CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

FOR

BACHELOR OF TECHNOLOGY (B.Tech.)

(4 Year Undergraduate Degree Programme)

IN

CIVIL ENGINEERING

[w. e. f. 2020-21]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
**Plot No.39, Rajiv Gandhi Education City, P.S. Rai, Sonepat
Haryana-131029**

SRM UNIVERSITY DELHI-NCR, SONEPAT (HARYANA)

VISION

SRM University Delhi-NCR, Sonepat, Haryana aims to emerge as a leading world-class university that creates and disseminates knowledge upholding the highest standards of instruction in Medicine & Health Sciences, Engineering & Technology, Management, Law, Science & Humanities. Along with academic excellence and skills, our curriculum imparts integrity and social sensitivity to mould our graduates who may be best suited to serve the nation and the world.

MISSION

- To create a diverse community campus that inspires freedom and innovation.
- Promote excellence in educational & skill development processes.
- Continue to build productive international alliances.
- Explore optimal development opportunities available to students and faculty.
- Cultivate an exciting and rigorous research environment.

BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING)

VISION

To emerge as a nationally recognized centre of excellence in the science and application of civil engineering, fueled by a rigorous and dynamic academic programme nurturing research and development in cutting edge areas, with strong emphasis on Industry linkages by way of rendering state of an art consultancy services.

MISSION

To impart quality civil engineering education attuned to the needs of the Industry with emphasis on practical exposure aided by well-equipped laboratories, which in turn feed a vigorous research and development programme in addition to creating capabilities for industrial consultancy.

OUTCOME

The curriculum and syllabus for B.Tech. (Civil Engineering) programs conform to outcome based on C-D-I-O Initiative. The framework provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating (CDIO) real-world systems and products.

In general, the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these under-mentioned outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

a) An ability to apply knowledge of mathematics, science, and engineering.

b) An ability to design and conduct experiments, as well as to analyze and interpret data.

c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) An ability to function on multidisciplinary teams.

e) An ability to identify, formulate and solve engineering problems.

f) An understanding of professional and ethical responsibility.

g) An ability to communicate effectively.

h) The broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context.

i) Recognition of the need for, and an ability to engage in life-long learning.

j) Knowledge of contemporary issues.

k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PROGRAM REQUIREMENT

General Education Requirements: Basic Science (BS),

Humanities and Management (HSMC)

Basic Science and Engineering Requirements: Engineering Science (ESC) through regular /

online mode

Disciplinary Requirements comprising of:

Civil Engineering	Professional Core (P) (through regular/online mode)
Civil Engineering	Program Electives (PE), Open Electives (OE) and Electives (E) (through regular/online mode)
Civil Engineering	Skill Development (SD) (through regular/online mode)

Practical and Research component:

1. Regular Practical and Research
2. Summer Internships
3. Specialized courses through the Study Abroad program
4. Minor and Major Project
5. Industry internship through the semester.

While framing a dynamic and all-inclusive course curriculum, emphasis has been laid on including the basic aspects of all facets of the discipline, namely, construction materials, structural analysis, structural design in steel and concrete, water resources engineering, transportation engineering, environmental engineering, surveying and geotechnical engineering. At the same time, in recognition of the importance of computer applications, course like structural analysis in particular, have been framed in such a manner as to encourage the student to exploit the potential of computers for solving engineering problems.

A strong curriculum is only one important component of the tripod of the Department's competitiveness. The second component is a competent, well qualified and dedicated faculty and supporting staff. The Department boasts of maximum number of faculty members with Technical Qualification from premier institutes. The faculty reputation is enhanced by its commendable publication record and its effectiveness is complimented by trained and skilled supporting staff. The third component of relevance is a vigorous and dynamic research programme aided by well-equipped laboratories which also serve to add value to the undergraduate programme.

The Department has powerful software for linear as well as non-linear finite element based analysis of structures,
e. g. STAAD III, STAAD PRO, and ATENA. All the faculty members of the Department are actively involved in teaching, research and providing consultancy services to the construction industry.

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SEMESTER – I

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
20LE0101	TECHNICAL ENGLISH- I	HSMC	1	0	2	3	2
20MA0111	CALCULUS AND SOLID GEOMETRY	BSC	3	1	0	4	4
20GE0108	VALUE EDUCATION	BSC	1	0	0	1	1
20PH0101	PHYSICS	BSC	3	0	0	3	3
20CY0101	CHEMISTRY	BSC	3	0	0	3	3
20CS1001	INTRODUCTION TO COMPUTER AND PROGRAMMING	BSC	3	0	0	3	3
19ME0111	BASIC MECHANICAL FOR CIVIL ENGINEERS	BSC	3	0	0	3	3
20ME0130	ENGINEERING GRAPHICS	ESC	1	0	2	3	2
20PH0103	PHYSICS LABORATORY	BSC	0	0	2	2	1
20CY0103	CHEMISTRY LABORATORY	BSC	0	0	2	2	1
20CS1111	COMPUTER PROGRAMMING LAB	BSC	0	0	2	2	1
20PD0101	PERSONALITY DEVELOPMENT-I	SD	1	0	0	1	1
	TOTAL		**19**	**1**	**10**	**30**	**25**

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SEMESTER – II

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
20LE0102	TECHNICAL ENGLISH- II	HSMC	1	0	2	3	2
20MA0102	ADVANCED CALCULUS AND COMPLEX ANALYSIS	BSC	3	1	0	4	4
20PH0102	MATERIALS SCIENCE	BSC	3	0	0	3	3
20GE0104	ENVIRONMENTAL STUDIES	HSMC	2	0	0	2	2
20GE0102	BIOLOGY FOR ENGINEERS	BSC	2	0	0	2	2
19CE0102	STRENGTH OF MATERIALS	ESC	3	0	0	3	3
19CE0104	BUILDING CONSTRUCTION AND MATERIAL	P	3	0	0	3	3
20GE0107	NSS / NCC/ NSO / YOGA	E	0	0	2	2	1
20ME0120	WORKSHOP PRACTICE	ESC	1	0	2	3	2
20PH0104	MATERIALS SCIENCE LABORATORY	BSC	0	0	2	2	1
20PD0102	PERSONALITY DEVELOPMENT-II	SD	1	0	0	1	1
	TOTAL		**19**	**1**	**8**	**28**	**24**

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SEMESTER – III

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19CE0201	STRUCTURAL ANALYSIS – I	P	3	1	0	3	4
19CE0203	SURVEYING – I	P	3	0	0	3	3
19CE0205	DESIGN OF STEEL STRUCTURES	P	3	0	2	5	4
19CE0207	FLUID MECHANICS	P	3	0	0	3	3
19CE0209	ENVIRONMENTAL ENGINEERING – I	P	3	0	0	3	3
19CE0211	STRUCTURAL ANALYSIS (P)	SD	0	0	2	2	1
19CE0213	SURVEYING – I (P)	SD	0	0	2	2	1
19CE0215	FLUID MECHANICS (P)	SD	0	0	2	2	1
19CE0217	ENVIRONMENTAL ENGINEERING (P)	SD	0	0	2	2	1
20LE0201/ 20LE0205	GERMAN LANGUAGE PHASE-I / FRENCH LANGUAGE PHASE-I	E	2	0	0	2	2
20PD0201	PERSONALITY DEVELOPMENT-III	SD	0	0	2	2	1
	TOTAL		17	1	12	30	24

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SEMESTER – IV

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
20MA0202	NUMERICAL METHODS	BSC	3	1	0	4	4
19CE0202	STRUCTURAL ANALYSIS – II	P	3	1	0	4	4
19CE0204	DESIGN OF CONCRETE STRUCTURES – I	P	3	0	2	5	4
19CE0208	ADVANCED SURVEYING	P	3	0	0	3	3
19CE0210	SOIL MECHANICS	P	3	1	0	4	4
19CE0212	SOIL MECHANICS (P)	SD	0	0	2	2	1
19CE0214	SURVEYING – II (P)	SD	0	0	2	2	1
20LE0202/ 20LE0206	GERMAN LANGUAGE PHASE-II / FRENCH LANGUAGE PHASE-II	E	2	0	0	2	2
20PD0202	PERSONALITY DEVELOPMENT-IV	SD	0	0	2	2	1
	TOTAL		**17**	**3**	**8**	**28**	**24**

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SEMESTER – V

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19CE0301	DESIGN OF CONCRETE STRUCTURES – II	P	3	0	2	5	4
19CE0303	GEOTECHNICAL ENGINEERING – I	P	3	1	0	4	4
19CE0305	HYDROLOGY & WATER RESOURCE ENGINEERING	P	3	0	0	3	3
19CE0307	ENVIRONMENTAL ENGINEERING – II	P	3	0	0	3	3
19CE0309	TRANSPORTATION ENGINEERING – I	P	3	1	0	4	4
19CE0311	GEOTECHNICAL ENGINEERING (P)	SD	0	0	2	2	1
19CE0313	TRANSPORTATION ENGINEERING – I (P)	SD	0	0	2	2	1
19CEPxxx	PROGRAMME ELECTIVE – I	PE	3	0	0	3	3
20PD0301	PERSONALITY DEVELOPMENT-V	SD	0	0	2	2	1
19CE0315	SURVEY CAMP##	SD	-	-	2	2	2
	TOTAL		18	2	10	30	26

TO BE CARRIED OUT AFTER 4TH SEMESTER IN HILLY REGION

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SEMESTER – VI

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19CE0302	STRUCTURAL ANALYSIS – III	P	3	1	0	4	4
19CE0304	RAILWAY & AIRPORT ENGINEERING	P	3	0	0	3	3
19CE0306	GEOTECHNICAL ENGINEERING – II	P	3	1	0	4	4
19CE0308	TRANSPORTATION ENGINEERING – II	P	3	1	0	4	4
19CE0310	IRRIGATION ENGINEERING	P	3	0	0	3	3
19CEOxxx	OPEN ELECTIVE – I	OE	3	0	0	3	3
19CEPxxx	PROGRAMME ELECTIVE – II	PE	3	0	0	3	3
19CE0312	TRANSPORTATION ENGINEERING – II (P)	SD	0	0	2	2	1
20PD 0302	PERSONALITY DEVELOPMENT-VI	SD	0	0	2	2	1
	TOTAL		**21**	**3**	**4**	**28**	**26**

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SEMESTER – VII

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19CE0401	CONSTRUCTION MANAGEMENT, ESTIMATING AND COSTING	P	3	0	0	3	3
19CEPxxx	PROGRAMME ELECTIVE – III	PE	3	0	0	3	3
19CEPxxx	PROGRAMME ELECTIVE – IV	PE	3	0	0	3	3
19CEPxxx	PROGRAMME ELECTIVE – V	PE	3	0	0	3	3
19CEOxxx	OPEN ELECTIVE – II	OE	3	0	0	3	3
19CEOxxx	OPEN ELECTIVE – III	OE	3	0	0	3	3
19CE0411	CONCRETE TECHNOLOGY LAB (P)	SD	0	0	2	2	1
19CE0413	MINOR PROJECT	SD	0	0	4	4	2
19CE0415	INDUSTRIAL TRAINING (TO BE CARRIED OUT AFTER 6th SEMESTER)	SD	0	0	2	2	1
	TOTAL		18	0	4	26	22

SEMESTER – VIII

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
20CE0410	INDUSTRIAL TRAINING*/ PROJECT WORK	SD	0	0	24(5)**	24(5)**	12

* TO BE MONITORED AT THE INSTITUTE LEVEL
** TEACHING LOAD

SCHEME OF EXAMINATION FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

CREDIT DISTRIBUTION

SEMESTER	DENOTE	I	II	III	IV	V	VI	VII	VIII	TOTAL	%AGE
HUMANITIES AND MANAGEMENT	HSMC	2	4	0	0	0	0	0	0	6	**3.28**
BASIC SCIENCE	BSC	20	10	0	4	0	0	0	0	34	**18.58**
ENGINEERING SCIENCE	ESC	2	5	0	0	0	0	0	0	7	**3.82**
ELECTIVE	E	0	1	2	2	0	0	0	0	5	**2.73**
PROGRAM ELECTIVE	PE	0	0	0	0	3	3	9	0	15	**8.20**
OPEN ELECTIVE	OE	0	0	0	0	0	3	6	0	9	**4.92**
SKILL DEVELOPMENT	SD	1	1	5	3	5	2	4	12	33	**18.03**
PROFESSIONAL CORE	P	0	3	17	15	18	18	3	0	74	**40.44**
TOTAL		25	24	24	24	26	26	22	12	183	

LIST OF PROGRAM ELECTIVES

S.NO.	SUBJECT CODE	SUBJECT NAME
1	19CEP001	STRUCTURAL DYNAMICS
2	19CEP002	INTRODUCTION TO FINITE ELEMENT METHOD
3	19CEP003	ROCK MECHANICS
4	19CEP004	GEOSYNTHETICS ENGINEERING
5	19CEP005	TRANSPORTATION PLANNING
6	19CEP006	POLLUTION CONTROL AND WASTE MANAGEMENT
7	19CEP007	GROUND WATER ENGINERING
8	19CEP008	HEALTH MONITORING OF STRUCTURES
9	19CEP009	EARTHQUAKE ANALYSIS AND DESIGN
10	19CEP010	HUMAN RESOURCE MANAGEMENT AND INDUSTRIAL RELATIONS
11	19CEP011	DISASTER MANAGEMENT
12	19CEP012	ADVANCED CONCRETE TECHNOLOGY
13	19CEP013	BRIDGE ENGINEERING
14	19CEP014	OPEN CHANNEL HYDRAULICS

LIST OF OPEN ELECTIVES

S.NO.	SUBJECT CODE	SUBJECT NAME
1	19CEO001	TRAFFIC ENGINEERING AND ROAD SAFETY
2	19CEO002	MACHINE FOUNDATION
3	19CEO003	GEOTECHNICAL EARTHQUAKE ENGINEERING
4	19CEO004	ADVANCED SURVERYING AND REMOTE SENSING
5	19CEO005	HYDRO POWER ENGINEERING
6	19CEO006	DRAUGHT AND FLOOD
7	19CEO007	CONSTRUCTION TECHNIQUES AND EQUIPMENTS
8	19CEO008	APPLICATION OF ARTIFICIAL INTELLIGENCE TO CIVIL ENGINEERING
9	19CEO009	COMPUTATIONAL PRACTICE
10	19CEO010	BUSINESS MANAGEMENT
11	19CEO011	INDUSTRIAL WASTE WATER TREATMENT

Department of Civil Engineering

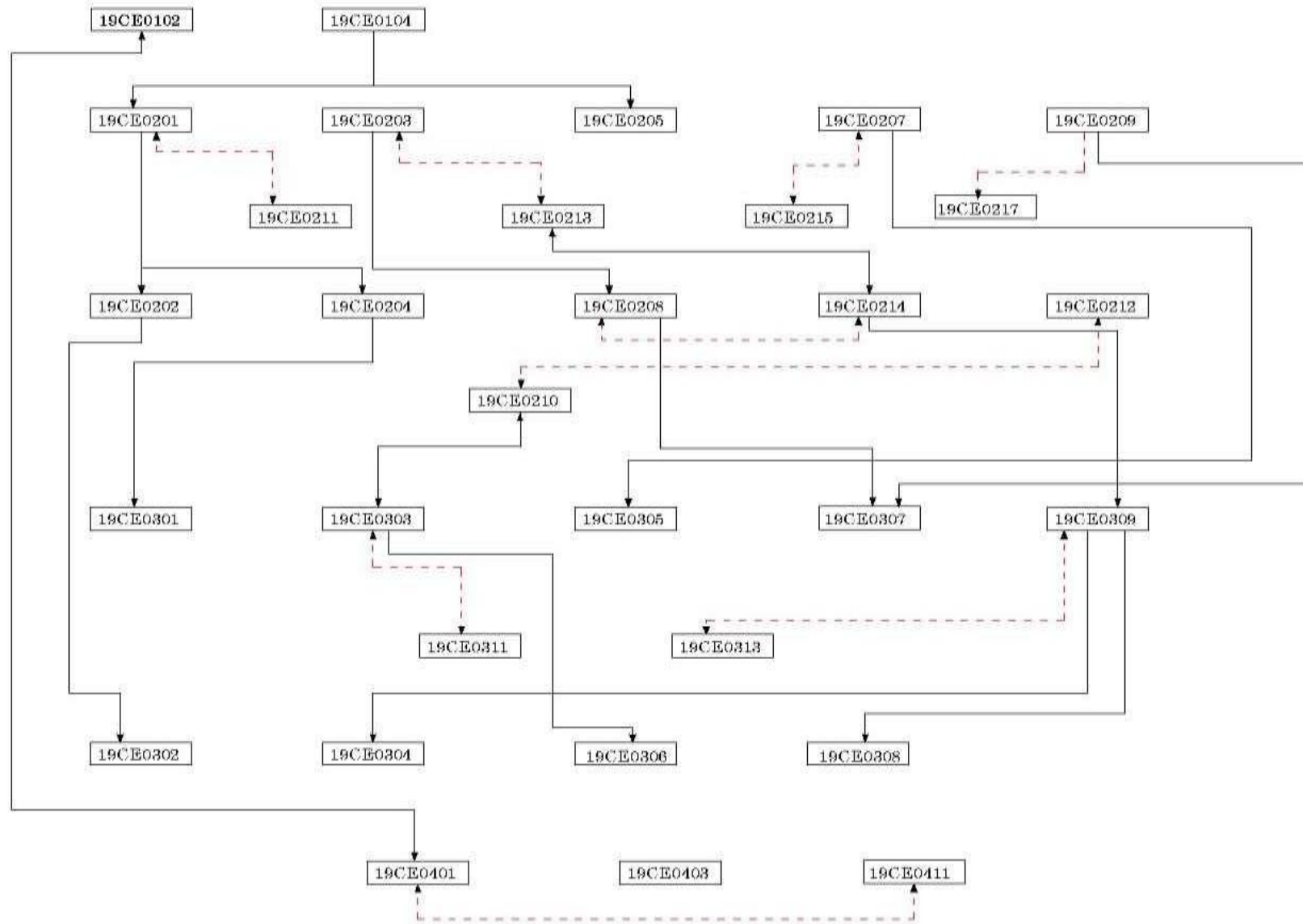## Co, & Pre requisite Subject Code Flowchart details

First Year
Odd

Even

| 19CE0102 | 19CE0104 |

Second Year

| 19CE0201 | 19CE0203 | 19CE0205 | 19CE0207 | 19CE0209 |

Odd

| 19CE0211 | 19CE0213 | 19CE0215 | 19CE0217 |

Even

| 19CE0202 | 19CE0204 | 19CE0208 | 19CE0214 | 19CE0212 |

| 19CE0210 |

Third Year

Odd

| 19CE0301 | 19CE0303 | 19CE0305 | 19CE0307 | 19CE0309 |

| 19CE0311 | 19CE0313 |

Even

| 19CE0302 | 19CE0304 | 19CE0306 | 19CE0308 |

Final Year
Odd

| 19CE0401 | 19CE0403 | 19CE0411 |

EVALUATION SCHEME

INTERNAL EVALUATION (THEORY)

Assessment	Internal Assessment-I	Internal Assessment-II	Faculty Specific Assessment	Assignment/Presentation/ Class participation	Total
Marks	15	15	10	10	50

INTERNAL EVALUATION (PRACTICAL)

Assessment	Daily Assessment/ Observation	Experiment performed during Lab hours	Experiment performed during Internal practical Examinations	Viva- Voce	Total
Marks	20	10	10	10	50

EXTERNAL EVALUATION (THEORY)

Assessment	End Semester Examination	Total
Marks	100	Will be scaled in 50

EXTERNAL EVALUATION (PRACTICAL)

Assessment	Record File	Experiment performed during External Practical Examinations	Written Work	Viva-Voce	Total
Marks	15	15	10	10	50

Note:
1. The evaluation Scheme may change as per the university guidelines.
2. Evaluation scheme of Industrial training may vary department wise.
3. Evaluation scheme project/minor project may vary department wise.

Department are advised to add the evaluation scheme in their respective curriculum.

FIRST YEAR

TECHNICAL ENGLISH I
Paper Code: 20LE0101

L T P C
1 0 2 2

Learning Objectives
The students need to prepare themselves for their career which may require them to listen to, read, speak, and write in English both for their professional as well as interpersonal communication in the globalized context. The aim of Technical English course is to empower the students to improve both abilities to communicate and your linguistic competence in the chosen language. A balance of Input (reading, listening) and output (speaking, writing) s abilities are created through open classes and self-study.

Unit-1: Nuances of English Language I
- Basic Grammar.
- Parts of speech and agreement (voice, tense, number).
- Modals and Auxiliaries.
- Phrasal Verbs

Unit-2: Nuances of English Language II
- Preposition
- Types of sentences (Interrogatives, Declaratives, Exclamatory and Imperative)
- Direct and Indirect speech
- Question Tags
- Common mistakes in English (spelling mistakes, uncountable noun mistakes, irregular plural mistakes, irregular verb mistakes, collocation mistakes, mistakes in the use of articles, prepositions, subject-verb agreement etc)

Unit-3: Language and Regional Variation
- Accent and Dialect
- Dialectology
- Regional Dialects
- Style, Slang and Jargon

Unit 4: Writing Skills
- Effective writing practice – Vocabulary expansion
- Effective sentences: role of acceptability, appropriateness, brevity & clarity in writing
- Cohesion & coherence in writing
- Writing of definitions, descriptions
- Paragraph writing.

Unit 5: Academic Writing Skills
- Reciprocal relationship between reading and writing
- Thinking and Writing
- Argument Writing Practice
- Perspectives in Writing
- Professional Writing
- Narrative Writing.

Prescribed Texts:
1. Practical English Grammar – A J Thomson and A V Martinet (OUP)
2. 1. M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.
3. 2. Strunk, William, and E B. White, The Elements of Style. Boston: Allyn and Bacon, Pearson Edition, 1999.
4. 3. Garner, Bryan A, HBR Guide to Better Business Writing, Harvard Business Review Press, Boston, Massachusetts, 2013.

The proposed course includes Practical classes to enable students to use good English and perform the following:
- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/ technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.
- Attending the highest levels of performance in accordance with the ethical requirement.

Code	Course	L	T	P	C
20MA0111	CALCULUS AND SOLID GEOMETRY	3	1	0	4

COURSE OBJECTIVES

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus and geometry for modeling the engineering problems mathematically and obtaining solutions.

OUTCOMES

At the end of the course, student should be able

- Apply advanced matrix knowledge to Engineering problems
- Equip themselves familiar with the functions of several variables
- Familiarize with the applications of differential equations
- Apply various techniques in solving differential equations.
- Expose to the concept of three-dimensional analytical geometry with the help of equation of sphere, equation of cylinder and other planes
- Expose the students towards the concept of convergence and divergence of sequence and series.
- Develop the ability to judge and apply appropriate tests to various infinite series

UNIT – I MATRICES

Types of Matrices- Elementary operations and their uses to finding the Rank, Consistent and Inconsistent System of Equation, Solution of linear simultaneous equations, Characteristic equation - Eigen values and Eigen vectors - Properties of Eigen values - Caley - Hamilton theorem-Statement and Application, Quadratic Form, Nature of Quadratic form, Reduction of Quadratic Form into Canonical form by orthogonal transformation

UNIT II – MULTIVARIATE DIFFERENTIAL CALCULUS

Function of two variables –limits and continuity, Partial derivatives, Partial derivatives of higher order, Homogeneous Function Euler's theorem on Homogeneous Function, - Total derivatives - Taylor's expansion –Jacobians, Maxima & Minima of Function of two variables, Lagrange's Multiplier method of Undetermined Multipliers.

UNIT – III ORDINARY DIFFERENTIAL EQUATIONS

Simultaneous first order linear equations with constant coefficients, Linear higher order ordinary differential equations with constant co-efficients -solutions of homogenous and non-homogenous equations - method of undetermined coefficients – method of variation of parameters – equations - Homogeneous equation of Euler type - Equations reducible to homogeneous form.

UNIT – IV SEQUENCE & SERIES

Sequence: Definition, types and examples, Convergence and divergence of sequence, Convergence and divergence of series, comparison tests, D'Alembert's ratio test, integral test, Rabbe's test, logarithmic and Cauchy root test, Gauss's test, Lebinitz's test and power series.

UNIT V THREE DIMENSIONAL ANALYTICAL GEOMETRY

Equation of a sphere, Plane section of a sphere, Tangent Plane, Orthogonal Sphere, Equation of a cone, Right circular cone, Equation of a cylinder, Right circular cylinder.

TEXT BOOKS

- Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017.
- Ramana B. V., Higher Engineering Mathematics, Tata McGraw – Hill Education, New Delhi, 2012.
- Dr.V.Ramamurthy& Dr. SundarammalKesavan, "Engineering Mathematics" - Vol I & II Anuradha Publications, Revised Edition 2006
- Kandasamy P etal. Engineering Mathematics, S.Chand & Co., New Delhi, Redevised edition2014.
- Bali N.P., Goyal M, Watkins C, Advanced Engineering Mathematics: A Complete Approach., Advanced Engineering Mathematics, Laxmi Publications, New, Delhi.2018

REFERENCE BOOKS

- Kreyszig.E, "Advanced Engineering Mathematics", 8th edition, John Wiley & Sons. Singapore,2012
- Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2013.

- Veerajan, T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi,2012

		L	T	P	C
20GE0108	**VALUE EDUCATION**	**1**	**0**	**0**	**1**
	Prerequisite				
	Nil				

Unit I: Concept of Values: Definition and Classification of values- type of values Espoused and Applied values Education – Natural and Social processes of Value Education – Fundamental values - Best practices of education - Knowledge and understanding – Cognitive Process –Instruction and Learning –Mahatma Gandhi – Jawaharlal Nehru – Rabindranath Tagore - Swami Vivekananda.

Unit II :Need of the hour: The need for education in Values - Implications of education in Values-Vision of a better India.

Unit III: Education in India – Indian Society - Ancient Education in India **-** Modern education in India –English Education – culture – **Technology in Education:** Technology and its values in education.

Unit IV: Educational Values: Personal values - Social values - **Learning values -** equality& brotherhood – unity - freedom – responsibility - **Religions** – people groups – different faiths – respect for other faiths – social evils.

Unit V: Professional Values and **Professional Ethics** – Openness – Transparency – Impartiality – Objective – Confidentiality – Diligent – Loyalty .

Unit V: Moral Values – Morality – Descriptive Morality – Normative Morality – Aristotle and his ideas on Moral values.

Unit VI: Social Values and Justice: Definition – Need – Parameters of Social Justice – Factors Causing – Social Injustice.

Unit VII: Challenges in Value Adoption: Cultural Challenges- Social Challenges- Religious Challenges- Intellectual and Personal Challenges.

Reference Books:
NCERT, *Basics in Education*, 2012.
CBSE, **Value Education: A Handbook for Teachers**, 2012.
I. K. Gandhi, **Value Education**
NCERT, **Education for Values in Schools: A Framework**
NCERT, **Value education**, 2005.

		L	T	P	C
20PH0101	**PHYSICS**	3	0	0	3
	Prerequisite				
	Nil				

Objective: To provide students with the knowledge of variety of important concepts of Physics and their applications in Engineering and Technology.

Outcome: The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.

UNIT 1 OSCILLATIONS & ULTRASONIC WAVES   8

Oscillations: Simple Harmonic Motion (SHM), Differential Equation of SHM and its Solutions, Conservation of Energy. Mass-string System. Damped Harmonic Oscillator-Over damped, Critically Damped, Under Damped motions, Relaxation Time, Forced vibrations. Resonance & Quality Factor. **Ultrasonic Waves**: Methods of production-Magnetostriction & Piezoelectric, Applications of Ultrasonic.

UNIT 2 ELECTROMAGNETISM   8

Mathematical Background: Gradient, Divergence, curl (Physical Significance), Irrotational & Solenoidal Field, Gauss Divergence and Stoke's Theorem, Important Vector Identities. **Maxwell's Equations**: Modification in Ampere's Circuital Law, Maxwell's Equation in Integral & Differential forms. Wave equation for Electromagnetic (EM) Waves-Propagation in free space, Characteristic Impedance, Poynting Vector (simple numericals), EM Energy Density.

UNIT 3 INTERFERENCE & DIFFRACTION   8

Interference: Superposition Principle, Division of Amplitude-Interference in Thin films, Application: Michelson's Interferometer, Interference in Wedge shaped Film, Application: Newton's Ring. **Diffraction**: Huygen's Wave Theory, Fraunhofer Vs Fresnel Diffractions, Fraunhofer Diffraction in Single & Multiple slits (Grating), Diffraction Vs Interference, Resolving power & Dispersive power of grating and prism.

UNIT 4 LASERS & FIBER OPTICS   9

Lasers: Basic Theory- Einstein Coefficients, Properties of Laser, Population inversion, Pumping Schemes, Three and Four level Lasers. Principle, Construction and working of Helium-Neon (He-Ne) & Nd:YAG Lasers. **Optical Fibers (OFs)**: Physical Structure and Principles, Modes, V-Number. Classification of Optical Fibers based on (a) Refractive Index-Step & Graded Index Fibers (b) Modes-Single & Multimode Fibers. Basic Application of OFs in Sensing & Communication. Hollow Core Photonic Crystal Fibers (Elementary Idea).

UNIT 5 MODERN PHYSICS & QUANTUM MECHANICS   7

Qualitative review of different experiments, Planck's Hypothesis, de-Broglie waves, Dual Nature of Matter, Uncertainty principle, Matter waves, Significance of Wave Functions, Schrodinger Wave Equation, Operators in Quantum Mechanics, Particle in a One-Dimensional Box, The Potential Barrier Problem and Tunnelling Effect (Qualitatively).

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REFERENCE BOOKS

1. Beiser A, Concepts of Modern Physics, 5th Ed., McGraw Hill International, 2003.

2. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012.

3. David J. Griffiths, Introduction to Electrodynamics, Pearson Education Limited, London, 2015.

4. Arumugam, M., Engineering Physics, 2nd edition, Anuradha Publishers, Kumbakonam, 2003.

5. Gaur and Gupta, Engineering Physics, 7th edition, Dhandapani and Sons, New Delhi, 1997.

6. Thiruvadigal, J. D., Ponnusamy, S., Vasuhi, P. S. And Kumar, C., Physics for Technologists, 5th edition, Vibrant Publication, Chennai, 2007.

7. H.K. Malik and A.K. Singh, Engineering Physics, McGraw Hill Education Private Limited, New Delhi, 2014.

8. N. Subrahmanyam and Brij Lal, Waves and Oscillations.

		L	T	P	C
20CY0101	CHEMISTRY	3	0	0	3
	Prerequisite				
	Nil				

Course Learning Objectives

• To enable the students to acquire knowledge of the principles of chemistry for engineering applications.

