews.

UNIT V: LEADERSHIP SKILLS& TIME MANAGEMENT **6 Hours**

Leadership - Leadership Traits - Leadership styles - Types of Leaders - Qualities of a leader -Developing Perspectives

Time Management - Necessity of Time Management - Types of time -Estimation of time - Process of Time management - Efficient utilization of Time - Time wasting culprits - Tips to manage time - Goal setting in Time Management

Course Outcomes	**Cognitive Level**
CO.1 Understand the emotions and necessity to handle them	Understand
CO.2 Build effective resumes to project the positives to be employable	Apply
CO.3 Facilitate collaborative work environment and to engage in healthy agreements for building person's professional facet	Understand
CO.4 Formulate the growth attribute to outperform, initiate and grow in professional arena	Apply
CO.5 Explain time management and impart leadership skills	Understand

Textbook(s):

T 1. Thea Kelley, "Get That Job! The Quick and Complete Guide to a Winning Interview " Plover crest Press, 2017

Reference Books

R 1. Daniel Goleman, " Emotional Intelligence Reader's Guide", BANTAM PUBLISHERS, 1997

R 2. Daniel Goleman, Richard Boyatzis & Annie McKee, " Primal Leadership: Unleashing the Power of Emotional Intelligence" Harvard Business Review Press; Anniversary edition, 2013

R 3. Stephen R Covey, " The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change" Simon & Schuster; Anniversary edition, 2013

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	-	1	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	1	-	-
CO3	-	-	-	-	-	-	-	-	1	1	-	1	-	-
CO4	-	-	-	-	-	-	-	-	1	-	-	1	-	-
CO5	-	-	-	-	-	-	-	1	-	-	1	1	-	-

High -3, Medium - 2, Low-1

Course Code: 19CEPN6601		Course Title: INNOVATIVE AND CREATIVE PROJECT	
Course Category: Project		Course Level: Practice	
L:T:P (Hours/Week) 0:0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to

- Gain knowledge on problem identification and to formulate the methodology to arrive a suitable solution.
- Enhance students' skills pertaining to scientific and technical report writing and presentation.

The student should carry out the literature survey, identification of the problem, development of the methodology and execution of their project in the civil engineering discipline. The project work can be allotted to either an individual student or a group of students comprising of not more than three. The progress of the project is evaluated based on a minimum of three reviews by the project review committee. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Analyze and compile information from various resources relevant to the specific area of project to be undertaken and relate with societal and global issues.	Analyse
CO.2 Analyze regional, national and international scenarios and compose the problem statements and the objectives of the project towards a sustainable development.	Analyse
CO.3 Formulate project methodology integrating clear fundamentals, theories and standards governing the project as well as project planning.	Analyse
CO.4 Apply relevant engineering principles and theories to design, built, operate, simulate and analyze the development of a system or concept.	Apply
CO.5 Plan and manage time effectively as a team or individually.	Apply
CO.6 Organize and present technical and scientific findings effectively through written and oral mode with the aid of multimedia tools and appropriate code of ethics.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	3	-	3	3	-	3	3	3
CO2	3	3	2	-	3	-	3	-	3	3	-	3	3	3
CO3	3	3	2	-	3	-	3	-	3	3	-	3	3	3
CO4	3	3	2	-	3	2	3	-	3	3	-	3	3	3
CO5	3	2	-	-	3	-	3	-	3	3	3	3	3	3
CO6	3	3	3	3	3		3	3	3	3	-	3	3	3

High -3, Medium - 2, Low-1

VII SEMESTER

Course Code: 19CECN1701		Course Title: WATER RESOURCES AND IRRIGATION ENGINEERING	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 4: 0: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Hydraulics Engineering

Course Objectives

The course is intended to:

- Understand the fundamentals of water resources engineering.
- Know about the principles of irrigation.
- Comprehend the methods of irrigation water management.
- Familiarize with the concepts of canal head works and cross drainage works.
- Facilitate the understanding of storage reservoirs.

UNIT I - WATER RESOURCES ENGINEERING AND MANAGEMENT 12 Hours

Water resources survey - Water resources of India and Tamil Nadu - Description of water resources planning - Economics of water resources planning, physical and socio-economic data - National Water Policy - Interlinking of rivers – Consumptive and non-consumptive use of water- Conjunctive use of surface and groundwater.

UNIT II – PRINCIPLES OF IRRIGATION 12 Hours

Irrigation – Need, mode and Influence of irrigation – Crop and crop seasons – Consumptive use of water – Duty - Factors affecting duty - Relationship between Duty, Delta, Base period - Irrigation efficiencies - Irrigation scheduling – Planning and Development of irrigation projects.

UNIT III – METHODS OF IRRIGATION 12 Hours

Tubewell irrigation - Lift irrigation – Flooding methods – Irrigation methods - Surface and Sub-Surface - Micro Irrigation – Drip and Sprinkler Irrigation - Merits and demerits

UNIT IV – CANAL IRRIGATION **12 Hours**

Classification of canals - Alignment of canals - Silt theories - Water logging - Canal losses - Weirs - Canal Head works - Canal regulators - Canal drops – Trapezoidal and Siphon well drop - Cross drainage works - Lining and maintenance of canals.

UNIT V – RESERVOIR PLANNING AND MANAGEMENT **12 Hours**

Reservoirs & dams - Single and multipurpose - Multi objective - Factors to be considered in selection of site for a dam - Fixation of storage capacity - Strategies for reservoir operation - Sedimentation of reservoirs - Design flood and its estimation - Flood control & mitigation methods - Levees and flood walls - Channel improvement - Flood warning.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the fundamentals of water resources planning and the national water policy.	Understand
CO.2 Describe the importance of irrigation, its scheduling and estimation of their efficiencies.	Understand
CO.3 Explain the methods of irrigation adopted in the field.	Understand
CO.4 Elucidate the various aspects of canal irrigation including canal head works and cross drainage works.	Understand
CO.5 Estimate the storage capacity of reservoirs and describe the strategies for flood control measures.	Apply

Text Book(s):

T1. Asawa. G.L, “Irrigation and water resources engineering”, New Age International Publishers.1st Edition, reprint 2012.

T2. Singh, G., “Irrigation engineering”, Standard Book House, 2018.

T3. Sharma, S.K., “Irrigation engineering and hydraulic structures”, S. Chand Publishers, New Delhi, 2017.

Reference Book(s):

R.1 Basak, N.N, “Irrigation Engineering”, Tata McGraw-Hill Publishing Co, Edition:2011-2012

R.2 Garg, S.K., “Irrigation Engineering”, Khanna Publishers, 2006

R.3 H.M., Ragunath, “Irrigation Engineering”, Wiley India Pvt Ltd., 2011

Web References:

1. http://nptel.ac.in/downloads/105105110/
2. http://www.civilenggforall.com/2015/09/irrigation-and-water-resources-engineering-gl-asawa-free-download-pdf-civilenggforall.html
3. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-731-water-resource-systems-fall-2006/lecture-notes/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	3	2	-

High-3; Medium-2; Low-1

Course Code: 19CECN1702		Course Title: CONSTRUCTION PROJECT MANAGEMENT	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 4: 0: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre–requisites

- Nil

Course Objectives

The course is intended to:

- Understand the concepts of project formulation in construction projects.
- Know the different stages of construction planning.
- Learn the different scheduling procedures and techniques required for project planning in construction projects.
- Study different cost control measures to be adopted in construction projects.
- Understand the purpose of resource levelling in construction projects.

UNIT I – CONSTRUCTION PROJECT FORMULATION **12 Hours**

Construction participants – Roles and responsibilities of client, construction management consultants, architect – Engineering associates and contractors – Different types of construction projects – Project life cycle – Phases in project life cycle – Pre – feasibility report and clearance – Techno economic feasibility report – Detailed project report

UNIT II – CONSTRUCTION PLANNING **12 Hours**

Basic concepts in the development of construction plans – Choice of technology and construction method – Importance of planning in construction project – Different periods of planning – Pretender data collection – Charts for labour, staff, material and plant requirements – BOQ and cost estimates – Types of contract – Contract procedures – Contract agreement – Principal clauses and conditions.

UNIT III – SCHEDULING PROCEDURES AND TECHNIQUES **12 Hours**

Construction schedules – CPM – Activities, their duration and interdependence – Construction of network diagram – forward and backward pass – critical path – float – PERT – three-time aspects and their identification based on statistical data and Beta distribution – Probability of achieving desired time targets for projects.

UNIT IV – CONSTRUCTION PROJECT CONTROL **12 Hours**

Inventory control – Types and tools – EOQ model – Direct cost and indirect cost and their relation to project duration – Time cost trade off – Quality and safety concerns in construction – Total quality control – Quality control by statistical methods – Sampling by attributes and variables.

UNIT V – RESOURCE ALLOCATION **12 Hours**

Resource aggregation diagrams as per early start and late start – smoothing by activity start time manipulation – Levelling of resources according to constraints – priorities of activities – sort rules – Minimum project duration subject to resource constraint.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the phases of project life cycle with the roles and responsibilities of construction participants.	Understand
CO.2 Explain the basic concepts of construction planning and explain the different types of contracts.	Understand
CO.3 Calculate the project duration using different network techniques.	Apply
CO.4 Determine the minimum project duration using time cost trade off technique.	Apply
CO.5 Compute the resources with different constraints and illustrate the resource levelling in construction projects.	Apply

Text Book(s):

T1. Chitkara. K.K, “Construction Project Management: planning, Scheduling and control”, Tata McGraw Hill Publishing Company, New Delhi, 4th edition, 2019

T2. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pittsburgh, 2000.

Reference Book(s):

R1. Kumar Neeraj Jha, “Construction Project Management: Theory and Practice”, second edition, Pearson Education India, 2015

R2. B.C Punmia and K.K Khandelwal “Project Planning and Control with PERT and CPM”, Laxmi Publications Private Limited, 2016

R3. Srinath L S, “PERT/CPM Principles and Applications”, Affiliated East West Press (P) ltd, 2002.

Web References:

1. http://nptel.ac.in/courses/105103093/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	3	2	-	3
CO2	2	-	-	-	-	-	-	-	-	-	3	2	-	3
CO3	3	2	-	-	-	-	-	-	-	-	3	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	3	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	3	3	-	3

High–3; Medium–2; Low–1

Course Code: 19CECN3701		Course Title: QUANTITY SURVEYING AND ESTIMATION LABORATORY	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Pre–requisites

- Building Drawing Laboratory

Course Objectives

The course is intended to:

- Know the quantities and to learn how to calculate the cost abstract for the given load bearing structure.
- Learn to estimate the quantities and cost abstract for the given framed structure.
- Learn to estimate the quantities and cost abstract for irrigation and environmental structures.
- Know how to calculate the volume of earthwork and cost abstract for bituminous and concrete roads.
- know how to calculate the rent for different types of buildings.

List of Exercises

1. Introduction to building components with detailed drawing.
2. Determine the rate for Damp proof course, RCC and plain concrete for various mix proportions with reference to the current schedule of rate.
3. Estimation of quantities for the given simple load bearing structures and give the cost abstract statement.
4. Estimation of quantities for the given G+1 framed structures and give the cost abstract statement.
5. Estimation of quantities for the given simple industrial building and give the cost abstract statement.
6. Estimation of quantities for the given retaining wall and give the cost abstract statement.
7. Estimation of quantities for the given culvert and give the cost abstract statement.
8. Estimation of quantities for the given septic tank and soak pit and give the cost abstract statement.
9. Estimation of quantities for bituminous and cement concrete roads and give the cost abstract statement.
10. Estimate the quantities and calculate the rate for shuttering and form work for the given the building.
11. Determination of rent for different types of building.
12. Preparation of plan and costing using software for duplex residential building.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Estimate the quantities and cost abstract for the given load bearing structure.	Apply
CO.2 Estimate the quantities and cost abstract for the given framed structure.	Apply
CO.3 Estimate the quantities and cost abstract for irrigation and environmental structures.	Apply
CO.4 Estimate the volume of earthwork and cost abstract for bituminous and concrete roads.	Apply
CO.5 Calculate the rent for different types of buildings.	Apply

Reference Book(s):

R1. Quantity Surveying and Estimation Lab Manual, Department of Civil Engineering, MCET, Pollachi

R2. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 28th Edition, 2016.

R3. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S. Chand & Company Ltd, 2012.

R4. Chakraborti. M., "Estimating, Costing, Specification and Valuation in Civil Engineering", 24th edition 2012 (Reprint 2013).

R5. Schedule of Rate for the current year, Section I – Civil Engineering Section, Coimbatore Corporation.

R6. Schedule of Rate for the current year, Section II – Road Works, Coimbatore

R7. Methods of Measurement of Building and Civil Engineering works, Bureau of Indian Standards.

R8. IS 1200 (Part-1 to 28), Methods of Measurement of Building and Civil Engineering works, Bureau of Indian Standards.

Web References:

1. https://nptel.ac.in/courses/105/103/105103093/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO2	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO3	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO4	3	2	-	-	-	-	-	-	3	3	-	3	-	3
CO5	3	2	-	-	-	-	-	-	3	3	-	3	-	3

High–3; Medium–2; Low–1

VIII SEMESTER

Course Code: 19SHVG6001		Course Title: ENTREPRENEURSHIP DEVELOPMENT	
Course Category: Humanities		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0: 0	Credits:1	Total Contact Hours: 15	Max Marks:100

Course Objectives:

The course is intended to equip students with the entrepreneurial mindset, understand market, apply the process of problem solving, and Entrepreneurship ecosystem.

Entrepreneurship **15 Hours**

Entrepreneur- Types of Entrepreneurship-Problem identification-Opportunity Discovery Explore Market, customer persona-customer segmentation, TAM,SOM,SAM- creating compelling value proposition- competitor analysis. Prototying- Types -Business model canvass-Idea pitching. Entrepreneurial eco system- Startups-Angel Investors, Venture Capitalist, Makers Space, Incubators, Accelerators-Financial models- Equity, Debt, Crowd funding.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Pitch an Idea for a problem with understanding entrepreneurial ecosystem.	Apply

Text Book(s):

1. Robert D.Hisrich, Micheal P. Peters, Dean A. Shepherd, Sabayasachi (2020), Entrepreneurship,McGrawHill, 11th Edition.
2. Donald F Kuratko,Entrepreneurship: Theory, Process, Practice with MindTap, 11th Edition.

Web References:

1. https://wadhwanifoundation.org/our-programs/ignite/
2. https://academy.forge-iv.co/#academia

Assessment Plan:

Internal Component: Idea Pitching Presentation- 75 Marks

End Semester Assessment: 25 Multiple Choice Questions- 25 Marks

Course Code: 19SHVG6002		Course Title: தமிழர் மரபும் பண்பாடும்	
Course Category: Humanities		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0: 0	Credits:1	Total Contact Hours:15	Max Marks:100

Course Objectives

மாணவர்கள் இப்பாடத்தை கற்பதன் மூலம்:
இந்திய தேசிய இயக்கத்திற்கும் இந்திய கலாச்சாரத்திற்கும் தமிழர்களின் பங்களிப்பை அறிந்து கொள்ள இயலும்.

அலகு 1 - **தமிழ் மொழி மற்றும் இலக்கியம்** **5 Hours**

தமிழ் ஒரு செம்மொழி - சங்க இலக்கியங்கள் - திருக்குறள் - தமிழ்க் காப்பியங்கள் - தமிழகத்தில் சமண, பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம் - ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

அலகு **2 -** தமிழர் கலைகள் மற்றும் விளையாட்டுகள் **5 Hours**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - நாட்டுப்புறத் தெய்வங்கள் - குமரி முனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

அலகு **3 -** இந்தியாவின் பண்பாடு மற்றும் வளர்ச்சியில் தமிழர்களின் பங்கு **5 Hours**

சங்ககால நகரங்களும், துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி. இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 இந்திய தேசிய இயக்கத்திற்கும் இந்திய கலாச்சாரத்திற்கும் தமிழர்களின் பங்களிப்பை அறிந்து கொள் வார்கள்.	அறிதல் (Understand)

Text Book(s):

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
3. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
5. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

Course Code: 19CEPN6801		Course Title: PROJECT	
Course Category: Project		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 16	Credits:8	Total Contact Hours: 240	Max Marks:200

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Impart and improve the manual design capability of the student as well as using civil engineering software.

This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of an RC structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to either an individual student or a group of students comprising of not more than three. The students will be guided by internal and external supervisors (if any). The external supervisor will be appointed by head of the department after consultation with Industry-Institute interaction cell. The progress of the project is evaluated based on a minimum of three reviews by the project review committee. At the end of the semester after completing the work to the satisfaction of the supervisor and review committee, course the student should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Apply the principles of planning to plan different types of structures considering futuristic need of an area with reference to different codes	Apply
CO.2 Analyse the load and load transfer phenomena of the structure.	Analyse
CO.3 Analysis the different component of structure based on SFD and BMD	Analyse
CO.4 Design the elements of a building using software.	Apply
CO.5 Present the project report using multimedia tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	3	-	-	3	3	3	-	-	-	3
CO2	3	3	2	-	3	-	-	-	3	3	-	-	3	-
CO3	3	3	2	-	3	-	-	-	3	3	-	-	3	-
CO4	3	2	-	-	-	-	-	3	3	3	-	-	-	3
CO5	3	2	-	-	3	-	-	3	3	3	-	-	-	3

High–3; Medium–2; Low–1

STRUCTURAL ENGINEERING ELECTIVES

Course Code: 19CEEN1002	Course Title: ADVANCED CONCRETE STRUCTURES		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Design of RC Structures

Course Objectives

The course is intended to:

- Study the design concepts of Retaining walls for different backfill conditions.
- Study the design concepts of Flat-bottomed elevated square and circular water tanks along with staging.
- Study the design concepts of Solid slab bridge and box culvert.
- Study the design concepts of Portal frames by substitute frame method.
- Study the design concepts of Prestressed concrete.

UNIT I –DESIGN OF RETAINING WALLS **9 Hours**

Design of cantilever and counter fort retaining walls.

UNIT II – DESIGN OF ELEVATED WATER TANKS **9 Hours**

Types of elevated water tanks– Design of flat–bottomed elevated water tanks (square and circular)

UNIT III – DESIGN OF RCC BRIDGES **9 Hours**

Introduction, Classification of bridges – IRC Loadings – Effective width of load dispersion – Design of solid slab Bridge – Box culverts.

UNIT IV – DESIGN OF PORTAL FRAMES **9 Hours**

Portal frames – Analysis of portal frames – substitute frame method – cantilever method – portal method (concept only) – Design of single bay portal frame by substitute frame method.

UNIT V – INTRODUCTION TO PRESTRESSED CONCRETE ELEMENTS **9 Hours**

Introduction– Principles of prestressing–types and methods of prestressing–Need for high strength materials– Losses in prestress–long term and short–term deflection– anchorage zone

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Design the retaining walls for various backfill conditions as per IS codal provisions.	Apply
CO.2 Design the flat bottomed circular and square elevated water tanks with staging as per IS codal provisions.	Apply
CO.3 Design the solid slab bridge and box culverts as per IRC standards.	Apply
CO.4 Design a single bay portal frame.	Apply
CO.5 Explain the basic concepts in prestressing and calculate the losses and deflections in the prestressed concrete.	Apply

Text Book(s):

T1. Gambhir, M.L., "Reinforced Concrete Structures", PHI Learning Private Ltd., New Delhi, 2012.

T2. Unnikrishna Pillai S. and DevdasMenon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 3rd Edition, New Delhi, 2019.

T3. Krishna Raju N, "Prestressed Concrete", Tata McGraw Hill Company, 6th Edition, New Delhi, 2018.

Reference Book(s):

R.1 Punmia, B.C., Ashok. K. Jain and Arun. K. Jain, "Reinforced Concrete Structures" Vol. II, Laxmi Publications,5thEdition New Delhi, 2019.

R.2 Varghese, P. C., Limit State Design of Reinforced Concrete, 2nd Edition, PHI Learning Private Ltd., New Delhi, 2013.