• To bring adaptability to new developments in engineering chemistry and a knowledge of contemporary issues relevant to engineering.

• To make them apply the knowledge of fundamental chemistry for identification, solution and analysis of 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.

Learning Outcomes

- The students should be conversant with

- The role of applied chemistry in the field of engineering.

- The knowledge of water quality parameters and the treatment of water.

- The principles involves in corrosion and its inhibitions.

- Important analytical techniques, instrumentation and the applications.

- Knowledge with respect to the phase equilibrium of different systems.

UNIT-I

Water Treatment: Impurities in Water, Hardness of Water-Softening Methods (Lime-Soda Process, Zeolite, Ion-Exchange Methods), Boiler feed Water-Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion, Desalination of Brackish Water-Electrodialysis and Reverse Osmosis, Water for Domestic Use-Chlorination, Ozonization, UV treatment, Analysis of Water-Alkalinity, Hardness (EDTA Method), Dissolved Oxygen (Winkel's method).

UNIT-II

PhaseEqullibrium and Fuels:-Terminologies-Phase, Components, Degree of Freedom, Phase Rule (W. Gibbs), One Component system-Water only (Area, Curve, Triple Point), Two component System and Reduced phase Rule, Eutectic System, Pb-Ag System (Area, Lines), KI-H_2O System (Area, Lines), Technical applications: freeze drying, solders, safety plugs and freezing mixtures.

Fuel and their classification, Caloric value, Cracking, Fuel for Internal Combustion Engine-Knocking, Octane Number, Diesel Engine Fuels-Cetane Rating, Non-Conventional Source-Solar Energy, Biomass, Biogas.

UNIT-III

Polymers:-Terminologies-Functionality, Degree of Polymerization, Classification of polymer, Molecular Weight of Polymer (Mw, Mn), Polymerization- Addition (ionic, free-radical), Co-ordination (Ziegler-Natta), Plastics- PE, Polystyrene, PVC, Teflon, PMMA, Polyesters, Epoxy Resins, Polyamide (Nylon-66, Nylon-6), Phenolic Resins (Bakelite), Amino Resins (Urea-Formaldehyde), Elastomer-Synthetic Rubber, Silicon Rubber.

UNIT-IV

Corrosion:-Corrosion: Basic concepts - mechanism of chemical, electrochemical corrosion, Types of Electrochemical corrosion - galvanic corrosion - differential aeration corrosion - pitting corrosion - stress corrosion, Factors Affecting Corrosion-Metal, Environment, Corrosion control: Cathodic

protection - sacrificial anodic method - corrosion inhibitors. Protective coatings: surface preparation for metallic coatings - electro plating (copper plating) and electroless plating (Nickel plating) - chemical conversion coatings - anodizing, phosphating & chromate coating.

UNIT-V

Engineering Materials: -High energy materials (HEMs)-Introduction; classification (explosives, propellants, pyrotechnics); requirements of HEM: sensitivity, detonation performance, oxygen balance; Important explosives (structure, preparation, properties): Lead azide, DDNP, dynamites, TNT, PETN, RDX, and plastic explosives.

TEXT BOOKS

1. Prasanta Rath , "Engineering Chemistry", 2015, Cenage Learning India Private Ltd.,
2. Shashi Chawla "A text book of Engineering Chemistry", Dhanpat Rai & Co.

REFERENCES

1. S.S. Dara, A Text book of Engineering Chemistry, 10th Edition, S. Chand & Company Ltd., New Delhi, 2003
2. Jain. P. C. and Monika Jain, "Engineering Chemistry", Danpat Rai publishing company (P) Ltd, New Delhi, 2010.

Guideline for Paper Setting

➢ Question paper will be divided into Two Part *i.e.* Part A and Part B
➢ All questions are compulsory.
➢ **Part A:** Contains ten questions of 2 marks each (10 x 2 = 20).

   In this section question will be asked for short answer/ MCQ/ Fill in the blanks from all the units.
➢ **Part B:**Consist of five questions of 16 marks (16 x 5 = 80).
➢ One question from each unit.
➢ There will be internal choice for each question.
➢ Examiners have right to ask one question of 20 marks or divide the question into three or four parts.

EVALUATION	
EXTERNAL	**INTERNAL**
50	50

		L	T	P	C
20CS 1001	**INTRODUCTION TO COMPUTER AND PROGRAMMING**	3	0	0	3

Course Objective:-

To impart a sound knowledge on working of the computer involving the different basic concepts of programming oriented topics required for developing computer software.

UNIT - I INTRODUCTION OF COMPUTER SYSTEM   9

Anatomy of a digital Computer, Different Units of Computer, System, Hardware & Software, Classification of Computer Systems, Number systems, Operating System: Definition, working & its functions, Basic concepts of Computer Networks, Network Topologies

UNIT - II PROGRAMMING FUNDAMENTS   9

Programming language- Definition, types; Syntax & Semantics, Type of programming errors, Assembler, Linker, Loader, Compiler, Interpreter, debuggers, Algorithms, flowcharts and their symbols

UNIT - III BASICS OF 'C' LANGUAGE   9

C Fundamentals, Basic data types, variables and scope, formatted input/ output, expressions, selection statements, loops and their applications

UNIT - IV ARRAY & FUNCTION   9

Arrays, functions, recursive functions, pointers and arrays. Strings literals, arrays of strings; applications.

UNIT - V STRUCTURE & FILE SYSTEM   9

Structures, Declaring a Structure, Accessing Structure Elements, Storing Structure elements, Array of Structures Unions and Enumerations.
File Input/Output, Data Organization, File Operations, Opening a File, Reading from a File, Closing the File, Writing to a File, File Opening Modes.

Course Learning Outcomes (CLOs):-

On completion of this course, the students will be able to:-
1. Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm/pseudocode.
2. Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
3. Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
4. Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

Text Books:
1. The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
2. Computer System & Programming in C by S Kumar & S Jain, Nano Edge Publications, Meerut.
3. Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2010, New Delhi.
4. Let Us C Yashwant Kanetkar 5th Edition

Reference Books

1. Computer Fundamentals and Programming in C, Reema Theraja, Oxford
2. Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH
3. Theory and problem of programming with C, Byron C Gottfried, TMH

		L	T	P	C
19ME0111	**BASICS MECHANICAL FOR CIVIL ENGINEERING**	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE
To familiarize the students with the basics of Mechanical Engineering

INSTRUCTIONAL OBJECTIVES
To familiarize with
1. The basic concept ofThermodynamics
2. The Sources of Energy and PowerGeneration
3. Various Turbines and Pumps
4. To know about different materials and their properties
5. Basic concepts of stress and strain

BASIC CONCEPT OF THERMODYNAMICS
Introduction, States, Work, Heat, Temperature, Zeroth law, 1st, 2nd and 3rd law of thermodynamics, Concept of internal energy, Enthalpy and Entropy. Working: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapour compressioncycle.

HYDRAULIC TURBINES & PUUMPS
Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines. Pumps: Types and operation of Reciprocating, and Centrifugal pump

ENERGY
Sources: Renewable and non-renewable (various types, characteristics, advantages/disadvantages).
Power Generation: External and internal combustion engines - Hydro and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). **Simple Problems.**

Engineering materials

Engineering Materials: Types and applications of Ferrous & Nonferrous metals, Timber, ceramics, glass, graphite, diamond, plastic and polymer
Composites: Introduction: Definition, Classification and applications (Air craft and Automobiles)

		L	T	P	C
20ME0130	**ENGINEERING GRAPHICS**	1	0	2	2
	Prerequisite				
	Nil				
	(Only First Angle Projection is to be followed)				

Learning Objectives

The objective of this course is to provide the basic knowledge about Engineering Drawing. Detailed concepts are given in projections, technical drawing, dimensioning and specifications, so useful for a student in preparing for an engineering career.

Learning Outcomes

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

1. Basic knowledge of construction of geometrical figures.
2. Dimension and annotate two-dimensional engineering drawings.
3. The projection of 1D, 2D and 3D elements.
4. Sectioning of solids and development of surfaces.
5. Sketch two-dimensional orthographic drawings and three-dimensional isometric views.

FUNDAMENTALS OF ENGINEERING GRAPHICS

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

PROJECTION OF POINTS, LINES AND PLANES

Orthographic Projections covering, Principles of Orthographic Projections Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes.

PROJECTION OF SOLIDS

Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views.

SECTIONS AND DEVELOPMENTS

Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone;

PICTORIAL PROJECTIONS

Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

TEXT BOOKS

1. Venugopal, K. and Prabhu Raja, V., *Engineering Graphics*, Eighth Edition (Revised), New Age International Publishers, Chennai, 2007.
2. Natarajan, K.V., *A Text Book of Engineering Graphics*, 21st Edition, Dhanalakshmi Publishers, Chennai, 2007
3. Jeyapoovan, T., *Engineering Drawing and Graphics using AutoCAD 2000*, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.

REFERENCE BOOKS

1. Bhatt, N.D., *Elementary Engineering Drawing (First Angle Projection)*, Charotar Publishing Co., Anand, 1999.
2. Narayanan, K. L. and Kannaiah, P., *Engineering Graphics*, Scitech Publications, Chennai, 1999.
3. Shah, M. B. and Rana, B. C., *Engineering Drawing*, Pearson Education (Singapore) Pvt. Ltd., New Delhi , 2005.

		L	T	P	C
20PH0103	**PHYSICS LABORATORY**	0	0	2	1
	Prerequisite				
	Nil				

Experiment 1:   To determine the dispersive power of a given prism

Experiment 2:   To determine the width of single slit by diffraction

Experiment 3:   To determine the wavelength of the given laser source using standard grating

Experiment 4:   To determine Planck's Constant (h)

Experiment 5:   To determine the attenuation, numerical aperture and acceptance angle of the given optical fiber

Experiment 6:   To determine the wavelength of sodium light by Michelson Interferometer Experiment

Experiment 7:   To determine the velocity of ultrasonic waves in liquids

Experiment 8:   To determine the wavelength of sodium light by Newton's ring experiment

Experiment 9:   To determine the *moment of inertia* of the disc and *rigidity modulus* of the wire by torsional pendulum

Experiment 10:   Ballistic Galvanometer

REFERENCE BOOKS
1. Chattopadhyay, D., Rakshit, P. C and Saha, B., "An advanced Course in Practical Physics", 2nd edition, Books & Allied Ltd, Calcutta, 1990.

2. Chauhan and Singh , " Advanced practical physics", Revised edition, Pragati Prakashan Meerut, 1985.

3. Thiruvadigal. J. D., Ponnusamy S. Vasuhi, P. S. and Kumar. C, "Hand Book of Practical physics", 5th edition, Vibrant Publication, Chennai, 2007.

		L	T	P	C
20CY 0103	**CHEMISTRY LABORATORY**	**0**	**0**	**2**	**1**
	Prerequisite				
	Nil				

LEARNING ASSESSMENT COMPONENTS

An integrated laboratory course consists of experiments from applied chemistry and is designed to illustrate the underlying principles of measurement techniques, synthesis, dynamics and chemical transformation.

LEARNING OUTCOMES

Students should be able to understand the basic concept and its applications.

LIST OF EXPERIMENTS: 10

1. Preparation of standard solutions.

2. Estimation of total hardness, permanent and temporary hardness by EDTA method.

3. Conductometric titration – determination of strength of an acid.

4. Estimation of iron by potentiometer – titration.

5. Determination of molecular weight of polymer by viscosity average – method.

6. Determination of dissolved oxygen in a water sample by Winkler"s method

7. Estimation of Copper.

8. Estimation of nickel in steel.

9. Determination of total alkalinity and acidity of a water sample.

10. Chromatography Technique: Paper Chromatography.

REFERENCE

1. Chemistry: Department Manual

TOTAL: 30 (all experiments have to repeat 3 times)

EVALUATION	
EXTERNAL	**INTERNAL**
50	**50**

		L	T	P	C
20CS1111	**COMPUTER PROGRAMMING LAB**	**0**	**0**	**2**	**1**

Course Objective:-
This fundamental course will enable the students to learn the concepts of Programming Language and design principles along with understanding of C Language, syntax and functional concepts.

LIST OF PROGRAMS
1. Write a program to find the largest of three numbers. (if-then-else)
2. Write a program to find the largest number out of ten numbers (for-statement)
3. Write a program to find the average mail height & average female heights in the class (input is in form of sex code, height).
4. Write a program to find roots of quadratic equation using functions and switch statements.
5. Write a program using arrays to find the largest and second largest no. out of given 50 nos.
6. Write a program to multiply two matrices.
7. Write a program to sort numbers using the sorting Algorithm.
8. Represent a deck of playing cards using arrays.
9. Write a program to check that the input string is a palindrome or not.
10. Write a program to read a string and write it in reverse order.
11. Write a program to concatenate two strings.
12. Write a program which manipulates structures (write, read, and update records).
13. Write a program which creates a file and writes into it supplied input.
14. Write a program which manipulates structures into files (write, read, and update records).

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

Course Learning Outcomes (CLOs): -
On completion of this course, the students will be able to:-
1. To understand the concepts of Programming language
2. To learn the basics of C declarations, operators and expressions
3. To learn on the manipulation of strings, functions and pointers
4. To apply concepts and techniques for implementation

REFERENCE: Let Us C Yashwant Kanetkar 5th Edition.

		L	T	P	C
20 PD 0101	**PERSONALITY DEVELOPMENT - I**	**1**	**0**	**0**	**1**

Learning Objective: -

    The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential.

Learning Outcome: -

At the end of the course the student will learn:

- The role of Personality Development in day-to-day life as well as in career.
- Develop confidence and make use of techniques for self-analysis & development.

Methodology: -

    The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students, which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

UNIT – I

    Introduction to soft skills, SWOT, Time Management, creative chain story telling   3

UNIT – II

    Vocabulary Games I, Attitude, Interpersonal Skills, Goal Setting   3

UNIT – III

    Motivation I, Vocabulary games –II, Article Review, Case Study   3

UNIT – IV

    Team Building exercise, Critical Thinking, Event management   3

UNIT – V

    Business Situation & Corporate Skills, Leadership Qualities, Review   3

SCHEME OF INSTRUCTION

    Marks allocated for regular participation in all PD activities in class.

SCHEME OF EXAMINATION

    Internal evaluation on a regular basis and external evaluation at the end of the semester.

TECHNICAL ENGLISH II

Paper Code: 20LE0102

L T P C
1 0 2 2

Learning Objective:
The paper aims at giving the students an opportunity to develop writing skill, concentrating on the various techniques involved in the competitive examinations. The students will be able to express themselves in a meaningful manner to different levels of people in their academic and social domains. The students will have knowledge of the various uses of English in their professional environment and they will be able to communicate themselves effectively in their chosen profession.

Unit-1: Technical Writing Skills
- Report Writing
- Article Writing
- Curriculum Vitae – Resume Writing
- Email Writing
- Abstract and Synopsis Writing
- Reviewing

Unit-2: Language for specific Speech events
- Drafting an Invitation
- Drafting the Minutes of a Meeting
- Addressing a Gathering (Welcome Address)
- Formal Speech (Occasions) Public Speech (Topics)
- Proposing Vote of Thanks

Unit 3: Presentation Skills
- Oral Presentation Skills
- PowerPoint Presentation
- Poster Presentation
- Body Language

Unit-4: Language and communication
- Reading Strategies: Skimming, Scanning, Inferring,
- Predicting and Responding to Content
- Guessing from Context
- Note Making
- Vocabulary Extension
- Speed Reading Practice
- Use of Extensive Reading Texts.

Unit 5: Acquisition of Corporate Communication/ Speaking Skills
- Group Discussion
- Stage Dynamics

- Role Play
- Interview
- Mock Interview

Reference Books
1. M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.
2. Strunk, William, and E B. White, The Elements of Style. Boston: Allyn and Bacon, Pearson Edition, 1999.
3. Garner, Bryan A, HBR Guide to Better Business Writing, Hardvard Business Review Press, Boston, Massachusetts, 2013.
4. Shirley Taylor (1999), 'Communication for Business', Longman, New Delhi.
5. Robert Gannon (2000), 'Best Science Writing: Readings and Insights', University Press, Hyderabad.
6. Richard A. Boning (1990), 'Multiple Reading Skills', McGraw Hill, Singapore.
7. Albert J. Harris, Edward R.Sipay (1990), 'How to Increase Reading Ability', Longman.
8. David Martin (1994), 'Tough Talking', University press, Hyderabad.

The proposed course includes Practical classes to enable students to use good English and perform the following:
- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/ technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.
- Attending the highest levels of performance in accordance with the ethical requirement.
   Learning 2005.

Code	Course	L	T	P	C
20MA0102	ADVANCED CALCULUS AND COMPLEX ANALYSIS	3	1	0	4

COURSE OBJECTIVES

The course aims to familiarize the learner with the advanced concepts of Integral and Vector Calculus. It also provides the knowledge of Laplace Transforms and it's application. The course gives the insights of functions of a complex variable including contour integration and residue theorem.

OUTCOMES
Upon completion of this course, the student will be able to:
- Evaluate Double & Triple integration
- Understand the applications of multiple integral
- Describe Laplace and inverse Laplace transform
- Expose the concept of line, surface and volume integrals.
- Familiar with Analytic functions, conformal mappings, complex integration

UNIT – I INTEGRAL CALCULUS

Improper Integral: Beta and Gamma function, Multiple Integral: Introduction of multiple integration by examples of Double and Triple integral, Evaluation of double and Triple Integration(in both Cartesian and polar coordinates),Change of order of integration ,Application of double integral- Area and Centre of gravity - Triple integration in Cartesian coordinates , Application of triple integral-volume.

UNIT – II LAPLACE TRANSFORMS

Laplace Transforms of simple functions, Basic operational properties, transforms of derivatives and integrals, Unit step function, periodic functions, Inverse Laplace transforms, Inverse Laplace transforms of derivatives and integrals, Convolution theorem, Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.

UNIT – III VECTOR CALCULUS

Differentiation of vectors: Scalar and vector point functions, Gradient, divergence, curl Solenoidal and irrotational vectors, Vector identities (without proof) ,Normal and Directional derivatives, Solenoidal and irrotational field, Integration of vectors: Line, surface and volume integrals , Green's, Gauss divergence and Stroke's theorems (Statements only) - Verification and applications to cubes and parallelepipeds only.

UNIT -IVFUNCTIONS OF COMPLEX VARIABLE

Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations (Cartesian and polar), Harmonic functions, Determination of harmonic conjugate, Milne-Thomson's method, and conformal mappings: rotation, reflection, inversion and bilinear transformation.

UNIT – V COMPLEX INTEGRATION

Line integral, Cauchy's integral theorem (without proof), Cauchy's integral formulae (with proof), application of Cauchy's integral formulae, Taylor's and Laurent's expansions (statements only),

Singularities, Poles and Residues, Cauchy's residue theorem and application.

TEXT BOOKS

- Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017.
- Bali N.P., Goyal M, Watkins C, Advanced Engineering Mathematics: A Complete Approach., Advanced Engineering Mathematics, Laxmi Publications, New, Delhi.2018
- Dass H. K., Advanced engineering Mathematics, Sultan Chand Publication, Delhi, 2013.
- Kandasamy P etal. Engineering Mathematics, S.Chand & Co., New Delhi, Redevised edition2014.

REFERENCE BOOKS

- Kreyszig.E, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons. Singapore, 2015.
- Ramana B. V., Higher Engineering Mathematics, Tata McGraw – Hill Education, New Delhi, 2012.
- Veerajan, T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi, 2012.

		L	T	P	C
20PH0102	**MATERIALS SCIENCE**	3	0	0	3
	Prerequisite				
	Nil				

Objective: The Material Science syllabus aims to provide an insight into the fundamental science behind the unique properties of variety of materials and their application in engineering.

Outcome: The students are expected to familiarize with various kind of materials and their properties and further how to leverage this knowledge for technological applications.

UNIT 1 ELECTRON THEORY OF SOLIDS   9

Quantum Free Electron Theory-Particle in a box, Fermi-Dirac Statistics, Filling of Energy Levels, Fermi Energy and its expression at and above 0° K. **Band Theory-** Bloch Theorem, Kronig-Penny Model, One Dimensional Brillouin Zone (Elementary Ideas), Concept of holes, Effective Mass of an Electron, Distinction Between Insulators, Semiconductors and Conductors, Direct band gap and indirect band gap semiconductor.

UNIT 2 SEMICONDUCTORS   8

Intrinsic & Extrinsic Semiconductors (*p* and *n*- type)- Expression for the Density of Electrons in Conduction Band & Holes in Conduction band, Fermi level Dependence on Temperature and Carrier Concentrations. **Semiconductor p-n Junction:** Energy Band Diagram, p-n Junction with Forward & Reverse bias. I-V Characteristics, Zener & Avalanche breakdown. Tunnel Diode & Applications in Engineering (Qualitatively). **Hall Effect**: Experimental Determination of Hall Coefficient, Mobility of *p* and *n*- type Semiconductors.

UNIT 3 PHOTONIC AND OPTOELECTRONIC MATERIALS   8

Photoconductivity-Simple Model of Photoconductor, Variation of Photoconductivity with Illumination, Response time, Gain Factor, Dark current, Applications of Photoconductivity - Light Dependent Resistor (LDR), **Photovoltaic Effect**-Principle, Solar cell Working & Application. **Light Emitting Diode (LED)**-Principle & Construction, Elementary Ideas of White Light LED & Organic LEDs

UNIT 4 MAGNETIC MATERIALS   7

Magnetic Parameters: Magnetic Moment, Susceptibility, Permeabilty, Magnetic Induction and their Relationships. **Types of Magnetic Materials**-Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic, Ferrimagnetic Materials and Comparison based on their Response to Temperature & Applied Magnetic Field, Langevin's theory of diamagnetism, **Ferromagnetism**: Domain Theory of Ferromagnetism, Hysteresis & Energy Loss. Elementary Idea of Ferrofluids. **Super conductivity**: Meissner effect, Type 1 & Type 2 super conductors.

UNIT 5 ENGINEERING MATERIALS   8

NANOMATERIALS-Surface Area & Quantum confinement effect, Degrees of freedom and confinement-Quantum well, Quantum Wire and Quantum Dot, Properties (Chemical, Magnetic, Magnetic, Optical, Electrical), Fabrication-Top Down & Bottom-Up Processes. Synthesis of Nanomaterials- Sol Gel method, Ball Milling.

Smart Materials- Metallic Glasses, Shape Memory Alloys, Polymers, Ceramics, Composites, Reinforced Materials (Elementary ideas only)

Total 40

REFERENCE BOOKS

1. Balasubramaniam, Calister's Material Science, Wiley 2nd edition.

2. J. D. Thiruvadigal, S. Ponnusamy and P. S. Vasuhi, Materials Science, 5th edition, Vibrant Publications, Chennai, 2007

3. L. H. Van Vlack, Elements of Materials Science and Engineering, 6th Edition, Wesley, 1985

4. V. K. Puri and R. K. Babbar, Solid State Physics, S. Chand and Company

5. H. K. Malik and A. K. Singh, Engineering Physics, Mc Graw Hill Education, India

6. Raghvan-Material Science and Engineering, 5th Ed. Eastern Economy Edition

7. Solid State Physics, S. O. Pillai, 7th Ed. New Age International Publishers.

8. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, New Delhi 2012.

9. R. S. Khurmi and R. S. Sedha, Material Science, 5th Ed. S. Chand Publishers

10. K. G. Budinski and M. K. Budinski, Engineering Materials: Properties and selection, 9th Ed.

11. K. K. Chattopadhyayy and A. N. Banerjee, Introduction to Nano Science and Nano Technology, Eastern Economy Edition

12. Ferroelectrics: Principles and Applications, A. K. bain & Prem Chand, Wiley- VCH, 2017

13. Raghvan-Material Science and Engineering, 5th Ed. Eastern Economy Edition

14.. Integrated Electronics: Jacob Millman, Christos Halkias and Chetan D Parikh

15. Electronic Devices: T.L. Floyd

16. Basic Semiconductor Physics by Chihiro Hamaguchi, Springer

17. Nanomaterials, Nanotechnologies and design by Michel F. Ashby, Paulo J Ferreira and Daniel L Schodek, Elsvier

18. Engineering analysis for Smart Material Systems by Donald J Leo John Wiley & Sons Inc. publisher, New York

ENVIRONMENTAL STUDIES
CODE: 20GE0104
Total 2 credits. (L 2, T 0)
FOR ALL BRANCHES OF B. Tech
1st semester CSE
2nd Semester ME Including Mech and Rob., CE, ECE, EEE, BME
Unit 1: The Multidisciplinary Nature of Environmental Studies
Definition, scope and importance
Need for public awareness.
Unit 2: Natural Resources
Renewable and Non-renewable Resources:
* Natural resources and associated problems.
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought,
conflicts over water, dams-benefits and problems.
 (c) Energy resources: Growing energy needs, renewable and non-renewable energy sources,
use of alternate energy sources. Case studies.
.**Unit 3: Ecosystems**
* Concept of an ecosystem.
* Structure and function of an ecosystem.
* Producers, consumers and decomposers.
* Energy flow in the ecosystem.
* Ecological succession.
* Food chains, food webs and ecological pyramids.
* Introduction, types, characteristic features, structure and function of the following ecosystem:
(a) Forest ecosystem
(b) Grassland ecosystem
(c) Desert ecosystem
(d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estauries)
Unit 4: Biodiversity and Its Conservation
* Introduction, definition: genetic, species and ecosystem diversity.
* Biogeographical classification of India.
* Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option
values.
* Biodiversity at global, National and local levels.
* India as a mega-diversity nation.
* Hot-spots of biodiversity.
* Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
* Endangered and endemic species of India.

* Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

Unit 5: Environmental Pollution

* Definition
* Types of pollutants
* Causes, effects and control measures of
(a) Air pollution (b) Water pollution

Text Books
1. Environmental Studies from crisis to cure, by R. Rajagopalan, 3rd edition, Oxford Higher Education
3. Kurian Joseph & R. Nagendran, "Essential of Environmental Studies"" Pearson Education, 2004.

Reference Books
1. Dara S.S., A Text Book of Environmental Chemistry and pollution control, S.Chand & Company Ltd., New Delhi, 2004.
2. Jeyalakshmi.R, Principles of Environmental Science, 1st Edition, Devi Publications, Chennai 2006.
3. Kamaraj.P & Arthanareeswari.M, Environmental Science – Challenges and Changes, 1st Edition, Sudhandhira Publications, 2007.
4. Arivalagan.K, Ramar.P & Kamatchi.P, Principles of Environmental Science, 1st Edition, Suji Publications, 2007.

BIOLOGY FOR ENGINEERS

Total Contact Hours - 30 (2 L)   **Subject code: 20GE0102**
Prerequisite
Nil

AIM
To engage and motivate outstanding engineering students to built their career in interdisciplinary areas. To utilize the technologies in solving healthcare problems.

INSTRUCTIONAL OBJECTIVES
1. To familiarize the students with the basic organization of organisms and subsequent building to a living being
2. To impart an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.
3. To provide knowledge about biological problems that requires engineering expertise to solve them

UNIT I BASIC CELL BIOLOGY AND MOLECULAR BIOLOGY 10 hrs.
Information transfer in organisms is like information transfer in a computer, Cell structure and its comparison to computers, function of cell organelles, Eukaryotic and prokaryotic cells working as it is like computers, Basic idea for Cell division, Mitosis, Meiosis. Basic idea how Central Dogma of life and Genetic information in body works like a computed system.

UNIT II ENGINEERING IN BIO-ORGANIC CHEMISTRY INDUSTRY AND HOSPITALS 6 hrs.
Introduction to major biomolecules Carbohydrates, fats and proteins. Role of Robotics and automation for human welfare like synthesis of biomolecules. Role of robotics in hospital aid like providing food or medicines to the pateints.

UNIT III MICROBIAL TECHNOLOGY IN ENVIRONMENT REMEDIATION 4 hrs.
Phases of microbial growth, Microbial growth curve, Sterilisation, Disinfection. Role of engineers in environment biology, characterisation of sludge, Aerobic and anaerobic sludge treatment, Trickling filters and other waste treatment systems.

UNIT IV ENGINEERS IN FERMENTATION TECHNOLOGY & DOWNSTREAM PROCESSING 4 hrs.
Fermentation, Fermentors/Bioreactors and their components, Role of engineers in fermentation industry and synthesis of essential comodities like antibiotics, vaccines etc. Understanding for the stages in downstream operations.

UNIT V PATHOGENS, CATASTROPHE AND DATA SCINECE 6 hrs.
Immunity, Active and passive, Vaccine, Immunization, Viruses, Fungi and bacteria, Data compilation in case of a catastrophe, Role of Artificial Intelligence and machine learning in Biology, Pandemics, Epidemics and outbreaks.

TEXT / REFERENCE BOOKS:
1. Satyanarayana, Biotechnology, 4th Edition, Books and Allied (p) Ltd. 2005-01-01, ISBN .
2. Lehninger A.L, Nelson D.L, Cox .M.M, Principles of Biochemistry. CBS Publications 1993
3. Shuler.M.L. and Kargi.F, Bioprocess Engineering 1st Edition. Pearson Education India, 2003.
    4. Stanbury P.F., A.Whitaker, and Hall S.J. , Principles of Fermentation Technology, 2nd Edition, Butterworth-Heinemann 1997.

19CE0102	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Determine the static indeterminacy and kinematic indeterminacy of trusses and to analyse the trusses by using methods of joints or method of sections.	a, e, i
2	To define and evaluate the different kinds of stresses and strains by analytical methods.	a, e, i
3	To define and reason about fundamental structural concepts such as shear force, bending moment relations, functions. To draw Shear force and Bending Moment Diagrams for determinate beams.	a, e, i
4	To evaluate bending and shear stresses for different loading of various types of beams.	a, e, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
UNIT -1 (BAS IC CONCEPTS)		**8**		
1	Concept of Rigid body and deformable bodies	1	C, I	1
2	Free body diagram	1	C, I	1
3	Types of beams, simple and continuous beams	1	C, I	1
4	Types of beams, simple and continuous beams	1	C, I	1
5	Type of supports and reaction	1	C, I	1
6	Fundamentals of Determinate and Indeterminate structures	1	C, I	1
7	Analysis of plane trusses by method of joint and method of section	1	C, I	1
8	Analysis of Plane frames	1	C, I	1
UNIT -2 (STRESS ES AND STRAINS)		**8**		
9	Concept of stress and strain (linear, lateral, shear and volumetric)	1	C, I	2
10	Hook's law, elastic constants and their relationship	1	C, I	2
11	Stress-strain diagrams for brittle, elastic and plastic materials	1	C, I	2
12	Generalized Hook's law	1	C, I	2
13	Analysis of axially loaded members: Stresses, strains and deformations of the structures under concentrated loads	1	C, I	2
14	Analysis of axially loaded members: Stresses, strains and deformations of the structures under concentrated loads	1	C, I	2
15	Analysis of axially loaded members: Stresses, strains and	1	C, I	2

	deformations of the structures under concentrated loads				
16	Self-weight and temperature changes	1	C, I	2	
UNIT -3 (SHEAR FORCE AND BENDING MOMENT DIAGRAM)		**8**			
17	Concept of shear force diagram and bending moment diagram.	1	C, I	3	
18	Relation between shear force, bending moment and intensity of loading	1	C, I	3	
19	Relation between shear force, bending moment and intensity of loading	1	C, I	3	
20	Shear force and bending moment diagrams for cantilevers and simple beams due to concentrated, uniformly distributed, uniformly varying loads and couples in beams	5	C, I	3	
UNIT -4 (BENDING STRESS ES AND S HEAR STRESS ES)		**6**			
21	Theory of simple bending	1	C, I	4	
22	Fle xu re formula, bending stress distribution	1	C, I	4	
23	Shear stresses in beams	2	C, I	4	
24	Shear stress distribution	2	C, I	4	
TOTAL CONTACT HOURS		**30**			

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Merian, J.L, Kraige, L.G. Engineering Mechanics–Statics, 5th Edition, W iley Publishers, New-Delhi, 2007.
2	Beer & Johnston, Mechanics for Engineers, 4th Edition, Mc Graw – Hill, New Delhi,1987.
3	Timoshenko, S.P., Young, D.H., Rao, J.V. Engineering Machines,4th Edition, Mc Graw-Hill, Singapore, 1956.
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Singer, F.L. Strength of Materials, Third Edition, Harper and Row Publishers, New Yo rk, 1980.
6	Hearn, E.J., Mechanics of Materials, Pergaman Press, England, 1972.
7	Beer and Johnston E. R. Mechanics of Materials, 3rd Edition, Tata Mc Graw Hill, New Delhi, 2007.
8	

19CE0104	BUILDING CONSTRUCTION AND MATERIALS	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**

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

1	Understand about masonry construction.	a, h, i
2	Understand about various construction materials	a, h, i
3	Understand about Concrete	a, h, i
4	Differentiate between concrete and special concrete	a, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (CONS TRUCTION)	**10**		
1	**Masonry Construction** Introduction, various terms used, stone masonry-Dressing of stones, Classifications of stone masonry, safe permissible loads, Brick masonry-bonds in brick work, laying brick work, structural brick work-cavity and hollow walls, reinforced brick work, Defects in brick masonry, composite stone and brick masonry, glass block masonry.	4	C	1
2	**Doors and Windows** Locations, sizes, types of doors and windows, fixtures and fasteners for doors and windows.	2	C, I	1
3	**Acoustics, Sound Insulation and Fire Protection** Classification, measurement and transmission of sound, sound absorber, classification of absorbers, sound insulation of buildings, wall construction and acoustical design of auditorium, fire-resisting properties of materials, fire resistant construction and fire protection requirements for buildings.	4	C, I	1
	UNIT -2 (MATERIALS)	**15**		
9	**Stones** Classification, requirements of good structural stone, quarrying, blasting and sorting out of stones, dressing, sawing and polishing, prevention and seasoning of stone.	2	C	2
10	**Brick and Tiles** Classification of bricks, constituents of good brick earth, harmful ingredients, manufacturing of bricks, testing of bricks. Tiles, Terra-cotta, manufacturing of tiles and terra-cotta, types of terra-cotta, uses of terra-cotta.	2	C	2
11	**Cement and Mortars**	2	C, I	2

S.No.	Topic	Hours		
	Cements composition, types of cement, manufacturing of ordinary Portland cement, testing of cement, special types of cement, storage of cement.			
12	**Mortars** Definition, proportions of lime and cement mortars, mortars for masonry and plastering.	2	C, I	2
13	**Timber** Classification of t imber, structure of timber, seasoning of timber, defects in timber, fire proofing of timber, plywood, fiberboard, masonite and its manufacturing, important Indian timbers.	2	C, I	2
14	**Concrete Constituents** Cement, tests on cement (physical tests), types of Portland cement, various types of cement- ordinary Portland cement, rapid hardening cement, low heat cement, sulphate resistant cement, portland-pozzolona cement, high strength Portland cement, high alumina cement, waterproof cement, white Portland cement, hydrophobic cement, coloured Portland cement. Aggregates, classification of aggregates based on petrographic, size, shape & te xures, deleterious substances in aggregates, bulking of fine aggregate, Sieve analysis, grading of aggregates as per IS-383-1970. Fineness Modulus, Maximum size of aggregate. Quality of mixing water, curing water.	5	C, I	2
	UNIT -3 (PROPERTIES Of CONCRETE)	**6**		
17	Introduction, workability, factors influencing workability, measurement of workability, requirements of workability, properties of hardened concrete, stress and strain characteristics of concrete, Young's modulus of concrete,	3	C, I	3
18	creep and shrinkage of concrete, permeability of concrete, durability of concrete sulphate attack, fire-resistance, thermal properties of concrete, construction joints, expansion and contraction joints.	3	C, I	3
	UNIT -4 (SPECIAL CONCRETE)	**4**		
25	Light weight concrete, definition and its properties, applications, high strength concrete, definitions, its properties and applications, mass concrete, waste material based concrete, shortcrete, fiber reinforced concrete: Materials. Fibers-types and properties, ferrocement, polymer concrete composites, heavy-weight concrete for radiation shielding.	4	C, I	4
	TOTAL CONTACT HOURS		**35**	

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Building Construction, Sushil Kumar, Standard Pub., N. Delhi
2	Building Material, Rangawala
3	
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Construction Engineering, Y.S. Sane
6	Building Construction, Gurcharan Singh, Standard Pub., N. Delhi.
7	
8	

		L	T	P	C
20GE0107	NSS/NCC / NSO /YOGA	0	0	2	1

Unit	Lecture	Practical
1	**Yoga**- History, Classification and importance	Practice of **Relaxing asanas** (Savasana, Shashankasana, Makarasana & its Variations)
2	**Asanas**- Meaning, Classifications of Asanas	Practice of **Meditative Asanas** (Padmasana, Swastrikasana, Sukhasana, Vajrasana, Siddhasana)
3	**Asanas-** General Benefits of Asanas	Practice of **Cultural Asanas** (Bhujangasana, Sarvangasana, Salabhasana, Ardha Matsyendrasana, Matsyasana, Dhanurasana, Setubandhasana, Chakrasana, Ardha Halasana, Purna Halasana)
4	**Suryanamaskar**- Meaning, Steps & Benefits	Practice of **Suryanakaskar**
5	**Pranayam** – Meaning,Types, Steps & Benefits	Practice of **Pranayam** (Purak, Rechak, Khumbhak, anulom-Vilom, Kapal-Bhathi, Bhramri, Shitli & Shitkari)
6	**Meditation**- Meaning, Rules & General Benefits	Practice of **Meditation**
		Hours = 22

NSO Curriculum

	Lecture	Practical
1	**Basketball-** History, Measurements, rules & regulations, basic skills, Awardees, Important Tournaments, Standard Venues	Practise of basic skills with the implementation of basic rules of **Basketball**
2	**Cricket-** History, Measurements, rules & regulations, basic skills, Awardees, Important Tournaments, Standard Venues	Practise of basic skills with the implementation of basic rules of **Cricket**
3	**Football-** History, Measurements, rules & regulations, basic skills, Awardees, Important Tournaments, Standard Venues	Practise of basic skills with the implementation of basic rules of **Football**
4	**Volleyball-** History, Measurements, rules & regulations, basic skills, Awardees, Important Tournaments, Standard Venues	Practise of basic skills with the implementation of basic rules of **Volleyball**
		Hours = 8

Assessment of Student Learnings:
Students will be assessed for their ability to focus, participate, make effort, and search alignment. Continual progress, the desire to improve, use of breath, posturing, and focus are the primary things the instructor will look for. Project file also has to be maintained for record keeping.

	Grading based upon	Percentage of grade
#1	Skill Performance	40%

#2	Project (Practical File)	30%
#3	Viva	30%
TOTAL		**100%**

Learning Outcomes:

By the end of Semester, a student will have:

- Increased balance, strength, and flexibility
- A beginning sense of alignment in the body
- Competence of all five breath techniques and variations
- An internal sense of focus and clarity in the movement meditation
- Understanding of the cultural and philosophical approaches to yoga
- Desire to learn, excel and continue studies on the art of yoga
- Basic knowledge of Basketball, Cricket, Football & Volleyball

TEXT BOOKS:

1. Vedatri Maharshi , *"Yoga for Modern Age"*

2. Vedatri Maharshi, " *Simplified Physical Exercises"*

3. Dr. Kalpana Sharma, *"Rules of Games & Sports 2018"*

		L	T	P	C
20ME 0120	**WORKSHOP PRACTICE**	**1**	**0**	**2**	**2**
	Prerequisite				
	Nil				

Learning Objectives

To provide the students with, hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

Learning Outcomes

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

1. Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working, etc) processes required to manufacture a product from the raw materials.
2. Use different measuring, marking, cutting tools used in workshop.
3. Aware of the safety precautions while working in workshop.

LIST OF EXPERIMENTS

EMPHASIS TO BE LAID ON REAL LIFE APPLICATIONS WHEN FRAMING THE EXERCISES.

FITTING

Tools & Equipments – Practice in Filing and Drilling.
Making Vee Joints, Square, dovetail joints, Key Making.

CARPENTARY

Tools and Equipments – Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, and a mini model of a single door window frame.

SHEET METAL

Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

WELDING

Tools and equipments - Arc welding of butt joint, Lap Joint, Tee Fillet. Demonstration of Gas welding, TIG & MIG.

SMITHY

Tools and Equipments –Simple exercises base on smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging, Making simple parts like hexagonal headed bolt, chisel.

TEXT BOOKS

1. Gopal, T.V., Kumar, T., and Murali, G., *"A first course on workshop practice –Theory, practice and workbook",* Suma Publications, 2005.

REFERENCE BOOKS

1. Kannaiah,P. & Narayanan,K.C. ―*Manual onWorkshop Practice"*, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. ―*First year Engineering Workshop Practice"*, Ramalinga Publications, Madurai, 1999.

		L	T	P	C
20PH0104	**MATERIALS SCIENCE LABORATORY**	0	0	2	1
	Prerequisite				
	Nil				

Experiment 1: Solar Cell characteristics
Experiment 2: P-N Junction Characteristics
Experiment 3: To determine the Hall coefficient of the given n type or p type semiconductor and determine the majority charge carrier concentration.
Experiment 4: To determine the dielectric constant of the given sample at different temperatures.
Experiment 5: To study the photoconductive nature of the given light dependent resistor (LDR).
Experiment 6: To determine the energy band gap of a semiconductor (Germanium) using four probe method.
Experiment 7: To measure the susceptibility of paramagnetic solution by Quincke's tube method.
Experiment 8: To find the thermal conductivity of given bad conductor of heat (card board- disc) by Lee's Disc Method.
Experiment 9: To determine the temperature coefficient of resistance
Experiment 10: Magnetic hysteresis and B-H Curve Tracer

REFERENCE BOOKS
1. Chattopadhyay, D., Rakshit, P. C and Saha, B., "An advanced Course in Practical Physics", 2nd edition, Books & Allied Ltd, Calcutta, 1990.

2. Chauhan and Singh , " Advanced practical physics", Revised edition, Pragati Prakashan Meerut, 1985.

3. Thiruvadigal. J. D., Ponnusamy S. Vasuhi, P. S. and Kumar. C, "Hand Book of Practical physics", 5th edition, Vibrant Publication, Chennai, 2007.

		L	T	P	C
20 PD 0102	**PERSONALITY DEVELOPMENT - II**	**1**	**0**	**0**	**1**

Learning Objective: -

> The purpose of this course is to build confidence and inculcate various soft skills and to help students to identify and achieve their personal potential.

Learning Outcome: -

At the end of the course the student will learn:

- The importance of public speaking and written communication
- Develop skills of effective speaking via Debate, GD, etc.

Methodology: -

> The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students, which they will be employing during various occasions in their real life.

6. Group activities + individual activities.
7. Collaborative learning.
8. Interactive sessions.
9. Ensure Participation.
10. Empirical Learning

UNIT – I

Introduction to Resume & Cover writing Skills 3

UNIT – II

Effective communication skills, Presentation Skills 3

UNIT – III

Public Speaking, Introduction to Interview process & interview skills 3

UNIT – IV

Basics of Mock Interview, Group Discussion, Debate 3

UNIT – V

Body Language, Non Verbal Activities, Role Plays 3

SCHEME OF INSTRUCTION

> Marks allocated for regular participation in all PD activities in class.

SCHEME OF EXAMINATION

> Internal evaluation on a regular basis and external evaluation at the end of the semester.

SECOND YEAR

19CE0201	STRUCTURAL ANALYSIS – I	**L**	**T**	**P**	**C**
		3	1	0	4

Co-requisite	None
Pre-requisite	19CE0102
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To evaluate the stresses due to combined loading analytically as well as graphically.	a, e, i
2 To understand the behaviour of different kind of columns under axial as well as eccentric loading.	a, e, i
3 To analyse the deflection of beams	a, e, i
4 To understand the concepts/ broad methods, sub-methods involved in the analysis of indeterminate structures.	a, e, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
UNIT -1 (PRINCIPAL STRESS ES AND STRAINS)		**8**		
1	Concept of principal planes and principal stresses.	2	C, I	1
2	Normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses and maximum shear stress	2	C, I	1
3	Mohr's circle for plane stresses. Combined effect of axial stress, moment and shear.	2	C, I	1
4	Theories of failure: maximum normal stress, ma ximu m shear stress and maximum strain theory.	2	C, I	1
UNIT -2 (AXIALLY AND ECCENTRICALLY LOADED COLUMNS)		**6**		
5	Slenderness ratio, end connections, short columns,	2	C, I	2
6	Euler's critical buckling loads, eccentrically loaded short columns,	2	C, I	2
7	Cylinder columns subjected to axia l and eccentric loading.	2	C, I	2
UNIT -3 (DEFLECTIONS OF BEAMS)		**8**		
8	Introduction	1	C, I	3
9	Slope and deflections in beams by differential equations,	1	C, I	3
10	moment area method	1	C, I	3
11	conjugate beam method,	2	C, I	3
12	unit load method, principle of virtual work,	1	C, I	3
13	Maxwell's Law of Reciprocal Deflections.	2	C, I	3
UNIT -4 (CABLES AND SUSPENSION BRIDGES)		**8**		
14	Introduction, shape of a loaded cable	2	C, I	4
15	Cable carrying point loads and UDL	1	C, I	4
16	cables with ends at different level	2	C, I	4
17	cable subjected to temperature stresses	1	C, I	4
18	Suspension bridge with two hinged and three hinged stiffening girders	2	C, I	4
TOTAL CONTACT HOURS		**30**		

LEARNING RESOURCE

S.No.	TEXT BOOKS
1	Statically Indeterminate Structures, C.K. Wang, Mc Graw Hill Book Co., New Yo rk.
2	Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee.
3	Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi.
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata Mc Graw Hill, New Delhi
6	
7	
8	

19CE0203	SURVEYING – I	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	P	PROFESSIONAL CORE			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1	To understand the importance of surveying in Civ il engineering	a
2	To study the basic of linear/angular/direction measurements using chain/tacheometer/compass and theodolite and their applications	a, e
3	To study the method of determination of height of points using various leveling method and Tacheometer	a, e
4	To study the significance of Plane Table surveying in preparation of map and setting of different types of curves	a, e
5	To study the determination of coordinates using satellite based method	a, e

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**10**		
1	**Basics of Sur ve ying**: Definition, objects, classification,	1	C	1
2	fundamental principles, methods of fixing stations,	1	C	1
3	concept of Geoid and reference spheroids	1	C, I	1
4	**Linear measurement**: Direct measurement, instruments For measuring distance,	1	C, I	1
5	instruments for making stations, chaining of line,	1	C, I	1
6	errors in chaining, tape corrections e xa mples, Chain traversing	1	C, I	1
7	**Direction Measurement:** Bearings and angles; Compass surveying- magnetic bearings,	1	C, I	1
8	prismatic and surveyors compass, declination, local attraction erro rs and adjustments;	1	C, I	1
9	Methods of compass traversing, checks in traversing, adjustment of closed traverse	2	C, I	1
	UNIT -2	**10**		
10	Angle Measurement: Theodolite: Theodolites, temporary adjustment of theodolite,	1	C, I	2
11	measurement of horizontal and vertical angles, theodolite traverse.	1	C, I	2
12	Leveling: Definition of terms used in leveling, types of levels and staff,	1	C, I	2
13	temporary adjustment of leve ls, principles of leveling	1	C, I	2
14	spirit and trigonometric levelling,	1	C, I	2, 3
15	reduction of levels, booking of staff readings, plane and geodetic trigonometric levelling,	2	C, I	2, 3
16	correction due to curvature and refraction, axis signal correction,	1	C, I	2, 3
17	Contouring, contour, characteristics of contours lines,	1	C, I	2, 3

18	locating contours, interpolation of contours, use of contours.	1	C, I	2, 3
	UNIT -3	**10**		
19	**Plane Table Sur ve ying** : Plane table accessories, various methods of plane table surveying, two point problems with advantages and disadvantages	2	C, I	4
20	three point problems, sources of error, advantages and disadvantages	1	C, I	4
21	Curves: Classification of curves, elements of simple circular curve, location of tangent points-chain and tape methods, instrumental methods,	2	C, I	4
22	e xamples of simple curves Transition Curves-Length and types of transition curves	1	C, I	4
23	length of combined curve, examples.	1	C, I	4
24	Vert ical Curves : Necessity and types of vertical curves,	1	C, I	4
25	setting out of a vertical curve by tangent correction, chord gradient and sight distance method	2	C, I	4
	UNIT -4	**10**		
26	Tacheometry: Principle of tacheometry, stadia and tangential method of tacheometry	2	C, I	5
27	GNNS: Global Navigation Satellite System (GNSS): basic concepts, History of GPS, GPS design objectives	1	C, I	5
28	details of segments: space, control and user.	1	C, I	5
29	Brief of different GPS systems, including, NA VSTA R GPS, GLONASS, GA LILEO, IRNSS, BeiDou etc,	2	C, I	5
30	Advantages and limitations of GPS.	1	C, I	5
31	GPS Signal structure: Carriers frequencies, GPS codes: C/A, P, navigational message,	1	C, I	5
32	GPS receiver: Types. Principles of GPS position fixing.	1	C, I	5
33	Pseudo ranging and carrier phase, GPS errors	1	C, I	5
	TOTAL CONTACT HOURS	**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Surveying volume I and II: B C Punmia
2	Engineering Surveying (Sixth Edition): W. Schofield
3	Te xt Book of Surveying: C.Venkata ra miah
	REFERENCE BOOKS AND OTHER MATERIALS
4	Introduction to GPS: The Global Positioning System: Ahmed El-Rabbany
5	Various Online resources including NPTEL

19CE0205	DESIGN OF STEEL STRUCTURES	L	T	P	C
		3	0	2	4

Co-requisite	None
Pre-requisite	19CE0102
Data Books / Codes / Standards	
Course Category	P	PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	Design Tension Members, Lug Angles and Splices.	a, c, e, i
2	Design Compression Members, Built-Up Compression Members.	a, c, e, i
3	Design a Welded and Riveted connection.	a, c, e, i
4	Design Plate Girders and Gantry Girders.	a, c, e, i
5	Design Roof trusses, Purlin, joints and end bearings of Steel Structures.	a, c, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**14**		
1	**Elementary Limit Analysis and Design**: Introduction, Scope of plastic analysis, ultimate load carrying capacity of tension members.	1	C, I	1
2	ultimate load carrying capacity o f compression members, fle xu ral members, shape factor,	1	C, I	1
3	mechanis ms, plastic collapse, analysis,	1	C, I	1
4	plastic analysis applied to steel beams and simple portal frames and design	1	C, I	1
5	**Connections**: Importance, various types of connections, simple and moment resistant,	1	C, I	1
6	riveted, bolted and welded connections.	1	C, I	1
7	**Design of Tension Members**: Introduction, types of tension members, net sectional areas,	1	D, I	1
8	design of tension members,	1	D, I	1
9	lug angles and splices.	1	D, I	1
10	**Design of Compression Members** : Introduction, effective length and slenderness ratio,	1	D, I	2
11	various types of sections used for columns, built up columns,	1	D, I	2
12	necessity, design of built up columns,	1	D, I	2
13	laced and battened columns including the design of lacing and battens,	1	D, I	2
14	design of eccentrically loaded compression members.	1	D, I	2
	UNIT -2	**12**		
15	**Design of Beams**: Introduction, types of sections, general design criteria for beams,	2	D, I	3
16	design of laterally supported and unsupported beams,	1	D, I	3
17	design of built up beams, web buckling,	2	D, I	3
18	web crippling and diagonal buckling.	1	D, I	3
19	**Plate Girder**: Introduction, elements of plate girder,	1	D, I	4
20	design steps of a plate girder, necessity of stiffeners in plate girder,	2	D, I	4

21	various types of stiffeners, web and flange splices (brief introduction), Curtailment of flange plates,	1	D, I	4
22	design beam to column connections: Introduction, design of framed and seat connection.	2	D, I	4
UNIT -3		**7**		
23	**Column Bases and Footings**: Introduction, types of column bases,	1	D, I	4
24	design of slab base and gussested base,	1	D, I	4
25	design of gussested base subjected to eccentrically loading,	1	D, I	4
26	design of grillage foundations.	1	D, I	5
27	**Beam Column**: Introduction, bending about one axis, bending about both axes	1	D, I	5
28	boundary constraints, design considerations	2	D, I	5
UNIT -4		**7**		
29	Roof Trusses: Types and compoenents of roof truss,	1	D, I	5
30	estimation of wind load, design of purlin with and without sag rod,	1	D, I	5
31	lateral bracing and design of roof truss	1	D, I	5
32	Cold Formed Sections: Introduction and brief description of various type of cold formed sections,	1	D, I	5
33	local buckling, concepts of effective width and effective sections,	1	D, I	5
34	elements with stiffeners, design of compression and bending elements	2	D, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Design of Steel Structures, A.S.Arya & J.L.Ajmani, Nem chand & Bros., Roorkee.
2	Design of Steel Structures, M.Raghupati, TMH Pub., New Delhi.
	REFERENCE BOOKS AND OTHER MATERIALS
3	Design of Steel Structures, S.M.A.Kazmi & S.K.Jindal, Prentice Hall, New Delhi.
4	Design of Steel Structures, S.K.Duggal, TMH Pub., New Delhi.

19CE0207	FLUID MECHANICS	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To study theories those expla in the behaviour and performance of flu id when the fluid is at rest and motion.	a, e
2 To study theories those expla in the behaviour and performance of flu id when the fluid is flowing through the pipe.	a, e
3 To study the features and function of various devices used to measure the pressure of flu id.	a, e, i
4 To study the features and function of various devices used to measure the velocity and discharge of fluid.	a, e, i
5 To understand the utilization of dimensional analysis as a tool in solving problems in the field of fluid mechanics.	a, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (Introduction to Fluid Mechanics)	**10**		
1	Fluid properties, mass density, specific weight, specific volume and specific volume and specific gravity, surface tension, capillarity	1	C	1
2	pressure inside a droplet and bubble due to surface tension	1	C	1
3	pressure inside a droplet and bubble due to surface tension	1	C	1
4	compressibility viscosity, Newtonian and Non-newtonian fluids, real and ideal flu ids	1	C, I	1
5	Stready & unsteady, uniform and non-uniform, laminar & turbulent flows, one, two & three dimensional.	1	C, I	1
6	flows, stream lines, streak lines and path lines, continuity equation in differential form, rotation and circulation,	2	C, I	1
7	elementary e xplanation of stream function and velocity potential, rotational and irrotational flows,	2	C, I	1
8	graphical and e xperimental methods of drawing flownets	1	C, I	1
	UNIT -2 (Fluid Statics and Dynamic of Fluid Flow)	**10**		
9	Pressure-density-height relationship, gauge and absolute pressure, simple differential and sensitive manometers	1	C, I	2
10	two liquid manometers, pressure on plane and curved surfaces, center of pressure	1	C, I	2
11	Buoyancy, stability of immersed and floating bodies	1	C, I	2
12	determination of metacentric height, fluid masses subjected to	1	C, I	2

	uniform acceleration, free and forced vortex			
13	Euler's equation of motion along a streamline and its integration	1	C, I	2
14	limitation of Bernoulli's equation, Pitot tubes	1	C, I	2
15	venturimeter, Orficemeter, flow through orifices & mouth pieces	2	C, I	3
16	sharp crested weirs and notches, aeration of nappe	2	C, I	3
UNIT -3 (Laminar Flow and Flow in Pipes)		**12**		
17	Navier Stoke's equation, Laminar flow between parallel plates	1	C, I	3
18	Couette flow, laminar flow through pipes-Hagen Poiseuille law,	1	C, I	3
19	laminar flow around a sphere-Stokes'law	1	C, I	3
20	Types of flows - Reynold's e xperiment, shear stress on turbulent flow, boundary layer in pipes- Establishment of flow	1	C, I	4
21	velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in s mooth and rough pipes	2	C, I	4
22	Stanton and Moody's diagram. Darcy's weisbach equation, other energy losses in pipes, loss due to sudden expansion	2	C, I	4
23	hydraulic gradient and total energy lines, pipes in series and in parallel	2	C, I	4
24	equivalent pipe, branched pipe, pipe networks, Hardy Cross method, water hammer	2	C, I	4
UNIT -4 (Drag and Lift)		**8**		
25	Types of drag, drag on a sphere, flat plate, cylinder and airfoil,	3	C, I	5
26	development of lift on immersed bodies like circular cylinder and airfoil.	5	C, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Theory and application of fluid Mechanics including Hydraulic Mechanics by K Subramanya
2	Introduction to Fluid Mechanics by Robert N.Fox & Alan T.Macnold
3	Hydraulic and Fluid Mechanic by P.N.Modi & S.M.Seth
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Introduction to Fluid Mechanics by Robert W.Fox & Alan T.Mc Donald
6	Fluid Mechanics Through Problems by R.J.Garde
7	Engineering Fluid Mechanics by R.J.Ga rde & A.G.Mirajgaoker
8	

19CE0209	ENVIRONMENTAL ENGINEERING – I	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES

	At the end of the course , student will be able to:	
1	To make the students conversant with sources of water and types of water demand	a
2	To understand the basic characteristics of water and its determination	a, h
3	To e xpose the students to understand components of water supply scheme	a, c
4	To provide adequate knowledge about the water treatment processes and its design	a, c, h, i
5	To have adequate knowledge on water conveyance and distribution network	a, c, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (WATER QUANTITY)	**8**		
1	Importance and necessity of water supply scheme. Components of water supply scheme,	2	C	1
2	water demands and its variations.	1	C	1
3	Population forecasting, estimation of total quantity of water requirement,	1	C	1
4	quality and quantity of surface and ground water sources,	1	C	1
5	selection of a source for water supply,	1	C	1
6	types of intakes,	1	C	1
7	pumps and pumping stations.	1	C, I	1
	UNIT -2 (WATER QUALITY)	**8**		
8	Sources of impurities,	1	C, I	2
9	type of impurities in water and their sanitary significance,	1	C, I	2
10	Physical analysis of water,	1	C, I	2
11	chemical analysis of water,	2	C, I	2
12	bacteriological analysis of water,	1	C, I	2
13	water quality standards	2	C, I	2
	UNIT -3 (WATER TREATMENT)	**14**		
14	Objectives, treatment processes and their sequence in conventional water treatment plant,	2	C, I	3, 4
15	aeration,	2	C, I	3, 4
16	sedimentation – plain and aided with coagulation-	2	C, I	3, 4
17	types, features and design aspects, mixing basins and flocculation units.	2	C, I	3, 4
18	Filtration – mechanis ms, types of filters - slow and rapid sand filtration units (features and design aspects),	2	C, I	3, 4
19	disinfection - theory, methods and practices,	2	C, I	3, 4
20	specific water treatment methods	2	C, I	3, 4

	UNIT -4 (WATER CONVEYANCE AND DIS TRIBUTION)	10		
21	Hydraulic design of pressure pipe, pipe materials	2	C, I	5
22	types of distribution system – gravity system, pumping system, dual system,.	2	C, I	5
23	layout of distribution system – dead end system, grid iron system, their merits and demerits	2	C, I	5
24	ring system, radial system, their merits and demerits	2	C, I	5
25	distribution reservoir - functions and determination of storage capacity	2	C, I	5
	TOTAL CONTACT HOURS	**40**		

LEARNING RES OURCE		
S.No.	**TEXT BOOKS**
1	Water Supply and Sewerage: E.W. Steel
2	Water Supply Engineering: S.R. Kshirsagar.
3	Water Supply Engineering: S.K. Ga rg
4	Water Supply Engineering: B.C. Punmia.
	REFERENCE BOOKS AND OTHER MATERIALS
5	Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
6	Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
7	Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
8	Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi

19CE0211	STRUCTURAL ANALYSIS (P)	L	T	P	C
		0	0	2	1

Co-requisite	19CE0201
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	SD SKILL DEVELOPMENT
Course designed by	Department of Civil Engineering
Approval	

PURPOS E		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Verification of reciprocal theorem and moment area theorem	b, i
2	Analysis of truss and curved members	b, i
3	Analysis of three hinge arches	b, i
4	Determine elastic properties of beam and analysis of struts	b, i

Session	Description of Experiments	Contact Hours	C-D-I-O	IOs
1	Verification of reciprocal theorem of deflection using a simply supported beam.	2	C, O	1
2	Verification of moment area theorem for slopes and deflections of the beam.	2	C, O	1
3	Deflections of a truss- horizontal deflections & vertical deflections of various joints of a pin- jo inted truss.	2	C, O	2
4	Elastic displacements (vertical & horizontal) of curved members.	2	C, O	2
5	Expe rimental and analytical study of 3 hinged arch and influence line for horizontal thrust.	2	C, O	3
6	Expe rimental and analytical study of behaviour of struts with various end conditions.	2	C, O	4
7	To determine elastic properties of a beam.	2	C, O	4
8	Expe riment on a two hinged arch for horizontal thrust & influence line for Horizontal thrust.	2	C, O	4
9	Expe rimental and analytical study of a 3 bar pin jo inted Truss.	2	C, O	2, 4
10	Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.	2	C, O	2, 4
11	Expe rimental and analytical study of an elastically coupled beam.	2	C, O	3, 4
12	Sway in portal frames - demonstration.	2	C, O	3, 4
13	To study the cable geometry and statics for different loading conditions.	2	C, O	3, 4
TOTAL CONTACT HOURS		**28**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Lab Manual
2	
	REFERENCE BOOKS AND OTHER MATERIALS
4	

19CE0213	SURVEYING-I (P)	L	T	P	C
		0	0	2	1

Co-requisite	19CE0203
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	SD SKILL DEVELOPMENT
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Use conventional surveying tools such as chain/tape, compass, plane table, levels in the field for various civil engineering applications	b, i
2 Enter observation in field book, adjusting and plotting a traverse	b, i
3 Use plane table to prepare map of a small area.	b, i

Session	Description of Experiments	Contact Hours	C-D-I-O	IOs
1	Chain Traversing	2	C, O	1, 2
2	Compass Traversing	2	C, O	1, 2
3	Differential Leve ling	2	C, O	1, 2
4	Fly Levelling	2	C, O	1, 2
5	Cross Sectioning	2	C, O	1, 2
6	Profile leveling	2	C, O	1, 2
7	Plane Table surveying: Rad iation and Intersection	2	C, O	1, 3
8	Resection- 2 and 3-point problem with plane Table	2	C, O	1, 3
9	Working with digital level	2	C, O	1, 3
	TOTAL CONTACT HOURS		**18**	

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Lab Manual
2	
	REFERENCE BOOKS AND OTHER MATERIALS
4	

19CE0215	FLUID MECHANICS (P)	L	T	P	C
		0	0	2	1

Co-requisite	19CE0106
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	SD SKILL DEVELOPMENT
Course designed by	Department of Civil Engineering
Approval	

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To learn the aim, working principle, components, function of hydraulic equipments.	b, i
2 To get hand-on experience in the operation of hydraulic equipments.	b, i
3 To study to take observations while the equipment is in operation.	b, i
4 To interpret the results obtained to arrive a conclusion.	b, i

Session	Description of Experiments	Contact Hours	C-D-I-O	IOs
1	To determine metacentric height of the ship model.	2	C, O	1, 2, 3, 4
2	To verify the Bernoulli's theorem.	2	C, O	1, 2, 3, 4
3	To determine coefficient of discharge for an Orificemeter/ venturimeter.	2	C, O	1, 2, 3, 4
4	To determine coefficient of discharge for an Orifice under variable head.	2	C, O	1, 2, 3, 4
5	To calibrate a given notch.	2	C, O	1, 2, 3, 4
6	To study velocity distribution in a rectangular open channel.	2	C, O	1, 2, 3, 4
7	To determine the coefficient of drag by Stoke's law for spherical bodies.	2	C, O	1, 2, 3, 4
8	To study the phenomenon of cavitation in pipe flow.	2	C, O	1, 2, 3, 4
9	To determine the critical Reynold's number for flow through commercial pipes.	2	C, O	1, 2, 3, 4
10	To determine the coefficient of discharge for flow over a broad crested weir.	2	C, O	1, 2, 3, 4
11	To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.	2	C, O	1, 2, 3, 4
12	To study the momentum characteristics of a given jet.	2	C, O	1, 2, 3, 4
13	To determine head loss due to various pipe fittings.	2	C, O	1, 2, 3, 4
	TOTAL CONTACT HOURS	**26**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Laboratory Manual.