R.3 Subramanian N, Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2014.

IS Code Books

1. IS 456:2000 Plain and Reinforced Concrete – Code of Practice.
2. SP 16:1980 Design Aids for Reinforced Concrete to IS 456:1978
3. IS 875(1–5):1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.
4. IRC 6 – 2014, Standard Specification and Code of practice for road bridges.
5. IRC 21 – 2000, standard specifications and Code of practice for Road bridges.
6. IRC 112 –2011, Code of Practice for Concrete Road Bridges.
7. IS 3370(Part 1–4): 1965 Code of Practice for Concrete Structures for the Storage of Liquids.
8. IS 1343–2012 Code of Practice for Prestressed Concrete.

Web References:

1. https://nptel.ac.in/courses/105/105/105105104/
2. http://www.ce.memphis.edu/4135/PDF/Notes/Chapter1–0%20.pdf
3. https://nptel.ac.in/courses/105/105/105105165/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	2	3	-

High–3; Medium–2;Low–1

Course Code: 19CEEN1008	Course Title: MAINTENANCE AND REHABILITATION OF STRUCTURES		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Construction Materials and Practices
- Concrete Technology

Course Objectives

The course is intended to:

- Understand the different types of maintenance and repair strategies.
- Understand the characterization of concrete under different environments.
- Know the different repair materials and repair techniques.
- Learn the various parameters for rehabilitation and retrofitting of structures.
- Understand the various demolition methods and its preventive measures adopted in buildings.

UNIT I – MAINTENANCE AND REPAIR STRATEGIES **9 Hours**

Maintenance – repair and rehabilitation, facets of maintenance, importance of maintenance – Various aspects of inspection – Assessment procedure for evaluating a damaged structure – Causes of deterioration.

UNIT II – QUALITY CONTROL **9 Hours**

Quality assurance for concrete construction – Concrete properties – strength, permeability, thermal properties and cracking – Effects due to climate, temperature, chemicals, corrosion – Design and construction errors – Effects of cover thickness and cracking.

Unit III – REPAIR MATERIALS AND TECHNIQUES **9 Hours**

Special concretes and mortar – Concrete chemicals, Special elements for accelerated strength gain – Expansive cement – Polymer concrete – Sulphur infiltrated concrete – Ferro cement – Fibre reinforced concrete – Rust eliminators and polymers coating for rebars – Foamed concrete – Mortar and dry pack – Vacuum concrete – Gunite and shotcrete – Epoxy injection – Mortar repair for cracks.

UNIT IV – REHABILITATION AND RETROFITTING OF STRUCTURES **9 Hours**

Strengthening of super structures, sub structures – Increasing the load carrying capacity of footing – Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure – Shoring and underpinning – Methods of corrosion protection – Corrosion inhibitors – Corrosion resistant steels – Coatings and cathodic protection.

UNIT V – DEMOLITION TECHNIQUES **9 Hours**

Introduction – planning, precautions and protective measures in demolition works –Sequences of operations – Demolition of structural elements – Engineered demolition techniques for dilapidated structures – Case studies.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the different types of maintenance and various aspects of inspection.	Understand
CO.2 Explain the serviceable and durable characterization of concrete under thermal and corrosive environment.	Understand
CO.3 Describe the properties of various repair materials and its method of application in building.	Understand
CO.4 Elucidate the various aspects in strengthening of buildings and the various corrosion protection methods adopted in building.	Understand
CO.5 Describe the planning and precautionary measures during demolition works and the sequence involved in demolition of building.	Understand

Textbook(s):

T 1. Dr.R.P.Rethaliya, “Maintenance and Rehabilitation of Structures”, Atul Prakashan publications, 2019

T 2. Dayarathnam. P and Rao. R,“Maintanence and Durability of Concrete Structures”, University Press,India 2015

Reference Book(s):

R 1. Gambhir. M.L, “Concrete Technology”, Tata Mc–Graw Hill Company, New Delhi, 2013.

R 2. Gupta B.L. and Amit Gupta, “Maintenance and Repair of Civil Structures”, Standard Publishers Distributors, 2009

R 3. CPWD and Indian Building Concepts, Hand Book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.

Web References:

1. http://fmcet.in/CIVIL/CE2071_uw.pdf
2. https://theconstructor.org/concrete/repair–rehabilitation–concrete–structure–failure–
3. https://nptel.ac.in/courses/105/106/105106202/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1011	Course Title: PREFABRICATED STRUCTURES		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Design of RC Structures

Course Objectives

The course is intended to:

- Know the Importance of prefabrication
- Learn the Components of prefabricated structures
- Know the design principles of prefabrication
- Learn Joints in structural members
- Design of prefabricated structure for abnormal loads

UNIT I – INTRODUCTION TO PREFABRICATION **9 Hours**

Prefabrication– Need of prefabrication – Comparison with monolithic construction – Advantages and Disadvantages – Methods of prefabrication – Types of precast systems – Materials – Modular coordination – Standardization– Systems – Production – Transportation – Erection.

UNIT II – PREFABRICATED COMPONENTS **9 Hours**

Planning for components of prefabrication structures– Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs, Wall panels – Columns – Shear walls– Provisions for non–structural fastenings

UNIT III – DESIGN PRINCIPLES **9 Hours**

Disuniting of structures – Design of cross section with the efficiency of material used – Problems in design due to joint flexibility – Allowance for joint deformation.

UNIT IV –JOINTS IN STRUCTURAL MEMBERS **9 Hours**

Joints for different structural connections – Dimensions and detailing – Design of expansion joints–Jointing Materials.

UNIT V – DESIGN FOR ABNORMAL LOADS **9 Hours**

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., – Importance of avoidance of progressive collapse.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Describe the principles of prefabrication as well as production and erection techniques.	Understand
CO.2 Explain the behaviour and construction methods of prefabricated structural components.	Understand
CO.3 Illustrate the design principles for prefabricated sections based on efficiency of members used.	Understand
CO.4 Classify joints for different structural connections in prefabricated system.	Understand
CO.5 Illustrate the importance of avoidance of progressive collapse using Indian codal provisions for prefabricated concrete.	Understand

Text book(s):

T1. K.M. Elliott, “Precast concrete structures”, CRC Press, Second edition, 2019.

T2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.

T3. L. Mokk, “Prefabricated Concrete for Industrial and Public Structures”, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.

T4. Gorostiza C.Z., Hendrikson C. and Rehak D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 2012.

Reference Book(s):

R 1. Building Materials and Components, CBRI, India, 1990.

R 2. Koncz T., Manual of Precast Concrete Construction, Vols. I, II and III, Bauverlag, GMBH, 1976.

R 3. Glover C.W, “Structural Precast Concrete”, Asia Publishing House, 1965

R 4. M. Levitt, “Precast Concrete Material, Manufacture, Properties and Usage” CRC Press, Second Edition, 2019.

R 5. Structural Design Manual, “Precast Concrete Connection Details”, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 2009.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1012	Course Title: PRESTRESSED CONCRETE STRUCTURES		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Design of RC Structures

Course Objectives

The course is intended to:

- Understand the concept of pre-stressing.
- Understand the design of pre-stress members for flexure and shear.
- Understand the deflection and design of anchorage zones.
- Understand the design of tension and compression member.
- Understand the design of composite members.

UNIT I – Introduction **9 Hours**

Principles of Pre–stressing – Classification and types – Advantages over reinforced concrete – Materials– high strength concrete and high tensile steel – Methods of Pre–stressing – Freyssinet, Magnel Blaton, Lee Mc Call and Killick anchorage systems – Analysis of sections for stresses by stress concept, strength concept and load balancing concept – Losses of pre–stress

UNIT II – Design for Flexure and Shear **9 Hours**

Basic assumptions – Permissible stresses in steel and concrete – Design of sections of Type I and Type II post tensioned and pre tensioned beams – Check for strength – Layout of cables in post–tensioned beams – Location of wires in pre–tensioned beams – Design for shear

UNIT III – Deflection and Design of Anchorage Zone **9 Hours**

Factors influencing deflections – Short term deflections of uncracked members – Prediction of long–term deflections due to creep and shrinkage – Check for serviceability limit state of deflection– Determination of anchorage zone stresses in post – tensioned beams by Magnel's method, Guyon's method and I.S code – Design of anchorage zone reinforcement

UNIT IV – Design of Tension and Compression Members **9 Hours**

Design of tension members –pre–stressed trusses– application in the design of pre–stressed pipes and pre–stressed concrete cylindrical water tanks – Design of compression members with and without flexure –its application in the design piles and flag masts.

UNIT V – Design of Composite Members **9 Hours**

Composite beams – design, longitudinal shear transfer, ultimate strength – applications – Partial pre–stressing – advantages and applications.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the concepts of pre-stressing in concrete structures, identify the materials for pre-stressing and estimate losses of pre-stressing	Apply
CO.2 Design pre-tensioned and post tensioned girders for flexure and shear.	Apply
CO.3 Calculate the short term and long-term deflections of pre-stressed members and design the anchorage zone for post-tensioned members.	Apply
CO.4 Design pre-stressed pipes and water tanks.	Apply
CO.5 Design the composite beams.	Apply

Text Book(s):

T 1. Krishna Raju N., "Prestressed concrete", 6th Edition, Tata McGraw Hill Company, New Delhi, 2018

T 2. Pandit. G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.

Reference Book(s):

R 1. Dayaratnam. P., "Prestressed Concrete Structures", Oxford and IBH, 2013.

R 2. Karuna Moy Ghosh, “Prestressed Concrete: Analysis and Design Practice Of Members”, PHI Learning Pvt. Ltd.,2014.

R 3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2013.

IS Code Book

1. IS 1343 – 2012: Code of practice for Pre–stressed concrete
2. IS 784 – 2001: Code of practice for Pre–stressed concrete pipes
3. IS 3370 – 1999: Code of practice for concrete structures for the storage of liquids

Web References:

1. http://www.nptel.ac.in/courses/105106118/
2. http://www.nptel.ac.in/courses/105106118/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	2	3	-

High–3; Medium–2; Low–1

Course Code: 19CEEN1019		Course Title: SEISMIC DESIGN OF STRUCTURES	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Solid Mechanics
- Geology and Soil Mechanics

Course Objectives

The course is intended to:

- Study the Theory of vibration and single degree of freedom.
- Study the Multiple degree of freedom.
- Study the Elements of seismology
- Know the Design principles of seismic design
- Study about the Retrofitting of buildings

UNIT I – THEORY OF VIBRATIONS **9 Hours**

Difference between static loading and dynamic loading – Degree of freedom – Single degree of freedom system – Formulation of Equations of motion for single degree of freedom (SDOF) system –Newtons Second Law – D'Alemberts principles – Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic and periodic forces.

UNIT II – MULTIPLE DEGREE OF FREEDOM SYSTEM **9 Hours**

Two degree of freedom system –Modes of vibrations –Formulation of equations of motion for multi –degree of freedom (MDOF) system – Eigen values and Eigen vectors– Response to free and forced vibrations – Damped and undamped MDOF system –Modal superposition methods.

UNIT III – ELEMENTS OF SEISMOLOGY **9 Hours**

Elements of engineering seismology – Causes of earthquakes – Seismic waves – Magnitude – Intensity and Energy release – Indian seismology – Earthquake history – Catastrophes – Failures – Liquefaction–Lessons learnt from past earthquakes – Seismic zone map of India – Estimation of Earthquake Parameters, Microzonation – Strong ground motion characteristics

UNIT IV –SEISMIC DESIGN OF BUILDINGS **9 Hours**

Introduction to methods of seismic analysis – Equivalent static analysis – IS code provisions – Design horizontal seismic coefficient – Design base shear distribution – Seismic resistant design of – Ductile detailing of reinforcements in RC buildings – Behavior masonry structures – Behaviour of tall building under seismic and wind conditions.

UNIT V –REPAIRS AND RETROFITTING **9 Hours**

Code of practices for repairs and retrofitting – Retrofitting of RC buildings and structural elements –Techniques of retrofitting – Improving structural integrity of masonry buildings – Tuned Mass Dampers –Retrofitting by seismic isolation – Case studies

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Determine the factors governing equation of motion for single degree of freedom systems.	Apply
CO.2 Determine the two degree and multi degree of freedom and develop equations for MDOF system.	Apply
CO.3 Illustrate the elements of seismology to explain the ground motion characteristics.	Understand
CO.4 Explain the effects of earthquake on different types of structures.	Understand
CO.5 Explain the various techniques for retrofitting of structures.	Understand

Textbook(s):

T 1. Pankaj Agarwal and Manish Shrikhande, Earthquake resistant design of structures, Prentice–Hall India Pvt. Ltd., 2012

T 2. Duggal S.K, “Earthquake resistant design of structures”, Oxford University Press, NewDelhi, 2015.

T 3. Damodarasamy S.R, and Kavitha S, “Basics of Structural Dynamics and Aseismic Design”, PHI Learning Pvt. Ltd, New Delhi. 2009

Reference Book(s):

R 1. George G Penelis and Andreas J Kappos –“Earthquake Resistant Concrete Structures”

R 2. Chopra Anil.K., “Dynamics of Structures – Theory and Applications to Earthquake Engineering”, 5th Edition, Pearson Education, 2017.

R 3. Park, R & Paulay, "Design of Reinforced Concrete Structure Elements", John Wiley & sons, 2009

IS Code Book

1. IS 1893 – 2002, Criteria for Earthquake Resistant Design of Structures
2. IS 4326 – 1993, Earthquake Resistant Design and Construction of Buildings – Code of Practice
3. IS 13920 – 1993, Ductile Detailing of Reinforced Concrete Structures to Seismic Forces –Code of Practice
4. IS 13935 – 1993, Repair and Seismic Strengthening of Buildings – Guidelines

Web References:

1. https://nptel.ac.in/courses/105102016/
2. https://nptel.ac.in/courses/105101004/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	3	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High–3; Medium–2; Low–1

Course Code: 19CEEN1020	Course Title: SMART MATERIALS AND STRUCTURES		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Study the various types of smart materials used in engineering applications.
- Acquire the fundamental knowledge of sensors and its application.
- Learn the basic aspects, types and application of measuring techniques
- Study basics of actuators and its application in engineering
- Know the importance of data acquisition and signal processing.

Unit I – PROPERTIES OF MATERIALS **9 Hours**

Introduction to Smart Materials and Structures –Piezoelectric Materials, Properties – Shape memory alloy, constitutive modelling, application – Vibration Control – Embedded actuators.

Unit II – SENSING TECHNOLOGY **9 Hours**

Type of sensors – Physical measurement – Piezo Electric Strain – Transducers – Fiber Optic Techniques– Chemical and bio–Chemical sensing in Structural Assessment – Spectroscopes – Fiber Optic Chemical Sensing Systems – Distributed measurement.

Unit III – MEASURING TECHNIQUES **9 Hours**

Measuring Techniques – Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells –Temperature Compensation – Strain Rosettes.

Unit IV – ACTUATOR TECHNIQUES **9 Hours**

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electro strictive Material – Magneto structure Material – Shape Memory Alloys – Electro rheological Fluids– Electromagnetic actuation – Role of actuators and Actuator Materials.

Unit V – SIGNAL PROCESSING AND CONTROL SYSTEMS **9 Hours**

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non–Linear.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the properties and applications of piezoelectric materials, vibration control and embedded actuators.	Understand
CO.2 Illustrate the sensing techniques for structural assessment.	Understand
CO.3 Explain the measuring techniques for health monitoring of structures.	Understand
CO.4 Illustrate the principles of actuator for various applications in construction industry.	Understand
CO.5 Explain the basic concepts of signal processing and control system for civil engineering applications.	Understand

Textbook(s):

T1. Srinivasan, A. V. and Michael McFarland, D., "Smart Structures: Analysis and Design" Cambridge University Press, 2009.

T2. Michelle Addington and Daniel L. Schodek, "Smart Materials and Technologies: For the Architecture and Design Professions", Routledge 2004.

Reference Book(s):

R.1 Mel.M Schwartz, Encyclopedia of Smart Materials, John Wiley and Sons, inc 2002.

R.2 A. J. Moulson and J. M. Herbert, Electro ceramics: Materials, Properties, Application, 2nd Edition John Wiley& Sons, Chichester, West Susses, New York, 2003

Web References:

1. https://nptel.ac.in/courses/112/104/112104251/
2. https://nptel.ac.in/courses/112/104/112104173/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1024		Course Title: EXPERIMENTAL TECHNIQUES	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- To impart knowledge on basic concepts of measurements and related instruments.
- To offer theoretical knowledge and hands on training in the usage of strain gauge, load cell, LVDT and data acquisition systems.
- To learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.
- To impart students' knowledge on working principle of non-destructive testing techniques and its usage in real time conditions. Explain the procedure for investigation by model analysis.
- To expose students the theory and principles involved in model analysis.

Unit I –FORCE AND STRAIN MEASUREMENTS 9 Hours

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long term monitoring – vibrating wire sensors– Fibre optic sensors.

Unit II –VIBRATION MEASUREMENTS 8 Hours

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – wind tunnels – Flow meters – Venturimeter – Digital data Acquisition systems.

Unit III –DISTRESS MEASUREMENTS AND CONTROL 10 Hours

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete – Half cell, construction and use – damage assessment – controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring.

Unit IV –NON DESTRUCTIVE TESTING METHODS 9 Hours

Load testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating, Advanced NDT methods – Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR , Ground penetrating radar (GPR).

Unit V – MODEL ANALYSIS **9 Hours**

Model Laws – Laws of similitude – Model materials – Necessity for Model analysis – Advantages – Applications – Types of similitude – Scale effect in models – Indirect model study – Direct model study - Limitations of models – investigations – structural problems – Usage of influence lines in model studies

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1 Usage of strain gauge, load cell, LVDT and data acquisition systems.	Understand
CO2 Analyze the structure by non-destructive testing methods and model analysis.	Understand
CO3 Calculate the distress measurement using load cell, sensitive dial gauges and LVDT for different application areas.	Apply
CO4 Determine load-deflection and load-strain behaviour using data acquisition systems.	Apply
CO5 Describe the importance of model analysis in predicting structural behaviour of large scale structures.	Understand

Text Book(s):

T1. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 2015.

T2. Rangan C S et al., 'Instrumentation – Devices and Systems', Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 2017

Reference Book(s):

R1. U.C. Jindal, Experimental Stress Analysis, Pearson Publication, Noida, 2012.

R2. Ravisankar.K.and Chellappan.A., "Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures", SERC, Chennai, 2007.

R3. Gandhi.M.V and Thompson.B.S, "Smart Materials and Structures", Chapman and Hall, NewYork, 1992.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_me02/preview
2. https://nptel.ac.in/courses/112106198/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	-

High-3; Medium-2;Low-1

ENVIRONMENTAL ENGINEERING ELECTIVES

Course Code: 19CEEN1003		Course Title: AIR POLLUTION MANAGEMENT	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Understand the sources and effects of air pollution
- Understand the Dispersion of Pollutants
- Understand the Air pollution control
- Understand the Air quality management
- Understand the Noise pollution

UNIT I – SOURCES AND EFFECTS OF AIR POLLUTANTS **9 Hours**

Sources and classification of air pollution – Effects of air pollution on human beings, materials, vegetation, animals – Global warming– Ozone layer depletion, Sampling and Analysis – Basic principles of sampling – Source and ambient sampling – Stack sampling

UNIT II – DISPERSION OFPOLLUTANTS **9 Hours**

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Inversion, Introduction to air quality modeling.