19CE0217	ENVIRONMENTAL ENGINEERING (P)	L	T	P	C
		0	0	2	1
Co-requisite	19CE0209				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	SD	SKILL DEVELOPMENT			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1	To analyze the physical and chemical characteristics of wastewater/sewage	b, i
2	To familiarize the methods to estimate the organic strength of wastewater/sewage	b, i
3	To study the growth of microorganisms and its quantification	b, i

Session	Description of Experiments	Contact Hours	C-D-I-O	IOs
1	To determine the acidity of a wastewater/sewage sample	2	C, O	1, 2, 3
2	To determine the alka lin ity of a wastewater/sewage sample	2	C, O	1, 2, 3
3	To determine total, suspended, dissolved and settable solids in a wastewater sample	2	C, O	1, 2, 3
4	To determine volatile and fixed solids in a wastewater sample	2	C, O	1, 2, 3
5	To determine oil and grease in a wastewater/sewage sample	2	C, O	1, 2, 3
6	To determine the chloride concentration in a wastewater/sewage sample.	2	C, O	1, 2, 3
7	To determine the sulphate concentration in a wastewater/sewage sample.	2	C, O	1, 2, 3
8	To determine the B.O.D. of a given wastewater/sewage sample.	2	C, O	1, 2, 3
9	To determine the C.O.D. of a given wastewater/sewage sample.	2	C, O	1, 2, 3
10	To determine the T.O.C. of a given wastewater/sewage sample.	2	C, O	1, 2, 3
11	To determine the fecal count of a given wastewater sample.	2	C, O	1, 2, 3
12	Microscopic studies of a wastewater	2	C, O	1, 2, 3
TOTAL CONTACT HOURS		**24**		

COURSE CODE	COURSE NAME	L	T	P	C
20LE0201	GERMAN LANGUAGE PHASE I	2	0	0	2
	Pre requisite				
	Nil				
Total Contact Hours	30				

Unit 1   Contact Hours: 10
Topics: Alphabet
                Aussprache
                Zahlen
                Zeit
Vocabulary: Zahlen
        Zeitangaben (Uhrzeit, Tag, Wochentage, Monate, usw.)

Unit 2   Contact Hours: 10
Topics: Über Personen sprechen (Name, Land, Stadt, Sprache, Alter, Beruf, Familie, usw.)
Grammar: Personalpronomen im Nominativ
                Konjugation von regelmäßigen Verben im Präsens (wohnen, lernen, arbeiten, usw.)
                Konjugation von unregelmäßigen Verben im Präsens (sein, haben, heißen, lesen, sprechen, usw.)
                Possessiv-Artikel
                Wortposition, Aussagen, W-Fragen, Ja-Nein-Fragen

Vocabulary: Deutsche Familiennamen und Vornamen
                Namen von Ländern, Städten und Sprachen
                Berufsbezeichnungen
                Familienmitglieder

Unit 3   Contact Hours: 10
Topics: Über Sachen sprechen
                Essen und Trinken
Grammar: Bestimmter Artikel, Unbestimmter Artikel, kein (Nominativ)
                Singular und Plural
                Personalpronomen im Akkusativ
                Bestimmter Artikel, Unbestimmter Artikel, kein (Akkusativ)
Vocabulary: Sachen des täglichen Lebens (Haus, Möbel, Schreibwaren, Lebensmittel, usw.)
                Einige allgemeine Adjektive und Adverbien, Gegenteile, Farben

COURSE CODE	COURSE NAME	L	T	P	C
20LE0205	**FRENCH LANGUAGE PHASE I**	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE
- The course develops oral and written skills of understanding, expressing and exchanging information/interacting.
- The course develops the ability to construct sentences and frame questions.
- French language provides a competitive edge in career choices.

INSTRUCTIONAL OBJECTIVE
- To read and write short, simple texts.
- To understand a dialogue between two native speakers and also to take part in short, simple conversations using the skills acquired.
- Fluency in reading and writing.

Sujets:
- L'Alphabet
- Le Prounciation
- Les Nombres
- Décrire votre pays, ville,
- Les Professions
- Parler de choses
- L'Heure
- Les Repas et les boissons

Grammaire:

- Le Nom et le pluriel des noms
- Les Articles
- Les Adjectifs Possessifs
- Les Adjectifs Qualificatifs
- Les Verbes(Regular,irregular, pronominaux)
- Les Pronoms Sujets
- Les Prepositions
- L'interrogation

Lexique
- Se présenter
- Présenter quelq'un
- Les nationalités
- Les Pays
- Les Nombres
- Parler des jours de la semaine
- Les mois de l'année
- Les Professions
- Les Couleurs
- Les Contraires
- Les phrase avec l'heure

Course Material:
- Version originale 1will be the main text book used for this course.
- Nathan verbs conjugasion
- Larrouse French to English Dictionary

- Beside, material prepared by the teachers and material taken from other sources will also be used.

Evaluation:

The evaluation of students performance in this course will consist of internal tests, class participation and external end- semester examination in accordance with the rules and regulations of the university

		L	T	P	C
20 PD 0201	**PERSONALITY DEVELOPMENT - III**	**0**	**0**	**2**	**1**

Learning Objective: -

The objective of this course is to develop the professional under graduate students, build confidence and inculcate various soft skills especially communication skills and to help students to identify and achieve their personal potential.

Learning Outcome: -

At the end of the course the student will learn:

- Apply the conceptual understanding of Personality Development topics in day-to-day life.
- Develop confidence and make use of techniques for self-analysis & development.
- Understand the importance of teamwork, stress & time management and apply it in life.

Methodology: -

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students, which they will be employing during various occasions in their real life.

11. Group activities + individual activities.
12. Collaborative learning.
13. Interactive sessions.
14. Ensure Participation.
15. Empirical Learning

UNIT – I

Goal Setting - Problem Solving - Emotional Quotient

UNIT – II

Stress Management – Sign of Stress – Ways to cope up with stress

UNIT – III

Lateral Thinking (Situational) - Team Work (Role Plays)

UNIT – IV

Time Management – Smart Work - Prioritize your work

UNIT – V

Leadership Skills – Roles & Responsibilities – Decision Making

SCHEME OF INSTRUCTION

Marks allocated for regular participation in all PD activities in class.

SCHEME OF EXAMINATION

Internal evaluation on a regular basis and external evaluation at the end of the semester.

Code	Course	L	T	P	C
20MA0202	NUMERICAL METHODS	3	1	0	4

COURSE OBJECTIVES
The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields and develop the analytical ability in solving numerical problems as applied to the respective branches of Engineering.

OUTCOMES

This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology. At the end of the course, student should be able

- To introduce various numerical methods to get approximation solutions
- To familiar with numerical solution of equations
- To get exposed to differences and interpolation
- To be thorough with the numerical Differentiation and Integration
- To find numerical solutions of ordinary and partial differential equations

UNIT – I ERROR ANALYSIS AND NUMERICAL SOLUTION OF EQUATIONS

Approximations and error in computation: Significant figures ,approximate numbers, Errors: Round-off Errors, Truncation Errors, Absolute Relative and Percentage Errors, Error in approximation of a function and series, Solution of algebraic and Transcendental equation: basic properties of equation, Bisection method, Newton-Raphson method. Solution of simultaneous equations: Gauss Elimination method, Gauss Jacobi method, Gauss Seidel method.

UNIT-II DIFFERENCES AND INTERPOLATION

Finite differences - Forward differences and backward differences, Shifting operator E - Difference tables, relation between operators, Differences of a polynomial - Factorial polynomials -. Interpolation with equal intervals: Newton- Forward and Backward Interpolation formulae, Interpolation with unequal interval: Divided differences - Newton's Divided difference formula - Lagrange's Interpolation formula.

UNIT – III NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical Differentiation: Newton's forward and backward differences formulae to compute first and higher order derivatives, Numerical Integration: The Trapezoidal rule - Simpson's one third rule and Simpson's three eighth rule.

UNIT – IV NUMERICAL SOLUTIONS OF ORDINARY AND PARTIAL DIFFERENTIALEQUATIONS

Solution by Taylor's series - Euler's method - Improved and modified Euler method - Runge-Kutta methods of fourth order (No proof).Classification of Partial differential equations of the second order - Difference quotients - Laplace's equation and its solution by Liebmann's process

UNIT – V CURVE FITTING; EIGEN VALUESAND EIGEN VECTORS

Method of Least Squares – Fitting a straight line – Fitting a parabola – Fitting an exponential curve – Fitting a curve of the form $y = ax^b$. Eigen values and Eigen vectors: determination of largest eigen value by power method, finding of all eigen values by Jacobi's method.

TEXT BOOK

- B.S. Grewal, "Numerical Methods in engineering and science", Khanna Publishers, 42nd Edition,2012.
- Davi Prasad, An Introduction to Numerical Analysis, Narsoa Publishing House, New Delhi, 2010.
- Steven Chapra and Raymond Canale, Numerical Methods for Engineers,8th Edition, McGraw Hill, N.Y., ISBN10: 1260232077,ISBN13: 9781260232073,Copyright: 2021.

REFERENCE BOOKS

- Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 1999
- Gerald C. F., Wheatley P. O., Applied Numerical Analysis, Pearson, 2011.
- Arumugam S., Isaac A. T., Somasundaram A., Numerical Methods, Scitech Publications Pvt. Ltd, 2009.
- S.S. Sastry, Introductory Methods of Numerical Analysis, 2001
- E. Balagurusamy, Computer Oriented Statistical and Numerical Methods - Tata McGraw Hill., 2000
- M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd., 1987
- Dr.P.Kandasamyetal., Numerical Methods, S.Chand& Co., New Delhi, 2003

19CE0202	STRUCTURAL ANALYSIS – II		L	T	P	C
			3	1	0	4

Co-requisite	None
Pre-requisite	19CE0102, 19CE0201
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To analysis the structures using different displacement methods	a, e, i
2 To understand the behaviour of structure under unsymmetrical bending	a, e, i
3 To understand influence line diagram and be able to draw influence lines for various functions of determinate and indeterminate structures	a, e, i
4 To analyse the arches	a, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (FIXED AND CONTINUOUS BEAMS)	**12**		
1	Introduction, types of supports-reaction components, external redundancy, statically indeterminate beams and frames, degree of redundancy.	4	C, I	1
2	Bending moment diagrams for fixed beams with different loadings, effect of sinking of supports	4	C, I	1
3	Clayperons theorem of three moments, various cases of load and geometry of continuous beams.	4	C, I	1
	UNIT -2 (SLOPE DEFLECTION & MOMENT DISTRIBUTION METHOD)	**12**		
5	Slope Deflection Introduction & Fundamental equations	2	C, I	2
6	Applications to continuous beams and portal frames, side sway in portal frames.	4	C, I	2
7	Momet Distribution Method Basic propositions, stiffness of a member, distribution theorem, carry-over theorem, relative stiffness, distribution factors	2	C, I	2
8	Applications to continuous beams, portal frames with and without side sway	4	C, I	2
	UNIT -3 (ROLLING LOADS AND INFLUENCE LINES DIAGRAMS)	**12**		
9	Introduction, Single concentrated load	1	C, I	3
10	uniformly distributed load longer than span	1	C, I	3
11	shorter than span , two point loads,	2	C, I	3
12	Several point loads, Max. B.M. and S.F., Absolute Max. B.M.	2	C, I	3
13	Introduction, influence lines for three hinged and two hinged arches	2	C, I	3
14	Load position for Max. S.F. and B.M. at a section in the span.	2	C, I	3
15	Muller-Breslau Principle, I.L. for B.M. & S.F. for continuous Beams.	2	C, I	3
	UNIT -4 (ANALYS IS OF ARCHES)	**12**		

16	Three Hinge Arches: Horizontal thrust, shear force and Bending Moment diagram	3	C, I	4
17	Two Hinge Arches: Parabolic and circular arches, Bending Moment Diagram for various loadings,	3	C, I	4
18	temperature effects, web shortening, Axia l thrust and Radial Shear force diagrams	2	C, I	4
19	Fixed Arches: Expression for Horizontal thrust	2	C, I	4
20	Bending Moment at a section, elastic centre	2	C, I	4
TOTAL CONTACT HOURS			**48**	

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Indeterminate Structures, R.L.Jindal S.Chand & Co.,N.Delhi.
2	Advanced Structural Analysis-A.K.Jain, Nem Chand & Bros., Roorkee.
3	Structural Analysis-A Unified Approach, D.S.Prakash Rao,, University Press , Hyderabad.
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Structural Analysis-A unified classical & Matrix Approach, A.Ghali & A.M.Neville, Chapman & Hall London.
6	Theory of Strucutres,- Vol. I&II,- S.P.Gupta & G.S.Pandit, Tata Mc Gra w Hill, N.Delhi.
7	
8	

19CE0204	DESIGN OF CONCRETE STRUCTURES – I	L	T	P	C
		3	0	2	4

Co-requisite	None
Pre-requisite	19CE0102, 19CE0201
Data Books / Codes / Standards	IS456:2000, SP16
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Know various design philosophies for Structural Design	a, i
2	Design a Beam structure	a, c, e, i
3	Design one way and two way slabs	a, c, e, i
4	Know various design considerations for design of column and footing	a, c, e, i
5	Design the retaining wall	a, c, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (DES IGN PHILOSOPHIES IN REINFORCED CONCRETE)		**8**		
1	Working stress and limit state methods, Limit s tate v/s working stress method	2	C, I	1
2	Building code, Normal distribution curve, characteristic strength and characteristics loads	2	C, I	1
3	design values, Partial safety factors and factored loads	2	C, I	1
4	stress -strain relationship for concrete and steel	2	C, I	1
UNIT -2 (DES IGN OF FLEXURAL MEMBER: LIMIT STATE METHOD)		**8**		
5	Basic assumptions, Analysis and design of singly reinforced rectangular sections	2	D, I	2
6	doubly reinforced rectangular sections	2	D, I	2
7	T-beams	2	D, I	2
8	continuous beams	2	D, I	2
UNIT -3 (DES IGN OF SLABS)		**8**		
9	One way and Two Ways Slabs: General considerations, Design of one way slabs for distributed and concentrated loads	2	D, I	3
10	Two ways slabs for distributed and concentrated loads	2	D, I	3
11	Non-rectangular slabs	2	D, I	3
12	openings in slabs	2	D, I	3
UNIT -4 (COLUMNS AND FOOTINGS)		**8**		
13	Effective length, Minimum eccentricity	2	D, I	4
14	short columns under axial compression	2	D, I	4
15	Uniaxial and biaxial bending, slender columns	2	D, I	4
16	Isolated and wall footing	2	D, I	4
UNIT -5 (FOUNDATIONS)		**8**		
17	Combined footings	2	D, I	5
18	raft foundation	2	D, I	5
19	design of pile cap and piles	2	D, I	5
20	under-reamed piles	2	D, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Design of Reinforced Concrete Structures,P.Dayaratnam,Oxford & IBH Pub.,N.Delhi.
2	Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
3	Reinforced Concrete, I.C.Syal & A,K,Goe l, A.H,Wheeler & Co.Delhi.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Reinforced Concrfete Design, S.N.Sinha, TMH Pub.,N.Delhi.
5	SP-16(S&T)-1980, 'Design Aids for Reinforced Concrete to IS:456, BIS, N.Delhi.
6	SP-34(S&T)-1987 'Handbook on Concrete Reinforcement and Detailing', BIS, N.Delhi.

19CE0208	ADVANCED SURVEYING	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	19CE0203
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**

	At the end of the course , student will be able to:	
1	To understand the principle of surveying on very large scale by locating precise horizontal controls	a
2	To learn about surveying applications in setting out works	a
3	To learn about determining absolute positions of a point using celestial measurements	a, e
4	To learn about different types of errors in measurements and their adjustment	a, e
5	To introduce the basic concept of photogrammetry, Remote sensing, and GIS	a, e

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**10**		
1	Triangulation and Trilateration: Triangulation systems, classification, strength of figure	2	C, I	1
2	selection of triangulation stations, grade of triangulation	2	C, I	1
3	field work of triangulation, t riangulation computations	2	C, I	1
4	Trilateration- Principle, Methods, advantages and disadvantages, introduction to total station	2	C, I	1
5	Survey layout/setting out: Introduction, controls for layout, e xa mples of laying out	2	C, I	1
	UNIT -2	**10**		
6	Survey Adjustment and computations: Definitions, types of error, weight of an observation	1	C, I	2
7	law of weights, most probable values, principle of least squares	2	C, I	2
8	method of correlates, normal equation, adjustment of triangulation figures by method of least squares	2	C, I	2
9	Astronomy: Definitions of astronomical terms, ce lestial coordinate systems	2	C, I	2
10	Napier's rule of circular parts, star at elongation, star at prime vertical star at horizon	1	C, I	2
11	star at culmination, Astronomical triangle	1	C, I	3
12	Time: definitions of sidereal, apparent, solar and mean solar time, equation of time	1	C, I	3
	UNIT -3	**14**		
13	Elements of Photogrammetry: Introduction, types of photographs	1	C, I	3
14	Terrestrial and aerial photographs	1	C, I	3
15	aerial, camera, scale and height displacements of vertical	2	C, I	3

	photographs			
16	Stereoscopic vision and stereoscopes, height determination from parallax measurement	1	C, I	3
17	flight planning, principle of photo interpretation	1	C, I	3
18	Introduction to remote sensing: Definition of Remote Sensing, types of remote sensing	1	C, I	4
19	remote sensing system and components. EMR source and characteristics	1	C, I	4
20	active and passive remote sensing, EMR propagation through medium	2	C, I	4
21	Role of atmosphere, Atmospheric windows	1	C, I	4
22	EMR interaction with objects, Spectral signature, EMR interaction with vegetation, soil and water	2	C, I	4
23	Satellite orbits and platforms: Geostationary and sun synchronous satellites	1	C, I	4
24	Resolution, Applications of remote sensing in civil engineering	1	C, I	4
UNIT -4		**6**		
25	Geographical Information System (GIS): Definition, and Objectives, Components of GIS	1	C, I	5
26	Spatial data models: Raster and Vector, Data inputting in GIS	1	C, I	5
27	Linkage between spatial and non spatial data, Spatial data analysis: Vector and raster based spatial dataanalysis	2	C, I	5
28	Integration of RS and GIS data, Digital Elevation Model	1	C, I	5
29	GIS Software Packages	1	C, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Chang.T.K. 2002: Geographic Information Systems, Tata Mc Gra wHill
2	Punmia, B.C. 2005: Surveying I and II, Luxmi Publications
3	Charles D. Ghilani: Adjustment Computations: Spatial Data Analysis (Fifth Edition)
4	Paul R Wolf: Elements of Photogrammetry
	REFERENCE BOOKS AND OTHER MATERIALS
5	G S Srivastava: An introduction to Geoinformatics
6	Basudeb Bhatta: Remote Sensing and GIS
7	G. L. Hosmer: Te xt-book on Practical Astronomy
8	Various Online resources including NPTEL

19CE0210	SOIL MECHANICS	L	T	P	C
		3	1	0	4

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	P	PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To e xpla in how three phase system is used in soil and how are soil properties estimated using three phase system	a, e, i
2	To e xpla in the role of water in soil behaviour and how soil stresses, permeability and quantity of seepage including flow net are estimated	a, e, i
3	To emphasis the importance of soil stress distribution and stress influence due to varies loads.	a, e, i
4	To e xpla in how soil shear parameters are affected by drainage conditions	a, e, i
5	To e xpla in mechanis m of compaction, factors affecting and effects of compaction on soil properties	a, e, i
6	To estimate the magnitude and time-rate of settlement due to consolidation.	a, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**10**		
1	**Soil Formation and Composition:** Introduction, soil and rock, Soil Mechanics and Foundation Engineering, soil deposits of India, particle size, particle shape, interparticle forces, soil structure, principal clay minerals.	3	C	1
2	**Basic Soil Properties:** Introduction, three phase system, weight-volume relationships, soil grain properties, soil aggregate properties,	2	C	1
3	grain size analysis, sieve analysis, sedimentation analysis, grain size distribution curves, consistency of soils, consistency limits and their determination, activity of clays, relative density of sands.	3	C	1
4	**Classification of soils:** Purpose of classification, Indian Standard Classification System.	2	C, I	1
	UNIT -2	**8**		
5	**Permeability of Soils:** Introduction, Darcy's law and its validity, discharge velocity and seepage velocity, factors affecting permeability,	2	C	2
6	laboratory determination of coefficient of permeability, determination of field permeability, permeability of stratified deposits.	2	C	2
7	**Effecti ve Stress Concept:** Principle of effective stress, effective stress under hydrostatic conditions, effective stress under steady state hydro- dynamic conditions, seepage force,	2	C, I	2
8	quick condition, crit ical hydraulic gradient, two dimensional flow, Laplace's equation, properties and utilities of flownet.	2	C, I	2
	UNIT -3	**8**		
9	**Compaction:** Introduction, role of moisture and compactive effect	2	C	3

	in compaction,			
10	Laboratory determination of optimum moisture content, moisture density relationship, compaction in field, field control of compaction.	2	C, O	3
11	**Vertical Stress Below Applied Loads:** Introduction, Boussinesq's equation, vertical stress distribution diagrams, vertical stress beneath loaded areas,	2	C, I	3
12	Newmark's in fluence chart, appro ximate stress distribution methods for loaded areas, Westergaard's analysis, contact pressure.	2	C, I	3
	UNIT -4	**12**		
13	**Compressibility and Consolidation:** Introduction, components of total settlement, consolidation process, one-dimensional consolidation test,	2	C	4
14	Typical void ratio-pressure relationships for sands and clays, normally consolidated and over consolidated clays, Casagrande's graphical method of estimating pre- consolidation pressure,	2	C	4
15	Terzaghi's theory of one-dimensional primary consolidation, determination of coefficients of consolidation, consolidation settlement, Construction period settlement, secondary consolidation.	2	C, I	4
16	**Shear Strength:** Introduction, Mohr stress circle, Mohr-Coulomb failure-criterion, relationship between principal stresses at failure, shear tests, direct shear test,	2	C, I	4
17	unconfined compression test, tria xia l compression tests, drainage conditions and strength parameters, Vane shear test,	2	C, I	4
18	shear strength characteristics of sands, normally consolidated clays, over-consolidated clays and partially saturated soils, sensitivity and thixotropy.	2	C, I	4
	UNIT -5	**4**		
19	**Earth Pressure:** Introduction, earth pressure at rest, Rankine's active & passive states of plastic equilibrium, Rankine's earth pressure theory,	2	C, I	5
20	Coulomb's earth pressure theory, Culmann's graphical construction, Rebhann's construction.	2	C, I	5
TOTAL CONTACT HOURS		**42**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Gopa l Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age Intetrnational (P) Ltd. Publishers - N.Delhi, Edition No. - 3rd, 2016.
2	Alam Singh, Soil Engg. In Theory and Practice, Vo l .I, Fundamentals and Genera l Principles, CBS Pub.,N.Delhi.
	REFERENCE BOOKS AND OTHER MATERIALS
3	S.K.Gu lati, Engg.Properties of Soils, Tata-Mcgraw Hill, N.Delhi.
4	P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, Edition No.- I, 1995.
5	B.M.Das, Principles of Geotechnical Engineering, PWS KENT, Boston.

19CE0212	SOIL MECHANICS (P)	L	T	P	C
		0	0	2	1

Co-requisite	19CE0210
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	SD SKILL DEVELOPMENT
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To estimate index properties of soils.	b, i
2 To estimate consistency limits of fine grained soils.	b, i
3 To estimate shear strength of soil by direct shear test, triaxia l shear test & unconfined compressive test.	b, i
4 To estimate the engineering properties of the soils by density tests & permeability test.	b, i

Session	Description of Experiments	Contact Hours	C-D-I-O	IOs
1	Visual Soil Classification and water content determination.	2	C, O	1
2	Determination of specific gravity of soil solids.	2	C, O	1
3	Grain size analysis-sieve analysis.	2	C, O	2
4	Atterberg's Limits determination.	2	C, O	2
5	Field density determination by Sand replacement method and Core cutter method.	2	C, O	4
6	Standard Proctor compaction test.	2	C, O	3
7	Coefficient of permeability of soils.	2	C, O	3
8	Unconfined compressive strength test.	2	C, O	3
9	Direct shear test on granular soil sample.	2	C, O	3
10	Unconsolidated undrained (UU) triaxial shear test of fine grained soil sample.	2	C, O	4
TOTAL CONTACT HOURS		**20**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Gopa l Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age Intetrnational (P) Ltd. Publishers- N.Delhi, Edition No. - 3rd, 2016.
2	P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, Edition No. - I, 1995.

19CE0214	**SURVEYING – II (P)**	**L**	**T**	**P**	**C**
		0	0	2	1
Co-requisite	19CE0210				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	SD	SKILL DEVELOPMENT			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Use the theodolite for measuring angles and using tacheometer to determine distance and elevation.	B
2	Use a total station to measure distance, elevation and coordinates	b, e
3	Use total station to plot a map of given area with softwares	b, e

Session	**Description of Experiments**	**Contact Hours**	**C-D-I-O**	**IOs**
1	Study of theodolite	2	C, O	1
2	measurement of horizontal / Vert ical angle with theodolite	2	C, O	1
3	Measurement of Tacheometric constants	2	C, O	1
4	Calculating horizontal distance and elevations using tacheometer.	2	C, O	1
5	Study of Total Station	2	C, O	2
6	Measurements of distance, elevation, coordinate with total station	2	C, O	2, 3
7	Special problems with Total station	2	C, O	2, 3
8	Plan and contour map with a total station and software (including AutoCAD)	2	C, O	2, 3
TOTAL CONTACT HOURS		**16**		

COURSE CODE	COURSE NAME	L	T	P	C
20LE0202	GERMAN LANGUAGE PHASE II	2	0	0	2
	Prerequisite				
	Knowledge of the basics taught in the third semester				
Total Contact Hours	**30**				

Unit 1   Contact Hours: 10
<u>Topics:</u>   Einkaufen
              Tagesablauf
<u>Grammar:</u>   Trennbare und untrennbare Verben
              Dativ
              Modalverben
<u>Vocabulary:</u>   Kleidung
              Haushaltswaren
              Sachen zum Essen und Trinken
              Maßeinheiten

Unit 2   Contact Hours: 10
<u>Topics:</u>   Reisen
              Ortsangaben und Richtungen
<u>Grammar:</u>   Imperativ
              Präpositionen mit Dativ und Akkusativ
              Wechselpräpositionen
<u>Vocabulary:</u>   Verkehrsmittel
              Namen von Orten und Sehenswürdigkeiten
              Information über Deutschland

Unit 3   Contact Hours: 10
<u>Topics:</u>   Ereignisse der Vergangenheit erzählen
              Lebenslauf
<u>Grammar:</u>   Präteritum von sein, haben
              Perfekt
<u>Vocabulary:</u>   Erweiterung des Wortschatzes von verschiedenen Bereichen
              Ordinalzahlen

Course Material:
Tangram aktuell 1 (Lektion 1-4 Kursbuch + Arbeitsbuch, Lektion 5-8 Kursbuch + Arbeitsbuch, Übungsheft) will be the main text book used for the two semesters of this course. Besides, material prepared by the teachers and material taken from other sources will also be used.

Evaluation:
The evaluation of students' performance in this course will consist of internal tests, class participation and external end-semester examination in accordance with the rules and regulations of the University.

Bibliography:

Rosa-Maria Dallapiazza, u.a.: **Tangram aktuell 1** (Lektion 1-4, Lektion 5-8, Übungsheft und Glossar). Max Hueber Verlag

Wolfgang Hieber: **Lernziel Deutsch, Teil 1**. Max Hueber Verlag

Korbinian Braun, u.a.: **Deutsch als Fremdsprache IA, Grundkurs**. Ernst Klett Stuttgart

Christiane Lemcke, u.a.: **Moment mal, Teil 1**: Langenscheidt

Ulrike Albrecht, u.a.: **Passwort Deutsch 1**. Ernst Klett Sprachen

Rolf Brüseke: **Starten Wir! A1**. München: Hueber Verlag

COURSE CODE	COURSE NAME	L	T	P	C
20LE0206	FRENCH LANGUAGE PHASE II	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

- A language skills are as valuable as technical skills a Knowledge of French enables the graduates in career orientation.
- As a second International global Language after English there is a wider choice of job opportunities in the International employment market and also multinationals in India and an understanding of French culture through language.

INSTRUCTIONAL OBJECTIVE

- A strong awareness of the culture of the countries where the language is spoken.
- A passion for languages and a commitment to the subject.
- The ability to use language creatively and spontaneously.
- An Independence in their studies and the ability to draw upon a wide range of resources.
- Fluency in reading.
- Fluency and Imagination in writing.

Sujets:
- La France
- Le Fromage, le vin
- Les saisons
- Les recettes
- Indiquer un chemin
- Demander la direction
- Donner des indications
- Le corps
- Les elements du passé
- Raconteur une journée

Grammaire:
- La negation
- L'imperatif
- Le passé recent
- Le future
- Le passé compose
- L'imparfait
- Les nombres ordinaux

Lexique:
- Les vêtements
- Les animaux
- Parler de prix
- Le corps
- Vocabulaire de la gare et du train
- Le voyage
- Les achats

Course Material:
- Version originale 1will be the main text book used for this course.
- Nathan verbs conjugasion

- Larrouse French to English Dictionary
- Beside, material prepared by the teachers and material taken from other sources will also be used.

Evaluation:

The evaluation of students performance in this course will consist of internal tests, class participation and external end- semester examination in accordance with the rules and regulations of the university

		L	T	P	C
20PD0202	**PERSONALITY DEVELOPMENT – IV**	0	0	2	1

Learning Objective: -

The objective of this course is to make the student understand the importance various corporate etiquettes, written and oral communication skills and to build self-awareness and self-development.

Learning Outcome: -

At the end of the course, the student will learn:

- Implementation of etiquettes in organization and society at large
- Importance of ethics in life as well as career
- Importance of written communication in organization.

METHODOLOGY

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students, which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

UNIT - I

Etiquettes – Professional Etiquette, Meeting Etiquette, Technology Etiquette (Phone & Email), Dressing Etiquette

UNIT - II

Resume – Types of Resume, Basic Resume writing skills

UNIT - III

Ethics – Ethical Values, Importance of Work Ethics

UNIT - IV

Extempore (JAM), Current affairs - I

UNIT - V

Letter Writing – Business Letters, Application letters, Covering letters, etc.

SCHEME OF INSTRUCTION

Marks allocated for regular participation in all PD activities in class.

SCHEME OF EXAMINATION

Internal evaluation on a regular basis and external evaluation at the end of the semester.

THIRD YEAR

19CE0301	**DESIGN OF CONCRETE STRUCTURES – II**	**L**	**T**	**P**	**C**
		3	0	2	4

Co-requisite	None
Pre-requisite	19CE0102, 19CE0201, 19CE0202, 19CE0204
Data Books / Codes / Standards	IS 1343-1980, IS Code of Practice for Prestressed Concrete. IS 3370-1976(Part I to IV), Indian Standard Code of Practice for Liquid Retaining structures IS 456-2000, Indian Standard of Pract ice for Pla in and Reinforced Concrete. IS 1893,4326 & 13920 Indian Standard code of practice for earthquake Resistant design of structures.
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	

1	To understand the design of Retaining wall and Beam	a, c, i
2	To Understand the Design of flat slab and Staircase	a, c, i
3	To Understand the design of Water tanks, Silos and Bunkers	a, c, i
4	To Understand the design of Prestressed Concrete	a, c, i
5	To Understand the Concept of Yield line Theory	a, c, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
UNIT -1 (RETAINING WALLS AND DES IGN OF BEAMS CURVED IN PLAN)		**8**		1
1	Classification, Forces on retaining walls	1	C, I	1
2	Design criteria, stability require ments	1	D, I	1
3	Proportioning of cantilever retain ing walls, counterfort retain ing Walls	1	D, I	1
4	Criteria for design of counteforts, design exa mples.	1	D, I	1
5	Maximum moments and shear for beams curved in plan	1	D, I	1
6	Analysis for torsion	1	D, I	1
7	Torsional reinforcement	1	D, I	1
8	Design e xa mples.	1	D, I	1
UNIT -2 (FLAT S LABS AND DES IGN OF STAIRCAS ES)		**8**		
9	Advantages of flat slabs, general design considerations	1	D, I	2
10	approximate direct design method	1	D, I	2
11	Design of flat slabs	1	D, I	2
12	Openings in flat slab	1	D, I	2
13	Design of various types of staircases	1	D, I	2
14	Design of various types of staircases	1	D, I	2
15	Design e xa mples	1	D, I	2
16	Design e xa mples	1	D, I	2
UNIT -3 (WATER TANKS , S ILOS AND BUNKERS)		**8**		
17	Design requirements of water retaining structures	1	D, I	3

18	Rectangular and cylindrical underground	1	D, I	3
19	Overhead tanks, Intze tanks, design considerations,	1	D, I	3
20	Design e xa mples	1	D, I	3
21	Various theories	1	D, I	3
22	Bunkers with sloping bottoms	1	D, I	3
23	Bunkers with high side wall	1	D, I	3
24	Design e xa mples	1	D, I	3
UNIT -4 (PRES TRESS ED CONCRETE)		**8**		
25	Introduction, basic concepts of prestress concrete	1	D, I	4
26	Various prestressing systems, losses in prestress	1	D, I	4
27	Initial and final stress conditions	1	D, I	4
28	load balancing concept	1	D, I	4
29	Analysis and design of sections for flexure	1	D, I	4
30	Analysis and design of sections for flexure	1	D, I	4
31	Analysis and design of sections for Shear stress	1	D, I	4
32	Analysis and design of sections for Shear stress	1	D, I	4
UNIT -5 (YIELD LINE THEORY)		**8**		
33	Basic assumptions, Methods of analysis	1	D, I	5
34	Yield line patterns and failure mechanisms	1	D, I	5
35	Analysis of one way	1	D, I	5
36	Analysis of Two way	1	D, I	5
37	Analysis of Non-rectangular slabs	1	D, I	5
38	Effect of top corner steel in square slabs	1	D, I	5
39	Design e xa mp les	1	D, I	5
40	Design e xa mp les	1	D, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Plain and Reinforced Concrete, Vo l.2, Jai Krishna & O.P.Jain, Nem Chand & Bros., Roorkee.
2	Pre-Stressed Concrete, N.Krishna Raju, TMH Pub.,N,.Delh i.
3	Reinforced Concrete-Limit StaTge Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Design of Prestressed Concrete Structures, T.Y.Lin, John Wiley & Sons., N.Delhi.

19CE0303	**GEOTECHNICAL ENGINEERING – I**	**L**	**T**	**P**	**C**
		3	1	0	4

Co-requisite	None
Pre-requisite	19CE0210
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To understand the concept of Sub-Surface Exploration, Drainage and Dewatering	a, e, i
2 To understand the Concept of shallow Foundation	a, c, e, i
3 To understand the concept of pile Foundation	a, c, e, i
4 To understand the concept of drilled pier	a, c, e, i
5 Knowledge of Cassion Foundation	a, c, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (S UB-S URFACE EXPLORATION, DRAINAGE AND DEWATERING)		**8**		
1	Purpose, stages in soil e xp loration, depth and lateral e xtent of e xploration, guidelines for various types of structures	1	C	1
2	e xcavation and boring methods	1	C	1
3	Soil sampling and disturbance, major types of samplers,	1	C, I	1
4	Sounding methods-SCPT, DCPT, SPT and interpretation	1	C, I	1
5	Geophysical methods, exp loration logs.	1	C, I	1
6	Introduction, ditches and sumps, well point systems	1	C, I	1
7	Shallow well system, deep we ll drainage,	1	C, I	1
8	Vacuum method, Electro-os mosis, consolidation by sand piles.	1	C, I	1
UNIT -2 (SHALLOW FOUNDATION)		**10**		
9	Design criteria for structural safety of foundation (i) location of footing, (ii) shear failure criterion, (iii) settlement criterion, ultimate bearing capacity, modes of shear failu re	2	D, I	2
10	Rankine's analysis Tergazi's theory, Ske mpton's formu la, effect of fluctuation of G.W.T.	2	C, I	2
11	Effect of eccentricity on bearing capacity, inclined load, I.S Code Recommendations	1	C, I	2
12	Factors affecting bearing capacity, methods of improving bearing capacity.	1	C, I	2
13	Various causes of settlement of foundation, allowable bearing pressure based on settlement, settlement calculation	1	C, I	2
14	Elastic and consolidation settlement, a llo wable settlement according to I.S.Code.	1	C, I	2
15	Plate load test and its interpretation	1	C, I	2
16	bearing capacity from penetration tests	1	D, I	2

		UNIT -3 (COMBINED FOOTING)	8		
17	Situation suitable for the shallow foundations, types of shallow foundations	1	C, I	2
18	Relative merits of shallow foundation, depth of foundation	1	C, I	2
19	Footing on slopes , uplift of footings	1	C, I	2
20	Conventional procedure of proportioning of footings	1	C, I	2
21	Combined footings, raft foundations	1	C, I	2
22	Bearing capacity of raft in sands and clays	1	C, I	2
23	Various methods of designing rafts	1	C, I	2
24	Floating foundations	1	C, I	2
	UNIT -4 (PILE FOUNDATION)	10		
25	Introduction, necessity of pile foundations, classification of piles, load capacity	2	C, I	3
26	static analysis, analysis of pile capacity in sands and clays, dynamic analysis, pile load tests	2	C, I	3
27	negative skin friction, batter piles, lateral load capacity	1	C, I	3
28	uplift capacity of single pile, under- rea med pile	1	C, I	3
29	Group action in piles, pile spacing, pile group capacity, stress on lower strata	1	C, I	3
30	settlement analysis,	1	C, I	3
31	negative skin frict ion of pile group, uplift resistance of pile group	1	C, I	3
32	lateral resistance, batter pile group	1	C, I	3
	UNIT -5 (CAISSONS)	8		
33	Caissons- Types, bearing capacity and settlement, construction procedure	2	C, I	5
34	Well foundations-shapes, depth of well foundations	1	C, I	5
35	Components, factors affecting well foundation, design lateral stability	1	C, I	5
36	Construction procedure	1	C, I	5
37	Sinking of wells	1	C, I	5
38	Rectification of t ilts and shifts	1	C, I	5
39	Recommended values of tilts & shifts as per I.S.3955	1	C, I	5
	TOTAL CONTACT HOURS	44		

LEARNING RES OURCE	
S.No.	TEXT BOOKS
1	Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2	Murthy, V.N.S, A te xt book of Soil Mechanics and Foundation Engineering, UBS Publishers & Distributors Pvt. Ltd., New Delhi 1999
3	Gopa l Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age Intetrnational (P) Ltd. Publishers- N.Delhi, Edition No. - 3rd, 2016
	REFERENCE BOOKS AND OTHER MATERIALS
4	Nainan P Kurian, Design of foundation Systems Principles and Practices, Narosa, 2011
5	Donald P. Coduto, Man-Chu Ronald Yeung and Willia m A. Kitch, Geotechnica l Engineering, Principles and Practices, PHI Learning Private limited, 2011
6	Braja M. Das, Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., Singapore, 2005.
7	P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, Edition No. - I, 1995

19CE0305	HYDROLOGY & WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	19CE0207				
Data Books / Codes / Standards					
Course Category	P	PROFESSIONAL CORE			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To provide student knowledge in hydrology and hydraulics and understand concepts of water resources systems.	a, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (INTRODUCTION AND PRECIPITATION)	**8**		
1	Hydrologic cycle, scope and application of hydrology to engineering problems	1	C, I	1
2	Drainage basins and its characteristics, stream geometry, hypsometric curves	1	C, I	1
3	Forms and types of precipitation, characteristics of precipitation in Ind ia,	1	C, I	1
4	Measurement of preciptation ,recording and non-recording raingages,	1	C, I	1
5	Raingage station, ra ingage, network, estimation of missing data,	1	C, I	1
6	Presentation of rain fall data, mean precipitation,	1	C, I	1
7	Depth -area -duration relationship, frequency of point rainfall,	1	C, I	1
8	Intensity - duration- frequency curves, probable ma x. precipitation	1	C, I	1
	UNIT -2 (EVAPORATION, TRANSPIRATION AND INFILTRATION)	**8**		
9	Process, evaporimeters and empirical re lationships, analytical method	1	C, I	1
10	Reservoir evaporation and methods of its control, transpiration	1	C, I	1
11	Evapotranspiration and its measurement	1	C, I	1
12	Penman's equation and potential evapotranspiration	1	C, I	1
13	Infiltration process	1	C, I	1
14	Initial loss, infiltration capacity	1	C, I	1
15	Measurement of in filt ration	1	C, I	1
16	Infiltration indices	1	C, I	1
	UNIT -3 (RUNOFF AND HYDROGRAPH)	**8**		
17	Factor affecting run-off, estimation of runoff, rainfall-run off re lationships, measurement of stage-staff gauge	1	C, I	1
18	Wire gauge, automatic stage recorder and stage hydrograph, measurement of velocity-current meters	1	C, I	1
19	Floats, area velocity method, moving boat and slope area method, electromagnetic	1	C, I	1
20	Ultra-sonic and dilution methods of stream flow measurement,	1	C, I	1

	stage discharge relationship			
21	Discharge hydrograph, components and factors affecting shape of hydrograph	1	C, I	1
22	Effective rainfall, unit hydrograph and its derivation, unit hydrograph of different durations, use and limitations of UH	1	C, I	1
23	Triangular UH, Snyder's synthetic UH, floods, rational methods, empirical fo rmulae	1	C, I	1
24	UH method, flood frequency methods, Gu mbel's method, graphical method, design flood	1	C, I	1
UNIT -4 (GROUND WATER)		**8**		
25	Occurrence, types of aquifers, compressibility of aquifers	1	C, I	1
26	Water table and its effects on fluctuations , wells and springs	1	C, I	1
27	Movement of g round water, Darcy's law,	1	C, I	1
28	Permeability and its determination	1	C, I	1
29	Porosity, specific yield and specific retention	1	C, I	1
30	Storage coefficient, t ransmissibility	1	C, I	1
31	Steady state flow to wells in unconfined aquifers	1	C, I	1
32	Steady state flow to wells in confined aquifers	1	C, I	1
UNIT -5 (WATER RES OURCES PLANNING & S YS TEMS ENGINEERING)		**8**		
33	Role of water in national development, assessment of water resources, planning process, environmental consideration in planning, system analysis in water planning	1	C, I	1
34	Some common problems in project planning, functional require ments in multipurpose projects	1	C, I	1
35	Multipurpose planning, basinwise planning, long term planning. Reservoir p lanning-dependable yield	1	C, I	1
36	Sedimentation in reservoir, reservoir capacity, empirical-area reduction method	1	C, I	1
37	Concept of system's engineering, optimal policy analysis, simu lation and simulat ion modeling	1	C, I	1
38	Nature of water resources system, analog simulation, limitations of simulation	1	C, I	1
39	Objective function, production function, optimality condition, linear, non- linear and dynamic progra mming	1	C, I	1
40	Applications to real time operations of existing system, hydrologic modeling and applications of basic concepts	1	C, I	1
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Engineering Hydrology by K.Subra manya
2	Hydrology by H.M.Raghunath
3	Water Resources Engineering by Linseley and Franzini
4	Groundwater Hydrology by David. K. Todd
	REFERENCE BOOKS AND OTHER MATERIALS
5	Water Resources Systems Planning & Economics by R.S.Varshney.
6	Operational Research-An Introduction by Ha mdy A.Taha

19CE0307	ENVIRONMENTAL ENGINEERING –II	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	19CE0209
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To learn basics of sewage collection and design of sewers	a, c, h
2 To learn the basics of sewage composition and its characteristics	a, h, i
3 To have adequate knowledge about various sewage treatment processes and its design	a, c, h, i
4 To provide adequate informat ion on various disposal standards for treated effluents	a, c, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (COLLECTION OF S EWAGE)	**12**		1
1	Importance of sanitation, types of sewerage systems – separate	2	C	1
2	Combined and partially separate, quantity of sanitary sewage and variations	2	C	1
3	Shapes of sewer - circular and egg shaped, design of sewers	2	C	1
4	Self-c leansing velocity and slopes	1	C, I	1
5	Construction and testing of sewer lines, sewer materia ls	2	C, I	1
6	Joints and sewer appurtenances	1	C, I	1
7	Building drainage and plumbing systems	2	C, I	1
	UNIT -2 (S EWAGE CHARACT ERIS ATION)	**7**		
8	Quality parameters- BOD, COD,	2	C, I	1,2
9	Solids, oil and grease	1	C, I	2
10	Indian Standards for disposal of effluents into inland surface sources and on land	2	C, I	2
11	Gu idelines for reuse of treated wastewater	2	C, I	2
	UNIT -3 (S EWAGE TR EATMENT)	**14**		
12	Objectives, sequence and efficiencies of conventional treatment units,	2	C,I	3
13	Preliminary treatment, screening and grit re moval units,	1	C,I	3
14	Theory and design aspects of primary treatment	1	C,I	3
15	Secondary treatment- activated sludge process & its modifications, tricking filter,	2	C,I	3
16	UASB process, Oxidation pond and Stabilizat ion pond,	2	C,I	3
17	aerated lagoon, septic tank	2	C,I	3
18	Sludge disposal – thickening-digestion-dewatering	2	C,I	3
19	Introduction of tertiary t reat ment	2	C,I	3

	UNIT -4 (DISPOSAL OF S EWAGE)	7		
20	Recycling and reuse of treated wastewater, ,	2	C, I	4
21	Disposal of sewage by dilution - self-purification of streams - Streeter Phelps equation - oxygen sag curve	3	C, I	4
22	Sewage disposal by irrigation (sewage treatment).	2	C, I	4
	TOTAL CONTACT HOURS		**40**	

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Sewage and Sewage Treatment: S.K. Garg.
2	Waste Water Engineering: B.C. Punmia
3	Sewage and Sewage Treatment: S.R. Krishansagar
4	Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
	REFERENCE BOOKS AND OTHER MATERIALS
5	Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.
6	Environmental Eng ineering: Peavy H. S., Rowe D. R. and Tchobanoglous G
7	Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
8	Wastewater Engineering, Co llection, Treatment and Disposal: Metcalf and Eddy

19CE0309	**TRANSPORTATION ENGINEERING – I**	**L**	**T**	**P**	**C**
		3	1	0	4

Co-requisite	None
Pre-requisite	19CE0203
Data Books / Codes / Standards	
Course Category	P	PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To understand the importance of transportation, characteristics of road transport, highway planning, alignment and surveys	a, h, i
2	To know the geometric design of highways	a, c, e, i
3	To study the traffic characteristics, traffic control devices and principles of signal /intersection design	a, c, e, h, i
4	To learn the characteristics, properties and testing procedures of aggregate and bituminous materials	a, e, i
5	To know about granular and bituminous mixes and their designs	a, c, e, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
	UNIT -1	**8**		
1	**Introduction:** Transportation and its importance. Different modes of transportation.	1	C	1
2	Brief review of history of road development in India and abroad. Road patterns.	2	C, I	1
3	PM GSY and other Highway projects	1	C, I	1
4	**Highway Plans, Highway Alignment and Sur veys:** Road development plans in India.	2	C, I	1
5	Classification of roads. Requirements of an ideal highway alignment.	1	C, I	1
6	Factors affecting alignment. Engineering surveys for highway alignment.	1	C, I	1
	UNIT -2	**10**		
7	**Cross Section Eleme nts and Sight Distance Considerations:** Cross section elements, Camber, IRC recommended values.	1	C, I	2
8	Sight distance: stopping sight distance, overtaking sight distance,	1	C, I	2
9	overtaking zones, intermediate sight distance,.	1	C, I	2
10	sight distance at intersections,	1	C, I	2
11	Critical locations for sight distance	1	C, I	2
12	**Design of Horizontal and Vertical Alignment:** Design of superelevation. Providing superelevation in the field.	1	D, I	2
13	Radius of circular curves. Extra -widening.	1	D, I	2
14	Length of transition curves. Gradient, Summit and Va lley curves, their design criteria.	2	D, I	2
15	Introduction to software like MXROAD.	1	D, I	2

	UNIT -3	12		
16	**Traffic Characteristics and Traffic Surveys:** Traffic characteristics. Traffic volume, speed,	2	C, I	3
17	O & D study, Parking and Accident studies.	1	C, I	3
18	Fundamental diagram of traffic flow. Level of service.	1	C, I	3
19	PCU. Capacity for non- urban roads. Road accidents. Introduction to Road Safety Audit	2	C, I	3
20	**Traffic Control De vices** : Traffic signs, signals, markings and islands.	1	C, I	3
21	Design of an isolated fixed time signal by IRC method.	2	D, I	3
22	Intersections at grade and grade separated intersections..	1	C, I	3
23	Design of a rotary. Traffic pollution	2	D, I	3
	UNIT -4	10		
24	**Highway Materials** : Soil and Aggregate Subgrade soil evaluation: CBR test, plate bearing test..	1	C, I	4
25	Desirable properties of aggregates. Various tests for suitability of aggregates.	2	C, I	4
26	Proportioning of aggregates for road construction by trial and error method	2	C, I	4
27	**Bituminous Materials and Bituminous Mixes** Types of bituminous materials: bitumen, tar, cutback and emulsions.	1	D, I	5
28	Various tests for suitability of bitumen. Bituminous mix, desirable properties. .	1	D, I	5
29	Marshall' method of mix design.	1	D, I	5
30	Basic concept of use of polymers and rubber modified bitumen in bituminous mixes,	1	D, I	5
31	use of waste plastic in bituminous mixes	1	D, I	5
	TOTAL CONTACT HOURS		**40**	

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Khanna, S.K. and Justo, C.E.G., Veeraragavan A., "Highway Engineering", Nem Chand & Bros.
2	Khanna, S.K. and Justo, C.E.G., " Highway Material Testing Manual", Nem Chand & Bros.
3	Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Jotin Khisty, C. and Kent Lall, B., "Transportation Engineering – An Introduction", Prentice Hall.
5	G.V.Rao, Principles of Transportation and Highway Engg, Tata Mc Graw Hill Pub
6	Principles of Transportation Engg, P. Chakroborty & Animesh Dass, Prentice Hall of India, 2003.

19CE0311	**GEOTECHNICAL ENGINEERING (P)**	**L**	**T**	**P**	**C**
		0	0	2	1
Co-requisite	19CE0303				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	SD	SKILL DEVELOPMENT			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	To estimate index properties of soils	b, i
2	To estimate consolidation parameters of c layey soil.	b, i
3	To estimate shear strength parameters of soil by triaxial shear test.	b, i
4	To estimate the relative density and ma ximu m dry density of soils.	b, i
5	To have a feel of plate load test.	b, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
1	Grain Size Analysis-Hydrometer method.	2	I	1
2	Modified Proctor compaction Test	2	I	1
3	Relative Density of Granular Soils.	2	I	1
4	Consolidated Drained (CD) Triaxial Test	2	I	2
5	Consolidated Undrained (CU) Triaxial Test with Pore Water Pressure Measurement.	2	I	3
6	Consolidation Test.	4	I	2
7	Undisturbed Sampling.	2	I	4
8	Standard Penetration Test.	4	I	4
9	Dynamic Cone Penetration Test	2	I	4
10	Model Plate Load Test.	2	I	5
	TOTAL CONTACT HOURS	**24**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Gopa l Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd. Publishers- N.De lhi, Edition No. - 3rd, 2016.
2	P. Purshotam Ra j, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, Edition No.- I, 1995

19CE0313	TRANSPORTATION ENGINEERING – I (P)	L	T	P	C
		0	0	2	1

Co-requisite	19CE0309
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	SD SKILL DEVELOPMENT
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Understand the characterization of highway materials	b
2 To know the procedure for testing of aggregate and bituminous materials	b, i
3 To know the standard specifications of IS/IRC/MoRTH for judging suitability of these materials	b, i

Session	Description of Experiments	Contact Hours	C-D-I-O	IOs
1	Aggregate Impact Test	2	C, O	1, 2, 3
2	Los-Angeles Abrasion Test on Aggregate	2	C, O	1, 2, 3
3	Crushing Strength Test on Aggregate	2	C, O	1, 2, 3
4	Flakiness and Elongation Index of aggregates	2	C, O	1, 2, 3
5	Penetration Test on Bitumen	2	C, O	1, 2, 3
6	Ductility Test on Bitumen	2	C, O	1, 2, 3
7	Viscosity Test on Bituminous Material	2	C, O	1, 2, 3
8	Softening Point Test on Bitumen	2	C, O	1, 2, 3
9	Flash and Fire Point Test on Bitumen	2	C, O	1, 2, 3
10	CBR lab test on soil	2	C, O	1, 2, 3
TOTAL CONTACT HOURS		**20**		

		L	T	P	C
20PD0301	**PERSONALITY DEVELOPMENT – V**	0	0	2	1

Learning Objective: -
> The objective of this course is to foster the confidence of student in public speaking by making them learn the style of effective communication skills, business correspondence skills both as individual and in group.

Learning Outcome: -
At the end of the course, the student will learn:
- Rules and means of business correspondence
- Effective public speaking
- Role of general knowledge / current affairs in social communication

Methodology: -
> The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students, which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

UNIT – I - Debate – Argument & Counter Argument, Modulation in Communication – Voice Modulation, Assertive & Aggressive

UNIT – I - Conversation Skills – Word –stress, Types of tones, Pronunciation, Body language

UNIT - III - Business Correspondence – Notice, Agenda, Minutes of meeting, Memo, etc.

UNIT – IV – Resume Making - I

UNIT – V - Importance of Listening skills, Chinese Whisper

SCHEME OF INSTRUCTION
> Marks allocated for regular participation in all PD activities in class.

SCHEME OF EXAMINATION
> Internal evaluation on a regular basis and external evaluation at the end of the semester.