UNIT III – AIR POLLUTION CONTROL **9 Hours**

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – gaseous pollutant control by adsorption, absorption, condensation, combustion – Biofiltration (Only theory and working of equipments only)

UNIT IV – AIR QUALITY MANAGEMENT **9 Hours**

Air quality standards – Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement– National Ambient Air quality standards – Air quality management in India

UNIT V – NOISE POLLUTION **9 Hours**

Sources of noise pollution – Effects – Assessment– Standards – Control methods (at the source and transmission) – Prevention– Protection of exposed people

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Classify and identify the sources of air pollutants and predict the effects of air pollutant on human health and environment.	Understand
CO.2 Explain and relate the significance of various air pollution dispersion models.	Understand
CO.3 Explain the methods available for controlling of air pollution from point, line and area sources.	Understand
CO.4 Elucidate the air quality and relate with air pollution regulation.	Understand
CO.5 Explain sources, effects and control of noise pollution.	Understand

Text Book(s):

T1. Anjaneyulu, Y., Air Pollution: Prevention and Control Technologies, B.S. Publications, 2nd edition, 2020.

T2. Rao, C.S. Environmental Pollution Control Engineering, New Age International publishers, Third Edition, 2018.

T3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata McGraw Hill, New Delhi, 2017.

T4. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi, 2019.

Reference Book(s):

R 1. Heumann, W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 1997.

R 2. Mahajan, S.P., "Pollution Control in Process Industries", Tata Mc–Graw Hill Publishing Company, New Delhi, 2017.

R 3. Peavy, S.W., Rowe, D.R. and Tchobanoglous, G. "Environmental Engineering", Tata Mc-Graw Hill, New Delhi, 2017.

Web References:

1. https://metnet.imd.gov.in/imdetp/lecture_notes/course11/LN_11_61_Air%20Pollution%20Measurment.pdf
2. https://web.iitd.ac.in/~arunku/files/CVL212_Y18/Airpollutioneffects.pdf

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1007		Course Title: INDUSTRIAL WASTE MANAGEMENT	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Environmental Engineering

Course Objectives

The course is intended to:

- Learn Industrial pollution prevention.
- Learn Industrial wastewater treatment.
- Learn Zero liquid discharge concepts.
- Learn Sludge and hazardous waste management.
- Learn Wastewater treatment process of selected industries.

UNIT I – INDUSTRIAL POLLUTION PREVENTION **9 Hours**

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters– Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay back period.

UNIT II – INDUSTRIAL WASTEWATER TREATMENT **9 Hours**

Physico–Chemical Treatment Processes – Equalisation, Neutralisation, Oil Seperation, Flotation – Precipitation, Aerobic and Anaerobic Biological Treatment Processes – Sequencing batch reactors, membrane bioreactors, Advanced oxidation and Tertiary Treatment processes for removal of dissolved organics and inorganics– Ozonation, photocatalysis, Evaporation and membrane Technologies

UNIT III – ZERO LIQUID DISCHARGE **9 Hours**

Individual and Common Effluent Treatment Plants – Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse – Industrial reuse, Disposal on water and land.

UNIT IV – SLUDGE AND HAZARDOUS WASTE MANAGEMENT **9 Hours**

Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills – Hazardous waste management.

UNIT V – CASE STUDIES **9 Hours**

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries– Textiles– Pulp and Paper – Metal finishing – Sugar and Distilleries.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the significance of industrial pollution prevention in today life.	Understand
CO.2 Explain the industrial wastewater treatment processes such as physical, chemical and biological treatment for effective removal of pollutants.	Understand
CO.3 Illustrate the concept of zero effluent discharge and quality requirements for disposal of effluent on land and water bodies.	Understand
CO.4 Explain the concepts of sludge and hazardous waste management techniques.	Understand
CO.5 Illustrate the wastewater treatment process of selected industries through.	Understand

Textbook(s):

T 1. S.C. Bhatia, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi,2003.

T 2. Mahajan, S.P. Pollution Control in Process Industries, Tata McGraw Hill Publishing Co., New Delhi, 2017.

Reference Book(s):

R 1. Eckenfelder, W.W., „Industrial Water Pollution Control" , Mc–Graw Hill,2000.

R 2. Frank Woodard, „ Industrial waste treatment Handbook" , Butterworth Heinemann, NewDelhi,2005.

R 3. Wang L.K., Yung–Tse Hung, Howard H.Lo and Constantine Yapijakis, „Handbook of Industrial and Hazardous Wastes Treatment" , Marcel Dekker, Inc., USA, 2004.

Web References:

1. http://nptel.ac.in/courses/105106119/36

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1009	Course Title: MUNICIPAL SOLID WASTE MANAGEMENT		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Environmental Engineering

Course Objectives

The course is intended to:

- Learn the Sources and characteristics of municipal solid wastes.
- Learn on-site storage and processing of municipal solid waste.
- Learn about the collection and transfer of MSW.
- Learn the offsite processing of MSW.
- Learn the disposal methods of MSW.

UNIT I – SOURCES AND CHARACTERISTICS **9 Hours**

Sources and types of municipal solid wastes–waste generation rates–factors affecting generation, characteristics–methods of sampling and characterization; Effects of improper disposal of solid wastes–Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – l solid waste (M&H) rules – integrated solid waste management–Public awareness; Role of NGO" s– Public Private participation

Unit II – ON-SITE STORAGE AND PROCESSING **9 Hours**

On–site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and environmental aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling of plastic waste –Construction and Demolishing waste

Unit III – COLLECTION AND TRANSFER **9 Hours**

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems– solving.

Unit IV – OFF–SITE PROCESSING **9 Hours**

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and bio-methanation; Thermal processing options – case studies under Indian conditions.

Unit V – DISPOSAL **9 Hours**

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas– Landfill bioreactor – Dumpsite capping –Biomining.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the sources, types and composition of solid wastes as well as elements of integrated solid waste management plan.	Understand
CO.2 Illustrate the on-site storage and processing of municipal solid waste for Indian conditions.	Understand
CO.3 Explain the appropriate method for solid waste collection, and transportation of waste and solve simple problems in transfer of solid wastes.	Understand
CO.4 Illustrate the off-site processing of municipal solid waste for waste recovery under Indian conditions.	Understand
CO.5 Explain the appropriate methods for municipal solid waste disposal.	Understand

Textbook(s):

T 1. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018

T 2. Rao M.N, Razia Sultana, Sri Harsha Kota, solid and hazardous waste management – Science and Engineering, Butterworth–Heinemann, 2016

Reference Book(s):

R 1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, “Integrated Solid Waste Management, Mc–Graw Hill India, First edition, 2015.

R 2. CPHEEO, “Manual on Municipal Solid waste management,Vol I, II and III, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2016.

R 3. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, Solid Waste Engineering – A Global Perspective, 3rd Edition, Cengage Learning, 2017.

R 4. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc–Graw Hill International edition, New York,2010.

R 5. John Pitchtel,Waste Management Practices, CRC Press,Taylor and Francis Group,2014.

R 6. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010

Web References:

1. https://nptel.ac.in/courses/120/108/120108005/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1025	Course Title: ENVIRONMENTAL IMPACT AND RISK ASSESSMENT		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.
- To provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting and managing human health risks.

Unit I – INTRODCUTION **9 Hours**

Impacts of Development on Environment –Sustainable Development and Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types EIA in project cycle –EIA Notification and Legal Framework in India– Selection & Registration Criteria for EIA Consultants Stakeholders and their Role in EIA.

Unit II - ENVIRONMENTAL ASSESSMENT **9 Hours**

Screening and Scoping in EIA – Drafting of Terms of Reference -Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis of alternatives.

Unit III - SOCIAL IMPACT ASSESSMENT AND EIA DOCUMENTATION **9 Hours**

Social impact assessment – Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition Documentation of EIA findings – planning – organization of information and visual display materials.

Unit IV - ENVIRONMENTAL MANAGEMENT PLAN **9 Hours**

EIA Report preparation. Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and

monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment- Case Studies.

Unit V - ENVIRONMENTAL RISK ASSESSMENT AND MANAGEMENT 9 Hours

Environmental risk assessment framework-Hazard identification -Dose Response Evaluation – Exposure Assessment – Exposure Factors, Tools for Environmental Risk Assessment– HAZOP and FEMA methods – Event tree and fault tree analysis – Multimedia and multipath way exposure modeling of contaminant- Risk Characterization Risk communication – Emergency Preparedness Plans –Design of risk management programs.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the concepts of EIA and types if EIA for various assessment process.	Understand
CO.2 Explain the EIA methods to identify the impacts of Ecosystems	Understand
CO.3 Explain the EIA methods to identify the social impacts	Understand
CO.4 Explain the concept of Environmental impact management plan	Understand
CO.5 Apply the various tools for identifying Environmental risk assessment and management.	Understand

Text Book(s):

T1. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996

T2. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999, Bimal Kanti Paul 2011.

T3. Raghavan K. V. and Khan A A, Methodologies in Hazard Identification and Risk Assessment, Manual by CLRI, 1990.

Reference Book(s):

R.1 Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey. 2003

R.2 World Bank –Source book on EIA

R.3 Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York, 1996.

R.4 Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	2	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1026	Course Title: CLIMATIC CHANGE AND ADAPTION		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

Unit I - EARTH'S CLIMATE SYSTEM **9 Hours**

Global, Regional and Local climates, Ocean Circulation, weather parameters - Role of ozone in environment - ozone layer - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Green House Gases and Global Warming – Carbon Cycle.

Unit II - IMPACTS OF CLIMATE CHANGE **9 Hours**

Impacts of Climate Change on various sectors – Agriculture, Forestry, and ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

Unit III - OBSERVED CHANGES AND ITS CAUSES **9 Hours**

Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India.

Unit IV - CLIMATE CHANGE AND MITIGATION MEASURES **9 Hours**

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices – Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

Unit V - NATIONAL ACTION PLAN ON CLIMATE CHANGE

9 Hours

National and State Action Plan on Climate Change, Significance on Sustainable development of Natural resources – National Water Mission, Sustainable Agriculture Mission, Green India Mission, Coastal Conservation.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the Earth's climate system	Understand
CO.2 Explain the impact of climatic change on different types of ecosystems	Understand
CO.3 Explain the protocol related to climate change and its causes	Understand
CO.4 Explain the mitigation measures to be adopted during climate change	Understand
CO.5 Explain the national action plan on climate change	Understand

Text Book(s):

T1. Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.

T2. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 'Climate Change and Water'. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.

T3. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Book(s):

R1. IPCC fourth assessment report - The AR4 synthesis report, 2007

R2. IPCC fourth assessment report –Working Group I Report, "The physical Science Basis", 2007

R3. IPCC fourth assessment report - Working Group II Report, "Impacts, Adaptation and Vulnerability", 2007

R4. IPCC fourth assessment report – Working Group III Report" Mitigation of Climate Change", 2007

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	2	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1027	Course Title: DISASTER MITIGATION AND MANAGEMENT		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster Management
- To acquaint with the skills for planning and organizing disaster response

Unit I - INTRODUCTION **9 Hours**

Introduction to Disaster - Definition: Disaster, Hazard, Vulnerability, Resilience, Risks –Types of disasters – Earthquake, Landslide, Flood, Drought, Fire, Volcanic eruption, Tsunami, Avalanches and Pest infestation. Impacts including social, economic, political, environmental, health, psychosocial.

Unit II - CONSEQUENCES AND CONTROL OF DISASTERS **9 Hours**

Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

Unit III - DISASTER MANAGEMENT CYCLE AND FRAMEWORK **9 Hours**

Disaster Management: Capability-Vulnerability- risk- preparedness and mitigation- Disaster management cycle; Disaster Risk Reduction and Resilience; Disaster Management Act and Policy.

Unit IV - DISASTER MANAGEMENT IN INDIA **9 Hours**

Disaster Profile of India, Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

Unit V - DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES **9 Hours**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the types of disasters and its various impacts	Understand
CO.2 Explain the consequences and control measures for various types of disasters	Understand
CO.3 Explain the cycle of disaster management and its framework	Understand
CO.4 Describe the various disasters profile in India and explain the policies on disasters management	Understand
CO.5 Explain the applications of disasters management with case studies.	Understand

Text Book(s):

T1. Damon P. Coppola, “Introduction to International Disaster management”, Elsevier publication, 2015

T2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012.

T3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011.

Reference Book(s):

R.1 Brassard, Caroline, Giles, David W., Howitt, Arnold M., “Natural Disaster Management in the Asia-Pacific”, Policy and Governance.

R.2 Jack Pinkowski, “Disaster Management Handbook”, CRC Press , January 22, 2008.

R.3 Disaster Management Guidelines, GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	2	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1028	Course Title: SUSTAINABLE ENGINEERING AND TECHNOLOGY		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- impart knowledge about the concepts of sustainable engineering and its various impacts on environment, construction and resources.

Unit I - INTRODUCTION TO SUSTAINABILITY **9 Hours**

Sustainability - Introduction, Need and concept of sustainability, Social environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM).

Unit II - SUSTAINABLE ENGINEERING CONCEPTS **9 Hours**

Key concepts – Factor 4 and Factor 10. Goals of sustainability, System Thinking, Life Cycle Thinking and Circular Economy.

Unit III - GLOBAL ENVIRONMENTAL ISSUES **9 Hours**

Air Pollution, Effects of Air Pollution; Water pollution- sources, Sustainable wastewater treatment, Solid waste - sources, impacts of solid waste, Zero waste concept, 3 R concept. Global environmental issues- Resource degradation, Climate change, Global warming, Ozone layer depletion, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon footprint.

Unit IV - SUSTAINABLE HABITAT **9 Hours**

Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainable cities, Sustainable transport.

Unit V - SUSTAINABLE ENERGY SOURCES **9 Hours**

Basic concepts-Conventional and non- conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the various concepts of sustainability.	Understand
CO.2 Explain the goals of sustainability and the concept of circular economy	Understand
CO.3 Explain the sources of pollution and various environmental issues globally.	Understand
CO.4 Explain the basic concepts of sustainable habitat.	Understand
CO.5 Explain the basic concepts of conventional and non-conventional energy sources.	Understand

Text Book(s):

T1. Allen, D. T. and Shonnard, D. R., "Sustainability Engineering: Concepts, Design and Case Studies", Prentice Hall, 2011.

T2. Twidell, J. W. and Weir, A. D.,"Renewable Energy Resources", Taylor & Francis Ltd, 2015.

Reference Book(s):

R.1 Bradley. A.S; Adebayo,A.O., Maria, P. "Engineering applications in sustainable design and development", Cengage learning, 2015.

R.2 ECBC Code 2007, "Bureau of Energy Efficiency", New Delhi Bureau of Energy Efficiency Publications

R.3 Ni bin Chang, "Systems Analysis for Sustainable Engineering: Theory and Applications", McGraw-Hill Professional, 2010.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	2	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	2	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1006	Course Title: GROUND IMPROVEMENT TECHNIQUES		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Geology and Soil Mechanics
- Foundation Engineering

Course Objectives

The course is intended to:

- Know the various problematic soils and understand the suitable techniques for ground improvement.
- Understand the dewatering techniques.
- Learn the methods of In-situ treatment of cohesionless and cohesive soil.
- Understand the concepts of earth reinforcement.
- Study the grouting techniques and stabilization in ground improvement.

UNIT I – PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES **9 Hours**

Different types of problematic soils – Role of ground improvement in foundation engineering– Methods of ground improvement– Geotechnical problems in alluvial, laterite and black cotton soils.
Selection of suitable ground improvement techniques based on soil condition.

UNIT II – DEWATERING **9 Hours**

Necessity of Dewatering – sumps and interceptor ditches – single and multi–stage well points – deep well – vacuum well points – Electro osmosis– Drains – criteria for choice for filler material around drains.

UNIT III – INSITU TREATEMENT OF COHESIONLESS AND COHESIVE SOILS **9 Hours**

Insitu densification of Cohesion–less soils– Dynamic compaction–vibrofloatation– Sand Compaction piles– Deep compaction.
Consolidation– Preloading with sand drains– fabric drains, stone columns– Lime piles – installation techniques– relative merits of above methods and their limitations.

UNIT IV – EARTH REINFORCEMENT AND GEOTEXTILES **9 Hours**

Concept of Earth reinforcement – Application of reinforced Earth– Geotextiles–Types– role of geotextiles for filtration, drainage, Separation and Construction Works – Soil nailing– Rock Anchoring– Micro–piles.

UNIT V – GROUTING TECHNIQUES **9 Hours**

Objectives of Grouting– Types of Grout– Grouting Equipment's and machinery–Injection Methods– Grout Monitoring–Stabilization with cement, lime and chemicals – Stabilization of Expansive Soils.

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO.1	Explain the characteristics of problematic soil and identify the suitable techniques for ground improvement.	Understand
CO.2	Explain various dewatering techniques for ground improvement.	Understand
CO.3	Explain the different methods of In-situ treatment of cohesionless and cohesive soil.	Understand
CO.4	Explain the concepts of earth reinforcement and identify suitable material for various applications.	Understand
CO.5	Explain the grouting techniques and select appropriate stabilization methods for expansive soils.	Understand

Text Book(s):

T 1. Purushothama Raj. P, Ground Improvement Techniques, Lakshmi Publications, 2nd Edition, 2016.

T 2. Koerner, R.M. Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill, 1994.

T 3. Nihar Ranjan Patra, Ground Improvement Techniques, Vikas Publishing House, First Edition, 2012.

T 4. Mittal.S, An Introduction to Ground Improvement Engineering, Medtech Publisher, First Edition, 2013.

Reference Book(s):

R 1. Moseley, M.P and Kirsch. K., Ground Improvement, Spon Press, Taylor and Francis Group, London, 2nd Edition, 2004.

R 2. Jones C.J.F.P. Earth Reinforcement and Soil Structure, Thomas Telford Publishing, 1996.

R 3. Winterkorn, H.F. and Fang, H.Y. Foundation Engineering Hand Book. Van Nostrand Reinhold, 1994.

R 4. Koerner, R.M., Designing with Geosynthetics (Sixth Edition), Xlibris Corporation, U.S.A, 2012.

IS Code Books:

1. IS Code 9759: 1981
2. IS Code 15284 (Part 1): 2003

Web References:

1. http://nptel.ac.in/courses/105103097/
2. http://home.iitk.ac.in/
3. https://nptel.ac.in/courses/111103021/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1029	Course Title: SUBSURFACE INVESTIGATION AND INSTRUMENTATION		
Course Category: Professional Elective		Course Level: Practice	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Soil Mechanics

Course Objective

The course is intended to the conduct and preparation of soil exploration report based on laboratory, field exploration and testing techniques.

UNIT I - EXPLORATION TECHNIQUES **9 Hours**

Scope and objectives - planning an exploration program - location – spacing – depth of borings – stabilization of bore holes– soil profile – bore logs – data presentation – soil investigation and exploration reports. Methods of boring and drilling - non-displacement and displacement methods, drilling in difficult subsoil conditions - limitations of various drilling techniques - geophysical exploration and interpretation – seismic refraction and electrical resistivity methods – Magnetic and Gravity Methods.

UNITII - SOIL SAMPLING **9 Hours**

Type of samples – sample disturbance - design features affecting sample disturbance - sampling techniques - types of samplers - shallow penetration samplers - advanced sampling techniques - offshore sampling - preservation and handling of samples.

UNIT III - IN-SITU TESTING **9 Hours**

Field tests – importance - penetration testing – standard penetration test – static cone penetration test – dynamic cone penetration test – plate load test – field vane shear test – pressure meter test – field permeability test - procedure, limitations, correction and data interpretation.

UNIT IV - INSTRUMENTATION **9 Hours**

Instrumentation in soil engineering – pore pressure – ground water table – strain gauges – resistance and induction type – load cells – earth pressure cells – settlement and heave gauges – piezometers and slope indications – inclinometer.

UNIT V - SPECIAL STRUCTURES **9 Hours**

Challenges in special structures – bridges, airport runway, tunnels, transmission towers, offshore structures, underground structures – Design considerations – process of monitoring the investigation and construction activities – Report preparation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the various methods of soil exploration techniques with different soil conditions.	Understand
CO.2 Explain the soil sampling techniques with different soil samplers based on soil conditions.	Understand
CO.3 Explain the in-situ testing methods with different soil conditions.	Understand
CO.4 Explain the methods instrumentation	Understand
CO.5 Explain the soil investigation and construction progress for special structures	Understand

Text Book(s):

T1. Alam Singh and Chowdhary, G.R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical Testing and Instrumentation, CBS Publishers and Distributors, New Delhi, 2006.