19CE0302	STRUCTURAL ANALYSIS-III	**L**	**T**	**P**	**C**
		3	1	0	4

Co-requisite	None		
Pre-requisite	19CE0102, 19CE0201, 19CE0202		
Data Books / Codes / Standards			
Course Category	P	PROFESSIONAL CORE	
Course designed by	Department of Civil Engineering		
Approval			

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	Analysing indeterminate beams and plane frames with and without sway.	a, e, i
2	To understand the flexibility method of analysis	a, e, i
3	To understand the stiffness method of analysis.	a, e, i
4	To understand the software of structural analysis.	a, e, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
\multicolumn{2}{}{**UNIT -1 (ROTATION CONTRIBUTION METHOD AND APPROXIMATE METHODS)**}	**12**		
1	Basic concepts, rotation factor	2	C, I	1
2	Application to continuous beams, portal frames and multistoried frames	4	C, I	1
3	Approximate Methods of Analysis of Multistoried Frames	2	C, I	1
4	Portal method, Cantilever Method for Multistory frames	4	C, I	1
\multicolumn{2}{}{**UNIT -2 (FLEXIBILITY METHOD OF ANALYS IS)**}	**10**		
5	Introduction, method of consistent deformation	2	C, I	2
6	application to pin jointed frames, effect of temperature and pre-strain, displacements	4	C, I	2
7	forces in members of indeterminate structures, flexibility matrix of plane member.	4	C, I	2
\multicolumn{2}{}{**UNIT -3 (STIFFNESS METHOD OF ANALYS IS)**}	**12**		
8	Introduction, relation between slope deflection method and stiffness method	2	C, I	3
9	Difference between flexibility and stiffness method,	1	C, I	3
10	stiffness method for members with relative displacement of supports	4	C, I	3
11	analysis of indeterminate structures	3	C, I	3
12	Analysis of pin-Jointed frames.	2	C, I	3
\multicolumn{2}{}{**UNIT -4 (INTRODUCTION TO S TRUCTURAL ANALYS IS SOFTWARE)**}	**14**		
13	Structural analysis using spreadsheets	5	C, I	4
14	Structural analysis using Etabs or STAAD.Pro	7	C, I	4
15	Comparison of both the methods	2	C, I	4
\multicolumn{2}{}{**TOTAL CONTACT HOURS**}	**48**		

LEARNING RESOURCE	
S.No.	TEXT BOOKS
1	Gere W and Weaver J M, "Matrix Analysis of Structures" CBS Publishers, New Delhi, 1986.
2	Pandit G S and Gupta S P, "Structural Analysis A Matrix Approach" Tata McGraw Hill, New Delhi, 1994.
3	Ganju T N, "Matrix Structural Analysis using Spreadsheets" TMH Publishing Co. Ltd. New Delhi,2002.
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	
6	
7	
8	

19CE0304	RAILWAY & AIRPORT ENGINEERING		L	T	P	C
			3	0	0	3
Co-requisite	None					
Pre-requisite	19CE0208, 19CE0309					
Data Books / Codes / Standards						
Course Category	P	PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering					
Approval						

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To understand the permanent way and its components	a
2	To know about points, crossings and train control systems	a, h
3	To understand the geometric design of track, about stations, yards and maintenance of tracks.	a, c, i
4	To learn airport layout planning and runway pavement design	a, c, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (INTRODUCTION OF PERMANENT WAY)		**10**		
1	History and general features of Indian railways	1	C	1
2	Railway Track Gauge, Rails, Sleepers, Track fittings and fastenings,	2	C	1
3	Creep of ra ils	1	C	1
4	Ballast, Subgrade and fo rmation	1	C, I	1
5	Rail joints and welding of rails	2	C, I	1
6	modern welded railway track	1	C, I	1
7	Track and Track stresses	2	C, I	1
UNIT -2 (STATION)		**10**		
8	Stations and Yards,	1	C	2
9	Points and Crossings	1	C	2
10	design of turnouts and crossings	2	C	2
11	Signalling and interlocking	2	C, I	2
12	Train Control systems	2	C, I	2
13	Track maintenance and drainage	2	C, I	2
UNIT -3 (DES IGN OF TRACK)		**10**		
14	Geo metric Design of Track	1	C	3
15	High speed train systems	1	C	3
16	Geo metric design of track	2	C	3
17	curves and super elevation	1	C, I	3
18	Train resistance and tractive power	1	C, I	3
19	Urban Railway system	1	C, I	3
20	High speed Tracks, high speed train system technologies	2	C, I	3
21	Introduction to RDSO/ IS specifications.	1	C	3
UNIT -4 (AIRPORT DES IGN)		**10**		
22	Airport Planning,	2	C	4

23	Runway Layout and Pavement Design	2	D, I	4
24	Airport planning, layout, geometric design	2	D, I	4
25	Airport pavements,	2	D, I	4
26	introduction to runway pavement design software like FAARFIELD	2	D, I	4
TOTAL CONTACT HOURS			**40**	

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Arora, S. P. and Saxena, S. C., "A Te xt Book of Railway Engineering", Dhanpat Rai Publications.
2	Khanna, S. K., Arora, M. G. and Jain, S. S., "Airport Planning & Design", Nem Chand and Bros.
3	Sa xena, S.C., "Airport Engineering – Planning and Design", CBS Publishers.
4	Transportation Engineering by C Venkatra maiah
	REFERENCE BOOKS AND OTHER MATERIALS
5	Chandra, S. and Agarwal, M. M., "Railway Engineering", Oxfo rd.
6	Mundrey, J. S., "Railway Track Engineering", Tata Mcgraw Hill.
7	Horonjeff, Robert and McKelvey, Francis X., " Planning & Design of airports', 4th Ed., McGraw Hill

19CE0306	GEOTECHNICAL ENGINEERING – II	L	T	P	C
		3	1	0	4

Co-requisite	None
Pre-requisite	19CE0303
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To exp lain the concept of earth dam design including stability analysis under seepage.	a, h, i
2	To evaluate stability of slopes under different drainage conditions using different methods	a, h, i
3	To e xp lain design princip les of retaining structures and coffer dams.	a, c, h, i
4	To e xp lain the concept of soil stabilization	a, h, i
5	To e xp lain the significance of dynamic load in machine foundation analysis	a, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (EARTH DAMS AND S TABILITY OF SLOPES)	**10**		
1	Introduction, types of sections, earth dam foundations	2	C	1
2	Causes of failure and criteria for safe design, control of seepage through the embankment	1	C	1
3	Control of seepage through the foundation	1	C	1
4	Drainage of foundations, criterion for filter design	1	C, I	1
5	Stability analysis of slopes-total stress analysis, effective stress analysis	1	C, I	1
6	Stability of infinite slopes, types of failures of finite slopes, analysis of finite slopes-mass procedure	2	C, I	1
7	Method of slices, effect of pore pressure, Fellinius method to locate center of most critical slip circ le	1	C, I	1
8	Friction circle method, Tayler's stability number.	1	C	1
	UNIT -2 (BRACED CUTS AND COFFERDAMS)	**10**		
9	Depth of unsupported vertical cut	1	C	2
10	Sheeting and bracing for deep e xcavation	1	C	2
11	Movements associated with sheeting and bracing	1	C	2
12	Modes of failure of braced cuts,	1	C, I	2
13	Introduction,	1	C, I	3
14	types of cofferdams	1	C, I	3
15	Design data for Cellular coffe rda ms	2	C, I	3
16	Stability analysis of cellu lar cofferdams on soil and rock, inter-locking stresses.	2	C	3
	UNIT -3 (CANTILEV ER S HEET PILES & ANCHORED BULKHEADS)	**8**		

17	Purpose of sheet piles	1	C	2	
18	Cantilever sheet piles, depth of embedment in granular soils-rigorous method	1	C	2	
19	Simp lified procedure	1	C	2	
20	Cantilever sheet pile penetrating clay.	1	D, I	2	
21	Methods of design of Anchored Bulkheads	1	D, I	1,2	
22	Free earth support method in cohesionless	1	D, I	1,2	
23	Free earth support method in cohesive soils	1	C, I	2,3	
24	Fixed earth support method in cohesionless soils	1	C, I	2,3	
UNIT -4 (SOIL STABILIZATION & ENVIRONMENTAL GEOTECHNOLOGY)		**10**			
25	Soil improvement, mechanical treatment,	1	C	4	
26	Use of admixtures, lime stabilization,	1	C	4	
27	cement stabilizat ion, Bitu minous stabilization	2	C	4	
28	Chemical stabilization, stone column, grouting, methods of grouting	2	C, I	4	
29	Introduction to Environmental Geotechnology, Environmental cycles	1	C, I	4	
30	Natural cycles, development of environmental Geotechnology, pollution process, contamination of sub-soil	1	C, I	4	
31	Contaminant transport, quantity of contaminants, contaminated site characterization	1	C, I	4	
32	Composition of solid wastes, waste containment.	1	C, I	4	
UNIT -5 (BAS ICS OF MACHINE FOUNDATIONS)		**8**			
33	Terminology, characteristics elements of vibratory systems	2	C	5	
34	Analysis of vibratory motions of single degree freedo m system-undamped free v ibrations	1	C	5	
35	Undamped forced vibrations, criteria for satisfactory action of a machine foundation	1	C	5	
36	Degrees of a freedom of a block foundation	1	C, I	5	
37	Barken's soil spring constant, Barken's method of a determining natural frequency of a block foundation subjected to vertical oscillations.	3	C, I	5	
TOTAL CONTACT HOURS		**46**			

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	S.Prakash, Gopal Ranjan & S.Saran, Analysis and Design of Foundation and Retaining Structures, Sarita Prakashan Meerut, 1977
2	Gopa l Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age Intetrnational (P) Ltd. Publishers- N.De lhi, Edition No. - 3rd, 2016
3	P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delh i, Edition No.- I, 1995
4	Debashis Moitra, Geotechnical Engineering, Universities Press, Edition No. - I, 2016.
	REFERENCE BOOKS AND OTHER MATERIALS
5	Swami Saran, Analysis and Design of Sub Structures, IBH Oxford
6	Teng, Foundation Design, Prentice Hall, Edition No. - 10th, 1984.
7	Debashis Moitra, Geotechnical Engineering, Universities Press, Edition No. - I, 2016

19CE0308	TRANSPORTATION ENGINEERING – II	L	T	P	C
		3	1	0	4

Co-requisite	None
Pre-requisite	19CE0309
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1 To understand the design of Design of Flexible and Rigid Pavement	a, c
2 To understand design of Highway construction: Non-Bituminous and bituminous pavements	a, c, i
3 To understand the highway maintenance, drainage and hill roads	a, h
4 To understand highway economics, finance and tunnels	a, h

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (DES IGN OF FLEXIBLE AND RIGID PAVEMENT)		**12**		
1	Components of flexible pavement and their functions, Factors affecting design of pavements	1	C	1
2	Difference between Fle xib le and rig id pavements,	1	C	1
3	Review of design by old methods	2	C, I	1
4	Design of a flexible pavement by CBR method (as per latest IRC guidelines)	2	D, I	1
5	Westergaard's theory, critical locations of loading, load and temperature stresses	2	C, I	1
6	Critical combination of stresses, IRC guidelines for determination of thickness of a rigid pavement.	1	C, I	1
7	Joints: require ments, types, patterns.	1	C, I	1
8	Spacing of e xpansion and contraction joints. Functions of dowel and tie bars	2	C, I	1
UNIT -2 (HIGHWAY CONS TRUCTION: NON-BITUMINOUS AND BITUMINOUS PAVEMENTS)		**10**		
9	Subgrade and embankment construction,	1	C	2
10	Construction of GSB, W BM, WMM.	2	C	2
11	Construction of DLC & PQC. Fixed form and Slip-form paving techniques	2	C	2
12	Various types of bituminous constructions	1	C, I	2
13	Prime coat, tack coat, seal coat and surface dressing	1	C, I	2
14	Construction of BUSG, Premix carpet, BM, DBM and BC. Mastic asphalt. Brief introduction to functions of Rollers	2	C, I	2
15	Paver and hot mix plants. Introduction to various IRC and MoRTH specifications	1	C, I	2
UNIT -3 (HIGHWAY MAINTENANCE, DRAINAGE AND HILL ROADS)		**9**		

16	Failures and remedies of bituminous and cement concrete pavements.	2	C, I	3
17	Pavement evaluat ion. Benkle man beam.	1	C, I	3
18	Introduction to various types of overlays. Overlay design	2	C, I	3
19	Surface drainage: types, brief design. Types of sub-surface drainage.	2	C, I	3
20	Special characte rist ics of hill roads: geometrics, hair pin bends	2	C, I	3
UNIT -4 (HIGHWAY ECONOMICS, FINANCE AND TUNNELS)		**9**		
21	Need of economic evaluation.,	1	C, I	4
22	Highway user benefits and costs. Methods of economic evaluation	1	C, I	4
23	Highway finance. PPP Projects.	1	C, I	4
24	Rate analysis of MoRTH standard data book & cost estimat ion.	2	C, I	4
25	Sections of tunnels, Shaft. Pilot tunnel. Driving tunnel in rocks.	2	C, I	4
26	Driving tunnel in soft ground. Drainage and Ventilat ion of Tunnels.	2	C, I	4
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Highway Engg by S.K.Khanna & C.E.G. Justo, Vee raragavan A., Nem Chand Bros., Roorkee, 2014
2	Principles and Practice of Highway Engg. by L.R.Kadiyali, N.B. Lal, Khanna Publishers,Delhi,2008.
3	A te xt book of Tunnel, Bridges and Railway Engg. by S.P.Bindra, Dhanpat Rai Delhi.
4	Tunnel Engineering by S.C.Sa xena, Dhanpat Rai Publications, N.Delhi
	REFERENCE BOOKS AND OTHER MATERIALS
5	Principles of Pavement Design by Yoder,E.J & Witczak,M.W., John Wiley and Sons, USA.

19CE0310	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	P	PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1	To know the basics, necessity, and types of irrigation.	a
2	Study and understand about canal irrigation and land reclamation.	a, h
3	Understand about canal and rivers	a, c, i
4	Study about canal head works and regulation works	a, c, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**10**		
1	**Introduction:** Irrigation-necessity, impact of irrigation on human environment,	1	C	1
2	need and historical development of irrigation in India,	1	C	1
3	National water policy- Haryana Scenario,	1	C, I	1
4	crops and crop seasons with crop water requirement.	2	C, I	1
5	**Soil-water relationship and irrigation methods:** Soil-water relationship, infiltration, basic terminology such as field capacity, wilting point, deltas, duty of water,	1	C, I	1
6	flooding methods, border strip method, check basin and furrow method,	2	C, I	1
7	assessment of irrigation water,	2	C, I	1
8	sprinkler irrigation and its design, drip irrigation & its design.	1	C, I	1
	UNIT -2	**10**		
9	**Canal irrigation:** Components of canal distribution system, alignment & losses of channels,	1	C	2
10	Kennedy's and Lacey's theories and design procedure,	2	C	2
11	Garrets and Lacey's diagrams.	1	C, I	2
12	**Water logging and land reclamation:** Water logging-effects, causes & preventive measures,	1	C, I	2
13	lin ing of irrigation channels with types & design of lined channel, land drainage,	2	C, I	2
14	open & closed drains design considerations, advantages of tile drains,	2	C, I	2
15	discharge and spacing of closed drains, methods of land reclamation, quality of irrigation water	1	C, I	2
	UNIT -3	**10**		
16	**Canal outlets:** Classification, requirements of a good outlet,	1	C	3
17	design of pipe, APM and open flume outlet,	2	C	3

18	flexibility proportionality, setting and sensitivity of outlet.	1	C, I	3
19	**Ri ver Training:** River train ing and its objectives,	1	C, I	3
20	classification of river training works, methods of river training,	2	C, I	3
21	marginal embankments, guide banks,	1	C, I	3
22	spurs, cutoffs,	1	C, I	3
23	bank pitching and launching apron.	1	C, I	3
	UNIT -4	**10**		
24	**Di version canal head works:** Va rious components and their functions, layout plan,	1	C	4
25	Bligh's creep theory,	1	C	4
26	Khosla's method of independent variables,	2	C, I	4
27	use of Khosla's curves, various corrections.	1	C, I	4
28	**Regulation works:** Canal falls-necessity and location, roughening devices,	1	C, I	4
29	design of Sarda type fall. Off-take alignment,	2	C, I	4
30	cross-regulator and distributory head regulators,	1	C, I	4
31	devices to control silt entry into the off-taking channel and silt ejector,	1	C, I	4
32	canal escapes.	1	C, I	4
	TOTAL CONTACT HOURS	**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Sharma, S.K., Principles and Practice of Irrigation Engg., S.Chand & Co, 1984.
2	Arora K R "Irrigation Water Power & Water Resources Engineering" Standard Publishers & Distributors, Delhi, 2002.
3	Garg S K "Irrigation Engineering & Hydraulic Structures" Khanna Publisherts, Delhi, 1995.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Varshney, Gupta & Gupta "Irrigation Engineering & Hydraulic Structure" Nem Chand & Bros., Roorkee, 1982.
5	Punmia, B.C., Irrigation and Water Power Engineering, Standard Publishers, 2001
6	Modi P N " Irrigation ,Water Resources and Water Power Engg" Standard Book House N Delhi 2000
7	A M Michael " Irrigation Theory and Practice" Vikas Publishing House Pvt Ltd N Delhi 2011

19CE0312	TRANSPORTATION ENGINEERING – II (P)	L	T	P	C
		0	0	2	1

Co-requisite	19CE0308
Pre-requisite	19CE0313
Data Books / Codes / Standards	
Course Category	SD	SKILL DEVELOPMENT
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To understand the characterization of highway materia ls	b, i
2	To learn the mix designs of granular, bituminous and CC mixes	b, i
3	To lea rn the use of modern equipment for tra ffic studies & pavement evaluation	b, i
4	To know the standard specifications of IS/IRC/MoRTH for judging suitability of these materia ls	b, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
1	Specific gravity and water absorption test on coarse aggregate	2	I	1
2	Specific gravity of bitumen	2	I	2
3	Stripping test on aggregates	2	I	1
4	Determination of bitumen content and gradation of bituminous mix	2	I	2
5	Granular Mix Design	4	I	1,3
6	Bituminous Mix Design by Marshall's method	4	I	2,3
7	Ce ment concrete mix design for pavements	2	I	1,2
8	Traffic volume and speed study using videography technique	2	I	3
9	Demonstration of Radar Gun & Automatic Counter Classifier	2	I	3
10	Demonstration of BBD & Bump Integrator	2	I	4
TOTAL CONTACT HOURS		**24**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Lab Manual for Transportation Engineering

		L	T	P	C
20 PD 0302	**PERSONALITY DEVELOPMENT –VI**	**0**	**0**	**2**	**1**

Learning Objective: -
The objective of the course is to prepare students to take part in group discussion and job interviews successfully and to gain self-confidence for placement process.

Learning Outcome: -
At then end of the course, the student will learn:

- Builds self-confidence by self-analysis of SWOT.
- To perform in job interviews
- Build confidence to speak confidently in job interview as well as group discussions

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students, which they will be employing during various occasions in their real life.
1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

UNIT – I - Interview skills, basic interview questions, Interview Etiquettes
UNIT – II - Group Discussion, Role & importance of GD in job placement, preparation for GD
UNIT – III – Resume making -II, SWOT Analysis
UNIT – IV - Mock Interview I & GD Practice sessions
UNIT –V - Interview Dressing Etiquettes and Behavior Etiquettes, Mock Interview -II

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all PD activities in class.

SCHEME OF EXAMINATION
Internal evaluation on a regular basis and external evaluation at the end of the semester.

FOURTH YEAR

SEMESTER-VII

19CE0401	CONSTRUCTION MANAGEMENT, ESTIMATING AND COSTING	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Understand the roles and responsibilities of a project manager	a
2 Prepare schedule of activities in a construction project	a, e
3 Prepare tender and contract document for a construction project	a, e
4 Understand safety practices in construction industry	a, e
5 Identify the equipment used in construction	a, e

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (NETWORK TECHNIQUES IN CONS TRUCTION MANAGEMENT-I:CPM)		**10**		
1	Introduction, network techniques, work break down, classification of activities	1	C	1
2	Rules for developing networks, network development-logic of network, a llocation of time to various activities, Fulkerson's rule for numbering events, network analysis	1	C	1
	Determination of project schedules, critical path, ladder construction, float in activities, shared float, updating, resources allocation, resources smoothing and resources leveling	2	C	1
3	Network Techniques in Construction Management -II PERT: Probability concept in network	1	C, I	1
4	Optimistic time, pessimistic time, most likely time, lapsed time, deviation, variance	1	C, I	1
5	Standard deviation, slack crit ical path, probability of achieving complet ion time, central limit theorem.	1	C, I	1
6	Cost- Time Analysis: Cost versus time	1	C, I	1
7	Direct cost, indirect cost, total project cost and optimum duration	1	C, I	1
8	Contracting the network for cost optimisation, steps in time cost optimisation, illustrative examples	1	C, I	1
UNIT -2 (CONSTRUCTION CONTRACTS & SPECIFICATIONS)		**6**		
9	Introduction, types of contracts	1	C	2
10	Contract document, specifications	1	C	2
11	Important conditions of contract, arbitration	1	C	3
12	Necessity of specifications, types of specifications, general	1	C, I	3

	specifications, specification for bricks			
13	Cement, sand, water, lime, reinforcement; Detailed specifications for Earthwork, Cement, concrete	1	C, I	3
14	Brick work, floorings, D.P.C., R.C.C., cement plastering, white and colour washing, distempering, painting.	1	C, I	3
UNIT -3 (INSPECTION & QUALITY CONTROL)		**9**		
15	Introduction, principles of inspection, enforcement of specifications,	1	C	4
16	Stages in inspection and quality control, testing of structures, statistical analysis.	1	C	4
17	Principles of estimation, units, items of work, different kinds of estimates, different methods of estimation	1	C	4
18	Estimation of materials in single room building, two roomed building with different sections of walls	1	C, I	4
19	Foundation, floors and roofs, R.B. and R.VC.C. works, Plastering, White-washing, Distempering and painting	1	C, I	4
20	Doors & windows, lump sum ite ms, Estimates of canals, roads etc.	1	C, I	4
21	Purpose, importance and require ments of rate analysis, units of measure ment, preparation of rate analysis	1	C, I	4
22	Procedure of rate analysis for items:- Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, finishing(white-washing, distempering)	2	C, I	4
UNIT-4 (PUBLIC WORKS DETAILS)		**5**		
23	Introduction, function of P.W. department, contract, guidelines	1	C	5
24	Types of contracts, their advantages and disadvantages, Tender and acceptance of tender, Earnest money, security money, retention money, measure ment book	2	C	5
25	Cash book, preparation, exa mination and payment of bills, first and final bills, administrative sanction, technical sanction	2	C	5
TOTAL CONTACT HOURS		**30**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Construction Management & Planning by B.sengupta & H.Guha, Tata Mc Gra w Hills.
2	Project Planning & Control with PERT & CPM by B.C.Punia & K.K.Khandelwal, Lakshmi Pub. Delhi
3	Estimating and Costing for Building & Civil Engg.Works by P.L.Bhasin, S.Chand & Co., N.De lhi
4	Estimating & Costing in Civil Engg..: Theory & Practice by B.N.Dutta, S.Dutta & Co., Lucknow
	REFERENCE BOOKS AND OTHER MATERIALS
5	Construction Planning & Management by P.S.Gehlot & B.M.Dhir, Wiley Eastern Ltd.
6	PERT & CPM -Principles & Applications by L.S.Srinath. Affiliated East-west Press(P)Ltd.
7	Estimating, Costing & Specification in Civil Engg. by M.Chakarborty, Calcutta
8	Building Construction Estimating by George H.Cooper, Mc Graw Hill Book Co., New York

19CE0411	CONCRETE TECHNOLOGY LAB (P)	L	T	P	C
		0	0	2	1

Co-requisite	19CE0401
Pre-requisite	19CE0112
Data Books / Codes / Standards	IS 456:2000, IS 10262:2009, ACI Code for Mix Design
Course Category	SD SKILL DEVELOPMENT
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Understand the properties of cement, concrete and its testing procedure	b, i
2 Understand and carry out design mix as per BIS and ACI	b, i
3 Study and understand properties of fresh concrete	b, i
4 Study and carry out testing on concrete cube and cylinder	b, i
5 Study and carry out testing on concrete beam	b, i
6 Understand and perform NDT of concrete	b, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	TES TS ON CEMENT			
1	Specific Gravity of cement	1	C, O	1
2	Standard Consistency of Cement	1	C, O	1
3	Initial and Final Setting Time	1	C, O	1
	TES TS ON CONCRETE			
4	Design Mix as per IS 10262:2009	3	C, O	2
5	Prepare the mix designed and cast cubes for 28 days compressive strength testing	2	C, O	2
6	Design Mix as per ACI code	3	C, O	2
7	Prepare the mix designed and cast cubes for 28 days compressive strength testing	2	C, O	2
8	Workability of cement concrete by (a) Slump test, (b) Compaction factor test, (c) Flow table test	3	C, O	3
9	Compressive strength of concrete by (a) Cube test, (b) Cylinder test	2	C, O	4
10	Indirect tensile strength of concrete-split cylinder test.	2	C, O	4
11	Modules of rupture of concrete by fle xure test	2	C, O	5
12	Bond strength between steel bar and concrete by pull-out test	2	C, O	5
13	Non-destructive testing of concrete	2	C, O	6
	TOTAL CONTACT HOURS	**26**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	M L Ga mbhir, " Concrete Lab Manual", Dhanpat Rai & Sons

LIST OF
PROGRAM
ELECTIVES
&
OPEN ELECTIVES

19CEP001	STRUCTURAL DYNAMICS	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	PE	Program Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	Understand the meaning of earthquake and seismology	a
2	Understand the various degree of freedom system	a, e
3	Study the design aspect related to earthquake	a, e
4	Understand about the seismic performance and repair of structures	a, e, i
5	Study about various codes related to earthquake	a, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (S EIS MOLOGY)	**5**		
1	Introduction, plate tectonics, earthquake distribution and mechanism	1	C	1
2	seismicity, seismic waves, earthquake magnitude and intensity	2	C	1
3	seismic zoning and seismomet ry	2	C	1
	UNIT -2 (SINGLE DEGREE OF FREEDOM S YS TEMS)	**8**		
4	Various types of dynamic loads, vibration of single degree of freedom system	2	C	2
5	Free and forced vibrations	2	C, I	2
6	Types of damping, critical damping	2	C, I	2
7	Transmissibility, vibration measuring instruments, response spectrum	2	C, I	2
	UNIT -3 (MULTI-DEGREES OF FREEDO M (MDOF) S YS TEMS)	**10**		
8	Equation of Motion, normal modes and natural frequencies	2	C	2
9	semi-defin ite systems, dynamic vibration absorbers	3	C, I	2
10	vibration dampers	2	C, I	2
11	principle of orthogonally, Stodolas method, Holzer's method, matrix method, modal analysis and its limitations	2	C, I	2
12	Mode super position method	1	C, I	2
	UNIT -4 (S EIS MIC ANALYS IS AND DES IGN)	**7**		
13	General principles, assumptions, seismic coefficient method	1	C	3
14	response spectrum method, strength and deflection	2	C, I	3
15	design criterion for structures	1	D, I	3
16	significance of ductility, design and detailing for ductility	1	D, I	3
17	codal provisions, design e xa mples	2	D, I	3
	UNIT -5 (S EIS MIC PERFORMANCE, REPAIR AND STRENGTHENING)	**6**		
18	Methods for assessing seismic performance	2	I	4

19	Influence of design ductility and masonry infills	1	I	4
20	Criterion for repair and strengthening, repair and strengthening techniques and their applications	1	D, I	4
21	Additions of new structural elements	2	I	4
UNIT -5 (VIBRATIONAL CONTROL)		**4**		
22	General features of structural control, base isolation	1	I	5
23	Active and passive control system	1	I	5
24	Earthquake resistance design as per I.S.:1893, I.S.4326 and I.S.13920	2	C, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Elements of Earthquake Engineering, Jai Krishna, A. R. Chandershekaran & Brajesh Chandra , South Asian Pub New Delhi.
2	Dynamics of Structures, Clough & Penzion, Mc Graw Hill
3	Earthquake Resistant Concrete Structures, George G. Penelis and J. Kapoors, E & FN Sons, Madras.
REFERENCE BOOKS AND OTHER MATERIALS	
4	Structural Dynamics, Mario Paz, CBB Pub. N. Delh i.
5	Earthquake Engineering, Y-X Hu,S-C.Liu and W.Dong, E and FN Sons., Madras.

19CEP002	INTRODUCTION TO FINITE ELEMENT METHOD	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	PE	Program Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Develop shape functions and stiffness matrices for spring and bar elements	a, e
2 Develop global stiffness matrices and global load vectors	a, e
3 Apply natural and arial coordinate systems to constant strain triangle and linear strain triangle elements	a, e
4 Analyze planar structural systems using finite element modelling	a, e

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (INTRODUCTION)	**3**		
1	Fie ld conditions, boundary conditions	1	C	1
2	functional approximation, finite differences method	1	C	1
3	development of finite element method	1	C	1
	UNIT -2 (ELEMENT PROPERTIES)	**7**		
4	Displacement models, relation between the nodal degrees of freedo m and generalized coordinates	1	C	1
5	convergence require ments, natural co-ordinate systems	1	C	1
6	shape functions, element strains and stresses	1	C	1
7	development of element stiffness,	2	C, I	2
8	matrix and equivalent nodal loads, static condensation	2	C, I	2
	UNIT -3 (ISOPARAMETRIC ELEMENTS)	**6**		
9	Isoparametric, super-parametric and sub-paramatric elements	1	C, I	3
10	computation of stiffness matrix of isoparametric e le ments	2	C, I	3
11	convergence criteria for isopara metric elements	1	C, I	3
12	numerical integration technique using Gauss Quadrature	2	C, I	3
	UNIT -4 (ELEMENTS AND ANALYS IS)	**12**		
13	Truss element, analysis of plane truss problem, He rmitian beam element	2	C, I	3
14	beam on elastic foundation, solution of beam problem	2	C, I	3
15	Triangular e le ments, rectangular e le ments, isoparametric e le ments	2	C, I	4
16	patch test, axisymmetric solid element	2	C, I	4
17	Displacement functions, plate ending elements	2	C, I	4
18	reduced integration, stress smoothing technique	2	C, I	4
UNIT -5 (HEAT TRANSFER, MATRIX AND SOFTWARE ANALYS IS)		**12**		
19	Formulat ion of finite element method for heat conduction, various weighted residual techniques	2	C, I	4
20	one dimensional heat conduction, two dimensional conduction heat transfer	2	C, I	4
21	Assemblage of elements, direct stiffness method	2	C, I	4

22	boundary conditions and reactions	1	C, I	4
23	Gauss elimination and matrix decompsition	1	C, I	4
24	Pre-and Post-processors finite e le ment analysis software	2	C, I	4
25	error estimates and adaptive meshing	2	C, I	4
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Krishnamurthy, C.S., 'Finite Element Analysis-Theory and Programming', TMH Pub. N.Delhi.
2	Cook, R.D., Malkus, D.S. and Plesha, M.E., 'Concept and Applications of Finite Element Analysis', John Wiley & Sons, New Yo rk
3	Manicka Selva m,V.K., 'Fin ite Element Primer', Dhanpat Rai Publications
REFERENCE BOOKS AND OTHER MATERIALS	
4	Desai, C.S. and Abel, J.F., 'Introduction to the Finite Element Method', Affiliated East- West Press Pvt. Ltd. N.De lhi

19CEP003	ROCK MECHANICS	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	PE Professional Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	

INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1 To understand the problems associated with underground excavations	a
2 To understand the rock mass classification	a, i
3 To understand the failure criteria of roc k	a, i
4 To understand about in-situ stresses from field test data	a, e, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (INTRODUCTION)		**8**		
1	Importance of rock mechanics, composition of rocks	1	C	2
2	geological and lithological classification of rocks	1	C	2
3	classification of rocks for engineering purposes	1	C	2
4	R.Q.D. method of classification of rocks	2	C	2
5	Theories of Brittle failu re	2	C, I	3
UNIT -2 (LABORATORY TES TING OF ROCKS)		**6**		
6	Various methods of obtaining rock cores, methods of sample preparation	1	C	1
7	methods of removing end friction of the rock samples	1	C	1
8	Compression testing machine, uniaxial compression strength of rock samples	1	C	1
9	methods of finding tensile strength-direct and indirect methods	1	C, I	4
10	Brazilian test, shear box test, triaxial shear test, punch shear test	2	C, I	4
UNIT -3 (TES TING AND EVALUATION)		**9**		
11	Field direct shear test on rock blocks, field triaxial strength	1	C	4
12	use of flat jacks, chamber test	1	C	4
13	plate load test, cable jacking test	1	C	4
14	Stress-relief technique (over coring), use of strain gauges	2	C, I	4
15	bore hole, deformation cell, photo- elastic stress meter	2	C, I	1
16	stress measurement with flat jack. Hydraulics Fracturing Techniques	2	C, I	4
UNIT -4 (ROCK STABILIZATION AND ROCK PROPERTIES)		**8**		
17	Rock bolting, principle of rock bolt ing, various types of rock bolts	2	C	4
18	application of rock bolting. Field testing of rock bolts and cable anchors	2	C, I	4
19	Stress-strain behaviour dynamic properties	2	C, I	4
20	resonance method and ultra-sonic pulse method	2	C, I	4
UNIT -5 (TUNNELING)		**9**		
21	Trap door experiment	1	C, I	4
22	Terzagh i's theory	1	C, I	4
23	Bieraumer, kommerel, Protodyakanov theory	3	C, I	4

24	Basic design and Principles of tunnels in rocks	2	D, I	4
25	design of pressure tunnels in roc ks	2	D, I	4
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	La ma, et. al Rock Mechanics, Vo l.I,II,III,IV
2	Jaeger and Cook, Fundamentals of Rock Mechanics
3	Stagg & Zienkiewie z, Rock Mechanics
4	Schzy, Art of Tunneling
	REFERENCE BOOKS AND OTHER MATERIALS
5	Jaeger, Rock Mechanics & Enginee ring
6	Obert & Duvell, Rock Mechanics & Design of Structures in Rocks

19CEP004	GEOSYNTHETICS ENGINEERING	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	PE	Professional Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES

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

1	To e xp lain the basic mechanisms of soil rein forcement and design principles in reinforced earth wall	a
2	To understand the applications of Geosynthetics in geotechnical problems and its design principles	a
3	To e xp lain the usage of Geosynthetics in geoenvironmental and pavement engineering with design	a, i
4	To e xp lain the present status of development in geo-synthetics and filed instrumentation and control	a, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (BAS IC DES CRIPTION OF GEOS YNTHETICS)		**5**		
1	Historical Develop ment, the Nomenclature	1	C	1
2	Function	1	C	1
3	Use Around the World, Applications	2	C	1
4	Development in India	1	C	1
UNIT -2 (RAW MATERIALS – THEIR DURABILITY AND AGEING)		**7**		
5	Raw Materia ls, Durability	2	C	1
6	Degrading Agencies	1	C	1
7	Polymers, Biological Resistance, Chemical Resistance, Weathering Resistance	4	C, I	1
UNIT -3 (MANUFACTURING, TES TING AND EVALUATION)		**10**		
8	Fibers, Yarn	1	C, I	2
9	Nonwoven Geote xtiles, Woven geotextiles	1	C, I	2
10	D.S.F. Fab rics	2	C, I	2
11	Geogrids - Factors Influencing Testing, Sampling	2	C, I	2
12	Physical Properties, Mechanical Properties under Uniaxial loading, Creep Testing	4	C, I	2
UNIT -4 (EROS ION CONTROL AND BEARING CAPACITY OF GEOGRIDS)		**6**		
13	Wind Erosion, Rain Water Erosion	1	C	3
14	Erosion Control Measures, Placement of Geogrid	1	C	3
15	Advantages, Mechanism. Modes of Failure	2	C, I	3
16	Friction Coefficient, Experimental Studies	2	C, I	3
UNIT -5 (APPLICATION OF GEOS YNTHETICS IN WATER RESOURCES PROJECTS)		**12**		
17	Case Studies: Dharoida m, Hiran-II Dam, Meda Creek Irrigation Scheme, Lining of Kakarapar Canal.	12	O	4
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE

S.No.	TEXT BOOKS
1	Robert M. Koerner, Designing with Geosynthetics, Prentice-Hall
2	G.V. Rao & G.V.S. Raju, Engineering with Geosynthetics, Tata McGraw-Hill
3	Debashis Moitra, Geotechnical Engineering, Universities Press, Edition No. - I, 2016

19CEP005	TRANSPORTATION PLANNING	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	PE	Program Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To understand the importance of transportation planning	a, i
2	To know the planning process	a, i
3	To study the forecasting of travel demand	a, i
4	To learn the evaluation of t ransportation plans	a, i
5	To learn the problems of u rbanisation	a, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
UNIT -1 (TRANSPORT PLANNING PROCESS AND S URVEYING)		**10**		
1	Status of transportation in India. Objectives and scope of transport planning.	1	C	1
2	Urban, regional and national transport planning.	1	C	1
3	Transport planning process, various stages. Land use and traffic.	1	C	1
4	Definition of study area. Zoning.	1	C	1
5	Types of surveys. O-D surveys.	2	C	1
6	Inventories of existing transport facilit ies	2	C	1
7	Land use and economic activities.	2	C	1
UNIT -2 (TRIP GENERATION AND DIS TRIBUTION)		**8**		
8	Trip purpose. Factors affecting trip generation.	1	C, I	2
9	Trip generation estimation by mu ltip le linear regression analysis	1	C, I	2
10	brief review of category analysis, advantages and limitations of these methods	2	C, I	2
11	Methods of trip distribution.	1	C, I	2
12	Basic concepts of uniform factor method, average factor method and opportunity model.	2	C, I	2
13	Trip distribution by gravity model.	1	C, I	2
UNIT -3 (TRAFFIC ASSIGNMENT AND MODAL SPLIT)		**6**		
14	Principles of assignment. Assignment techniques. All or nothing assignment.	2	C, I	3
15	Brief review of multipath assignment, capacity restraint assignment and diversion curves.	2	C, I	3
16	General considerations for modal split. Factors affecting modal split.	1	C, I	3
17	Brief introduction to various methods of modal split.	1	C, I	3
UNIT -4 (EVALUATION)		**8**		
18	Need for eva luation. Several p lans to be formulated.	2	C, I	4
19	Testing. Considerations in evaluation.	2	C, I	4
20	Economic evaluation, basic principles,	2	C, I	4
21	Brief introduction to various methods of economic evaluation, comparison.	2	C, I	4

	UNIT -5 (MASS RAPID TRANS IT S YS TEMS)	8		
22	Proble ms of Urban Transport.	2	C, I	5
23	Introduction to MRTS. Requirements of MRTS.	2	C, I	5
24	Types of MRTS. MRTS in India.	2	C, I	5
25	MRTS Corridor selection	2	C, I	5
	TOTAL CONTACT HOURS		**40**	

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Traffic Enginee ring and Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
2	Highway Engineering by S. K. Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee
3	Principles of Transportation Engineering, P. Chakroborty & Animesh Dass, Prentice Ha ll of India, 2003.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Introduction to Transport Planning by Bruton, M.J., Hutchinson Technical Education, London.