T2. Hunt, R.E., "Geotechnical Engineering Investigation Manual, McGraw Hill,1984.

T3. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, The McGraw-Hill companies, Inc., New York, 1995.

Reference Book(s):

R1. Hunt, R.E., "Geotechnical Engineering Investigation Manual, McGraw Hill,1984.

R2. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Hand Book, a Nostrand Reinhold 1994.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1030	Course Title: ENGINEERING BEHAVIOUR OF SOILS		
Course Category: Professional Elective		Course Level: Practice	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Geology

Course Objective

The course is intended to gain the knowledge of the basic mechanics which governs the physio chemical, engineering, swell and shrinkage behaviour of soil.

UNIT I - SOIL DEPOSITS AND CLAY MINERALS 9 Hours

Introduction – formation of soils – different soil deposits and their engineering properties – composition and structure of clay minerals – classification and identification – anion and cation exchange capacity of clays – specific surface area – bonding in clays.

UNITII - PHYSIO CHEMICAL BEHAVIOUR OF SOILS 9 Hours

Physio chemical behaviour of soils – diffused double layer theory – computation of double layer distance – dielectric constant – temperature on double layer – ion exchange – cation exchange capacity – cause, fixation and determination of cation exchange effect– exchangeable cations - types of soil water – water interactions - soil structure.

UNIT III - SWELLING AND SHRINKAGE BEHAVIOUR OF SOILS 9 Hours

Problems associated with swelling and shrinkage behaviour of soils – causes, consequences and mechanisms – factors influencing swell – shrink characteristics – swell potential – swell pressure – volume changes and engineering problems in the field - soil fabric and measurement – sensitivity, thixotrophy of soils – soil suction – identification of expansive clays.

UNIT IV - ENGINEERING PROPERTIES OF SOILS 9 Hours

Compressibility, shear strength and permeability behaviour of fine and coarse grained soils – mechanisms - factors influencing engineering properties – liquefaction potential – causes and consequences - soil suction – determination of suction potential – collapsible soil – its identification – effect on foundation.

UNIT V - CONDUCTION PHENOMENA OF SOIL BEHAVIOUR 9 Hours

Conduction in soils – hydraulic, electrical, chemical and thermal flows in soils – applications - coupled flows – Electro-kinetic process – thermo osmosis - electro osmosis – prediction of engineering behaviour of soils using index properties – empirical equations and their applicability.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Understand the various types of soil deposits and clay minerals.	Understand
CO.2 Examine the physio chemical behavior with different soil.	Understand
CO.3 Interpret the swell behavior with different soil.	Understand
CO.4 Compare the engineering properties with different soil.	Understand
CO.5 Describe the hydraulic, electrical, chemical and thermal flows in soils and its applications.	Understand

Text Book(s):

T 1. Mitchell, J. K., 1993. Fundamentals of soil Behaviour. Edition, John Wiley and sons, New York

T 2. Das, B.M., 1997. Advanced soil Mechanics. Taylor and Francis.

T 3. Gulhati, S. K. and Datta M. 2008. Geotechnical Engineering. Tata Mcgraw-Hill Company Ltd.

Reference Book(s):

R 1. Lambe, T.W. and Whitman, R.V., 1987. Soil Mechanics. John Wiley and Sons

R 2. Coduto, D. P. 2002. Geotechnical Engineering, Principles and Practices. Pearson Education International, New Jersey.

R 3. Yong, R.N. and Warkentin, B.P., Introduction to Soil Behaviour, Macmillan, Limited, London, 1979.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	-

High–3; Medium–2; Low–1

Course Code: 19CEEN1031	Course Title: SHALLOW FOUNDATIONS		
Course Category: Professional Elective		Course Level: Practice	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Soil Mechanics

Course Objective

The course is intended to

- understand the various aspects related to shallow foundations and its design in the field of Civil Engineering.

UNIT I - TYPES AND SELECTION OF FOUNDATIOS 9 Hours

Types of foundations – types of shallow foundation – design concept - general requirements - additional consideration - selection of type of foundation - hostile environment - structural integrity – economy, foundation drainage and water proofing.

UNITII - BEARING CAPACITY 9 Hours

Theories of bearing capacity – ultimate bearing capacity – factors affecting bearing capacity -evaluation of bearing capacity from in-situ tests – safe bearing capacity – bearing capacity of foundations in slope – effect of ground water table and eccentricity of foundations– codal provisions.

UNIT III - SETTLEMENT AND ALLOWABLE BEARING PRESSURE 9 Hours

Component of settlement - immediate, primary and secondary consolidation settlement-stress path method of settlement evaluation-layered soil - construction period correction - evaluation from in-situ tests – allowable settlement – allowable bearing pressure - codal provisions.

UNIT IV - DESIGN OF FOUNDATIONS 9 Hours

Analysis of foundation - isolated - strip - combined footings and mat foundations - conventional - elastic approach - soil structure interaction principles - application - numerical techniques - software applications

UNIT V - FOUNDATION FOR SPECIAL CONDITIONS 9 Hours

Structural design of shallow foundations – limit state method-codal provisions- special foundations - foundation design in relation to ground movements - foundation on compressible fills – foundation for tower-design of foundation for seismic forces - codal provisions.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Classify and Identify the suitable type of foundation based on soil condition.	Understand
CO.2 Estimate the safe bearing capacity from various methods.	Apply
CO.3 Calculate the settlement component for different soil conditions.	Apply
CO.4 Design the isolated, strip, combined and mat foundation.	Apply
CO.5 Design the foundation for special conditions.	Apply

Text Book(s):

T 1. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw Hill, New York, 1996.
T 2. Das, B.M., 'Principles of Foundation Engineering, Design and Construction", Fourth Edition, PWS Publishing, 1999
T 3. Donald P. Coduto, "Foundation Design Principles and Practices" - Prentice Hall, Inc., Englewood Cliffs, New Jersey, 2001.
T 4. Nainan P. Kurian, "Design of Foundation Systems, Principles and Practices, Narosa Publishing House, Third Edition, 2006.
T 5. Muni Budhu, "Soil Mechanics and Foundation, John Wiley and Sons, INC 2000.

Reference Book(s):

R 1. Poulos, H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980
R 2. Cernica, J.N. "Geotechnical Engineering Foundation Design", John Wiley and Sons, Inc. 1995.
R 3. Tomlinson, M.J. "Foundation engineering", ELBS, Longman Group, U.K. Ltd., England 1995.
R 4. Winterkorn, H.F. and Fang, Y.F., "Foundation Engineering Handbook", Van Nostrand Reinhold, 1994.
R 5. Day, R.W., "Geotechnical and Foundation Engineering, Design and Construction, McGraw Hill 1999.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	3	3	3	-	3	-	-
CO2	3	-	-	-	-	-	-	3	3	3	-	3	-	-
CO3	3	-	-	-	-	-	-	3	3	3	-	3	-	-
CO4	3	-	-	-	-	-	-	3	3	3	-	3	-	-
CO5	3	-	-	-	-	-	-	3	3	3	-	3	-	-

High–3; Medium–2; Low–1

Course Code: 19CEEN1032	Course Title: DEEP FOUNDATIONS		
Course Category: Professional Elective		Course Level: Practice	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Soil Mechanics

Course Objective

The course is intended to gain the knowledge in different types of deep foundations and to estimate the load carrying capacity on various soil conditions.

UNIT I - CLASSIFICATIONS AND LOAD CAPACITY PILES 9 Hours

Necessity of pile foundation – classification of piles – factors governing choice of type of pile – load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition. Allowable load of piles and pile groups – static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – wave equation application – interpretation of field test and pile load test results – settlement of piles and pile group - codal provisions.

UNITII - LATERAL AND UPLIFT LOAD EVALUATION OF PILES 9 Hours

Piles under lateral loads – broms method, elastic, p-y curve analyses – batter piles – response to moment – piles under uplift loads – under reamed piles – drilled shaft – lateral and pull out load tests – codal provision.

UNIT III - STRUCTURAL DESIGN OF PILE AND PILE GROUPS 9 Hours

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- reinforcement details of pile and pile caps – pile raft system – basic interactive analysis – pile subjected to vibration – codal provision.

UNIT IV – SHEET PILES 9 Hours

Sheet piles structures- cantilever sheet pile walls in granular and cohesive soils – anchored bulk head – free earth support method – fixed earth support method – lateral earth pressure on braced sheet piles.

UNIT V - WELL FOUNDATIONS 9 Hours

Well foundation - design and construction - bearing capacity, settlement and lateral resistance stability of well foundation - drilled shaft - construction procedures - design considerations - load carrying capacity and settlement analysis.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Calculate the pile capacity and settlement of piles and pile group.	Apply
CO.2 Calculate the lateral loads on pile foundations.	Apply
CO.3 Explain the design procedures for structural pile and pile cap.	Undersand
CO.4 Calculate the earth pressure on sheet piles.	Apply
CO.5 Explain the various components and forces acting on well foundation.	Understand

Text Book(s):

T 1. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw Hill, New York, 1996.

T 2. Das, B.M., 'Principles of Foundation Engineering, Design and Construction", Fourth Edition, PWS Publishing, 1999

T 3. Donald P. Coduto, "Foundation Design Principles and Practices" - Prentice Hall, Inc., Englewood Cliffs, New Jersey, 2001.

T 4. Nainan P. Kurian, "Design of Foundation Systems, Principles and Practices, Narosa Publishing House, Third Edition, 2006.

T 5. Muni Budhu, "Soil Mechanics and Foundation, John Wiley and Sons, INC 2000.

Reference Book(s):

R 1. Poulos, H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980

R 2. Cernica, J.N. "Geotechnical Engineering Foundation Design", John Wiley and Sons, Inc. 1995.

R 3. Tomlinson, M.J. "Foundation engineering", ELBS, Longman Group, U.K. Ltd., England 1995.

R 4. Winterkorn, H.F. and Fang, Y.F., "Foundation Engineering Handbook", Van Nostrand Reinhold, 1994.

R 5. Day, R.W., "Geotechnical and Foundation Engineering, Design and Construction, McGraw Hill 1999.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	3	-	-	-	3	3	-
CO2	3	2	-	-	-	-	-	3	-	-	-	3	3	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	2	-	-	-	-	-	3	-	-	-	3	3	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High–3; Medium–2; Low–1

Course Code: 19CEEN1033	Course Title: SOIL DYNAMICS AND MACHINE FOUNDATIONS		
Course Category: Professional Elective		Course Level: Practice	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Soil Mechanics
- Foundation Engineering

Course Objective

The course is intended to

- understand the theory of vibrations and behavior of soils under dynamic loads so that to design foundations for various types of machines.

UNIT I - THEORY OF VIBRATION **9 Hours**

Introduction – nature of dynamic loads – fundamentals of vibration - vibrations of single and multi degree freedom system – free vibrations of spring – mass systems – forced vibrations – resonance - viscous damping - Principles of vibration measuring instruments - effect of transient and pulsating loads.

UNITII - DYNAMIC SOIL PROPERTIES **9 Hours**

Dynamic stress-strain characteristics – principles of measuring dynamic properties – laboratory techniques – field tests – factors affecting dynamic properties - typical values - dynamic bearing capacity – dynamic earth pressure.

UNIT III - MACHINE FOUNDATIONS **9 Hours**

Types of Machines and Foundations – General requirements – Design approach for machine foundation - Vibration analysis – Elastic Half-Space theory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.

UNIT IV - DESIGN OF MACHINE FOUNDATIONS **9 Hours**

General requirements – evaluation of design parameters – analysis and design of block type and framed type machine foundations – modes of vibration of a rigid foundation – foundations for reciprocating machines, impact machines, two-cylinder vertical compressor, double-acting steam hammer – codal recommendations.

UNIT V - INFLUENCE OF VIBRATION AND REMEDIATION **9 Hours**

Mechanism of liquefaction – influencing factors- vibration isolation – types of isolation - active and passive isolation – methods of isolation – use of springs and damping materials – properties of isolating materials – vibration control of existing machine foundation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the importance of soil dynamics and the theory of vibrations.	Understand
CO.2 Explain the principles of measuring dynamic properties of soils and determine the properties.	Understand
CO.3 Explain machine foundations inducing soil dynamics and its importance in the design criteria.	Understand
CO.4 Explain the design procedure for various types of machine foundation.	Understand
CO.5 Explain the influence of vibration and its remediation.	Understand

Text Book(s):

T 1. Saran, S., 1999. Soil Dynamics and Machine Foundations. Galogotia Publications Pvt. Ltd, New Delhi.
T 2. Prakash, S and Puri, V.K., Foundations for Machines, McGraw Hill, 1987.McGraw Hill Book Company, New York.
T 3. Kameswara Rao, N.S.V., "Dynamics soil tests and applications", Wheeler Publishing, New Delhi, 2000

Reference Book(s):

R 1. Barken, D. D.,1962. Dynamics of bases and foundations. McGraw Hill, New York.

R 2. Krammer, S., 2003. Geotechnical Earthquake Engineering. Pearson Education Pvt. Ltd. New Delhi.

R 3. Moore, P.J., "Analysis & Design of Foundations for Vibrations", Oxford & IBH, 2006.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High–3; Medium–2; Low–1

Course Code: 19CEEN1034	Course Title: REINFORCED SOIL STRUCTURES		
Course Category: Professional Elective		Course Level: Practice	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Soil Mechanics
- Foundation Engineering

Course Objective

The course is intended to

- gain the knowledge in the concept of geosynthetics, reinforced materials and their behavior and their applications in different civil engineering design.

UNIT I - PRINCIPLES AND MECHANISMS **9 Hours**

Historical background – initial and recent developments – principles – concepts and mechanisms of reinforced soil – factors affecting behaviour and performance of soil – reinforcement interactions.

UNITII - REINFORCING MATERIALS **9 Hours**

Materials used in reinforced soil structures – fill materials, reinforcing materials, metal strips, and geosynthetics – bamboo – timber – facing elements – properties methods of testing – advantages and disadvantages – influence of environmental factors on the performance of geosynthetic materials.

UNIT III - DESIGN PRINCIPLES **9 Hours**

Design aspects of reinforced soil – soil reinforcement function – separator, filtration, drainage, barrier function – design and applications of reinforced soil of various structures – retaining walls – foundations – embankments and slopes.

UNIT IV - DESIGN FOR FUNCTIONS **9 Hours**

Geotextiles - requirement for design of separation – filtration – general behaviour - filtration behind retaining wall, under drains, erosion control and silt fence – drainage design – liners for liquid containment – geo membrane and geosynthetic clay liners.

UNIT V - GEOSYNTHETICS AND APPLICATIONS **9 Hours**

Geosynthetics in roads – geosynthetics in landfills – barrier walls - soil nailing – soil-nail interaction – behaviour in seismic conditions - case studies of reinforced dams, embankments, pavements, railroads, foundations–

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the concept and mechanism of reinforced soil structures and the factors affecting the performance.	Understand
CO.2 Explain the different materials used for reinforced soil structure and compare the properties of different materials.	Understand
CO.3 Explain the design principles of various reinforced soil structures	Understand
CO.4 Explain the design procedures for the structures with geosynthetics applications	Understand
CO.5 Explain the applications of geosynthetics in roads, dams, embankments and pavements.	Understand

Text Book(s):

T 1. Sivakumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, University Press (India), Pvt. Ltd., Hyderabad, 2006.

T 2. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.

T 3. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.

Reference Book(s):

R 1. Jones, C.J.F.P., Earth Reinforcement and Soil Structures, Earthworks, London, 1982.

R 2. Ramanathan Ayyar , T.S., Ramachandran Nair, C.G. and Balakrishna Nair, N., Comprehensive Reference Book on Coir Geotextile, Centre for Development for Coir Technology, 2002.

R 3. Muller, W.W. HDPE Geomembranes in Geotechnics, Springer, New York 2007.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High–3; Medium–2; Low–1

WATER RESOURCES ENGINEERING ELECTIVES

Course Code: 19CEEN1023	Course Title: HYDROLOGY		
Course Category: Professional Elective		Course Level: practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Define the key drivers on water resources, hydrological processes and their integrated behavior in catchments.
- Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and hydrograph
- Explain the concept of hydrological extremes such as flood and drought and its management strategies
- Describe the importance of spatial analysis of rainfall and design water storage reservoirs
- Apply the concepts of groundwater for water resources management

UNIT I - PRECIPITATION AND ABSTRACTIONS **9 Hours**

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyetal methods - Interception - Evaporation. Horton‟s equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton‟s equation - double ring infiltrometer, infiltration indices.

UNIT II – RUNOFF **9 Hours**

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange‟s table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT III – FLOOD AND DROUGHT **9 Hours**

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV – RESERVOIRS **9 Hours**

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V – GROUNDWATER MANAGEMENT

9 Hours

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Define the key drivers on water resources, hydrological processes and their integrated behavior in catchments.	Understand
CO.2 Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and hydrograph	Understand
CO.3 Explain the concept of hydrological extremes such as flood and drought and its management strategies	Understand
CO.4 Describe the importance of spatial analysis of rainfall and design water storage reservoirs	Understand
CO.5 Apply the concepts of groundwater for water resources management	Understand

Text Book(s):

T 1. Subramanya, K. "Engineering Hydrology"- Tata McGraw Hill, 2010

T 2. Jayarami Reddy, P., "Hydrology", Tata McGraw Hill, 2008.

Reference Book(s):

R 1. Garg. S. K., “Hydrology And Water Resources Engineering”, Khanna Publishers-Delhi, 2010.

R 2. Ven Te Chow, Maidment, D.R. and Mays, L.W., "Applied Hydrology", McGraw Hill

R 3. International Book Company, 1998.

R 4. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.

Web References:

1. http://nptel.ac.in/downloads/105105110/
2. http://www.civilenggforall.com/2015/09/irrigation-and-water-resources-engineering-gl-asawa-free-download-pdf-civilenggforall.html
3. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-731-water-resource-systems-fall-2006/lecture-notes/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code:19CEEN1035		Course title: GROUNDWATER ENGINEERING	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to:

- Learn about the basics of groundwater hydrology
- Outline the objectives of groundwater hydraulics
- Understand the various types of wells, its construction and maintenance
- Know about the different method of evaluation of aquifer parameters
- Study the concepts involved in modelling and recharge of groundwater

Unit I – GROUNDWATER HYDROLOGY **9 Hours**

Introduction- Water bearing formations- geological formation of water supply-subsurface distribution of water – hydrological cycle – sources of groundwater – types of aquifers – aquifer parameters – groundwater development and potential in India

Unit II – GROUNDWATER HYDRAULICS **9 Hours**

Groundwater flow- Permeability – Transmissibility – Darcy's law and its limitations – Properties of aquifer materials – Radial flow towards a well in a confined and unconfined aquifer – Relation of well size to yield – unsteady flow conditions – determination of aquifer constants – Theis method – Jacob's method – Chow's method – Theis recovery method – Conditions to check for steady state – Well losses and well efficiency

Unit III – WELLS AND EXPLORATION **9 Hours**

Types of wells – water well design – drilling of tubewells – drilling methods – percussion drilling – rotary drilling – auger core drilling and water jet methods – construction of wells – collector wells and infiltration wells – construction of strainer type tube wells- types of strainers – Construction of cavity type tube wells – Construction of gravel packed wells – Construction of open wells - testing yield of tube wells

Unit IV – EVALUATION OF AQUIFER PARAMETERS **9 Hours**

Pumping test analysis – Recuperation test – well characteristics – well capacity – confined and unconfined aquifer – groundwater investigation – subsurface geophysical methods

Unit V – GROUNDWATER QUALITY AND CONSERVATION **9 hours**

Groundwater development – hydrological maps – groundwater quality standards – groundwater contamination – seawater intrusion – control measures – Groundwater recharge methods – Groundwater modelling

Course Outcomes At the end of this course, students will be able to:	Cognitive level
CO.1 Explain the basics of groundwater hydrology and movement of groundwater	Understand
CO.2 Describe the objectives of groundwater hydraulics and properties of aquifer materials	Understand
CO.3 Classify the various types of wells, and brief about its construction and maintenance	Understand
CO.4 Enumerate the different methods of evaluation of aquifer parameters	Understand
CO.5 Explain the concepts involved in modelling and recharge of groundwater	Understand

Text Books:

T1. Todd, D.K., Mays, L.W., Groundwater Hydrology, John Wiley and Sons, New York, 2005.
T2. Raghunath, H.M., Groundwater Hydrology, Wiley Eastern Ltd., Third edition, New Age International, 2007.
T3. R.N. Saxena, Gupta, D.C., Elements and Hydrology and groundwater, PHI Learning private limited, 2017.

Reference Books:

R1. Murthy, V.V.N., Land and water management engineering, Kalyani publishers, New Delhi, 1985.
R2. Delleur, J.W., The Handbook of groundwater engineering, CRC Press, Taylor and Francis Group, 2007.

Web References:

1. https://nptel.ac.in/courses/105105042
2. https://nptel.ac.in/courses/105101214

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1036	Course title: IRRIGATION MANAGEMENT		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to:

- Expose students to irrigation development in India
- Understand the various systems of irrigation and their performance indicators
- Learn the various aspects of main system management
- Inculcate the principles of participatory irrigation management
- Outline the policies related to irrigation

Unit I – IRRIGATION DEVELOPMENT IN INDIA **9 hours**

Importance of Irrigation in Agriculture - Historical evolution of irrigation in India – Irrigation development during pre-colonisation – Colonisation and post-colonization – Different types of Irrigation prevalent in India: Warabandi, Shejpali and South Indian systems - Focus of Irrigation in India – Command area development approach and farmers" participation.

Unit II – IRRIGATION SYSTEMS AND PERFORMANCE INDICATORS **9 hours**

Systems classification - Institutions for irrigation management–Diagnostic Analysis of Irrigation Systems -Rehabilitation and modernization – Performance indicators – Improving system performance – Conjunctive management – constraints faced.

Unit III – MAIN SYSTEM MANAGEMENT **9 hours**

Main system components – Reservoir allocation rule, Operating rule and optimization methods to improve main system performance - irrigation scheduling – Constraints.

Unit IV – COMMAND AREA DEVELOPMENT AND PARTICIPATORY IRRIGATION MANAGEMENT **9 hours**

Command area development principles – Participatory Irrigation Management and Irrigation management transfer – Case studies – Constraints.

Unit V – IRRIGATION POLICY **9 hours**

Present status of irrigation policy and institutions – Irrigation related conflicts – Institutional transformation needed – Constraints in effecting institutional transformation – Irrigation financing – Water pricing – Water market – Policy changes.

Course Outcomes At the end of this course, students will be able to:	Cognitive level
CO1. Explain about irrigation development in India	Understand
CO2. Explain the various systems of irrigation and their performance indicators	Understand
CO3. Explain the various aspects of irrigation scheduling and reservoir operation	Understand
CO4. Explain the conflicts based on principles of participatory irrigation management	Understand
CO5. Enumerate the policies related to irrigation	Understand

Text Books:

T1. Rakesh Hooja, Management of Water for Agriculture: Irrigation, Water sheds and Drainage, Rawat Publications, New Delhi, 2006.
T2. Kijne, J.W., Barker, R and Molden, D, Water Productivity in Agriculture; Limits and Opportunities for improved, CABI Publishing, Walling ford, U.K, 2003.

Reference Books:

R1. Giodano.M and Villbolth K.G, The Agricultural Ground Water Revolution - Opportunities and threats to development, CABI Publishing, Walling ford, U.K, 2007.

Web References:

1. https://nptel.ac.in/courses/105108081
2. http://www.irrigationtoolbox.com/NEH/Part652_NationalIrrigationGuide/ch9.pdf

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code:19CEEN1037	Course title: IRRIGATION WATER QUALITY		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to:

- Understand the physical and chemical characteristics of irrigation water.
- Study the role of salinity in irrigation water
- Learn the various sources of pollution
- Understand the recycling and reuse techniques adopted in irrigation
- Discuss the water quality standards and models

Unit I – WATER QUALITY **9 hours**

Physical and chemical properties of water – Suspended and dissolved solids – EC and pH – major ions –. Water quality investigation – Sampling design - Samplers and automatic samplers - Data collection platforms – Field kits – Water quality data storage, analysis and inference – Software packages

Unit II – SALINITY **9 hours**

Water quality for irrigation – Salinity and permeability problem – Root zone salinity - Irrigation practices for poor quality water – Saline water irrigation – Future strategies

Unit III – WATER POLLUTION **9 hours**

Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland.

Unit IV – RECYCLING AND REUSE OF WATER **9 hours**

Multiple uses of water – Reuse of water in agriculture – Low cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation.

Unit V – WATER QUALITY MANAGEMENT **9 hours**

Principles of water quality – Water quality classification – Water quality standards - Water quality indices – TMDL Concepts – Water quality models.

Course Outcomes At the end of this course, students will be able to:	Cognitive level
CO.1 Explain the physical and chemical characteristics of irrigation water.	Understand
CO.2 Enumerate the role of salinity in irrigation water	Understand
CO.3 Explain the various sources of pollution affecting irrigation water	Understand
CO.4 Explain the recycling and reuse techniques adopted in irrigation	Understand
CO.5 Explain the standards and classification of water quality	Understand

Text Books:

T1. George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, "Wastewater Engineering: Treatment and Reuse", McGraw-Hill, 2002.
T2. Vladimir Novonty, "Water Quality: Diffuse pollution and watershed Management", 2nd edition, John Wiley & Sons, 2003.

Reference Books:

R1. Mackenzie L Davis, David A Cornwell, "Introduction to Environmental Engineering", McGraw- Hill 2006.
R2. Stum, M and Morgan, A., "Aquatic Chemistry", Plenum Publishing company, USA, 1985.
R3. Lloyd, J.W. and Heathcote, J.A., "Natural inorganic chemistry" in relation to groundwater resources, Oxford University Press, Oxford, 1988.

Web References:

1. https://archive.nptel.ac.in/courses/126/105/126105010/
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1530

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1038	Course title: WATERSHED CONSERVATION AND MANAGEMENT		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to:

- Learn about the watershed concepts
- Understand the various soil conservation measures
- Become aware of the watershed harvesting techniques
- Develop a watershed management plan
- Understand the role of remote sensing and GIS in watershed conservation

Unit I – WATERSHED CONCEPTS **9 hours**

Watershed- Need for an integrated approach – Influencing factors; Geology – Soil – Morphological characteristics – Toposheet – Delineation – Codification – Prioritization of watershed

Unit II – SOIL CONSERVATION MEASURES **9 hours**

Types of erosion – Water and wind erosion; Causes, factors, effects and control – Soil conservation measure: Agronomical and mechanical – Estimation of soil loss – Sedimentation

Unit III – WATER HAREVESTING AND CONSERVATION **9 hours**

Water harvesting techniques – Micro catchments – Design of small water harvesting structures – Farm ponds – Percolation Tanks – Yield of a catchment

Unit IV – WATERSHED MANAGEMENT **9 hours**

Watershed development plan – Entry point activities – Estimation – Watershed economics – Agroforestry – Grassland management – Wasteland management – Watershed approach in government programmes – Developing collaborative know how – People's participation – Evaluation of watershed management

Unit V – GIS FOR WATERSHED MANAGEMENT **9 hours**

Applications of Remote Sensing and Geographical Information System – Role of decision support system – Conceptual models and case studies

Course Outcomes At the end of this course, students will be able to:	Cognitive level
CO.1 Explain the concepts of watersheds	Understand
CO.2 Enumerate the causes, effects and control measures for soil conservation	Understand
CO.3 Explain the design procedure for small watershed harvesting structures	Understand
CO.4 Explain the management plan for a watershed	Understand
CO.5 Explain the role of remote sensing and GIS in watershed conservation	Understand

Text Books:

T1. Ghanashyam, D., Hydrology and Soil Conservation engineering, Prentice Hall of India Private Limited, New Delhi, 2000.
T2. Glenn, O. S., Soil and Water Conservation Engineering, John Wiley and Sons, 1981.
T3. Gurmail, S., A Manual on Soil and Water Conservation, ICAR Publication, New Delhi, 1982.
T4. Suresh, R., Soil and Water Conservation Engineering, Standard Publication, New Delhi, 1982.
T5. Vir Singh, Raj., Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

Reference Books:

R1. Brooks, K. N., P. F. Ffolliott, H. M. Joseph, A. Magner. Hydrology and the Management of Watersheds. Fourth Edition, 2013.
R2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. John Wiley and Sons, Inc., New York, 1998.
R3. Lal, Ruttan. Integrated Watershed Management in the Global Ecosystem. CRC Press, New York, 2000.
R4. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. John Wiley and Sons, Inc., New York, 1988.
R5. Dhruva Narayana, G. Sastry, V. S. Patnaik, “Watershed Management”, CSWCTRI, Dehradun, ICAR Publications, 1997.

Web References:

1. https://nptel.ac.in/courses/105101010
2. http://ecoursesonline.iasri.res.in/course/view.php?id=542

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN3001	Course Title: IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to:

- understand the layout of Diversion Head works and its components
- study and draw the different aspects of design of hydraulic structures.
- understand and draw the aspects of canal drop, regulator and siphon aqueduct
- understand the layout of water and waste treatment plants
- understand the the flow controlling and flow diversion structures

List of Exercises

IRRIGATION ENGINEERING DRAWING

1. Typical layout of Diversion Head works and its components
2. Tank surplus weir
3. Tank sluice with tower head
4. Canal drop (Notch Type)
5. Canal regulator
6. Siphon aqueduct

ENVIRONMENTAL ENGINEERING DRAWING

1. General layout of water and waste treatment plants
2. Sedimentation aided with coagulation

3 .Slow sand filter

4. Rapid sand filter
5. Trickling filter
6. Septic tank

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Design the components of irrigation engineering structures.	Apply
CO.2 Design water and waste water treatment units.	Apply
CO.3 Draw the components of irrigation engineering structures, water, and waste water treatment units as per the specifications.	Apply
CO.4 Design the flow controlling structures	Apply
CO.5 Design the flow diversion structures.	Apply

Text Book(s):

T 1. Garg, S.K, "Irrigation Engineering and Design of Structures", Khanna Publishers, 36th Edition, 2019.

T 2. Sharma S.K, "Irrigation Engineering and Hydraulic Structures", S. Chand Publication, 2017

T 3. S.R. Sahasrabudhe, "Irrigation Engineering & Hydraulic Structures", S.K. Kataria & Sons, 2013.

T 4. Satyanarayana Murthy, "Irrigation Design and Drawing", Published by Mrs. L.Banumathi, Tuni, East Godavari District, A.P. 1998

Reference Book(s):

R 1. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi,1999

R 2. Manual of Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 2013

R 3. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987

R 4. Peary, H.S., Rowe, D.R., and Tchobanoglous, G., "Environmental Engineering", McGraw-Hill Book Co., New Delhi, 7th Edition.

R 5. Metcalf & Eddy, "Wastewater Engineering (Treatment and Reuse)", 4th Edition, Tata McGraw-Hill, New Delhi, 2017. (Kindle edition – 2021)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	2	-	-	-	2	2	-
CO2	3	2	-	-	-	-	-	2	-	-	-	2	2	-
CO3	3	2	-	-	-	-	-	2	-	-	-	2	2	-
CO4	3	2	-	-	-	-	-	2	-	-	-	2	2	-
CO5	3	2	-	-	-	-	-	2	-	-	-	2	2	-

High-3; Medium-2;Low-1

Course Code: 19CEEN1040	Course Title: REMOTE SENSING & GIS APPLICATIONS IN WATER RESOURCES		
Course Category: Professional Elective		Course Level: Practice	
L: T: P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Maximum Marks: 100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Learn the basic concepts of Remote Sensing and sensors in India.
- Understand the various types of image processing used for different data products.
- Learn the concepts of GIS based on vector and raster data model
- Understand the mapping and analysis of data.
- Understand the application of remote sensing and GIS in field of water resources engineering

Unit I – INTRODUCTION TO REMOTE SENSING 9 Hours

Definition, Principle of Remote Sensing, Remote Sensing Systems, Remote Sensing from Space, Remote Sensing Sensors, Resolution, Imaging sensors, Optical Infrared (OIR) Imagers, Optical Sensors, Thermal Sensors, Microwave Sensors, Active Microwave Sensors, Data Preprocessing, Remote Sensing in India.

Unit II – INTRODUCTION TO IMAGE INTERPRETATION 9 Hours

Basic Principles of Image Interpretation, Elements of Image Interpretation, Techniques of Image Interpretation, Interpretation Keys, Introduction to Digital Image Processing, Digital Image- Image Rectification And Registration- Geometric Correction, Image Enhancement Techniques (only concepts), Image Classification - Unsupervised Classification and Supervised Classification.

Unit III – GEOGRAPHIC INFORMATION SYSTEMS (GIS) 9 Hours

Definitions and related technology, GIS Operations, GIS Elements, GIS Concepts and Practice, Map projection and Coordinate system. Introduction, Vector Data Representation, Geometric Objects, Topology. Introduction, Elements of the Raster Data Model, Types of Raster Data, Satellite Imagery, Digital Elevation Models, Integration of Raster and Vector Data.

Unit IV – TERRAIN MAPPING AND ANALYSIS 9 Hours

Introduction, Data for Terrain Mapping and Analysis, DEM, TIN, Terrain Mapping, Contouring, Vertical Profiling, Hill Shading, Hypsometric Tinting, Perspective View, Terrain Analysis, Slope and Aspect, Surface Curvature, View shed Analysis, Grid versus TIN.

Unit V – GIS APPLICATIONS IN WATER RECOURCES **9 Hours**

Introduction, GIS Modeling, Binary Models, Index Models. Integration of Remote sensing and GIS. Remote Sensing & GIS application in water resources engineering with case studies

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1 Describe the basic concepts of Remote Sensing and various sensors in India	Understand
CO2 Explain various types of image processing used for different data products.	Understand
CO3 Describe the concepts of GIS and its practical applications based and vector and raster model.	Understand
CO4 Explain the mapping and analysis of data.	Understand
CO5 Explain the application of remote sensing and GIS in field of water resources engineering with case studies	Understand

Text Book(s)

T1. Fundamentals of Remote Sensing, George Joseph, C. Jeganathan, 3rd Edition, 2018, University Press, New Delhi.

T2. Introduction to Geographic Information systems – Kang tsung chang, 9th Edition, 2017, McGraw Hill publications, New Delhi.

Reference Book(s):

R.1 Remote Sensing of the Environment – An earth resource perspective, John R. Jensen, 2nd Edition, 2013, Pearson Education, New Delhi.

R.2 Principles of Geographical Information, Burrough Peter A., 2015, Oxford University

R.3 Lo, C.P., and Albert K.W. Young concepts and Technologies of Geographic Information Systems, 2007, Prentice hall of India (Pvt) Ltd, New Delhi.

R.4 Remote sensing and image interpretation, Lillesand, T.M. and Kieffer, 7th Edition, 2015, John Wiley and Sons, New York, 1987.

R.5 Introductory Digital Image processing, John R Jensen, 4th edition, 2018, Prentice Hall, New Jersey.

R.6 Farsworth, R.K., Bawetl, E.C. & Dhanju, M.S., Application of remote sensing to hydrology including groundwater, IHP, UNESCO, 1984.

Web References:

1. http://www.wamis.org/agm/pubs/agm8/Paper–1.pdf
2. http://ags.geography.du.ac.in/Study%20Materials_files/Punyatoya%20Patra_AM.pdf
3. http://hydrologie.org/hsj/410/hysj_41_04_0593.pdf
4. http://www.wiley.com/legacy/wileychi/gis/Volume1/BB1v1_ch14.pdf
5. http://gis–lab.info/docs/books/aerial–mapping/cr1557_15.pdf

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2;Low-1.

CONSTRUCTION ENGINEERING AND MANAGEMENT ELECTIVES

Course Code: 19CEEN1001		Course Title: ADVANCED CONSTRUCTION TECHNIQUES	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Construction Materials and Practices

Course Objectives

The course is intended to:

- Study the substructure construction techniques.
- Study the components and procedure of super structure construction.
- Study the construction procedure for special structures.
- Study the erection procedure of prefabricated& precast structures.
- Study various repair and demolition techniques used in construction.

UNIT I – SUB STRUCTURE **9 Hours**

Box jacking – Pipe jacking – Diaphragm walls and basement – Tunneling techniques – Piling techniques – Caissons – types – sinking process – Cofferdam – Cable anchoring and grouting – Shoring for deep cutting – Dewatering for underground open excavation.

UNIT II – SUPER STRUCTURE **9 Hours**

Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Slipform technique – Suspended formwork – Construction sequence in cooling towers, silos, chimney, sky scraper – In–situ pre–stressing in high rise structures – Post tensioning – Aerial transporting – handling and erecting lightweight components on tall structures – Erection of lattice towers – Rigging of transmission line structures.

UNIT III – SPECIAL STRUCTURE **9 Hours**

Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Laying operations for built up offshore system – Vacuum dewatered flooring – Concrete paving technology – Large span structures – launching techniques for heavy decks – Support structure for heavy equipment and conveyor – Construction sequence and methods in domes – Erection of articulated structures and space decks.

UNIT IV – PRECAST AND PREFABRICATION **9 Hours**

Pre–casting techniques – handling techniques – transportation, storage and erection of structures – Curing techniques – steam curing, hot air blowing – Skeletal and large panel constructions – Pre-cast and pre-fabricating technology for low cost and mass housing schemes – Ferro–cement in housing – quality control – Repairs and economical aspects on prefabrication.

UNIT V – REPAIR AND DEMOLITION **9 Hours**

Mud Jacking and grouting for foundation – micro piling and underpinning for strengthening floor and shallow profile – Sub grade water proofing – Repair techniques for cracks in concrete – Demolition techniques – sequence of operation – Dismantling – Safety precaution in demolition and dismantling.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the various techniques adopted for substructure construction.	Understand
CO.2 Explain the construction techniques for commercial and modern engineering structures	Understand
CO.3 Elucidate the construction techniques to be adopted for special structures.	Understand
CO.4 Explain the process involved in construction of prefabricated structures, precast structures and ferrocement.	Understand
CO.5 Explain the repair and demolition techniques.	Understand

Text Book(s):

T 1. Subir K. Sarkar and Subhajit Saraswati, “Construction Technology”, Oxford University Press, New Delhi, 2008.

T 2. R. Chudley, Roger Greeno, "Advanced Construction Technology" Prentice Hall, 2006

Reference Book(s):

R 1. Jerry Irvine, "Advanced Construction Techniques" CA Rockers, 1984.

R 2. Peter.H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008

R 3. Robertwade Brown, "Practical Foundation Engineering Hand Book", McGraw Hill Publications, 1995.

Web References:

1. http://nptel.ac.in/video.php?subjectId=105102088
2. https://sites.google.com/a/venusict.org/actech/lecture–notes

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1004	Course Title: BUILDING SERVICES		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Understand the different types of machineries used in the buildings.
- understand the fundamentals of electrical systems in buildings.
- know the concepts of lighting and air conditioning systems in buildings.
- study the fixtures and fittings of plumbing and sanitary systems in buildings.
- understand the importance and systems of fire safety installation.

UNIT I – MACHINERIES **9 Hours**

Hot Water Boilers – Lifts and Escalators – Special features for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II – ELECTRICAL SYSTEMS IN BUILDINGS **9 Hours**

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT III – PRINCIPLES OF ILLUMINATION AND REFRIGERATION **10 Hours**

Visual tasks – Modern theory of light and colour – Classification of lighting –Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Special features for physically handicapped and elderly – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Refrigerant control devices – Air conditioning systems for different types of buildings – Protection against fire caused by A.C. Systems

UNIT IV – PLUMBING AND SANITARY SYSTEMS IN BUILDINGS **8 Hours**

Plumbing system components – Water supply and distribution system – plumbing valves – plumbing fixtures – Piping systems – Valves – Sanitary piping systems – Soil piping system – Ventilation system – House drain.