19CEP0006	POLLUTION CONTROL AND WASTE MANAGEMENT	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	PE	Professional Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1	To understanding environment, impact of various activities on environment, sustainable development, ecology and biodiversity conservation	a, h
2	To understand air pollution, its effects and control methods	a, h
3	To understand noise pollution, its effects and control measures	a, h
4	To understand the sources, types and composition of mun icipal solid waste and the methods of solid waste disposal	a, h

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (ENVIRONMENT, ECOLOGY AND BIODIVERS ITY)		**8**		
1	Global environ ment, impact of humans upon environment, impact of environment upon humans, population explosion and its effects on environment	2	C	1
2	Need of sustainable development, conventional sources of energy and their impact on environment	2	C	1
3	Ecology: Ecosystem and its types, energy flow in ecosystems, food chains, trophic levels, food web, ecological pyra mids	2	C, I	1
4	biogeochemical cycles- nitrogen, sulphur and phosphorus cycles, biodiversity and its importance, measures of biodiversity conservation	2	C, I	1
UNIT -2 (AIR POLLUTION)		**8**		
5	Composition and structure of atmosphere, classification and sources of air pollutants,	2	C	2
6	Effects of air pollution on plants, animals, human health, economic effects of air pollution	2	C	2
7	Greenhouse effect and global warming, ozone layer depletion and acid rains	2	C, I	2
8	Meteorological paramete rs influencing air pollution, plu me behaviour	2	C, I	2
UNIT -3 (AIR QUALITY AND INDEX)		**8**		
9	Air quality standards, air quality inde x, automob ile pollution - effects and control measures	2	C	2
10	Atmospheric self – cleansing processes, approaches and techniques of air pollution control	3	C	2
11	Air pollution control devices: Gravitational settling chamber, cyclones, wet scrubbers, fabric filters, ESP and catalytic converters	3	C, I	2
UNIT -4 (NOIS E POLLUTION)		**8**		
12	General introduction to noise pollution, human acoustics	2	C	3

13	unit of measurement, loudness, measurements of noise and weighting networks	2	C	3
14	Sources and effects of noise pollution	2	C, I	3
15	noise abatement/control, noise standards	2	C, I	3
UNIT -5 (SOLID WASTE MANAGEMENT)		**8**		
16	Definition, types, composition and sources of solid wastes	2	C	4
17	Solid Waste Management Rules (2016), storage and collection of municipal solid waste	2	C	4
18	Methods of solid waste disposal – composting, incineration	2	C, I	4
19	pyrolysis and sanitary land filling, recovery of materials and energy from solid waste	2	C, I	4
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Environmental Engineering by H. S. Peavy, D. R. Rowe and G. Tchobanoglous
2	Ecology by E. P. Odu m
3	Air Pollution by M. N. Rao
4	Environmental Noise Po llution by P. F. Cuniff
	REFERENCE BOOKS AND OTHER MATERIALS
5	Solid Waste Management Collection, Processing and Disposal by A. D. Bhide and B. B. Sunderan

19CEP007	GROUND WATER ENGINERING	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	PE	Professional Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1	Understand about ground water flow	a, h, i
2	Study about aquifers	a, h, i
3	Study and understand about tube wells	a, h, i
4	Understand about recharging of ground water	a, h, i
5	Study about salty water	a, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (AQUIFERS: INTRODUCTION)	**9**		
1	Properties of Aquifers, Formation constants, compressibility of aquifers	2	C	1
2	Equation of motion for steady and unsteady ground water flow in isotropic homogeneous aquifers	2	C	1
3	Dupit's assumptions	1	C, I	1
4	Unconfined flow with a recharge, tiled t rain problem	2	C, I	1
5	Ground water e xp loration and methods of investigations	2	C, I	1
	UNIT -2 (AQUIFERS: FLOW)	**7**		
6	Effect of boundaries, interference of water, leaky aquifers	1	C	2
7	Thiem's equilibrium formula for unconfined and confined aquifers and determination of hydraulic properties of aquifers	2	C	2
8	Partial penetration of an aquifer by a well, spherical flow in a well	2	C, I	2
9	Non equilibrium formula for aquifer (unsteady radial flows)	2	C, I	2
	UNIT -3 (TUBE WELL)	**10**		
10	Tube wells, optimum capacity, silting of tube well, design of tube wells in different aquifers	1	C	3
11	Tube well types, parts, bore hole, strains, its types, well pipe, casing pipe, blind pipe.	1	C	3
12	Construction and working of tube wells, site selection, drilling operation, cable tool method, hydraulic method	2	C	3
13	Rivers Rotary Method and drilling fluids, well screen assembly installation, verticality and alignment of tube we lls	2	C, I	3
14	Gravel pac king, development of tube wells, sickness, corrosion and failure of tube wells	2	C, I	3
15	Pumping equipment and hydraulic testing of pumps	2	C, I	3
	UNIT -4 (GROUND WATER RECHARGE)	**6**		
16	Artificial recharge of ground water, considerations and methods	2	C	4
17	Recharge techniques induced infiltration, water spreading, flooding , basins, ditching	2	C	4
18	Modification of natural channels , irrigation, recharge pits, shafts	2	C, I	4

	and recharge wells				
UNIT -5 (SALINE AND FRES H WATER)		**8**			
19	Occurrence of saline water intrusion, Ghyben-Herzberg Relation between fresh and saline water	2	C	5	
20	Shape and structure of fresh water and salt water interface	2	C	5	
21	Upcoming saline water, fresh water and salt water relat ions on oceanic islands	2	C, I	5	
22	Control of salt water intrusion, Recognition of sea water in the ground water	2	C, I	5	
TOTAL CONTACT HOURS		**40**			

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Ground water Hydrology, D.K.Todd, John Wiley & Sons Inc.Newyork.
2	Groundwater, H.M.Raghunath, Wiley Eastern Ltd., N.Delhi
3	Karamouz, M, Ahmadi, A, and Akhbari, M, Groundwater Hydrology: Engineering, Planning and Management, CRC Press
	REFERENCE BOOKS AND OTHER MATERIALS
4	Davis, S.N., and De Weist, R.J.M., Hydrogeology, John Wiley & Sons, New Yo rk

19CEP008	HEALTH MONITORING OF STRUCTURES	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	PE	Professional Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1 Understand about Evaluation of Structure	a, h
2 Investigate the material damage	a, h, j
3 Study about data interpretation	a, h, j
4 Study about assessment	a, h, j
5 Study various case studies	a, h, j

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (INTRODUCTION)	**6**		
1	Introduction- Qualitative and non-continuous methods of evaluation of structures	3	C	1
2	SHM definition	3	C	1
	UNIT -2 (STRUCTURAL DAMAGE)	**6**		
3	Detecting the e xistence of the damage on the structure	3	C, I	2
4	Locating the damage- Identifying the types of damage- Quantifying the severity of the damage	3	C, I	2
	UNIT -3 (DATA COLLECTION)	**12**		
5	Sensors- Feature e xtraction through signal processing and statistical classification	3	C, I	3
6	Structure- Data acquisition systems-Data transfer and storage mechanis m	3	C, I	3
7	Data management- Data interpretation and diagnosis: System Identification	3	C, I	3
8	Structural model update -Structural condition assessment	3	C, I	3
	UNIT -4 (ASS ESSMENT OF DATA)	**8**		
9	Prediction of remaining service life Different sensors	2	C, I	4
10	Accelerometers, strain gauges, displacement transducers	2	C, I	4
11	Level sensing stations, anemometers, temperature sensors and dynamic we ight-in-motion sensors	4	C, I	4
	UNIT -5 (CAS E S TUDIES)	**8**		
12	SHM for bridges	8	C, O	5
	TOTAL CONTACT HOURS	**40**		

LEARNING RES OURCE	
S.No.	TEXT BOOKS
1	Raghavan, A. and Cesnik, C. E., Review of guided-wave structural health monitoring," Shock and Vibration Digest, vol. 39, no. 2, pp. 91-114, 2007
2	Shen-En Chen, R. Janardhanam, C. Natarajan, Ryan Schmidt, Ino-U.S. Forensic Practices-

	Investigation Techniques and Technology, ASCE, U.S.A., 2010.
3	Natarajan C., R. Janardhanam, Shen-En Chen, Ryan Schmidt, Ino-U.S. Forensic Practices-Investigation Techniques and Technology, NIT, Tiruchirappalli, 2010
4	Gary L. Lewis, Guidelines for Forensic Engineering Pract ice, A SCE, U.S.A., 2003
	REFERENCE BOOKS AND OTHER MATERIALS
5	Joshua B. Kardon, Gu idelines for Forensic Eng ineering Practice, ASCE, U.S.A., 2012

19CEP009	EARTHQUAKE ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	PE	Professional Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	Introduction about vibrations, degree of freedom of a system	a, h
2	Study of damped and undamped system	a, h
3	Study about earthquake resistant design of building	a, h, i
4	Effect of lateral loading on building	a, h, i
5	Provision by BIS for earthquake resistance of a building	a, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (UNDAMPED FREE VIBRATIONS OF S INGLE DEGREE OF FREEDOM S YSTEMS)		**8**		
1	Introduction, definitions, characteristics of a dynamic problem	1	C	1
2	degrees of freedom, Newton's law of motion, De Alembert's Principal	1	C, I	1
3	free body diagram, derivations of differential equation of motion	1	C, I	1
4	derivations of differential equation of motion	1	C, I	1
5	solution of differential equation of motion	1	C, I	1
6	equivalent stiffness of spring combinations	1	C, I	1
7	springs in series	1	C, I	1
8	springs in parallel	1	C, I	1
UNIT -2 (DAMPED FREE VIBRATIONS OF S INGLE DEGREE OF FREEDOM S YSTEMS)		**8**		
9	Introduction, types of damping	1	C, I	2
10	free vibrations with viscous damping	1	C, I	2
11	free vibrations with viscous damping	1	C, I	2
12	over-damped, crit ically- damped and under- damped systems	1	C, I	2
13	over-damped, crit ically- damped and under- damped systems	1	C, I	2
14	logarithmic decrement	1	C, I	2
15	logarithmic decrement, structural damping	1	C, I	2
16	structural damping	1	C, I	2
UNIT -3 (EARTHQUAKE RES IS TANT DES IGN PHILOSOPHY)		**8**		
17	Introduction	1	C, I	3
18	criteria for earthquake resistant design	1	C, I	3
19	criteria for earthquake resistant design	1	C, I	3
20	principles of reliable seismic behaviour	1	C, I	3
21	principles of reliable seismic behaviour	1	C, I	3
22	structural forms for earthquake resistance	1	C, I	3
23	earthquake forces versus other forces	1	C, I	3
24	earthquake forces versus other forces	1	C, I	3
UNIT -4 (LATERAL LOAD ANALYS IS)		**8**		

25	Idealization of structures and selection of analysis	1	C, I	4
26	Idealization of structures and selection of analysis	1	C, I	4
27	equivalent lateral force concepts	1	C, I	4
28	equivalent lateral force concepts	1	C, I	4
29	response spectrum analysis	1	C, I	4
30	response spectrum analysis	1	C, I	4
31	seismic forces as per IS:1893– 1984, IS:1893–2002, IS:1893–2016	1	C, I	4
32	seismic forces as per IS:1893– 1984, IS:1893–2002, IS:1893–2016	1	C, I	4
UNIT -5 (BEHAVIOUR AND DES IGN OF CONCRETE S TRUCTURES)		**8**		
33	Characteristics of concrete and reinforcing steel, ,	1	C, I	5
34	influence of bond and anchorage and confinement of concrete	1	C, I	5
35	Seis mic design and detailing of reinforced concrete and masonry buildings (IS 13920; IS 13827: IS 13828; IS 4326) and fle xura l strength and ductility of RC members	6	D, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Paz M, "Structural Dynamics – Theory and Computation" CBS Publishers and Distributors, New Delhi, 2003
2	Chopra A K, "Structural Dynamics" John Wiley & Sons, New Delhi, 2002
3	Dowrick D J, " Earthquake Resistant Design for Engineers and Architects" John Wiley & Sons, New Yo rk, 2000
4	Paulay and Priestley, "Seismic Design of Reinforced Concrete and Masonry Buildings" John Wiley and sons, New York, 1992
	REFERENCE BOOKS AND OTHER MATERIALS
5	Rao S S., "Mechanical Vibrations" Pearson Education Publishers, 2004

19CEP010	HUMAN RESOURCE MANAGEMENT AND INDUSTRIAL RELATIONS	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	PE	Professional Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1 Understand about Human Resource Management	a, h
2 Understand the concept of training and motivation	a, h
3 Study and understand about labour and labour relationship	a, h
4 Study and understand about industrial relationship	a, h
5 Study and understand about industrial conflict	a, h

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (INTRODUCTION)	**5**		
1	Nature and scope of Human Resources Management, Differences between personnel management and HRM	1	C, I	1
2	Human resource planning , Methods of Selection	2	C, I	1
3	Uses of various test, interview techniques in selection and placement	2	C, I	1
	UNIT -2 (TRAINING AND MOTIVATION)	**7**		
5	Training, Methods, Techniques, Identification of the training needs, Training and Development	1	C, I	2
6	Performance appraisal, Transfer, Promotion and termination of services	2	C, I	2
7	Career development. Remuneration, Components of remuneration, incentives, Benefits	2	C, I	2
8	Motivation, Welfare and Social security measures	2	C, I	2
	UNIT -3 (LABOUR RELATIONS HIP)	**7**		
9	Labour Relation, Functions of Trade Unions	1	C, I	3
10	Forms of collective bargaining, Workers' participation in management	2	C, I	3
11	Types and effectiveness, Industrial disputes and Settlements (laws e xcluded)	2	C, I	3
12	Human Resource Audit, Nature, Benefits, Scope approaches	2	C, I	3
	UNIT -4 (INDUS TRIAL RELATIONS)	**5**		
13	Overview of Industrial Relations	1	C, I	4
14	Development of IR System in India, Labour-management Relations	2	C, I	4
15	Trade Unionis m, Collective Bargaining, Employee Grievances	2	C, I	4
	UNIT -5 (INDUS TRIAL CONFLICTS)	**6**		
16	Employee Discipline, Industrial Conflict	2	C, I	5
17	India and International Labour Standards, Judicial activis m	2	C, I	5
18	New Paradigms of Industrial Relations	2	C, I	5
	TOTAL CONTACT HOURS	**30**		

LEARNING RES OURCE	
S.No.	TEXT BOOKS
1	Aswathappa K, Human Resource Management, Tata Mc Gra w Hill, New Delhi, 2013
2	Arun Monappa, Industrial Relations, TMH, New Delhi, 2011.
3	Chandra Mohan A, Human Resource Management, APH Publishing Corporation, 2012
4	Arun Monappa, Managing Human Resources, MacMillan India Ltd., 2012
	REFERENCE BOOKS AND OTHER MATERIALS
5	Venkataratnam, C.S., Industrial Relations, Oxford University Press, 2011
6	Mamoria, Mamoria, Gankar, Dynamics of Industrial Relations, Himalaya Publishing House, Mumbai, 2010
7	
8	

19CEP011	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	PE Professional Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Introduction to disasters.	a, h
2 To study about natural, man-made disasters.	a, h
3 To study about disaster management.	a, h

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (NATURAL DISASTERS)	**6**		
1	Meaning and nature of natural disasters, their types and effects.	1	C, I	1
2	Floods, drought, cyclone, earthquakes, landslides, avalanches.	2	C, I	1
3	Vo lcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.	3	C, I	1
	UNIT -2 (MAN MADE DIS ASTERS)	**8**		
5	Nuclear disasters, chemical disasters, biological disasters	2	C, I	2
6	building fire, coal fire, forest fire, oil fire	2	C, I	2
7	air pollution, water pollution, deforestation, industrial waste water pollution	2	C, I	2
8	road accidents, rail accidents, air accidents, sea accidents.	2	C, I	2
	UNIT -3 (DISAS TER MANAGEMENT)	**16**		
9	Preparedness through (IEC) Information, education & communication	2	C, I	3
10	Pre-disaster stage (mitigation), Effect to mitigate natural disaster at national and global levels	2	C, I	3
11	International strategy for disaster reduction, Emerging approaches in Disaster Management-Concept of disaster management	2	C, I	3
12	national disaster management framework; financial arrangements	2	C, I	3
13	role of NGOs, community –based organizations and media	2	C, I	3
14	Central, state, district and local administration	2	C, I	3
15	Armed forces in disaster response; Disaster response	2	C, I	3
16	Police and other organizations	2	C, I	3
	TOTAL CONTACT HOURS	**30**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Khanna B K, " Disasters: All you wanted to know about", NIPA, New Delhi ,2005
2	Edwards B, "Natural Hazards" Cambridge University Press, U.K, 2005
3	Chakraborty, S C, "Natural Hazards and Disaster Management" Pargatishil Prokashak, Kolkata,2007
4	Sahni, P, (eds), "Disaster Mitigation Experiences and Reflections" Prentice Hall of India , New Delhi, 2002

19CEP012	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	19CE0102
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**

At the end of the course , student will be able to:	
1	Test all the concrete materials as per IS code.	a
2	Design the concrete mix using ACI and IS code methods.	a, c
3	Determine the properties of fresh and hardened of concrete.	a
4	Design special concretes and their specific applications.	a, i
5	Ensure quality control while testing/ sampling and acceptance criteria.	a, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (Concrete: Introduction)	**7**		
1	Concrete materials, Cement: Physical tests on cement	2	C	1
2	Tests on aggregates, Quality of Water for mixing and curing	2	C	1
3	Use of sea water for mixing concrete. Rheology of concrete, Introduction	2	C	2
4	Rheological behaviour, Factors affecting rheological properties	2	C	2
5	Mixture adjustments.	1	C	2
	UNIT -2 (Mix Design)	**9**		
6	Factors influencing mix proportion, Mix design by ACI method and I.S. code method	3	D, I	2
7	Design of normal concrete, high strength concrete and self-compacting concrete.	2	D, I	2
8	Admixtures - accelerating admixtures, Retarding admixtures, water reducing admixtures, Air entraining admixtures, coloring agent, Plasticizers.	2	C	2
9	Batching, Mixing, Transportation, Placing of concrete, Curing of Concrete.	2	C	2
	UNIT -3 (Strength of Concrete)	**9**		
10	Shrinkage and temperature effects, creep of concrete, permeability of concrete	1	C	3
11	Durability of concrete, Corrosion, Causes and effects, remedial measures	1	C	3
12	Thermal properties of concrete, Micro cracking of concrete, microstructure of concrete.	1	C	3
13	Classification of causes of concrete deterioration	1	C	3
14	Permeability of concrete, Chloride penetration	1	C	3
15	Acid attack, Sulfate attack, Alkali-aggregate reaction, Concrete in sea water	2	C	3
16	AC impedance test, Corrosion of embedded steel in concrete, Case histories	2	C	3

	UNIT -4 (S pecial Concrete)	15		
17	High Performance Concrete (HPC) Introduction – Principles of HPC, Ingredients used for HPC, Production of HPC, Curing of HPC, Mechanism of HPC, Properties of HPC during the fresh and hardened state.	5	C, I	4
18	Durability of HPC – Acid Attack, Permeability, Scaling resistance, Chloride penetration, Resistance to sea water, sulfate attack, Alkali-aggregate reaction, Fire resistance	4	C	4
19	Mix design methods of HPC. Special High Performance Concrete-Air-entrained HPC Reactive powder Concrete	2	D, I	4
20	Bio concrete, Geo polymer	2	C	4
21	Fiber reinforced concrete	1	C	4
22	Quality control - Sampling and testing-Acceptance criteria	1	C, I	5
	TOTAL CONTACT HOURS	**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007.
2	Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co, 2004.
3	Gambhir, M.L., Concrete Technology, Tata McGraw Hill, 2004.
4	Neville, Properties of Concrete, Longman Publishers, 2004.
	REFERENCE BOOKS AND OTHER MATERIALS
5	P.-C.A ïtcin, High Performance Concrete, E &FN SPON, 1998
6	E. G. Nawy, Fundamentals of High Performance Concrete, John Wiley & Sons., 2nd edition, 2000
7	High Performance Concrete Structural Designers Gu ide published by FHWA, USA , 2005.

19CEP013	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	19CE0204, 19CE0208, 19CE0309
Data Books / Codes / Standards	
Course Category	P · PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 · Design the slab culvert, Box culvert	a, c, i
2 · Design the T beam bridge and substructures	a, c, i
3 · Design the Bridge bearings	a, c, i
4 · Design the steel bridge for railways	a, c, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (STANDARD SPECIFICATIONS FOR ROADS AND RAILWAYS BRIDGES)	**12**		
1	Definition, components of bridge	1	C	1
2	Classification of bridges, selection of site	1	C	1
3	Economical span and essential design data.	2	C	1
4	General, Indian Road Congress Bridge Code, width of carriage way,	2	C, I	1
5	Clearance, various loads to be considered for the design of roads and railway bridges	4	C, I	1
6	Detailed e xp lanation of IRC standard live loads.	2	C, I	1
	UNIT -2 (DES IGN CONSIDERATION FOR R. C. C. BRIDGES)	**10**		
7	Various types of R.C.C. bridges (brief description of each type)	1	C, I	1,3
8	Design of R.C.C. culvert	3	D, I	1
9	Design of T-beam bridges	3	D, I	2
10	Design of PSC Bridges	3	D, I	2
	UNIT -3 (DES IGN CONSIDERATION FOR S TEEL BRIDGES)	**8**		
11	Various types of steel bridges (brief description of each)	2	C, I	4
12	Design of truss	2	D, I	4
13	Design of plate girder bridges	2	D, I	4
14	Design of composite bridges	2	D, I	3,4
	UNIT -4 (HYDRAULIC & S TRUCTURAL DES IGN)	**10**		
15	Design of Piers	3	D, I	3
16	Design of abutments	3	D, I	3
17	Design of wingwall	2	D, I	3
18	Design of approaches.	2	D, I	3
	TOTAL CONTACT HOURS	**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Essentials of Bridge Engineering, D.J.Victor, Oxford & IBH Pub.N.Delhi.

2	Design of Bridges, N.Krishna Raju, Oxford & IBH, N.Delhi.
3	Bridge Deck Analysis, R.P.Pa ma & A.R.Cusens, John Wiley & Sons
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Design of Bridge Structures, T.R.Jagadish & M.A.Jairam, Prentice Hall of India, N.Delhi.
6	
7	
8	

19CEP014	**OPEN CHANNEL HYDRAULICS**	**L**	**T**	**P**	**C**
		3	0	0	3

Co-requisite	None
Pre-requisite	19CE0106
Data Books / Codes / Standards	
Course Category	P PROFESSIONAL CORE
Course designed by	Department of Civil Engineering
Approval	

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**

	At the end of the course , student will be able to:	
1	Understand the flow and its types.	a, i
2	Understand the various channels and effect of depth	a, h
3	Understand the flow in various kind of channels	a, i
4	Study about various elements of hydraulic structures	a, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
	UNIT -1 (BAS IC FLUID FLOW CONCEPTS)	**8**		
1	Definition, importance of study of open channel flow	1	C	1
2	Types of channels, Classification of Flows	2	C, I	1
3	Velocity distribution, One-Dimensional method of flow analysis	2	C, I	1
4	Pressure Distribution, Equation of Continuity	1	C, I	1
5	Energy Equation, Momentum equation	2	C, I	1
	UNIT -2 (ENERGY-DEPTH RELATIONS HIPS)	**6**		
6	Specific Energy, specific fore	1	C, I	2
7	Crit ical Flow, crit ical depth	2	C, I	2
8	Calculation of Crit ica l Depth for some shapes of channels	3	C, I	2
	UNIT -3 (UNIFORM FLOW IN RIGID BOUNDARY CHANNELS)	**10**		
9	Introduction, shear stress on boundary, shear stress in open channels	2	C, I	3
10	velocity distribution and effect of secondary circulation on velocity distribution, flow over roughness elements	2	C, I	3
11	Chezy Equation, Darcy-Weisbach Friction Factor, Manning's roughness Formu la	3	C, I	3
12	Resistance Formu late for Practical Use	1	C, I	3
13	Normal Depth and it computation for some shapes of channels	2	C, I	3
	UNIT -4 (UNIFORM FLOW IN MOB ILE BOUNDARY CHANNELS)	**6**		
14	Incipient motion, Shield's diagram,	1	C, I	3
15	regimes of flow, bed forms,	1	C, I	3
16	sediment load and its measurement,	2	C, I	3
17	regime channels, design of stable channels.	2	C, I	3
	UNIT -5 (HYDRAULIC JUMP)	**8**		
18	Occurrence and importance, Momentum Equation for hydraulic Jump,	2	C, I	4
19	Computation of sequent depth, Classification of Jumps,	2	C, I	4
20	Characteristics of Jump in a Rectangular Channel, location of jump,	2	C, I	4

21	Hydraulic jump application,	1	C, I	4
22	Use of the Ju mp as an Energy Dissipater.	1	C, I	4
UNIT -6 (RAPIDLY-VARIED FLOW)		**6**		
23	Weirs, Sharp-crested Weir, Broad-crested Weir, submergence of weirs,	2	C, I	4
24	Critical-Depth Flumes,	1	C, I	4
25	Slu ice-gate Flow, free and submerged flow and its analysis of sluice gate, free overfall.	3	C, I	4
TOTAL CONTACT HOURS		**44**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Ranga Ra ju, K.G. "Flow Through Open Channel". Tata Mc Graw-Hill
2	Choudhary, Hanif "Open Channel Hydraulics" Prentice Hall of India
3	Subramanya K. " Flow in Open Channels". Tata Mc Graw-Hill
4	Srivastava, R. "Flow Through Open Channels". Oxford University Press.
	REFERENCE BOOKS AND OTHER MATERIALS
5	Chow Ven Te, "Open Channel Hydraulics". Mc Gaw Hill International Edition.