UNIT V – FIRE SAFETY INSTALLATION **9 Hours**

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non–combustible materials, construction of staircases and lift lobbies, fire escapes and A.C. systems. Special features for physically handicapped and elderly in building types –

Heat and smoke detectors – Fire alarm system, snorkel ladder –Dry and wet risers – Automatic sprinklers.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the working principle and functions of boilers, conveyors, motors and generators used in building.	Understand
CO.2 Explain the elements of electrical systems and the different types of earthing & wiring adopted in building.	Understand
CO.3 Explain the types of lighting, air conditioning systems and its control devices used in building.	Understand
CO.4 Explain the various fixtures and fittings of plumbing and sanitary systems used in building.	Understand
CO.5 Explain the planning considerations for fire safety and the various fire-fighting equipments used in building.	Understand

Text Book(s):

T 1. Fred Hall and Roger Greeno, “Building Services Handbook”, Routledge and CRC Press, 2017.

T 2. Subhash M. Patil, “Building services”, Standard publishers, 2014.

Reference Book(s):

R 1. Thomas Everitt Coleman, “Sanitary House Drainage: Its Principles and Practice: A Handbook”, Wentworth Press publishers, 2019

R 2. William Paul Gerhard, “House–Drainage and Sanitary Plumbing”, General Books publishers, 2012

R 3. R. Udayakumar, “A text book on Building Services”, Eswar Press, Chennai, 2011

Web References:

1. https://www.scribd.com/doc/55417572/Building–Services–Notes
2. https://lecturenotes.in/download/material/47960–note–of–building–services–by–

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2;Low–1

Course Code: 19CEEN1015	Course Title: QUALITY CONTROL AND ASSURANCE		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- To learn about the quality plan, quality management guidelines and responsibilities of the authorities.
- To know the quality standards, training, implementation and certification process.
- To study about the importance of quality planning, documentation and inspection procedures in execution of a project.
- To learn about the need of QA/QC, magnificent seven tools and FMEA for quality analysis.
- To know about the various factors influencing quality and the ways of improving quality.

UNIT I – QUALITY MANAGEMENT **9 Hours**

Introduction – Definitions and objectives – Factor influencing construction quality – Responsibilities and authority – Quality plan – Quality management guidelines – Quality circles.

UNIT II – QUALITY SYSTEMS **9 Hours**

Introduction – Quality system standard – ISO 9000 family of standards – Requirements – Preparing quality system documents – Quality related training – Implementing a quality system – Third party certification.

UNIT III – QUALITY PLANNING **9 Hours**

Quality policy, Objectives and methods in construction industry –Consumer's satisfaction, Ergonomics – Time of completion – Statistical tolerance – Taguchi's concept of quality – Six Sigma – Codes and standards – Documents – Contract and construction programming – Inspection procedures – Cost implication.

UNIT IV – QUALITY ANALYSIS **9 Hours**

Objectives – Regularity agent, owner, design, contract and construction-oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality –Appraisals, factors affecting construction quality management – Critical, major failure aspects and failure mode analysis –Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction.

UNIT V – QUALITY IMPROVEMENT TECHNIQUES **9 Hours**

Selection of new materials – Influence of drawings, detailing, specification, standardisation– Bid preparation – Construction activity, environmental safety, social and environmental factors

– Natural causes and speed of construction – Life cycle costing – Value engineering and value analysis.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the quality management principles.	Understand
CO.2 Explain the quality system standards.	Understand
CO.3 Explain the elements of quality planning and its implication.	Understand
CO.4 Explain the objectives and perform failure analysis related to QA/QC.	Understand
CO.5 Explain the quality improvement techniques.	Understand

Textbook(s):

T 1. James J.O'Brien, "Construction Inspection Handbook: Quality Assurance and Quality Control", Third Edition, Van Nostrand Reinhold Company, 2012.

T 2. J.L. Ashford, "The Management of Quality in Construction", E & FN SPON, 2003

Reference Book(s):

R 1. Ram Babu Sao, "Perfect Quality Assurance & Quality Control", First Edition, Create space Independent Pub, 2016

R 2. Frank M. Gryna, Richard C.H. Chua and Joseph A. Defeo, "Juran's Quality Planning & Analysis for Enterprise Quality", McGraw–Hill Education, 2017

Web References:

1. http://nptel.ac.in/courses/116102019/
2. http://pmbook.ce.cmu.edu/13_Quality_Control_and_Safety_During_Construction.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code: 19CEEN1018	Course Title: SAFETY IN CONSTRUCTION		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Study the cases of constructional accidents and legal implications.
- Acquire knowledge on safety programme.
- List the safety considerations in a construction contract.
- Study the importance of designing safety work culture.
- Know the responsibility of owner and designers.

UNIT I – CONSTRUCTION ACCIDENTS AND SAFETY MANAGEMENT 9 Hours

Accidents – Types of accidents and their causes – Cost of Constructional Accidents – Direct and Indirect cost – Occupational and safety hazard assessment – Safety Management of Accidents – Human errors and their role in safety management – Legal Implications.

UNIT II – SAFETY PROGRAMMES 9 Hours

Construction Safety – Benefits – Safety meetings – Elements of effective safety programme – problem areas in construction site – Job–site safety assessment – Safety Incentives – approaches to Improve Safety – OSHA – Indian Standards and Acts.

UNIT III –CONTRACTUAL OBLIGATIONS 9 Hours

Safety in construction contracts – Obligations and Types – Sub contractual Obligations –Substance abuse – Drug Abuse, Alcohol Abuse, Tobacco Abuse – Safety record keeping– Safety Personnel.

UNIT IV – DESIGNING FOR SAFETY 9 Hours

Safety culture – Safe Workers – Role of Employee, safety officer and management in designing safety – Safety Personnel– Safety Checklist – Project coordination and safety Procedures –Workers' compensation

UNIT V –OWNER'S, ENGINEER AND DESIGNERS OUTLOOK 9 Hours

Owner's responsibility for safety – Owner preparedness – Role of Engineer and Designer in ensuring safety – Safety clause in design document.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Identify the types of construction accidents, effects and safety measures to be followed in construction projects.	Understand
CO.2 Explain the safety norms as per various acts and standards.	Understand
CO.3 Explain the types of obligations on contracts and sub contracts and to describe the types of substance abuse.	Understand
CO.4 Illustrate the role of employee in designing safety norms in construction industry.	Understand
CO.5 Illustrate the roles and responsibilities of owner, engineer and designers in a construction project.	Understand

Textbook(s):

T 1. Jimmy W. Hinze, “Construction Safety”, Prentice Hall Inc., 1997.

T 2. Amarjit Singh, Jimmie Hinze, “Implementation of Safety and Health on Construction Sites” Taylor & Francis, 1999.

Reference Book(s):

R 1. Richard J. Coble, Jimme Hinze and Theo C. Haupt, “Construction Safety and Health Management” Prentice Hall Inc., 2001

R 2. Tim Howrath, Paul Watson “Construction Safety Management” John Wiley & Sons, 2008.

R 3. Tamil Nadu Factory Act, Department of Inspectorate of factories, Tamil Nadu

IS Code Books:

1. IS 13415:1992
2. IS 7293:1974
3. IS 13416:1992(Part 1 to 5)
4. SP 70: 2001

Web References:

1. http://www.osha.gov/video/
2. http://www.youtube.com/watch?v=t–P6mMp23ug
3. https://nptel.ac.in/courses/114106017/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2;Low–1

Course Code: 19CEEN1041	Course Title: CONSTRUCTION PERSONNEL MANAGEMENT		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

- Understand the various aspects of manpower management.
- Recognise the roles and responsibilities of individuals in an organisation structure.
- Help the student further develop their management, team building and leadership skills.
- Realise the pay plans, incentives and other additional benefits to be provided by an organisation to their employees.
- Know about the professional advancement options and process involved.

Unit I MANPOWER PLANNING 9 Hours

Manpower planning and forecasting - Recruitment, selection process - Sources - Induction, orientation and training - Manpower Planning process - Organising, staffing, directing and controlling - Factors influencing supply and demand of human resources - Role of HR manager - Personnel Principles.

Unit II ORGANISATION 9 Hours

Elements of an organisation - Organisation structure - Delegation of authority, responsibility and accountability - Staffing Plan - lines and staff organisation. Workforce diversity - International dimensions of organisation - determinants of organisational design.

Unit III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR 9 Hours

Basic individual psychology - Approaches to job design and job redesign - Self managing work teams - Intergroup - Conflict in organizations - Leadership - Engineer as manager - Aspects of decision making - Significance of human relation and organizational - Individual in organization - Motivation - Personality and creativity - Group dynamics, Team working - Communication and negotiation skills.

Unit IV WELFARE MEASURES 9 Hours

Establishing pay plans - Basics of compensation - Factors determining pay rate - Current trends in compensation - Job evaluation – Incentives- Practices in Indian organisations - Statutory benefits - Non-statutory (voluntary) benefits - Insurance benefits - Retirement benefits and other welfare measures to build employee commitment - Laws related to welfare measures.

Unit V MANAGEMENT AND DEVELOPMENT METHODS 9 Hours

Management developments - On the job and off the job - Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfers of operations - Developing policies, practices and establishing process pattern - Competency up gradation and their assessment - New methods of training and development - Performance management.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the role of human resource manager and the process of manpower planning.	Understand
CO.2 Explain the elements, dimensions, determinants and structure of an organisation.	Understand
CO.3 Elucidate the influence of interpersonal skills of individuals in an organisation towards teamness and organisational behaviour.	Understand
CO.4 Explicate the monetary benefits and other relevant perks an organisation should offer and the prevailing laws relevant to it.	Understand
CO.5 Explain the career advancement options in an organisation in terms of training, promotions and transfer based on performance assessment.	Understand

Reference Book(s):

R 1. K.Aswathappa and Sadhna Dash, “Human Resource Management”, McGraw Hill Publisher, 9th Edition, 2021.

R 2. Dwivedi R.S, Human Relations and Organisational Behaviour, Laxmi Publications, 5th Edition, 2008.

R 3. Michael Armstrong, “A handbook of Human Resource Management Practice, Kongan Page Limited, 10th Edition, 2006.

R 4. Carleton Counter III and Jill Justice Coulter, “The Complete Standard Hand Book of Construction Personnel Management ", Prentice Hall, New Jersey, 1989.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	2	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	2	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	2	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	2	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	2	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1042		Course Title: ALTERNATIVE BUILDING MATERIALS	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19CECN1301- Construction Materials and Practices

Course Objective

The course is intended to

- acquire knowledge about the properties of alternative construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non-weathering materials and smart materials.

Unit I STRUCTURAL MATERIALS 9 Hours

Wood and wood product - Metals - Types of steels - Manufacturing process of steel - Advantages of new alloy steels - Properties and advantages of aluminum and its products - Types of coatings & coatings to reinforcement - Applications of coatings.

Unit II NON-STRUCTURAL MATERIALS, ASSOCESSORIES AND FINISHES 9 Hours

Introduction of non-structural materials and criteria for selection - Types and properties of water proofing materials - Types of non-weathering materials and its uses - Types of polymer floor finishes - Paint - Tiles - Acoustic treatment materials - Dry walls - anchors.

Unit III COMPOSITES 9 Hours

Types of Plastics - Polymer - Properties & manufacturing process - Advantages of reinforced polymers - Types of FRP - FRP on different structural elements - Applications of FRP - Bituminous materials - Glass - Closure - Environmental concerns.

Unit IV SPECIAL CONCRETES 9 Hours

Concretes - Behavior of concretes - Properties and advantages of High Strength and High Performance Concrete - Properties and applications of Fibre Reinforced Concrete, Self-Compacting Concrete, Geo Polymer Concrete - Alternate materials to concrete on High Performance & High Strength Concrete.

Unit V SMART AND INTELLIGENT MATERIALS 9 Hours

Types & differences between smart and intelligent materials - Special features - Nano Concrete - Nano technology in construction - Case studies showing the applications of smart & intelligent materials.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explicate the properties and applications of wood, metals, alloys and significance of coating the rebar.	Understand
CO.2 Explain the properties and types of materials used for water proofing, floor finishes and acoustic treatment.	Understand
CO.3 Elucidate the manufacturing process and applications of polymer composites.	Understand
CO.4 Explain the properties and applications of various types of special concretes.	Understand
CO.5 Explain the applications of smart and intelligent materials in construction.	Understand

Reference Book(s):

R 1. N. Subramanian, “Building Materials”, Oxford University Press, 1st Edition, 2019.

R 2. C. Ganapathy, “Modern Construction Materials”, Eswar Press, 2015.

R 3. M.S. Shetty, “Concrete Technology: Theory and Practice”, S.Chand & Company Ltd., 8th Edition, 2019.

Web References:

1. https://archive.nptel.ac.in/courses/105/106/105106053/
2. http://www.infocobuild.com/education/audio-video-courses/architectural-and-civil-engineering/modern-construction-materials-iit-madras.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	-	3	-	2
CO2	2	-	-	-	-	-	2	-	-	-	-	3	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	3	-	2
CO4	2	-	-	-	-	-	2	-	-	-	-	3	-	2
CO5	2	-	-	-	-	-	2	-	-	-	-	3	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1043	Course Title: ECONOMICS AND FINANCE FOR CIVIL ENGINEERING		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Prepare students to become financially conversant in their professional career and personal life.
- To learn the basics of economics, finance, accounting and cost estimation necessary for a civil engineering enterprise to be successful and profitable.

Unit I BASICS OF ECONOMICS 9 Hours

Economics - Role of Civil Engineering in industrial development - Support matters of economy as related to engineering - Market demand and supply - Choice of technology, quality control and production - Audit in economic law of returns governing production.

Unit II URBAN ECONOMICS 9 Hours

Land and construction economics - Urban land use and values - Construction development in housing, transport and other infrastructures - Economics of ecology, environment, energy resources, local material selection, form and functional designs - Construction workers - Urban problems - Poverty - Migration - Unemployment - Pollution.

Unit III FINANCIAL MANAGEMENT 9 Hours

Financing - Need for financial management - Types of financing - Short term and long term borrowing - Leasing - Equity financing - Internal generation of funds - External commercial borrowings - Assistance from government - International financial corporations. Analysis of financial statements - Balance sheet - Profit and loss account - Funds flow statement - Ratio analysis - Investment and financing decision - Financial control - Job control - Centralised management.

Unit IV ACCOUNTING 9 Hours

Accounting method - General - Cash basis of accounting - Accrual basis of accounting - Percentage completion method - Completed contract method - Accounting for tax and financial reporting purposes.

Unit V COST ESTIMATION 9 Hours

Cost estimation of equipment - Depreciation and Interest - Maintenance and repair costs - Degree of utilisation - Equivalent annual cost - Operating cost standards - Project benefit cost analysis - least cost - Net Present Value (NPV) - Equivalent annual cost method - Internal Rate of Return method (IRR) - Benefit - Cost ratio.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the basics of economics and the contribution of civil engineering to the economy.	Understand
CO.2 Elucidate the construction economics with respect to land, resources and design and complications related to construction labourers.	Understand
CO.3 Explain the significance and process involved in financial management and analysis.	Understand
CO.4 Explain the different methods of accounting applied in civil engineering.	Understand
CO.5 Explain the various cost estimation methods adopted for construction equipments.	Understand

Reference Book(s):

R 1. Kiran H.Ghorpade and Shrikant R Kate "Engineering Economics & Financial Management", Tech-Neo Publications, 2021.

R 2. Patel, B M Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi, 2000

R 3. Shrivastava,U.K., Construction Planning and Management,2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi, 2001.

Web References:

1. https://archive.nptel.ac.in/courses/105/103/105103023/
2. https://www.coursera.org/learn/construction-finance

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

TRANSPORTATION AND URBAN PLANNING ELECTIVES

Course Code: 19CEEN1016		Course Title: RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week)	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Transportation Engineering

Course Objectives

The course is intended to:

- Understand the functions of various components of railway track.
- Learn the operation, construction, and maintenance of railway track.
- Know the various factors considered for planning and design of airport.
- Understand the importance of visual aids and air traffic control in airport.
- Study the various components of harbour and dock.

UNIT I – RAILWAY PLANNING AND DESIGN **9 Hours**

Role of Indian Railways in National Development –Factors controlling Alignment – Engineering Surveys for Track Alignment –Elements of permanent way and its functions – Rails, Sleepers, Ballast, rail fixtures and fastenings – Coning of wheels – Creep in rails – Defects in rails – Geometric design of railway tracks – gradient, super elevation, widening of gauge on curves.

UNIT II – RAILWAY TRACK OPERATION, CONSTRUCTION AND MAINTENANCE **9 Hours**

Working Principle of Points and Crossing, Signaling, Interlocking and Track Circuiting – Lay outs of Railway Stations and Yards – Level Crossings – Earthwork – Stabilization of track on poor soil – Tunneling Methods, drainage and ventilation – Calculation of Materials required for track laying – Construction and maintenance of tracks – Track renewals – Passenger amenities

UNIT III – AIRPORT PLANNING AND DESIGN **9 Hours**

Advantages and Limitations of Air Transport, Classification – Components of Airports – Airport Planning – Site Selection, Airport Obstructions and Zones – Runway Design – Orientation, Cross wind Component, Wind rose Diagram, Geometric Design and

Corrections for Gradients (Problems), Elements of Taxiway Design, Clearance over Highways and Railways.

UNIT IV – AIRPORT LAYOUTS, VISUAL AIDS, AND AIR TRAFFIC CONTROL **9 Hours**

Airport Layouts –Parking and Circulation Pattern–Airport Buildings – Primary functions, Planning Concept, Principles of Passenger Flow, Passenger Facilities–Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings– Air traffic control – primary functions, Air traffic control network.

UNIT V – HARBOUR AND DOCKS ENGINEERING **9 Hours**

Advantages and Limitations of Water transport – Definition of terms –Requirements, Classification and location of harbour –planning and design considerations. Docks – classification – Mooring and Mooring accessories – Navigational aids – Coastal structures – Waves and their actions on Coastal structures – classifications of coastal regulation zones – coastal protection works.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Calculate the geometric design elements for railway track.	Apply
CO.2 Explain the operation, construction, and maintenance of railway track.	Understand
CO.3 Elaborate the various components of airports and the factors considered for geometric design of runway and taxiway.	Understand
CO.4 Describe the elements of airport building and the different types of visual aids and control devices.	Understand
CO.5 Describe the different types of harbour and dock and the various types of navigational aids and coastal protection works.	Understand

Textbook(s):

T 1. Subramaniam K.P., “Railway, Airport and Harbour Engineering”, Scitech Publications (India) pvt Ltd. Chennai (2018)

T 2. Subhash C. Saxena, “Airport engineering Planning and Design”, CBS publications, New Delhi, 2020

Reference Book(s):

R 1. Saxena, S.C. Arora, S. P. “A text book of Railway Engineering”, Dhanpat Rai & Sons, New Delhi. 2015

R 2. Horonjeff, R. Mckelvey, F. X. “Planning & Design of Airports”, McGraw hill, New York, 2010

R 3. Gautam H. Oza, Hasmukh P. Oza, “Dock & Harbour Engineering”, Charotar Publishing House Pvt. Ltd, 2017.

Web References:

1. http://annauniversityweb.blogspot.com/2013/06/anna–university–civil–notes–3rd–
2. https://easyengineering.net/ce6604–railways–airports–and–harbour/damage/13870/
3. http://nptel.ac.in/courses/105107123/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	-

High–3; Medium–2;Low–1

Course Code: 19CEEN1021	Course Title: ARCHITECTURE AND TOWN PLANNING		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Understand the difference between architectural styles of eastern and western world.
- Comprehend the principles of Architectural design
- Gain knowledge on the concept of composing spaces of buildings using design concepts, planning principles.
- Know about the town planning concepts in ancient India
- Understand the standards, landscaping features and regulations controlling expansion of the towns and the cities.

UNIT I – HISTORY OF ARCHITECTURE **9 Hours**

Western Architecture: Egyptian, Greek, Roman Architectures.
Indian Architecture: Vedic age, Indus valley civilization– Buddhist period: Stambas, Stupa, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles– Temple of Aihole, Madurai, Bhuvaneshwar, Mount Abu.
Indo Sarsanic (Islamic) Architecture: Mosque – Palace – Fort – Tomb.

UNIT II – PRINCIPLES OF ARCHITECTURAL DESIGN **9 Hours**

Principles of designing – Composition of Plan – relationship between plan and elevation– building elements, form, surface texture, mass, line, color, tone– Principles of Composition: Unity, contrast, proportion, scale, balance, circulation, rhythm, character, expression.

UNIT III – PRINCIPLES OF PLANNING **9 Hours**

Principles of planning a residence– site selection, site orientation– aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.
Post–classic Architecture: Introduction of post–classic architecture contribution of eminent architects to modern period–Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping

UNIT IV – HISTORICAL BACKGROUND OF TOWN PLANNING **9 Hours**

Town planning in India – Town plans of mythological Manasa–Town plans of ancient towns: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT V – MODERN TOWN PLANNING **9 Hours**

Zoning – Roads and road traffic – Housing – Slums, Parks, Playgrounds – Public Utility Services – Surveys and maps for planning – Neighborhood Planning. Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation – planning regulations and limitations. Land scaping for the towns, horizontal and vertical expansion of towns – garden cities, satellite towns – floating towns – skyscrapers – pyramidal cities.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO.1	Explain the architectural styles adopted in western architecture and Indian architecture.	Understand
CO.2	Illustrate the principles of architectural design for planning a building.	Understand
CO.3	Identify proper aligned dimensioning techniques, and spacing as per planning principles for planning a residential building.	Understand
CO.4	Describe the ancient town planning techniques adopted in India.	Understand
CO.5	Explain the standards, landscaping features and regulations controlling expansion of the towns and the cities towards modern town planning.	Understand

Textbook(s):

T 1. G. K. Hiraskar, “The Great Ages of World Architecture” (With Introduction to Landscape Architecture) (2018–2019), Session Paperback – 1 January 2018

T 2. G.K. Haraskar , ‘Fundamentals of Town Planning’, Dhanpat Rai Publishing Co Pvt Ltd, 2018.

Reference Book(s):

R 1. Hepler Drafting and Design for Architecture, Cengage Learning, 2012

R 2. John Patten Guthrie, Architect’s Portable Handbook, Mc Graw Hill International Publications, 2010

R 3. R. S. Deshpande, Modern Ideal Homes for India, United book corporation digital library India,2017

Web References:

1. https://nptel.ac.in/courses/124/106/124106009/
2. https://nptel.ac.in/courses/124/107/124107001/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2;Low–1

Course Code: 19CEEN1044	Course Title: PAVEMENT ENGINEERING		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Transportation Engineering

Course Objectives

The course is intended to:

- Gain knowledge on various IRC guidelines for designing rigid and flexible pavements.
- assess quality and serviceability conditions of roads.

Unit I – PAVEMENT MATERIALS AND SUBGRADE ANALYSIS **9 Hours**

Introduction – Pavement as layered structure – Pavement types -rigid and flexible- Subgrade
analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

Unit II - DESIGN OF FLEXIBLE PAVEMENTS **9 Hours**

Flexible pavement design – Advantages and disadvantages -Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

Unit III - DESIGN OF RIGID PAVEMENTS **9 Hours**

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

Unit IV – PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE **10 Hours**

Construction Techniques practice of flexible and concrete pavement Pavement Evaluation – Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

Unit V - STABILISATION OF PAVEMENTS **8 Hours**

Stabilisation with special reference to highway pavements - Choice of stabilisers -Testing and field control –Stabilisation for rural roads in India -use of Geosynthetics (geotextiles & geogrids) in roads.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the significance, functions and various construction methods of flexible and rigid pavements.	Understand
CO.2 Design the flexible pavement as per IRC guidelines.	Apply
CO.3 Design the rigid pavement as per IRC guidelines.	Apply
CO.4 Explain the various construction methods, evaluation surveys and its methods for measuring the performance of pavements as per IRC recommendations.	Understand
CO.5 Explain the various factors and methods involved in the stabilisation of pavements.	Understand

Text Book(s):

T1. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna Publications, New Delhi, 2005.

T2. Croney, D., Design and Performance of Road Pavements, HMO Stationary Office, 1979.

T3. Wright, P.H., “Highway Engineers”, John Wiley & Sons, Inc., New York, 1996.

T4. Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi, 2001

Reference Book(s):

R.1 Yoder R.J and Witczak M.W., “Principles of Pavement Design”, John Wiley, 1975.

R.2 Guidelines for the “Design of Flexible Pavements”, IRC:37 - 2001, The Indian roads Congress, New Delhi.

R.3 Guideline for the “Design of Rigid Pavements for Highways”, IRC:58-1998, The Indian Roads Congress, New Delhi.

R.4 Guideline for "Standard Specifications and Code of Practice for Construction of Concrete Roads", IRC 15 – 2002, The Indian Roads Congress, New Delhi.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	3	-	-	-	3	3	-
CO3	3	-	-	-	-	-	-	3	-	-	-	3	3	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High-3; Medium-2; Low-1

Course Code: 19CEEN1045	Course Title: TRAFFIC ENGINEERING AND MANAGEMENT		
Course Category: Professional Elective		Course Level: practice	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Transportation Engineering

Course Objectives

The course is intended to:

- Gain knowledge of the traffic components and assess the traffic characteristics and related problems.
- Gain knowledge of traffic planning and its management in any transportation area
- Gain knowledge of traffic control devices and its techniques in transportation interaction.

Unit I - TRAFFIC SURVEYS AND ANALYSES **9 Hours**

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

Unit II - TRAFFIC FLOW AND ROADWAY CAPACITY **9 Hours**

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed- Flow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

Unit III - COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES **9 Hours**

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self-Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

Unit IV - DESIGN OF ROAD INTERSECTIONS **9 Hours**

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated

Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

Unit V - DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS **9 Hours**

Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; Pedestrians: Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; Cycle Tracks: Principles of design, Design criteria, Design standards for Rural Expressways.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards	Understand
CO.2 Explain the principles of traffic flow characteristics and their relationships	Understand
CO.3 Explain the various traffic management measures in addressing the demand Pricing and ITS applications.	Understand
CO.4 Explain the various types of control and regulatory measures to meet an efficient traffic network.	Understand
CO.5 Explain the various type of facilities and plan for Non Motorized Transport	Understand

Text Book(s):

T1. Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi

T2. Jotin Khisty, S.C. and Kent Lall, B., Transportation Engineering – An Introduction, Prentice-Hall, NJ

T3. S.C. Saxena Traffic Planning And Design, Dhanpat Rai Pub, New Delhi

Reference Book(s):

R.1 Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co.

R.2 John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Pub. Co.

R.3 Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall,

R.4 Papacostas, C.S., Fundamentals of Transportation System Analysis, PHI

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2	-

High-3; Medium-2; Low-1

Course Code: 19CEEN1046		Course Title: HOUSING PLANNING AND MANAGEMENT	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max. Marks:100

Pre-requisites

- **Nil**

Course Objective:

The course is intended to:

- train the students to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects.
- Study the course focuses on cost effective construction materials and methods.
- Students able to emphasis on the principles of sustainable housing policies and programmes.

Unit-I INTRODUCTION TO HOUSING 7 Hours

Definition of Basic Terms -House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing -Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration -Institutions for Housing at National, State and Local levels.

Unit-II HOUSING PROGRAMMES 9 Hours

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes - Slum improvement - Slum redevelopment and Relocation -Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply , quality, infrastructure and pricing - Role of Non-Government Organizations in slum housing.

Unit-III PLANNING AND DESIGN OF HOUSING PROJECTS 10 Hours

Formulation of Housing Projects - Land Use and Soil suitability analysis -Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Design Problems) - Housing Project Formulation.

Unit-IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 10 Hours

New Constructions Techniques - Cost Effective Modern Materials and methods of Construction- Green building concept

Unit-V HOUSING FINANCE AND PROJECT APPRAISAL 9 Hours

Evaluation of Housing Projects for sustainable principles - Housing Finance, Cost Recovery - Cash Flow Analysis, Subsidy and Cross Subsidy- Public Private Partnership Projects - Viability Gap Funding.

COURSE OUTCOMES:	**Cognitive Level**
CO.1 Explain the basics of housing	Understand
CO.2 Exlpain the different types of housing programmes	Understand
CO.3 Explain the planning and Design of housing projects	Understand
CO.4 Explain the construction techniques and materials used in housing projects	Understand
CO.5 Explain the concepts of housing finance.	Understand

TEXTBOOKS:

T1. Meera Mehta and Dinesh Mehta, “Metropolitan Housing Markets”, Sage Publications Pvt. Ltd., New Delhi, 1999.

T2. Francis Cherunilam and Odeyar D Heggade, “Housing in India”, Himalaya Publishing House, Bombay, 1997.

REFERENCES:

R1. Wiley- Blackwell, “Neufert Architects” Data, 4th Edition, Blackwell Publishing Ltd, 2012
R2. Donald Watson and Michael J.Crosbie, “Time Saver Standards for Architectural Design”, 8th Edition, Tata McGraw Hill Edition, 2011
R3. Walter Martin Hosack, “Land Development Calculations”, McGraw Hill 2nd Edition, USA 2010
R4. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.
R5. Government of India, National Housing Policy, 1994

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

Course Code: 19CEEN1047	Course Title: INTELLIGENT TRANSPORTATION SYSTEMS(ITS)		
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max. Marks:100

Pre-requisites

- **Transportation Engineering**

Course Objective:

The course is intended to:

- Learn the fundamentals of ITS.
- Study the ITS functional areas.
- Have an overview of ITS implementation in developing countries.

Unit-I INTRODUCTION TO INTELLIGENT TRANSPORT SYSTEM (ITS) 7 Hours

Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS Deployment Benefits of ITS- Overview of application of ITS in Transportation Planning

Unit-II DATA COLLECTION THROUGH ITS 9 Hours

Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT)

Unit-III ITS IN TRAFFIC MANAGEMENT 10 Hours

ITS User Needs and Services and Functional areas Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections

Unit-IV ITS IN TRANSPORTATION PLANNING 10 Hours

ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations - public transportation applications- Weight -in Motion

Unit-V ITS IN TRANSPORTATION PLANNING 9 Hours

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics- E commerce

COURSE OUTCOMES

At the end of the course, students will be able to:	**Cognitive Level**
CO.1 Explain the fundamentals of ITS and its benefits.	Understand
CO.2 Explain the various data collection methods using sensors and its applications.	Understand
CO.3 Explain the principles of ITS in Traffic Management	Understand
CO.4 Explain the applications of ITS in Transportation Planning	Understand
CO.5 Explain the various applications of ITS in Logistics	Understand

TEXT BOOKS:

T1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.

REFERENCES:

R1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.

R2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.

R3. TurbanE.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.

R4. Sitausu S. Mittra, "Decision Support Systems–Tools and Techniques", John Wiley, New York,1986.

R5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application", Springer Verlog, New York, 1987

R6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	-	3

High-3; Medium-2; Low-1

Course Code: 19CEEN1048		Course Title: URBAN PLANNING AND DEVELOPMENT	
Course Category: Professional Elective		Course Level: Practice	
L:T:P (Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max. Marks:100

Pre-requisites

- **Transportation Engineering**

Course Objective:

The course is intended to:

- Enable students to have the knowledge on planning process
- Study about the regulations and laws related to Urban Planning.
- Study about the regulations and laws related to Urban Planning.

Unit-I INTRODUCTION 7 Hours

Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

Unit-II PLANNING PROCESS AND THEORIES 9 Hours

Principles of Planning Stages in Planning Process Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept

Unit-III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10 Hours

ITS User Needs and Services and Functional areas Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections

Unit-IV PLAN IMPLEMENTATION **10 Hours**

Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation.

Unit-V URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS **9 Hours**

Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

COURSE OUTCOMES	**Cognitive Level**
CO.1 Explain the basic issues and terminologies in urban planning	Understand
CO.2 Explain the different types of theories of urban planning and city development.	Understand
CO.3 Explain the different types of plan, their strategies and their preparation process.	Understand
CO.4 Explain the planning standards, constraints and the financial mechanism	Understand
CO.5 Explain the various country planning acts and their functions.	Understand

TEXT BOOKS:

T1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002

T2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978

T3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001

T4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986

REFERENCES:

R1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai

R2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005

R3. Chennai City Municipal Corporation Act, 1919 and Tamil Nadu District Municipalities Act, 1920

R4. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013

R5. The Tamil Nadu Combined Development and Building Rules, 2019

R6. Urban & Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, Vol I & II, Jan 2015, Govt of India, Ministry of Urban Development

R7. http:/.moud.gov.inCourse Articulation Matrix

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High-3; Medium-2; Low-1

OPEN ELECTIVES

Course Code: 19CEOC1001		Course Title: ENVIRONMENTAL IMPACT ASSESSMENT	
Course Category: Open Elective		Course Level: Mastery	
L: T: P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre–requisites

- Environmental Sciences

Course Objectives

The course is intended to:

- Understand the basic concepts involved in the EIA process.
- Apprehend the methods of EIA adopted for various infrastructural projects.
- Know the impacts of infrastructure projects on the environment.
- Understand the steps involved in preparation of environmental management plans.
- Familiarize with environmental impact assessment of infrastructural projects.

Unit I – INTRODUCTION **9 Hours**

Impact of development projects under civil engineering on the environment– Environmental impact assessment (EIA) – Environmental impact statement (EIS) – EIA capability and limitations – EIA notifications – EIA consultants

UNIT II – METHODOLOGIES **9 Hours**

Methods of EIA – Strength, weakness and applicability of EIA – Appropriate methodology – Process screening, Baseline studies, Mitigations. Types – Checklists, Matrices, Networks, Cost benefit analysis

UNIT III – AIR QUALITY, NOISE, ENERGY, WATER QUALITY, VEGETATION AND WILDLIFE IMPACT **9 Hours**

Background – typical consideration and factors, Air quality impact of industries, transport systems, human settlements. Effects of noise on people, noise scales and rating methods. Energy impact considerations – Water quality criteria and standards – Impact on flora and fauna – Socio economic impact – Rapid EIA – Environmental audit

UNIT IV – ENVIRONMENTAL MANAGEMENT PLAN **9 Hours**

Plan for mitigation of adverse impact on the environment – options for mitigation of impact on water, air and land, flora and fauna – ISO 14001

UNIT V – CASE STUDIES **9 Hours**

EIA for infrastructural projects – Highways and bridges – stadium – railways – dams – multi–storey buildings – water supply and drainage projects – power plants.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1. Describe the objectives, capability, and limitations of EIA.	Understand
CO 2. Elucidate the methods of EIA with case studies.	Understand
CO 3. Explain the impacts of infrastructure projects on air quality, water quality, vegetation and wildlife.	Understand
CO 4. Explain and prepare an environmental management plan for an infrastructural project.	Understand
CO 5. Explain and prepare environmental impact assessment report for various infrastructural projects.	Understand

Textbook(s):

T1. Peter Morris and Riki Therivel, “Methods of Environmental Impact Assessment”, Routledge Publishers, First edition, 1995.

T2. Y. Anjanayulu, “Environmental impact assessment methodologies”, B.S. Publications, Hyderabad, Third edition, 2020.

T3. S.R. Khandeshwar, N.S. Raman, A.R. Gajbhiye, “Environmental impact assessment”, Dreamtech Press, 2019.

Reference Book(s):

R1. John G. Rau and David C Hooten (Ed)., “Environmental impact analysis handbook”, McGraw–Hill book company, 1990.

R2. “Environmental assessment source book”, Vol. I, II and III. The world bank, Washington, D.C., 1991.

R3. Judith Petts, “Handbook of environmental impact assessment Vol. I and II”, Blackwell science, 1999.

Web References:

1. http://nptel.ac.in/courses/120108004
2. http://environmentalclearance.nic.in/writereaddata/EIA%20Notifications

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	3	3	-	-	-	-	2	-	2
CO2	2	-	-	-	-	3	3	-	-	-	-	2	-	2
CO3	2	-	-	-	-	3	3	-	-	-	-	2	-	2
CO4	2	-	-	-	-	3	3	-	-	-	-	2	-	2
CO5	2	-	-	-	-	3	3	-	-	-	-	2	-	2

High–3; Medium–2; Low–1

Course Code:19CEOC1002	Course Title: SAFETY ENGINEERING		
Course Category: Open Elective		Course Level: Mastery	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Study the concepts in safety, safety policy and its techniques.
- Study the concepts in Health and hygiene in the occupational environment.
- Learn about Fire explosion control techniques in various industries.
- Know the Safety standards in construction industry.
- Know the Safety materials to be used in the field of work.

UNIT I – INTRODUCTION TO CONCEPTS **9 Hours**

Concept of safety – Evolution of modern safety concept– Safety policy – Safety Organization – line and staff – functions for safety – Safety Committee– budgeting for safety. Techniques–Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT II – OCCUPATIONAL HEALTH AND HYGIENE **9 Hours**

Physical hazards – Noise, noise exposure regulation, occupational damage, risk factors, and permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, control measures. Chemical hazards – Recognition of chemical hazards–dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, Methods of Control. Concept and spectrum of health – pre-employment and post–employment medical examinations –occupational related diseases, prevention of diseases.

UNIT III – FIRE ENGINEERING AND EXPLOSION CONTROL **9 Hours**

Fire chemistry – Dynamics of fire behavior – Fire properties of solid, liquid and gas – Fire spread – Toxicity of products of combustion. Building evaluation for fire safety – Fire load – Fire resistance materials and fire testing – Structural Fire protection – Exits and egress. Statutory Rules and Techniques of firefighting – Indian Explosive acts and rules – Techniques of firefighting and demonstration.

UNIT IV – SAFETY IN CONSTRUCTION **9 Hours**

General safety consideration – Analyzing construction jobs for safety–Contract document Safety certificate for statutory authorities for old building and construction. Safety in Erection and closing operation – Construction materials – Specifications – suitability – Limitations. Safety in typical civil structures – Dams–bridges–water Tanks–Retaining walls – Critical factors for failure–Regular Inspection and monitoring.

UNIT V – SAFETY IN MATERIAL HANDLING **9 Hours**

General safety consideration in material handling – Ropes, Chains, Sling, Hoops, Clamps, Arresting gears. Selection, operation and maintenance of Industrial Trucks – Mobile Cranes, Tower crane – Checklist – Competent persons.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO.1	Explain the concepts of safety, techniques and safety audit procedure for industrial applications.	Understand
CO.2	Illustrate the types and effects of physical, chemical hazards and methods to control the hazards towards occupational health and hygienic.	Understand
CO.3	Explain the concepts of fire safety and control measures to be followed in industries.	Understand
CO.4	Illustrate the safety procedure to be adopted during construction of various civil engineering structures.	Understand
CO.5	Explain the safety considerations to be followed during handling of safety materials and machineries.	Understand

Textbook(s):

T 1. R. K. Jain , Sunil S. Rao, Industrial Safety, Health and Environment Management Systems, Khanna Publisher, 2000

T 2. D.S.S.Ganguly , C.S.Changeriya, Safety Engineering, Chetan Publication, 2016

Reference Book(s):

R 1. Accident Prevention Manual for Industrial Operations: National Safety Council, Chicago

R 2. Construction Industry Training Board (CITB); 2nd Revised edition,2018

R 3. Safety Management System and Documentation Training Programme Handbook– 2019

Web References:

1. https://nptel.ac.in/courses/110/105/110105094/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2;Low–1

Course Code: 19CEOC1003	Course Title: GEOGRAPHICAL INFORMATION SYSTEM		
Course Category: Open Elective		Course Level: Mastery	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

- Learn the basic concepts and principles of Remote Sensing.
- Know about the sensors in India and other countries with their characteristics.
- Understand the various types of image processing used for different data products.
- Learn the components of GIS and its practical applications in civil engineering.
- Understand the raster and vector data analysis and application of GIS.

UNIT I – FUNDAMENTALS OF GIS **9 Hours**

Introduction to GIS – Basic spatial concepts – Coordinate Systems – GIS and Information Systems – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open–source Software – Types of data – Spatial, Attribute data types of attributes – scales/ levels of measurements.

UNIT II – SPATIAL DATA MODELS **9 Hours**

Database Structures – Relational, Object Oriented – Entities – Entity Relationship (ER) diagram – data models conceptual, logical and physical models – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster vs Vector Models– TIN and GRID data models.

UNIT III – DATA INPUT AND TOPOLOGY **9 Hours**

Scanner – Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input –Digitiser–Datum Projection and reprojection –Coordinate Transformation – Topology – Adjacency, connectivity and containment – Topological Consistency – Non topological file formats – Attribute Data linking –Linking External Databases – ODBC – GPS (Global Positioning System) – GPS based mapping – GPS Data Integration

UNIT IV – DATA ANALYSIS **9 Hours**

Vector Data Analysis tools – Raster Data Analysis tools – Network Analysis – Digital Education models – 3D data collection and utilisation.

UNIT V – APPLICATIONS **9 Hours**

GIS Applicant – Natural Resource Management – Engineering – Navigation – Vehicle tracking and fleet management – Marketing and Business applications – Case studies

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Describe the basic concepts and principles of Remote Sensing.	Understand

CO.2	Classify the sensors in India and other countries with their characteristics.	Understand
CO.3	Explain various types of image processing used for different data products.	Understand
CO.4	Describe the components of GIS and its practical applications in civil engineering.	Understand
CO.5	Distinguish raster and vector data analysis and application of GIS.	Understand

Textbook(s):

T 1. Kang–Tsung Chang, Introduction to Geographic Information Systems with Data Set CD– ROM, 9th Edition, Mc Graw Hill, 2018

T 2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, 4th Edition, Pearson Education, 2012

Reference Book(s):

R.1 C.P. Lo, Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, 2nd Edition, Prentice Hall, 2017

R.2 Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, NEW and UPDATED 6th Edition, 2019

Web References:

1. https://www.gislounge.com/open–source–gis–applications/
2. https://www.arcweb.com/blog/geographic–information–systems–gis–defined
3. http://www.fresnostate.edu/csm/ees/documents/facstaff/wang/gis200/lecture–notes/gis/chap11.pdf
4. https://geogra.uah.es/patxi/gisweb/GISModule/GIST_Vector.htm

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2;Low–1

Course Code: 19CEOC1004	Course Title: APPLIED DESIGN THINKING CONCEPTS		
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks:100

Pre-requisites

- Nil

Course Objective

The course is intended to:

- Apply a scientific method to define & test various hypotheses to mitigate the inherent risks in product innovations.
- Design the solution concept based on the proposed value defined for the target customer exploring various alternate solutions to achieve value-price fit.
- Develop Skills in empathizing, Critical thinking, analyzing, storytelling & Pitching.
- Apply system thinking to reverse engineer a product/prototype and understand its internal components and their correlations.

UNIT I – DESIGN THINKING PRINCIPLES **9 Hours**

Exploring Human centered Design – Understanding the Innovation process, Discovering areas of opportunity, Interviewing & empathy building techniques, Mitigate validation risk with FIR [Forge Innovation rubric] – Case studies

UNIT II – CUSTOMER-CENTRIC INNOVATION **9 Hours**

Importance of customer centric innovation – Problem Validation and Customer Discovery – Understanding problem significance and problem incidence - Customer Validation. Target user, User persona &user stories. Activity: Customer development process – Customer interviews and field visits

UNIT III - APPLIED DESIGN THINKING TOOLS **9 Hours**

Concept of Minimum Usable Prototype [MUP] – MUP challenge brief – Designing & Crafting the value proposition – Deriving the Solution concept [MUP] iteratively-Activity: Ideate, Proto type and Test.

UNIT IV – SYSTEM THINKING &REVERSE ENGINEERING **9 Hours**

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems, Reverse Engineering Methodology, Identify building blocks/Components - Re-Engineering a complex system.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Enlighten Scientific Methods in product innovation	Apply
CO2: Expertise on the target customer exploring various alternate solutions to achieve value-price fit.	Apply
CO3: Inculcate variety of applied design thinking tools	Apply
CO4: Describe various skills in system thinking	Apply

Web References:

1. https://www.ideou.com/pages/design-thinking#process.
2. https://blog.forgeforward.in/valuation-risk-versus-validation-risk-in-product-innovations-49f253ca8624.
3. https://blog.forgeforward.in/product-innovation-rubric-adf5ebdfd356.
4. https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e.
5. https://blog.forgeforward.in/user-guide-for-product-innovation-rubric-857181b253dd.
6. https://blog.forgeforward.in/startup-failure-is-like-true-lie-7812cdfe9b85.

Course Articulation Matrix:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	1	-	2	2	-	-	2	1	2	-	1
CO2	2	1	-	2	2	-	-	2	1	2	-	1
CO3	2	1	-	2	2	-	-	2	1	2	-	1
CO4	2	1	-	2	2	-	-	2	1	2	-	1

High-3; Medium-2; Low-1

Course Code: 19CEOC1005	Course Title: STARTUP FUNDAMENTALS FOR ENGINEERS		
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks:100

Prerequisites

- Nil

Course Objectives

The course is intended to:

- Develop an entrepreneurial mind-set that will help them identify, assess, shape & act on opportunities in a variety of contexts & organization.
- Demonstrate the potential of an innovative idea to create economic value, as a startup.
- Understand the scientific process to explore a viable business model to build a scale business.
- Acquire knowledge on the fundamental concepts of Intellectual Property to Draft the Patent for a product.

UNIT I – ENTREPRENEURIAL MINDSET & METHOD **9 Hours**

Introduction to Innovation-led, tech-powered entrepreneurship – Understand from research the attributes of an expert entrepreneur- Effectuation principles – Dealing with the unknowns – Case studies of startup failures.

UNIT II – IDEA TO ENTERPRISE **9 Hours**

Design and Planning of Product Concept – Business Model – Business Planning – Building Proof of Product and Value Testing – Target Market and Revenue Planning.

UNIT III – MINIMUM VIABLE BUSINESS **9 Hours**

Framework for Minimum Viable Business – Disruptive Innovation – Theory of Disruption – Competitive advantage – Building proof of viable business model –Demystifying Scalability – Pitch Clinic.

UNIT IV – IPR AND PATENT DRAFTING **9 Hours**

Intellectual Property 101- Introduction and the need for Intellectual Property Rights, Prior Art Search &Case studies of IPR. Fundamentals of Patent Drafting - Invention as a concept - Keywords formation - Structure of patent - Key attributes in patent drafting - Drafting provisional specifications – Drafting complete specifications – Draft claims – Case studies on patent drafting.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the diverse in Scientific entrepreneurial mindset & method	Apply
CO2: Expertise on the potential of an innovative idea	Apply
CO3: llustrate the Scientific process in business models	Apply
CO4: Exemplify fundamental concepts of Intellectual Property	Apply

Reference Book(s):

R1. Steven Blank and Bob Dorf, (2012), The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, K&S Ranch.

R2. Dr. SarasSarasvathy, (2008), Effectuation: Elements of Entrepreneurial Expertise, New Horizons in Entrepreneurship series.

Web References:

1. https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	2	2	-	-	2	1	2	-	1
CO2	2	1	-	2	2	-	-	2	1	2	-	1
CO3	2	1	-	2	2	-	-	2	1	2	-	1
CO4	2	1	-	2	2	-	-	2	1	2	-	1

High-3; Medium-2;Low-1

SKILL DEVELOPMENT COURSES

Course Code: 19CEPN6011		Course Title: INTRODUCTION TO INTERIOR DESIGN SKETCH-UP TOOL	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 2: 0:0	Credits:1	Total Contact Hours:30	Max Marks:100

Pr–requisites

- 19CECN3201– Computer Aided Building Drawing Laboratory

Course Objectives

The course is intended to:

1. Gain knowledge on basic tools of sketch up software.
2. Know the components/objects used in interior of a residential building.
3. Learn the Landscapes in a residential building.
4. Know the 3D exposure of a residential building.

Unit I – INTRODUCTION **7 Hours**

Introduction to Sketch Up – The fundamental tools – Lines, Rectangles, and Circles – Move, Rotate and offset – Push, Pull and Follow Me – Understanding How Sketch UP Works

Unit II – GROUPS AND COMPONENTS **7 Hours**

Creating and Editing Groups – Creating and Editing Components – Textures and Materials – Applying Colours and Materials – Creating Materials – Exporting Images

Unit III – LANDSCAPE **7 Hours**

Sand box Tools – Creating Landscaping – Importing Trees – Importing CAD Files

Unit IV – Modeling and Layer Management **9 Hours**

Real World Modelling Assignment – Good Layer Management – Cleaning Up CAD Files – Turning 2D into 3D – Real World Modelling Assignment – Presentations of Modelling Assignment

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Explain the basic tools of sketch up software	Understand
CO2. Develop the components/objects used in interior of a residential building.	Apply
CO3. Develop the suitable elements of landscapes in a residential building	Apply
CO4. Develop three–dimensional view of a residential building	Apply

Text Book(s):

T1. Aidan Chopra and Laura Town Chris Pichereau, “Introduction to Google Sketch Up” John Wiley & Sons Publications, 2012

Reference Book(s):

R1. Alexander C. Schreyer**, "**Architectural Design with Sketch Up: 3D Modeling, Extensions, BIM, Rendering, Making, and Scripting**"** 2nd Edition**,** 2012

Web References:

3. https://help.sketchup.com/en/sketchup/getting–started–self–paced–tutorials

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	3	-	-	-	-	-	-	3	-	2
CO2	3	2	-	-	3	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	3	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	3	-	-	-	-	-	-	3	-	3

High–3; Medium–2;Low–1

Course Code: 19CEPN6012		Course Title: INTRODUCTION TO ANSYS	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 2: 0: 0	Credits:1	Total Contact Hours:30	Max Marks:100

Pr–requisites

- NIL

Course Objectives

The course is intended to:

1. Acquire basic knowledge on various building materials used in construction.
2. Discuss the importance of metals, timber and other materials.
3. Study the specifications, details and sequence of sub structure construction activities.
4. List the concepts and techniques used in super structure construction.
5. Identify the equipment required in various levels of construction.

UNIT I – INTRODUCTION TO CAE AND ANSYS WORKBENCH **6 Hours**

Introduction to CAE – General working of FEA– Boundary conditions– Elements and Element Shapes, Types of Engineering Analysis– General procedure to conduct FEA – Classification of materials.

Starting ANSYS Workbench 14.0– Working on a Project– Units in ANSYS Workbench– ANSYS Workbench Database and File format – Changing the unit system– Components of the system

UNIT II – SKETCHING FEATURES, TOOLS AND ASSEMBLY **6 Hours**

Modeling– Design Modeler Window– Illustration of I–section, Spring Plate, Clamp. Static loadings–ductile materials, Brittle materials– Fatigue loading–ductile material, Adding a hole, Adding a round, Adding a chamfer, Patterns, Assembly, Alternate solid modeler

UNIT III – MODELING TECHNIQUES, MATERIAL PROPERTIES AND MESHING **6 Hours**

Solid Modeling Fundamentals – Extrusion, Revolution, Sweep, Sketching. Parameters for modeling techniques – Surface and Line models. Introduction to Engineering Workspace – Creating and Adding Materials – Assigning Material to the Beam, Clamp, Assembly. Meshing of Plate with Holes – Generating the mesh, optimize the model and generating the local mesh (illustration through Assembly Meshing)

UNIT IV – STATIC STRUCTURAL ANALYSIS **6 Hours**

Introduction to Static Structural Analysis– Pre–processing, Solution, Post–processing– Static Structural Analysis of RC elements.

UNIT V – NATURAL FREQUENCIES, BUCKLING LOADS AND THERMAL STRESS **6 Hours**

Introduction to natural frequencies – Performing the Modal analysis – Specifying analysis settings – Modal analysis: Cantilever beam and Simply supported beam. Buckling analysis of Fixed free column (flag pole), Pinned–pinned column and Built–up structure. Thermal stress – uniform temperature change – Thermal stress in a cylinder

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

CO1.	Apply the fundamentals of finite element analysis (FEA) and behind its implementation in computer-aided engineering (CAE) as well as basics of ANSYS Workbench.	Apply
CO2.	Apply sketching features for brittle and ductile materials under static and fatigue loading by using appropriate tools and assembly.	Apply
CO3.	Apply modelling techniques and material properties to generate a model through assembly meshing.	Apply
CO4.	Analyse an RC element statically to determine the displacements, stresses, strains, and forces to solve complex problems.	Apply
CO5.	Perform model analysis for different types of beams and columns with various end conditions as well as thermal analysis for cylinders.	Apply

Text Book(s):

T1. An Introduction to ANSYS Fluent 2021, By John E. Matsson Ph.D., P.E.

Reference Book(s):

R1. Finite Element Simulations with ANSYS Workbench 2021, By Huei–Huang Lee

Web References:

1. https://www.sdcpublications.com/Textbooks/Introduction–ANSYS–Fluent–2020/ISBN/ 978-1-63057-396-6/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	2	3	-
CO2	3	2	-	3	-	-	-	-	-	-	-	2	3	-
CO3	3	2	-	3	-	-	-	-	-	-	-	2	3	-
CO4	3	2	-	3	-	-	-	-	-	-	-	2	3	-
CO5	3	2	-	3	-	-	-	-	-	-	-	2	3	-

High–3; Medium–2; Low–1

Course Code: 19CEPN6013	Course Title: WELDING TECHNOLOGY		
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 1: 0: 1	Credits:1	Total Contact Hours:30	Max Marks:100

Pre–requisites

- Nil

Course Objectives

The course is intended to:

1. The welding principles and to learn the process of typical welding (Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, shielded metal arc welding, Submerged arc welding) as per Indian Standards
2. The process, advantages and applications of TIG and MIG welding as per Indian Standards
3. The process, advantages and applications of solid-state welding as per Indian Standards
4. The typical advanced welding processes and to know welding automation in typical fields (aerospace, nuclear and surface transport vehicles)
5. The design of weld joints, material weldability (for Aluminium, Copper & Stainless Steel) and testing of weldments

UNIT I – GAS AND ARC WELDING PROCESSES **3 Hours**

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding.

UNIT II – TIG & MIG WELDING PROCESSES **3 Hours**

TIG & MIG welding–Process – advantages, limitations and applications.

UNIT III – SOLID STATE WELDING PROCESSES **3 Hours**

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes – advantages, limitations and applications

UNIT IV – ADVANCED WELDING PROCESSES **3 Hours**

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

UNIT V – DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS **3 Hours**

Various weld joint designs – Weldability of Aluminium, Copper, and Stainless steels. Destructive and non-destructive testing of weldments.

List of Exercises **15 Hours**

1. Oxyacetylene welding on Aluminium, Copper, and Stainless steels
2. Carbon arc welding on Aluminium, Copper, and Stainless steels
3. Submerged arc welding on Aluminium, Copper, and Stainless steels
4. TIG welding on Aluminium, Copper, and Stainless steels
5. MIG welding on Aluminium, Copper, and Stainless steels

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO.1	Demonstrate typical welding (Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding) as per Indian Standards.	Apply
CO.2	Demonstrate TIG and MIG welding as per Indian Standards.	Apply
CO.3	Describe the process, advantages and applications of solid-state welding as per Indian Standards	Understand
CO.4	Explain the typical advanced welding processes and describe the welding automation in various fields such as aerospace, nuclear and surface transport vehicles.	Understand
CO.5	Explain the design of weld joints, material weld ability (for Aluminium, Copper & Stainless Steel) and testing of weldments.	Understand

Text Book(s):

T1. Parmer R.S., “Welding Engineering and Technology”, 1st edition, Khanna Publishers, New Delhi, 2008.

T2. Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

Reference Book(s):

R1. Nadkarni S.V. “Modern Arc Welding Technology”, 1st edition, Oxford IBH Publishers, 2005.

R2. Schwartz M.M. “Metals Joining Manual”. McGraw Hill Books, 1979.

R3. Davis A.C., “The Science and Practice of Welding”, Cambridge University Press, Cambridge, 1993

Web References:

1. https://www.jfe–steel.co.jp/en/research/report/020/pdf/020–17.pdf

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-	3
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2;Low–1

Course Code: 19CEPN6014		Course Title: FIRE AND SAFETY ENGINEERING	
Course Category: Professional Core		Course Level: Practice	
L:T:P (Hours/Week) 4: 0: 0	Credits:4	Total Contact Hours: 60	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Understand the principles, policies and fundamentals of Fire and Safety Engineering as per OSHA standards
2. Learn about the tools and equipment's involved in Fire and Safety and its applications
3. Study the procedures for fire safety protection of buildings
4. Study the Fire safety risk assessment and evacuation procedures
5. Learn about Industrial Fire Safety management and laws on Industrial safety.

UNIT I – INTRODUCTION TO FIRE & SAFETY **12 Hours**

History of fires – Ancient & Modern Fire safety construction techniques – fire investigation – National Fire Protection Association – Occupational Safety and Health Administration standards.

Safety goals and objectives – Monitoring safety progress – Safety and the balanced scorecard – Setting targets and ensuring commitment – Policies and procedures – Safety values and principles.

UNIT II – FIRE SAFETY TOOLS & EQUIPMENT'S **12 Hours**

General Causes of fire – Detection of fire – Classification of fire – Extinguishing methods – Portable fire extinguishers – Pumps and primers – Foam and foam making equipment's – Hose and hose fittings – Water relay systems – Breathing apparatus – Small gears – Fire protective clothing – Ladders, Ropes and lines, bends & hitches.

UNIT III – FIRE SAFETY PROTECTION FOR BUILDINGS **12 Hours**

Emergency Plans & Staff Training – Highly Flammables & LPG – Firefighting equipment requirements – Fire resisting construction & compartmentation – Active fire safety for building protection: Sprinklers & Automatic roof vents, Scaffolding – Types, installation methods and procedures for Fire safety protection.

UNIT IV – FIRE RISK ASSESSMENT & EVACUATION **12 Hours**

Fire risk assessment structure and layout – Identifying hazards and risks –Means of escape principles – Basic requirements – Fire signage: National requirements, Fire Alarms & fire detection – Basic components, and testing, Emergency lighting –Measures to prevent and reduce fire pollution

UNIT V – INDUSTRIAL FIRE SAFETY MANAGEMENT

12 Hours

Job safety analysis – Safety audit – Safety survey – Risk assessment and management –Risk management and corporate policy on insurance – Accident investigation – Work permit system – Emergency planning, industrial light and ventilation – personal protective equipment – First aid & Safety Management and safety laws.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Explain the principles, policies and fundamentals of Fire and Safety Engineering as per OSHA standards	Understand
CO.2 Explain the tools and equipment's involved in Fire and Safety for various applications	Understand
CO.3 Illustrate the procedures for fire safety protection of buildings.	Understand
CO.4 Explain the procedure for Fire safety risk assessment and emergency evacuation.	Understand
CO.5 Explain about Industrial Fire Safety management and enumerate the laws on Industrial safety.	Understand

Text Book(s):

1. Akhil kumar Das, "Principles of Fire Safety Engineering: Understanding Fire and Fire Protection", Prentice Hall India Learning Private Limited, 2014.
2. Andrew Furness and Matrin Muckett, "Introduction to fire safety Management",

Reference Book(s):

1. Daniel E. Della Gustina, "Fire Safety Management Hnadbook", CRC Press, Third Edition, 2014.
2. N Prekash Sesha,"Manual of Fire Safety" ,CBS Publishers & Distributors Pvt Ltd,2017.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	-	2

High–3; Medium–2;Low–1