19CEO001	**TRAFFIC ENGINEERING AND ROAD SAFETY**	**L**	**T**	**P**	**C**
		3	0	0	3

Co-requisite	None		
Pre-requisite	None		
Data Books / Codes / Standards			
Course Category	OE	Open Elective	
Course designed by	Department of Civil Engineering		
Approval			

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 To understand the importance of traffic engineering, characteristics of traffic and Causes of road accidents	a, h
2 To know the relationship between contributing factors and road accidents	a, h
3 To study the traffic control devices and principles of signal / intersection design to address the problem of road accidents	a, h
4 To learn the environmental issues related to road traffic	a, h, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
	UNIT -1 (TRANSPORTATION - INTRODUCTION)	**10**		
1	Organisational set up of traffic engineering department in India. Traffic characteristics.	2	C	1
2	Max dimensions and weights of vehicles. Traffic growth. Traffic studies.	2	C	1
3	Accident statistics, Accident study.	2	C	1
4	Parking Issues. Road alignments and road geometrics affecting road safety.	2	C	1
5	Land use planning and road safety.	2	C	1
	UNIT -2 (INTRODUCTION TO TRAFFIC)	**8**		
6	Space and time headway. Fundamental diagram of traffic flow.	2	C, I	1
7	Relat ionship between speed, volume and density.	2	C, I	1
8	Level of service. PCU. Design service volume.	2	C, I	1
9	Capacity of non-urban & urban roads. Road congestion and road safety.	2	C, I	1
	UNIT -3 (IRC AND REGULATIONS)	**8**		
10	IRC reco mmendations. Traffic control devices.	2	C	2
11	Signal & Intersection Designs.	2	D, I	2
12	Road ma rkings, Traffic control aids and street furniture.	2	D, I	2
13	Traffic control devices and road safety.	2	D, I	2
	UNIT -4 (TRAFFIC REGULATIONS)	**8**		
14	Traffic regulations. Regulation of speed, vehicles and drivers.	2	C	3
15	General traffic regulations. Motor vehicle act. Scope of traffic management.	2	C	3
16	Traffic management measures: restrictions on turning movements, one way streets, tidal flow operations, e xclusive bus lanes, traffic restraint, road pricing.	2	C	3

17	Enforcement and education measures for road safety.	2	C	3
UNIT -5 (ROAD SAFETY AND POLLUTION)		**6**		
18	Road safety audit, RSA team, RSA Report, Elements of RSA, Detrimental effects of traffic.	2	C	4
19	Vehicular air pollution. Situation in India. Vehicular emission norms in India and abroad.	2	C	4
20	Alternate fuels. Factors affecting fuel consumption. Arboriculture.	2	C	4
TOTAL CONTACT HOURS		**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Traffic Engineering and Transportation Planning by L.R.Kadiyali, Khanna Publishers, Delhi, 2002.
2	Highway Engineering by S.K.Khanna & C.E.G. Justo, Veeraragavan A., Nem Chand Bros., Roorkee, 2014
3	Trainers Road Safety Manual, NHA and Ministry of Shipping, Road Transport and Highways, Govt of India.
4	Traffic Engineering by Matson, T.M., Smith, W.S. and Hurd, F.W., Mc Graw- Hill Book Co., New York.
REFERENCE BOOKS AND OTHER MATERIALS	
5	Traffic Flow Theory by Drew, D.R., Mc Graw- Hill Book Co., New York.

19CEO002	MACHINE FOUNDATION	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	OE Open Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Explain the principles of machine foundation	a
2 Understand the design for reciprocating and impact machines	a
3 Exp lain the concept of foundation isolation	a, h
4 Exp lain the method of foundation isolation	a, h

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (PRINCIPLES OF VIBRATIONS AND MACHINE FOUNDATION DES IGN)		**5**		
1	Definitions, harmonic motion, vibrations of a single degree freedom system	1	C	1
2	Transmissibility, theory of vibration measuring instruments	1	C, I	1
3	Types of machines and machine foundations, criteria for satisfactory action of a machine foundation	1	C, I	1
4	Permissible amplitude, allowable soil pressure	1	C, I	1
5	Permissible stresses in concrete and steel, permissible stresses in timber	1	C, I	1
UNIT -2 (FOUNDATIONS FOR RECIPROCATING MACHIN ES)		**9**		
6	Modes of vibration of a rigid block foundation, Barken's soil spring constants	1	C, I	1
7	Determination of coefficients of elastic uniform compression and Elastic uniform shear	1	C, I	1
8	Analysis of block foundation by Barken's theory of linear elastic weightless spring analogy	2	C, I	2
9	Indian Standard for design and construction of foundation for reciprocating machine	2	C, I	2
10	Design procedure, design exa mples	3	D, I	2
UNIT -3 (FOUNDATION FOR IMPACT MACHIN ES)		**9**		
11	Dynamic analysis, Barken's reco mmendations for weight and base contact area	2	C, I	2
12	IS Code practice for design and construction of foundations for impact machines	2	C, I	2
13	Design procedure, design e xa mples	5	D, I	2
UNIT -4 (FOUNDATION FOR ROTARY MACHINES)		**9**		
14	Special considerations	2	C, I	3, 4
15	Design criteria	2	C, I	3, 4
16	Methods of analysis and design	5	D, I	3, 4
UNIT -5 (VIBRATION ISOLATION AND SCREENING)		**8**		
17	Active isolation, passive isolation, methods of isolation	2	D, I	3, 4

18	Wave screening	3	D, I	3, 4
19	Vibration absorbing materials, planning for vibration isolat ion	3	D, I	3, 4
TOTAL CONTACT HOURS			**40**	

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	D. D. Barken, Dynamics of Bases and Foundations
2	Shamsher Prakash, Soil Dynamic, Mc Graw Hill, 1981
3	Swami Saran, Soil Dynamics and Machine Foundations
4	B. M. Das, Principles of Soil Dynamics
	REFERENCE BOOKS AND OTHER MATERIALS
5	Crede, Vibration and Shock Isolation

19CEO003	GEOTECHNICAL EARTHQUAKE ENGINEERING	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	OE	Open Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	To e xp lain the mechanism of earthquake and its related causes to build structures and in-situ soils	a, h, i
2	To e xp lain how ground motion is recorded and how do quantify the earthquake intensity and frequency related parameters	a, h, i
3	To e xp lain how seis mic site investigation will be done and seismic soil design parameters are estimated	a, h, i
4	To e xpla in how seismic resistant design of foundation will be done and also expla in the concept of liquefaction and related causes including codal reco mmendations	a, h, i
5	To e xp lain how to do hazard assessment and mitigation and e xpla in how do prepare a risk and micro zonation mapping	a, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (INTRODUCTION)	**8**		
1	Mechanism of Earthquakes - Causes of earthquake - Earthquake Fault sources	2	C	1
2	Elastic Rebound theory - Seismic wave in Earthquake shaking - terminology	2	C, I	1
3	Locating an earthquake - Quantification of earthquakes	1	C, I	1
4	Strong Motion Records - characteristics of ground motion - Factors influencing Ground motion - Estimation of frequency content parameters	3	C, I	1
	UNIT -2 (SITE INVES TIGATIONS)	**6**		
5	Seis mic site investigations – Selected Case Studies	4	D, I	2
6	Evaluation of Dynamic soil properties - Codal Provisions	2	D, I	2
	UNIT -3 (DES IGN GROUND MOTION)	**6**		
7	Design Ground Motion - Developing	2	D, I	3, 4
8	Design Ground Motion-Codal recommendations.	4	D, I	3, 4
	UNIT -4 (EARTHQUAKE RES IS TANT DES IGN)	**12**		
9	Earthquake Resistant Design of foundation of buildings	3	D, I	3, 4
10	Design considerations - Earthquake Response of slopes	3	D, I	3, 4
11	Eva luation of slope stability – Liquefaction - Susceptibility	3	D, I	3, 4
12	Liquefaction Resistance-Codal recommendations	3	D, I	3, 4
	UNIT -5 (RIS K FACTORS AND ASS ESS MENT)	**8**		
13	Risk mapping - Hazard assessment	3	C, I	5
14	Mitigation measures	2	C, I	5
15	Seis mic microzonation and its importance	3	C, I	5
	TOTAL CONTACT HOURS	**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Ka meswara Rao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing - New Delhi, 2000
2	Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, Internationa l Series, Pearson Education (Singapore) Pvt. Ltd., 2004
3	Ka meswara Rao, Vibration Analysis and Foundation Dynamics, Wheeler
4	Robert W. Day, Geotechnical Ea rthquake Engineering Hand book, Mc Graw Hill, 2002
	REFERENCE BOOKS AND OTHER MATERIALS
5	Debashis Moitra, Geotechnical Engineering, Universities Press, Edition No. - I, 2016

19CEO004	ADVANCED SURVERYING AND REMOTE SENSING	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	OE	Open Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Develop understanding about Photogrammetry	a, i
2	Develop understanding about remote sensing system	a, i
3	Develop understanding about Global Nav igation Satellite System (GNSS)	a, i
4	Develop understanding about GIS	a, i
5	To enable students to understand the process of acquiring remotely sensed data and e xtract information from them	a, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (AERIAL PHHOTOGRAMMETR Y)	**8**		
1	History and classification of Photogrammetry	1	C	1
2	Aerial Photogrammetric processes: acquisition of data	1	C	1
3	classification of photographs	1	C	1
4	photographic scale	1	C, I	1
5	relief displace ment, flight planning	1	C, I	1
6	stereo Photogrammetry: parallax	1	C, I	1
7	stereoscopic view	1	C, I	1
8	streoscope and parallax bar	1	C, I	1
	UNIT -2 (REMOTE S ENS ING)	**8**		
9	Introduction to Electro magnetic Spectrum (EMR)	1	C	2
10	interaction of EMR with at mosphere and target	1	C	2
11	Resolutions: Spatial, tempora l, spectral and radio met ric	1	C	2
12	sensor characteristics, satellite data products	1	C, I	2
13	digital imaging, digital image processing	1	C, I	2
14	visual i mag e interpretation	1	C, I	2
15	digital image interpretation	1	C, I	2
16	microwave re mot e sensing	1	C, I	2
	UNIT -3 (GNSS)	**8**		
17	Global Navigation Satellite System (GNSS) basic concepts	1	C	3
18	GPS (NAVSTAR), Ga lileo	1	C	3
19	GLONASS and Indian Reg ional Navigation Satellite System (IRNSS)	1	C	3
20	Functional segments of GPS and co mponents	1	C, I	3
21	Working principle, factors affecting,	1	C, I	3
22	GPS setup and accessories	1	C, I	3
23	satellites & receivers	1	C, I	3
24	Differential GPS (DGPS), Applications of GNSS	1	C, I	3
	UNIT -4 (GIS)	**8**		
25	Structure of GIS: Cartography	1	C	4

26	Ge ographic mapping process, GIS data models	1	C	4
27	database manage ment systems	1	C	4
28	Raster data representation	1	C, I	4
29	Vector data representation	1	C, I	4
30	transformations, map projections	1	C, I	4
31	Geographic Data Representation, Storage,	1	C, I	4
32	Quality and Standards	1	C, I	4
UNIT -5 (DATA INTERPRETATION)		**8**		
33	Assessment of data quality	1	C	5
34	Managing data errors	1	C	5
35	Geographic data standards	1	C	5
36	Raster and vector based GIS data processing – Queries	1	C, I	5
37	patial analysis	1	C, I	5
38	Descript ive statistics, Spatial autocorrelation	1	C, I	5
39	Surface Network	1	C, I	5
40	analysis mode ling	1	C, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	B. Bhatta, Re mote Sensing and GIS, 2nd Edition, Oxford University Press, New Delhi
2	G S Srivastava: An introduction to Geo informatics
3	P.A. Burrough and R.A. McDonnell, Principles of Ge ographical Information Systems, 2nd ed. Oxford, England, Oxford University Press
4	T.M. Lillesand, R.W. Kiefer and J.W. Chip man, Re mote Sensing and Image Interpretation, (5th edition), John Wiley and Sons, India
REFERENCE BOOKS AND OTHER MATERIALS	
5	George Joseph, Fundamentals of Re mote Sensing, Universities Press, India, 2005
6	
7	
8	

19CEO005	**HYDRO POWER ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	OE	Open Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**

At the end of the course , student will be able to:	
1	Understand about power and flow to generate power	a, h
2	Study about hydro power plants	a, h
3	Study and Understand about Intake and Conveyance system	a, i
4	Study and Understand about turbines	a, i
5	Study and Understand about power house	a, h, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
	UNIT -1 (INTRODUCTION)	**8**		
1	Sources of power	1	C	1
2	estimation of water power	1	C	1
3	necessity and importance of harnessing small hydro power	1	C	1
4	flow duration	1	C	1
5	power duration curves	1	C, I	1
6	load curve, load factors	1	C, I	1
7	capacity factors, utilization factors	1	C, I	1
8	firm and secondary power	1	C, I	1
	UNIT -2 (TYPES OF HYDRO POWER PLANTS)	**8**		
9	Elements of Hydro power	1	C	2
10	classification of hydro-power plants	1	C	2
11	run-of-river plants	1	C	2
12	storage plants diversion canal development	1	C	2
13	pumped storage plants	1	C, I	2
14	tidal power plants	1	C, I	2
15	base load and peak load plants in a power grid	1	C, I	2
16	base load and peak load plants in a power grid	1	C, I	2
	UNIT -3 (INTAKES AND CONVEYANCE S YS TEM)	**8**		
17	Intake structures, functions and their types	1	C	3
18	components of intakes-forebay	1	C	3
19	trash racks, gates and valves	1	C	3
20	force required to operate gates	1	C	3
21	Penstocks, design criterion	1	C, I	3
22	economical diameter anchor blocks, cradles and footings	1	C, I	3
23	water ha mmer, instantaneous closure of power canal	1	C, I	3
24	surge tank, surges in canals	1	C, I	3
	UNIT -4 (TURBIN ES)	**8**		
25	Types of turbines	1	C	4
26	specific speed and classification of turbines	1	C	4

27	synchronous speed	1	C	4
28	scroll casing	1	C	4
29	flu mes and draft tubes	1	C, I	4
30	dimensions of scroll casing and draft tubes	1	C, I	4
31	setting of turbines	1	C, I	4
32	setting of turbines	1	C, I	4
UNIT -5 (POWER HOUS E)		**8**		
33	General layout and arrangements of hydro-power units	1	C	5
34	General layout and arrangements of hydro-power units	1	C	5
35	number and size of units	1	C	5
36	sub- structure	1	C	5
37	spacing of units	1	C, I	5
38	super-structure	1	C, I	5
39	underground power stations	1	C, I	5
40	tidal power	1	C, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Water Power Engineering, Dandekar, M.M., Sharma,K.N
2	Hydro-Electric Engineering Practice Vol.I ,II & III Brown J.G
3	Water Power Engineering, Borrows, H.K
4	Water Power Development, Vol.I & II, Mosonyi,E
	REFERENCE BOOKS AND OTHER MATERIALS
5	Water Power Engineering, M.M.Deshmukh
6	
7	
8	

19CEO006	DRAUGHT AND FLOOD	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	OE	Open Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1 Understand about drought and flood	a, h
2 Study about design flood and flood routing	a, h
3 Study and understand design of spillways	a, c, h
4 Study and understand design of sub surface drainage system	a, c, h
5 Study and understand design of surface drainage system	a, c, h

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (DROUGHT AND FLOOD PROBLEMS)	**8**		
1	Drought Defin ition	1	C, I	1
2	causes, types	1	C, I	1
3	indices, management	1	C, I	1
4	water harvesting	1	C, I	1
5	Flood Problem Causes	1	C, I	1
6	Flood Problem Causes	1	C, I	1
7	alleviation	1	C, I	1
8	alleviation	1	C, I	1
	UNIT -2 (ES TIMATION OF DES IGN FLOODS AND FLOOD ROUTING THROUGH RES ERVOIRS AND CHANNELS)	**8**		
9	Estimation of design floods	1	C, I	2
10	Estimation of design floods	1	C, I	2
11	Methods of computations	1	C, I	2
12	Methods of computations	1	C, I	2
13	Flood routing through reservoirs and channels	1	C, I	2
14	Puls method, Muskingum method	1	C, I	2
15	Puls method, Muskingum method	1	C, I	2
16	Puls method, Muskingum method	1	C, I	2
	UNIT -3 (SPILLWAY DES IGNS, FLOOD MIT IGATION AND FLOOD FORECAS TING, WARNING AND FIGHTING)	**8**		
17	Spillway designs	1	D, I	3
18	Spillway designs	1	D, I	3
19	Spillway designs	1	D, I	3
20	Various types of storages	1	C, I	3
21	Reservoir operation	1	C, I	3
22	river improve ment works	1	C, I	3
23	Flood forecasting	1	C, I	3
24	warning and fighting	1	C, I	3
	UNIT -4 (DES IGN OF S UBS URFACE DRAINAGE S YS TEMS)	**8**		

25	Necessity, design of underdrains	8	D, I	4
UNIT -5 (DES IGN OF S URFACE DRAINAGE S YS TEMS)		**8**		
33	Necessity, design of underdrains	8	D, I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	
2	
3	
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	
6	
7	
8	

19CEO007	CONSTRUCTION TECHNIQUES AND EQUIPMENTS	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	OE	Open Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1	To learn the principles of construction of building components	a, h, i
2	To know about prefabricated construction and building services	a, h, i
3	To study the different repair and rehabilitation technique	a, h, i
4	To understand the planning and operation of various construction equipment	a, h, i

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (PRINCIPLES OF CONS TRUCTION)	**8**		
1	Bonding, Reinforced brick work, Stone masonry, Hollow block masonry	2	C	1
2	Composite masonry, Cavity walls, Flooring, Formwork, Centering and Shuttering sheet piles, Slip and moving forms	3	C, I	1
3	Roofs and roof covering, Joints in Concrete, Plastering and Pointing, Shoring and Scaffolding	3	C, I	1
	UNIT -2 (BUILDING S ERVICES)	**8**		
4	Under pinning, Submerge Structures. Prefabricated structures	2	C	2
5	Build ing services: Prefabricate panels & structures, Production, Transportation and Erection of structures	3	C, I	2
6	Sound insulations, Ventilations, Fire resisting construction, Damp proofing, Termite proofing	3	C, I	2
	UNIT -3 (REPAIR AND REHABILITATION)	**8**		
7	Construction damages & repair techniques: Causes of damage and deterioration in masonry and concrete structures	2	C	3
8	Symptoms & Diagnosis	3	C, I	3
9	Types of repair and rehabilitation techniques	3	C, I	3
	UNIT -4 (BAS IC CONS TRUCTION EQUIPMENT)	**8**		
10	Basics of construction equipment: Factors affecting the selection of equipment	2	C	4
11	Economic life of equipment, cost of equipment	3	C, I	4
12	Maintenance of equipment. Construction equipment and machine ry	3	C, I	4
	UNIT -5 (EARTHWORK EQUIPMENT)	**8**		
13	Earthwork equipment, Hoisting and lifting equipment	2	C	4
14	Material handling equipment	2	C, I	4
15	Concrete equipment	2	C, I	4
16	Dewatering equipment	2	C, I	4
	TOTAL CONTACT HOURS	**40**		

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Arora, S.P. and Bindra, S.P. A Te xt Book of Building Construction, Dhanpat Rai Publications, New Delhi, 2005
2	Va rghese, P.C., Building Constructions, Prentice Hall, 2007
3	Sharma & Kaul, Bu ild ing Construction, S. Chand & Company Pvt, New Delhi, 1998
4	Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delh i, 2013
	REFERENCE BOOKS AND OTHER MATERIALS
5	Peurifoy, R.L., Sche xnayder, J.C., and Shapira, A, Construction Planning, Equipment and Methods, Tata McGra w Hill, New Delhi, 2010.

19CEO008	APPLICATION OF ARTIFICIAL INTELLIGENCE TO CIVIL ENGINEERING	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	OE	Open Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1 Have a knowledge of Artificial Intelligence	a
2 Understand about network	a
3 Understand Fuzzy logy	a
4 Study about Fuzzy relation	a

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (NEURAL NETWORK)	**10**		
1	Introduction to Artificial Neural Network: Feed-forward and Feed-Backward-work	2	C	1
2	Neural network learning rules. Linear separability of t raining patterns	2	C	1
3	Perceptron learning Algorithms.	2	C	1
4	Multilayer Networks: Exact and approximate representation using feed forward net-works	2	C, I	1
5	Fixed Multilayer feed forward Network Train ing by Back propagation	2	C, I	1
	UNIT -2 (MEMORY)	**10**		
6	Recurrent Network: Symmetric networks and Associative Memory	2	C	2
7	Bi-directional Associative Memo ry	2	C	2
8	Analog Hopfield networks	2	C	2
9	Simulated Annealing in optimization	2	C, I	2
10	Case studies for modeling using ANN and Fuzzy	2	C, I	2
	UNIT -3 (FUZZY LOGIC)	**10**		
11	Introduction to Fuzzy logic: Statistics and random Processes	2	C	3
12	Uncertainty in information. Classical Sets and Fuzzy Sets: Classical sets	2	C	3
13	Operations on classical sets, properties of classical sets	2	C	3
14	Mapping of classical sets to functions, Fuzzy sets	2	C, I	3
15	Fuzzy set operations, properties of Fuzzy sets	2	C, I	3
	UNIT -4 (FUZZY RELATIONS)	**10**		
16	Classical Relations and Fuzzy Relations: Cartesian product, crisp, relations, cardinality of crisp relations	2	C	4
17	Operations on crisp relation, properties of crisp relations. Composition, fuzzy relations	2	C	4
18	Cardinality of Fuzzy re lations, operations on Fuzzy re lations. Properties of Fuzzy relations	2	C	4
19	Membership Functions: Fuzzification, Membership value assignment	2	C, I	4

20	Fuzzy-to- crisp Conversions: Defuzzification Methods	2	C, I	4
TOTAL CONTACT HOURS			**40**	

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Zurada, J.M. Introduction to artificial neural Network System. Jaico Publicating House
2	Haykin, S.ANN a comprehensive Foundation. Macmillan College Publising Company, New York
3	Bose, N.K. and Liang, P. Neural network Fundamentals with Graphs Algorithms and Applications. Tata Mc'Gra w Hill
4	Ross, J. Timothy. "Fuzzy logic with Engineering Applications". Mc Gra w Hill
	REFERENCE BOOKS AND OTHER MATERIALS
5	Asai, K. "Fuzzy systems for in formation processing". IOS press

19CEO009	COMPUTATIONAL PRACTICE	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	OE	Open Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	STUDENT OUTCOMES
At the end of the course , student will be able to:	
1	Understand the need for software tools in analysis and design of Civil Engineering Systems	a, k
2	Identify the available open source software tools used for specific problems in Civil Engineering	a, k
3	Use the latest software tools for Modeling, Analysis and Design of Civil Eng ineering Systems	a, k
4	Apply the software skills in the transportation engineering, water resources and environmental engineering.	a, k
5	Apply computing skills to geotechnical engineering.	a, k

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
Solution of the following problems using MATLAB / C language / Excel				
1	Design of the structural elements in concrete and steel.	4	C, O	1,3
2	Development of simple programs for solving Transportation Engineering problems : Highway geometrics, pavement design.	4	C, O	2,3
3	Development of simple programs for solving Geotechnical Engineering problems : Earth pressure, Foundation settlement and stress analysis, Consolidation.	4	C, O	3,5
4	Problems in Environmental and Water resources engineering: Treatment systems, Pipe networks analysis, Synthetic Unit hydrograph derivation, Flood routing, Water balance model.	4	C, O	4,5
5	Analysis, Design and detailing using software packages in Structural Engineering/Transportation Engineering/Environmental/Water Resources/Geotechnical Engineering/ GIS and Remote sensing applications	8	C, O	4,5
TOTAL CONTACT HOURS		24		

LEARNING RES OURCE	
S.No.	TEXT BOOKS
1	Rajasekaran S, Computational Structural Mechanics, Prentice Hall of India, New Delhi, 2001.
2	Manickaselvam V.K., Ele ments of Matrix and Stability Analysis of Structures, Khanna Publishers, New De lhi, 1998.
3	Software Manuals (STAAD Pro, SAP, ETABS etc.)

19CEO010	BUSINESS MANAGEMENT	L	T	P	C
		3	0	0	3

Co-requisite	None
Pre-requisite	None
Data Books / Codes / Standards	
Course Category	OE	Open Elective
Course designed by	Department of Civil Engineering
Approval	

PURPOS E	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To make students understand about the application of basic business concepts of Financial Management, Personnel Management, Marketing Management & Production Management in evaluating business issues.	a
2	To make students aware about the Global Environment in which business operates	a
3	To make students acquaint about the Ethical and Corporate Social Responsibility of organizations.	a

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1 (FINANCIAL MANAGEMENT)	**8**		
1	Introduction of Financial Management, Objectives of Financial Decisions, Status and duties of Financial Executives.	2	C	1
2	Financial Planning – Tools of financial planning, Management of working capital	2	C	1
3	Factors affecting requirements of working capital, Capital structure decisions	2	C	1
4	Features of appropriate capital structure, Sources of finance.	2	C	1
	UNIT -2 (PERSONNEL MANAGEMENT)	**10**		
9	Personnel Management – Meaning, Nature and Importance	2	C	2
10	Functions of Personnel Management – (a) Managerial Functions and (b) Operative functions.	3	C	2
11	Job Analysis: Meaning and Importance; Process of Job Analysis; Job Description and Job specification	3	C	2
12	Human Resource Development-Meaning and concept.	2	C	2
	UNIT -3 (PRODUCTION MANAGEMENT)	**12**		
17	Production Management : Definition and Objectives	1	C	2
18	Plant location: Ideal plant location. Factors affecting plant location,	2	C	2
19	Plant Layout : Ideal plant layout, factors affecting plant layout	2	C	2
20	Work Measurement: Meaning, Objectives and Essentials of work measurement.	3	C	3
21	Production Control : Meaning and importance of production control and steps involved in production control.	4	C	3
	UNIT -4 (MARKETING MANAGEMENT)	**10**		
25	Nature, scope and importance of marketing management	2	C	3
26	Modern Marketing concepts, Role of marketing in economic development	3	C	3
27	Marketing Mix, Marketing Information System,	2	C	3
28	Meaning, nature and scope of International Marketing.	3	C	3

TOTAL CONTACT HOURS	40

LEARNING RES OURCE	
S.No.	**TEXT BOOKS**
1	Business Environment – Francis Charurilam (Himalaya Publishing House).
2	Management – Harold, Koontz and Cyrilo' Donell (Mc Graw Hill)
3	Principles of Personnel Management – Edwin B. Flippo (Mc Graw Hill)
4	Personnel Management and Industrial Relations – D.C. Sharma and R.C. Sharma) (SJ Publications, Meerut)
5	Basic Marketing – Cundiff and Still (PHI, India)
	REFERENCE BOOKS AND OTHER MATERIALS
6	Marketing Management – S.A. Sherlekar (Himalaya Publishing House Bombay)
7	Principles and Practice of Management – L.M. Prasad
8	Financial Management – I.M. Pandey (Vikas Publishing House, New Delhi)
9	International Marketing – Vorn terpestre and Ravi Sasathy.
10	Production Management – E.S. Buffa & W. H. Tausart, Richand D. Irwin, Homewood, Illion is.
11	Personnel Management – C.B. Mamoria, (Himalaya Publishing House)

19CEO011	INDUSTRIAL WASTE WATER TREATMENT	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	OE	Open Elective			
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	To study characteristics of industrial wastewater and its effects on water bodies.	a
2	To know the quality of industrial effluents required before disposal on environment	a
3	To learn various physico-chemical and biological t reatment techniques to treat industrial wastewater	a
4	To gain knowledge about the reuse of treated industrial effluents	a

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1		**10**		
1	Prevention Vs control of industrial pollution, zero discharge concept,	2	C	1
2	effects of industrial waste disposal on streams,	1	C	1
3	sewerage systems and wastewater treatment plants,	2	C	1
4	effluent standards for disposal into inland surface water sources and on land for irrigation,	3	C	1
5	industry specific standards,	1	C	2
6	quality requirements for reuse,	1	C	2
UNIT -2		**10**		
7	various steps to minimize effects of industrial effluents on waste water treatment plants and receiving streams	3	C	2
8	conservation of water, process change,	3	C	2
9	reuse of waste water, volume reduction, strength reduction, neutralization, equalization and proportioning,	4	C	3
UNIT -3		**10**		
10	population equivalent, common effluent treatment plant (CETP),	1	C	3
11	study of the following industries from waste generation,	1	C	4
12	quality and its treatment including brief overview of manufacturing process: Textile, tannery, sugar mill, distillery, dairy, pulp & paper, metal plating, oil refinery, nitrogenous fertilizers, thermal power plants and radioactive wastes.	8	C	4
TOTAL CONTACT HOURS		**30**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Industrial and Hazardous Waste Treatment: N. L. Nemerow and A. Dasgupta
2	Industrial Effluents by N. Manivasakam
3	Waste Water Treatment: M. N. Rao and A. K. Dutta
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	Industrial Water Pollution Control: W. W. Eckenfelder
6	Handbook of Industrial Pollution and Control, Volume I & II: S. C. Bhatia
7	Pollution Control in Process Industries: S. P. Mahajan
8	

20CEO001	**NON DESTRUCTIVE TESTING AND MATERIALS**	**L**	**T**	**P**	**C**
		3	0	0	3
Co-requisite					
Pre-requisite					
Data Books / Codes / Standards					
Course Category					
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**
At the end of the course , student will be able to:	
1	To understand the Nondestructive testing	a
2	To study and understand the various Non Destructive Evaluation	a, h
3	To study and understand the various ND testing for concrete and steel	a, h, b, i

Session	**Description of Topic**	**Contact Hours**	**C-D-I-O**	**IOs**
	UNIT -1 (INTRODUCTION)	**7**		
1	NDT Versus Mechanical testing,	1	C	1
2	Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material Characterisation.	2	C,I	1
3	Relative merits and limitations, Various physical characteristics of materials and their applications in NDT.	2	C,I	1
4	Visual inspection – Unaided and aided.	2		
	UNIT -2 (SURFACE NDE METHODS)	**8**		
5	Liquid Penetrant Testing – Principles, types and properties of liquid penetrants	2	C,I	2
6	developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results	2	C,D,I	2
7	Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods	2	C,D,I	2
8	Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism	2	C,D,I	2
	UNIT -3 (NDT OF CONCRETE AND STEEL)	**9**		
8	NDT requirement in civil engineering structures,	3	C,D,I	3
9	Various NDT tests for concrete and steel, methodology of Rebound hammer test, Ultrasonic pulse velocity test, Rebar locator, Carbonation test, Core test and tests for corrosion.	6	D,I	3
TOTAL CONTACT HOURS		**24**		

PRACTICAL COMPONENT

Session	**Description of Experiment**	**Contact Hours**	**C-D-I-O**	**IOs**
1	Rebound Hammer Test, Ultrasonic Pulse Velocity test	2	C, O	3
2	Rebar Locator, Core Test	2	C, O	3
3	Carbonation Tests	6	C, O	3
4	Test for Corrosion	6	C, O	3
TOTAL CONTACT HOURS		**16**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**

1	Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2	Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010
	REFERENCE BOOKS AND OTHER MATERIALS
3	ASM Metals Handbook,"Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
4	Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005
5	Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
6	ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing.