B. M. S. COLLEGE OF ENGINEERING

(Autonomous Institute, Affiliated to VTU, Belgaum)

DEPARTMENT OF CIVIL ENGINEERING
Bull Temple Road,
Bengaluru -560 019.

SCHEME & SYLLABUS FOR B.E CIVIL ENGINEERING - AUTONOMOUS (III to VIII SEMESTER)

(ADMISSION YEAR: 2018-19 onwards)

VISION AND MISSION OF THE DEPARTMENT

Vision

To be an excellent center for imparting quality higher education in Civil Engineering for a constantly changing societal needs with credibility, integrity and ethical standards.

Mission

Accomplish excellence in curricular, co-curricular activities with a committed faculty through teaching and research which creates technically competent and dedicated civil engineers to serve their surroundings with pride.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

1. Practice Civil Engineering in construction industry public sector undertaking and as an entrepreneur for successful professional career.
2. Pursue higher education for professional development.
3. Exhibit leadership qualities with demonstrable attributes in lifelong learning to contribute to the societal needs.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

The Graduates after completion of the programme will be able to:

PSO1	Analyze and design Buildings and Transportation systems
PSO2	Become environmentally and socially responsible citizens with awareness of the use of sustainable material and technologies and provide alternate engineered solutions
PSO3	To design water supply and sewerage systems

PROGRAMME OUTCOMES (POs):

The graduates will have ability to

PO1:	Apply the knowledge of mathematics, science, and engineering fundamentals to the solution of civil engineering problems.
PO2:	Identify and analyze civil engineering problems for meaningful solutions to form the basis for design of civil engineering system components.
PO3:	Design solutions for complex civil engineering problems and system components.
PO4:	Conduct experiments, analyze and interpret data to provide valid conclusions.
PO5:	Apply appropriate techniques and use modern engineering tools to civil engineering systems.
PO6:	Assess safety and legal issues and the consequent responsibilities relevant to the professional civil engineering practice.
PO7:	Understand the impact of the professional civil engineering solutions in relations to societal needs, environmental concerns and sustainable development.
PO8:	Understand the importance of professional ethics and norms of the Civil Engineering practice.
PO9:	Function effectively as a member and/or leader in diverse teams.
PO10:	Comprehend, write reports and present it effectively.
PO11:	Demonstrate knowledge of management and financial principles to apply to civil engineering projects.
PO12:	Engage in life-long learning in the context of technological change.

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

CREDITS DISTRIBUTION: **B.E CIVIL ENGINEERING 2018-2019 onwards**

Sem	I sem	II sem	III	IV	V	VI	VII	VIII	Total credits CIVIL ENGG
OE						3	3	3	09
PE					3	3+3	3	3	15
PW				02	2	3	2	6	15 =17
Seminar/ internship						-	-	2	02
HSS			01	-	2	2	3	2	10
PC			16	19	18	11	6	-	70
BS	9	9	4	4	-	-	2	-	18+10 =28
ES	11	11	4	-	-	-	-	-	22+04=26
TOTAL credits	20	20	25	25	25	25	19	16	Σ=175 credits
Noncredit Courses	English	Kannada	Env. studies	PDC	YOGA/ NCC/sports	Physical/cultural activity/sports/community service	Physical/cultural activity	-	

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

III SEMESTER B. E. **(Admission year 2018 onwards)** **WEF: Aug 2019-20**

Course type	COURSE CODE	Course title	Teaching department	Credits			Total credits	Contact hours	MARKS			SEE DURATION Hours
				L	T	P			CIE	SEE	TOTAL	
BS-5	19MA3BSEM3	Engineering Mathematics- 3	Maths	3	1	0	**4**	5	50	50	100	3
ES-7	19CV3ESGEO	Engineering Geology	Civil	3	0	1	**4**	5	50	50	100	3
PC-1	19CV3PCBMC	Building materials and construction	Civil	3	0	1	**4**	5	50	50	100	3
PC-2	19CV3PCGDY	Geodesy	Civil	3	0	1	**4**	5	50	50	100	3
PC-3	19CV3PCMOF	Mechanics of Fluids	Civil	3	1	0	**4**	5	50	50	100	3
PC-4	19CV3PCSOM	Strength of materials	Civil	3	1	0	**4**	5	50	50	100	3
HS-1	19IC3HSCPH	Constitution of India and Professional Ethics and Human Rights	Humanities	1	0	0	**1**	1	50	50	100	
		TOTAL					**25**	31hrs			**700**	
NC-3	**19NC3HSEVS**	**Environmental studies**	Civil	0			0	1	50	-		

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

IV Semester B. E. **(Admission year 2018 onwards)** **WEF: Aug 2019-20**

Course type	Course code	Course title	Teaching Department	Credits			Total Credits	Contact hours	MARKS			SEE Duration Hours
				L	T	P			CIE	SEE	TOTAL	
BS-6	19MA4BSEM4	Engineering Mathematics-4	Maths	3	1	0	**4**	5	50	50	100	3
PC-5	19CV4PCSTA	Structural Analysis	Civil	2	1	0	**3**	4	50	50	100	3
PC-6	19CV4PCCON	Concrete Technology	Civil	2	0	1	**3**	4	50	50	100	3
PC-7	19CV4PCGTE	Geotechnical Engineering-I	Civil	3	0	1	**4**	5	50	50	100	3
PC-8	19CV4PCHYM	Hydraulics and hydraulic machines	Civil	3	0	1	**4**	5	50	50	100	3
PC-9	19CV4PCWSE	Water supply Engineering	Civil	3	0	0	**3**	3	50	50	100	3
PC-10	19CV4PCBPD	Building planning & drawing	CIVIL	1	0	1	**2**	3	50	50	100	4
PW-1	19CV4PCPW1	PROJECT WORK-1		0	0	2	**2**	1	50	50	**100**	
		TOTAL					**25**	30 hrs			**800**	
NC-4	**19NC4HSPDC**	Personality Development and Communication Skills	CIVIL/ Humanities/ MBA	Non-credit mandatory			0		50	-		

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

V SEMESTER B. E. **(Admission year 2018 onwards)**

Course Code	Course title	Teaching Department	Credits			Total credits	Contact hrs	MARKS			SEE DURATION Hours
			L	T	P			CIE	SEE	TOTAL	
20CV5PCDRC	Design of RCC structural elements and CAD lab	CIVIL	2	1	1	**4**	6	50	50	100	3
20CV5PCWWT	Waste Water Treatment	CIVIL	3	0	1	**4**	5	50	50	100	3
20CV5PCGTE	Geotechnical Engineering-II	CIVIL	2	1	0	**3**	4	50	50	100	3
20CV5PCTRE	Transportation Engineering-I	CIVIL	3	0	1	**4**	5	50	50	100	3
20CV5PCISA	Indeterminate Structural Analysis	CIVIL	2	1	0	**3**	4	50	50	100	3
20CV5HS* **	Management & Entrepreneurship/ Basics of Marketing & Sales/ Economics for Engineers	MBA	2	0	0	**2**	2	50	50	100	3
20CV5PE* **	Advanced Concrete Technology, Air pollution, Disaster Management and Mitigation, Alternative Building Materials, Theory of Elasticity	CIVIL	3	0	0	**3**	3	50	50	100	3
20CV5PCPW2	Project work -2	CIVIL	0	0	2	**2**	1	50	50	**100**	-
	TOTAL					**25**	30 hrs			**800**	
20CV5NCCLA	Physical activity: Yoga/Sports/Martial arts		Non-credit mandatory			0					

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

V SEMESTER ELECTIVES **(Admission year 2018 onwards)**

Course type	Course code	Course title	Teaching Department	Credits			Total credits	Contact hours	MARKS			SEE DURATION Hours
				L	T	P			CIE	SEE	TOTAL	
PE-1	**20CV5PEACT**	Advanced Concrete technology	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-1	**20CV5PEAPL**	Air Pollution	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-1	**20CV5PEDMM**	Disaster Management & Mitigation	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-1	**20CV5PEABM**	Alternate Building Materials	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-1	**20CV5PETOE**	Theory of Elasticity	CIVIL	3	0	0	**3**	3	50	50	100	3

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

VI SEMESTER B.E **(Admission year 2018 onwards)**

Course Code	Course title	Teaching Department	Credits			Total credits	Contact hours	MARKS			SEE DURATION Hours
			L	T	P			CIE	SEE	TOTAL	
20CV6PCDSS	Design of Steel Structural Elements and Software Application lab	CIVIL	2	1	1	**4**	6	50	50	100	3
20CV6PCIWR	Irrigation and Water resources	CIVIL	3	0	0	**3**	3	50	50	100	3
20CV6PCTRE	Transportation Engineering-II	CIVIL	4	0	0	**4**	4	50	50	100	3
20CV6HSLFE	Law for Engineers	HUMANITIES	2	0	0	**2**	2	50	50	100	3
20CV6PE* **	Matrix method of Structural Analysis, Ground Improvement Techniques, Solid Waste Management, Pavement Materials & Construction	CIVIL	3	0	0	**3**	3	50	50	100	3
20CV6PE* **	Structural Masonry, Earth Retaining Structures, Pavement Design, Geospatial Surveying	CIVIL	3	0	0	**3**	3	50	50	100	3
20CV6OE* **	Mechanics of FRP Composites/ Global warming & climate change	CIVIL	3	0	0	**3**	3	50	50	100	3
20CV6PWESP	Extensive Survey Project	CIVIL	1	0	2	**3**	2	50	50	**100**	
	Total					**25**	26 hrs			**800**	
20CV6NCCLA	Cultural Activity: Music, Theatre, Dance, Folklore	Non-credit mandatory	-			0					

NOTE: XXCV8DMITP – Mandatory Course of Industrial training internship (to be completed either during the vacation of 6th& 7th semester or 7th& 8th Semester) for a minimum period of 4 weeks. Students shall apply reasoning based on the solutions provided in the civil Engg construction projects and assess issues related to societal, health, safety, legal and cultural issues as applied to civil engineering practice. The assessment for internship will be in VIII semester.

VI SEMESTER B.E **ELECTIVES**

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course type	Course code	Course title	Teaching dept	Credits			Total credits	Contact hours	MARKS			SEE DURATION
				L	T	P			CIE	SEE	TOTAL	Hours
PE-2	**20CV6PEMMA**	Matrix method of Structural analysis	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-2	**20CV6PEGIT**	Ground Improvement Techniques	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-2	**20CV6PESWM**	Solid Waste Management	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-2	**20CV6PEPMC**	Pavement Materials & Construction	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-3	**20CV6PESMA**	Structural Masonry	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-3	**20CV6PEERS**	Earth Retaining Structures	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-3	**20CV6PEPAD**	Pavement Design	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-3	**20CV6PEGSS**	Geospatial surveying	CIVIL	3	0	0	**3**	3	50	50	100	3

VI SEMESTER OPEN ELECTIVE

Course type	Subject Code	Course Title	Teaching Department	Hrs /week			Total Credits	Contact Hours
				L	T	P		
OE-1	20CV6OEMFC	**Mechanics of FRP Composites**	CIVIL	3	-	-	3	3
OE-1	20CV6OEGWC	Global warming & Climate change	CIVIL	3	-	-	3	3

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course type	Course Code	Course title	Teaching Dept	Credits			Total credits	Contact hours	MARKS			SEE DURATION Hours
				L	T	P			CIE	SEE	TOTAL	
BS-7	**21CV7BSBFE**	Biology for Engineers	---	2	0	0	**2**	**2**	50	50	100	3
HS-5	**21CV7HSHIA**	History of Indian Architecture	CIVIL	3	0	0	**3**	**3**	50	50	100	3
PC-19	**21CV7PCCSE**	Contracts, Specification and Estimation	CIVIL	2	1	0	**3**	**4**	50	50	100	4
PC-20	**21CV7PCDDG**	Design & Drawing of RCC & Steel structures	CIVIL	2	0	1	**3**	**4**	50	50	100	4
PE-4	**21CV7PE*** **	i)Analysis & Design of PSC elements ii)Advanced Design of RC Structures iii)Advanced Foundation Design iv)Geometric Design of Roads v)Industrial Waste Water Treatment vi)Structural Dynamics vii) Groundwater hydrology	CIVIL	3	0	0	**3**	**3**	50	50	100	3
OE-2	21CV7OE***	i) Remote Sensing & GIS, ii)Finite Element Analysis	CIVIL	3	0	0	**3**	**3**	50	50	100	3
PW-4	21CV7PWMAP	Major Project Phase-1	CIVIL	0	0	2	**2**	**1**	50	50	100	
		Total					**19**	**20 hrs.**			**700**	
NC-6		Cultural Activity / Physical Activity		Noncredit mandatory								

Admission year 2018 onwards **VII semester B. E. ELECTIVES** **WEF: 2021-22**

Course type ELECTIVES	COURSE CODE	Course title	Teaching Dept.	Credits			Total credits	Contact hours	MARKS			SEE DURATION Hours
				L	T	P			CIE	SEE	TOTAL	
PE-4	**21CV7PEADR**	Advanced Design of R C Structures	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-4	**21CV7PEPSC**	Analysis & Design of PSC Elements	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-4	**21CV7PEADF**	Advanced Foundation Design	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-4	**21CV7PEGDR**	Geometric Design of Roads	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-4	**21CV7PEIWW**	Industrial Waste Water Treatment	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-4	**21CV7PESDY**	Structural Dynamics	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-4	**21CV7PEGWH**	Groundwater Hydrology	CIVIL	3	0	0	**3**	3	50	50	100	3

VII SEM B.E OPEN ELECTIVES

Course type	Course Code	Course Title	Teaching Department	Hrs /week			Total Credits	Contact Hours
				L	T	P		
OE-2	**21CV7OERSG**	Remote Sensing & Geographic Information System	CIVIL	3	0	0	3	3
OE-2	**21CV7OEFEA**	Finite Element Analysis	CIVIL	3	0	0	3	3

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

VIII semester B.E **Admission year 2018 onwards** **WEF: Jan 2022**

Course type	Course Code	Course title	Teaching dept.	Credits			Total credits	Contact hours	MARKS			SEE DURATION Hours
				L	T	P			CIE	SEE	TOTAL	
HS-6	**21CV8HSCEP**	Construction Project Management, Economics & Professional Ethics	CIVIL	2	0	0	**2**	2	50	50	100	3
OE-3	**21CV8OE*** **	i)Sustainability and Life Cycle Analysis ii)Occupational Safety and Health Administration (OSHA)	CIVIL	3	0	0	**3**	3	50	50	100	3
PE-5	**21CV8PE*** **	i)Environmental Impact Assessment, ii)Earthquake Resistant Design of Structures iii) Geosynthetics and soil Reinforcement v) Urban Transport Planning vi)Integrated Watershed Management	CIVIL	3	0	0	**3**	3	50	50	100	3
PW-1	**21CV8PWITP**	Internship		0	0	2	**2**	0	50	50	100	-
PW-5	**21CV8PWMAP**	Major Project Phase-2	CIVIL	0	0	6	**6**	1	100	100	200	-
		TOTAL					**16**	**9 hrs.**			**600**	
NC-6		Cultural/ Physical activity	Non-credit mandatory	-								

(Admission year 2018 onwards)

NOTE:
21CV8PWITP – Mandatory Course of Industrial training internship (to be completed either during the vacation of 6th & 7th semester or 7th & 8th Semester) for a minimum period of 4 weeks. Students shall apply reasoning based on the solutions provided in the civil Engg construction projects and assess issues related to societal, health, safety, legal and cultural issues as applied to civil engineering practice.
The assessment for internship will be in VIII semester.

VIII SEMESTER-OPEN ELECTIVE wef 2021-22

	Course Code	Course Title	Teaching Department	Hrs/Week			Total Credits	Contact Hours
				L	T	P		
OE-3	21CV8OEOSH	Occupational Safety and Health Administration (OSHA)	CIVIL	3	0	0	3	3
	21CV8OESLA	Sustainability and Life Cycle Assessment	CIVIL	3	0	0	3	3

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

(Admission year 2018 onwards) **VIII SEMESTER B.E-DEPARTMENT ELECTIVE**

Course type	Subject Code	Course Title	Teaching Department	Credits			Total Credits	Contact Hours
				L	T	P		
PE-5	**21CV8PEERD**	Earthquake Resistant Design of Structures	CIVIL	3	0	0	3	3
	21CV8PEEIA	Environmental Impact Assessment	CIVIL	3	0	0	3	3
	21CV8PEIWM	Integrated Watershed Management	CIVIL	3	0	0	3	3
	21CV8PEGSR	Geosynthetics and soil Reinforcement	CIVIL	3	0	0	3	3
	21CV8PEUTP	Urban Transport Planning	CIVIL	3	0	0	3	3

* Independent study for one or two credits can be offered additionally to those students who fall short of minimum 175 credits.

****

III SEMESTER
CIVIL ENGINEERING
SYLLABUS

Course Title	**Engineering Mathematics - 3**	**Course Code**	**19MA3BSEM3**
Credits	**04**	**L – T – P**	**3 - 1 - 0**
Contact hours	**48 hours**		

Prerequisites: Basic concepts of Trigonometry, methods of differentiation, methods of integration, solution of ordinary differential equations.

Course Objectives: The purpose of the course is to make the students conversant with concepts of Linear Algebraic systems, Fourier series, Fourier Transforms and develop computational skills using efficient numerical methods for problems arising in science and engineering.

UNIT-1

MATRICES **[9 hours]**

Introduction: Elementary row transformations, Echelon form of a matrix, rank of a matrix by elementary row transformations. Consistency of a system of linear equations and solution. Solution of a system of non-homogenous equations: Gauss elimination method, Gauss-Seidel method, LU decomposition method, eigenvalues and eigenvectors of matrices, reduction of a matrix to diagonal form.

(7L + 2T)

UNIT-2

FOURIER SERIES **[9 hours]**

Introduction: Dirichlet's conditions, Fourier series of periodic functions of period 2*l*, Fourier series of functions having points of discontinuity. Applications: Fourier series of typical waveforms like saw toothed waveform, triangular waveform, square waveform, half-wave rectifier, full wave rectifier and modified saw tooth waveform, exponential Fourier series, practical harmonic analysis. **(7L + 2T)**

UNIT-3

FOURIER TRANSFORMS **[9 hours]**

Infinite Fourier transform: Fourier Sine and Cosine transforms, properties, Inverse transforms. Convolution theorem, Parseval's identities. **(6L + 3T)**

UNIT-4

NUMERICAL METHODS **[10 hours]**

Solution of algebraic and transcendental equations: Newton-Raphson method.

Finite Differences and interpolation: Forward differences, backward differences. Newton- Gregory forward interpolation formula, Newton-Gregory backward interpolation formula, Lagrange's interpolation formula, Lagrange's inverse interpolation. Numerical integration: Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule. Numerical solution of ordinary differential equations: modified Euler's method, Runge-Kutta method of fourth order**.** **(8L + 2T)**

UNIT-5

CALCULUS OF VARIATIONS **[11 hours]**

Variation of a functional, Euler's equation, variational problems. Applications: Hanging cable problem, Brachistochrone problem. **Z -TRANSFORMS** Definition, Properties, Transforms of

standard functions, Inverse transforms. Solution of difference equations using Z- transforms.

(8L + 3T)

On completion of the course, student will have the ability to:

Course Code	CO #	COURSE OUTCOME (CO)	PO
19MA3BSEM3	CO 1	Apply Numerical techniques to solve problems arising in engineering.	1
	CO 2	Demonstrate an understanding of Fourier Series, Fourier Transforms and Z- Transforms.	
	CO 3	Apply the concepts of calculus to functionals.	

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, 43rd edition, 2014, Khanna Publishers.
2. Advanced Engineering Mathematics, 4th edition, 2011, Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd.

Reference Books:

1. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition Vol.1 and Vol.2, 2014, Wiley-
India.

E books and online course materials:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-993j-introduction-to-numerical-analysis-forengineering-13-002j-spring-2005/lecture-notes/
2. https://www.pdfdrive.com/calculus-of-variations-e34313748.html

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/111103021/22 (Fourier series and Transforms, Heat and Wave Equations)
2. https://nptel.ac.in/courses/122104018/2 (Numerical Methods)
3. https://nptel.ac.in/courses/111104025/ (Calculus of variation)

Question Paper Pattern:

1. Five full questions to be answered.
2. To set one question each from units 1, 2, 4 and two questions each from Unit 3 and Unit 5.

Course Name	Engineering Geology	**Course Code**	19CV3ESGEO	**SEE Duration Theory/Practical**	3 hrs / 2 hrs
Credits	04	**L-T-P**	3-0-1	**SEE+CIE**	50+50
LECTURE hours	36	**Lab Marks**	25	**CIE lab marks**	25

COURSE OBJECTIVES:

To make students conversant with Internal structure of Earth, plate tectonics, different minerals and rocks, their suitability, and provide insight into hydrogeology.

COURSE OUTCOMES: An ability to

CO1: Explain the Internal structure of the earth. Identify and classify minerals and rocks.

CO2: Provide decision support on Lithological characters and related groundwater conditions.

CO3: Describe various geological maps and interpretation of geological data for mining and mineral excavations, tunneling and other civil engineering projects.

Unit -1

INTRODUCTION:

Introduction to Geology and its importance in Civil Engineering practices. Internal structure and composition of the earth.

MINERALOGY:

Study of rock forming and economically important minerals. Physical properties, chemical composition, uses and contribution of the following minerals in preparation of construction materials - : Quartz and its varieties: Feldspar group: Mica Group: Carbonate group: Calcite, Asbestos, Kaolin and Garnet. Ore minerals: Hematite, Magnetite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Chromite, Galena and Bauxite.

6 Hours

Unit -2

PETROLOGY: Introduction, Rock cycle and study of the following Rocks.

IGNEOUS ROCKS: Definition, origin, classification, and forms of Igneous Rocks. Texture structure, Petrological description and Engineering importance of the following rocks: Granite Diorite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite and Basalt.

SEDIMENTARY ROCKS:

Definition, origin, classification of Sedimentary rocks. Primary structures Petrological description and engineering importance of the following Rocks. Conglomerate Breccia, Sand Stone, Shale, Limestone and Laterite.

METAMORPHIC ROCKS:

Definition, types of Metamorphism, Metamorphic structures. Petrological, description and Engineering importance of the following rocks. Slate, Schist, Gneiss, Quartzite, and Marble. Weathering and deterioration of rocks. Types and agents of weathering.

6 Hours

Unit -3

APPLIED GEOLOGY:

Selection of rocks for foundation, construction, cladding, flooring, concrete aggregate, road metal, and railway ballast with examples, Site selection for Dams, Reservoirs, and Tunnels. Silting up of reservoir and remedial measures.

GEODYNAMICS:

Dynamic activities of the Earth, Plate tectonics. Geological and Engineering considerations of Land slide, (mass movements) Avalanches causes and precautions. Earthquakes - seismic waves, seismic zones, causes and effects.

8 Hours

Unit -4

STRUCTURAL GEOLOGY (ROCK MECHANICS):

Introduction, Stress and Strain in rocks, Outcrop, Dip and Strike, and Compass clinometers. Study of structural features of rocks. Description of Folds, Faults and Joints, their identification in the field. Importance in various Civil Engineering projects.

6 Hours

Unit -5

HYDROGEOLOGY:

Introduction, Study of Groundwater and its importance, Occurrence of groundwater in different Geological rock formation, Water table, Water level fluctuation. Types of Aquifers- Confined and unconfined Aquifers, Artificial recharge of ground water. Selection of well sites, Geological and Geophysical Methods of Groundwater exploration and Applications of Electric resistivity method.

6 Hours

EXPERIMENTS/EXERCISES:

MINEROLOGY: Study of Physical Properties of the mineral and their contribution in preparation of construction materials

Practical no. 1: Study of the Physical Properties of the following minerals.

- **Quartz group of Minerals:-** Rock crystal, Rose Quartz, Jasper banded Agate/Jasper, Smoky Quartz
- **Feldspar Group:** Orthoclase, Plagioclase, Microcline.
- **Mica Group:** Biotite Mica, Muscovite mica.

Practical no. 2: Study of the Physical Properties of the following minerals.

- **Carbonate Group:** Calcite, Magnesite, Dolomite.
- **Ferro-Magnesium Minerals:** Hornblende, Augite, Olivine, Asbestos, Talc, Garnet, Gypsum

Practical no.3: Study of the Physical Properties of the following minerals

- **Ore Minerals:** Hematite, Magnetite, Limonite, Iron Pyrite, Chalcopyrite, Pyrolusite, Chromite, Galena, Bauxite.
- **PETROLOGY:** Identification of Rocks Based on their Index Properties Practical no.4:
- **Igneous Rocks:** Granite, Diorite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite and Basalt.

Practical no. 5:

- **Sedimentary Rocks:** Conglomerate, Breccia, Sandstone, Shale, Limestone and Laterite.

Practical no. 6:

- **Metamorphic Rocks:** Slate, Schist, Gneiss, Quartzite, and Marble.

2. STRUCTURAL GEOLOGY (ROCK MECHANICS):

Practical no. 7: Analysis and understanding of the Lithological Character of sub surface by Vertical Electrical Sounding (VES) resistivity method.

Practical no. 8: Dip and Strike Problems (Three types).

Practical no. 9: Bore well Problems on level Ground (Three types).

Practical no. 10: Study and Interpretation of Standard Structural Geological Maps.

TEXT BOOKS:

1. A Text of Engineering and General Geology, By Parbin Singh, 2009
2. A Text of Geology, by P.K. Mukherjee, 2006

REFERENCES:

1. A Text of Engineering and Geology, by B.S. Sathyanarayanaswamy
2. Physical Geology, By Arthur Homes
3. Principle of Engineering Geology, by KVGK Gokhale
4. Principle of Engineering Geology, by K.M. Bangar
5. Physical and Engineering Geology, by S.K. Garg
6. Geology for Engineers, By D.S. Arora
7. Engg Geology by S K, Duggalet. Al
8. Engineering Geology by D.Venkatareddy
9. Ground water Geology by Todd D.K. Jhon Willey and Sons, New York

LEARNING RESOURCES:

1. www.geoscienceworld.org
2. www.springer.com
3. http://en.wikipedia.org
4. www.gle.wisc.edu
5. www.geoexpro.com
6. http://freevideolectures.com/Course/87/Engineering-Geology

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

PATTERN OF SEE QUESTION PAPER
SUB: ENGINEERING GEOLOGY (19CV3DCGEO)

- Units 1, 4 and 5 will have one main question with a maximum of 3 sub-questions.
- Internal choice for Units 2 and 3 with maximum of 3 subdivisions. .
- Student should answer one FULL question from each unit.

	COURSE : Engineering Geology												**CODE: 19CV3PCGEO**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1					1	1			1		
CO2	3	2		2					2	2			1		
CO3	3	2		2					2	2			1		

****

Course	**Building Materials and Construction**	**Course Code**	**19CV3PCBMC**	**SEE Duration Theory/Practical**	3 hrs/2hrs
Credits	**04**	**L:T:P**	3 :0 :1	**CIE + SEE marks**	50+50
LECTURE Hours	36	**CIE THEORY marks**	25	**CIE lab marks**	**25**

COURSE OBJECTIVES:

To enable students to gain knowledge of various materials and processes involved in building construction. This will enable the students to apply the knowledge for building planning and estimation.

COURSE OUTCOMES:

An ability to

CO1: Discuss the physical and mechanical properties of a variety of construction materials.

CO2: Explain the functional components of a building.

CO3: Describe the construction process of various components of a building.

CO4: Conduct experiments to determine properties of civil engineering materials.

UNIT 1

INTRODUCTION TO BUILDING MATERIALS

Physical and mechanical properties, parameters to define strength, durability and performance for the following materials.

STRUCTURAL CLAY PRODUCTS: Bricks, Concrete blocks, manufacturing process of bricks.

NATURAL STONE: Types, qualities of good stone for construction.

TIMBER: Natural timber, properties, Timber products. Plywood, veneers, laminates

LIME , CEMENT, ADMIXTURES: Properties and uses, Types**,** field test and manufacturing process.

OTHER BUILDING MATERIALS: Iron and Steel, Paints and enamels, Glass, water proofing materials **10 hours**

UNIT 2

INTRODUCTION TO BUILDING CONSTRUCTION:

Building components viz. foundations, walls, lintels roofs, openings, framed structures and masonry structures.

FOUNDATION

Function and requirements of a good foundation, Types of foundations, Preliminary investigation of soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations.

Simple design of masonry spread footing. **5 hours**

UNIT 3

MASONRY

Definition of terms used in Masonry, Classification of Masonry, Bonds in Brick work, Reinforced Brick Masonry, Joints in stone masonry, Introduction to load bearing, cavity and partition walls.

4 hours

DAMP PROOFING, WATER PROOFING AND ANTITERMITE TREATMENT

Definition of technical terms, Defects, causes and sources of dampness, damp proofing and terrace water proofing methods, Pre and post constructional anti termite treatment. **3 hours**

UNIT 4

DOORS AND WINDOWS

Definition of technical terms, Location of doors and windows, Types of Doors, Types of windows.

Sound and fire resistant doors. Specifications for the provision of windows. **3hours**

ARCHES, LINTEL AND BALCONY

Arches: Elements, Classification. Lintel, Chejja and Balcony: Definition, classification, function and uses **3 hours**

ROOFS AND FLOORS

Types of Roofs & Roofing materials, Types of flooring, Factors affecting selection of flooring materials, Flat roof (RCC), Types of pitched roofs. *Centering and shuttering, Scaffolding, Underpinning.* **5 hours**

UNIT 5

STAIRS

Definition of technical terms, Requirements of good stair, Types of Stairs, Geometrical design of RCC Dog legged stair (Plan and sectional elevation).

3 hours

PLASTERING AND PAINTING

Plastering: Purpose, Materials, Types and Methods of plastering, Paints: Constituents, types, Purpose, defects. **3Hours**

Materials Laboratory List of Experiments:

1. Charpy and Izod Impact test on Ductile Materials (Mild Steel)
2. Compression test (Brittle Material (cast Iron) and Ductile Material (Mild Steel))
3. Tension test (Mild Steel)
4. Bending test on Wood and Mild steel specimen
5. Hardness test: Brinnells and Vicker's hardness test on Ductile Materials (Aluminum and Mild Steel)
6. Shear test Ductile Materials (Aluminum and Mild Steel)
7. Tests on Bricks (water absorption, dimension analysis, compressive strength)
8. Tests on coarse and Fine Aggregates (Specific Gravity, Sieve Analysis, water absorption) 9. Field Tests of Cement

TEXT BOOKS:

1. **A Text Book Building Materials**, by P.G. Varghese, Prentice-Hall of India Pvt. Ltd., Publication., 2nd Edition,.2015
2. **Building Construction,** Sushil Kumar, Standard Publication and Distributors, New Delhi, 19th Edition, 2001.

REFERENCE BOOKS:

1. **Advances in Building Materials and Construction** by Mohan Rai and M.P. Jain Singh – publication by CBRI, Roorkee.

2. **Building Materials (3rd revised edition)**, S.K. Duggal, New Age International publishers, India.

3. **Building Construction**, by Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain,Laxmi Publications Pvt Ltd.

NOTE:

1. Internal choice is drawn from UNIT 1 and UNIT 4.
2. Compulsory questions to be given from UNIT 2, UNIT 3 and UNIT 5.

	COURSE : Building Materials and Construction											**CODE: 19CV3PCBMC**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1				1						1		
CO2	2	1											1		
CO3	2	1	2										1		
CO4	2			3					3	2			1		

****

Course	Geodesy	Course Code	19CV3PCGDY	SEE / LAB Duration	3 / 2 hrs
Credits	04	**L:T:P**	3:0:1	**SEE+ CIE marks**	50+50
LECTURE hours	36	**CIE MARKS**	25	**CIE lab marks**	**25**

COURSE OBJECTIVE:
To gain knowledge and skill about conventional as well as latest methods and instruments used for measuring distances, angles, and elevation of objects.

COURSE OUTCOME : **An ability to**

- **CO1** Explain concepts of linear, direction, angular and elevation measurements, discuss recording methods and Instruments used.
- **CO2** **Calculate** various parameters of linear, direction, angular measurement and elevation of objects.
- **CO3** Explain latest technologies and modern instruments used for surveying.
- **CO4** **Conduct** experiments on linear, direction, angular and elevation measurements, record and interpret the data.

Unit-1

Introduction: Definition, Historical perspective of surveying, comparison between geometry & surveying. Necessity of surveying, Principles, plans and maps, classification, Basic measurements, control surveys, - horizontal and vertical. Cardinal principles of surveying, coordinate system, topomaps of survey of India, their numbering, Measurement errors and their adjustments - numerical, precision and accuracy-numericals.

Linear measurements: methods, instruments-chain, tape, ranging rods, area measurement, numericals. **(7 hrs)**

Unit-2

Compass survey: Definitions, meridians, azimuth, bearings, error adjustment Compass, uses, types, local attraction, dip, declination, numericals on - finding bearing, error adjustment.

Plane table survey:

Definitions, Plane table accessories, principles, Advantages & Disadvantages, orientation, Methods of plotting- Radiation, Intersection & Traversing, two-point problem. **(7 hrs)**

Unit 3

ELEVATION MEASUREMENT: Levelling: Concepts of levelling, instruments used. Terms and definitions. Reductions of level, Booking of levels, Classification of levelling. Curvature and refraction effects, Reciprocal levelling, Errors. Numerical examples on booking and reduction of levels, calculation of gradients, correction for curvature and refraction, true difference in height using reciprocal observations. Contouring, characteristics and applications.

Trigonometric levelling Introduction, Base of the object accessible, Base of the object inaccessible: instruments stations in same and different vertical plane, Determination of height of an elevated object, Numerical problems **(8 hrs)**

Unit 4

ANGULAR MEASUREMENTS: THEODOLITE SURVEYING: Essentials of transit Theodolite, Definitions and terms, Temporary and permanent adjustments, Measurement of horizontal and vertical angles, Fundamental lines and desired relations, Sources of error in Theodolite.

Curves; Introduction, TYPES- simple, circular, transition, reverse curve, their elements, setting out, numericals on angular method

Triangulation: Classification, Signals and towers, Base line measurement, Computations. **(8 Hours)**

Unit5 Modern Methods of Surveying:

Photogrammetry and aerial survey: Introduction, definitions, basics principles, methods, importance of scale, height, applications.

Remote sensing: Introduction, Principle of Remote sensing, EMR, types, resolutions, types of satellites, type of sensors, LIDAR, visual and digital image processing and its applications.

Global Positioning System: Definition, Principles of GPS and applications.

Geographical Information System: Introduction and principle of Geographical Information System, components of GIS, applications

Advanced instrumentation in surveying: classification, measuring principles,
Electronic theodolite, EDM, Total Station, Drones **(6hours)**

Text books:

1) Surveying & levelling Vol. I ,II & III, B. C. Punmia, Laxmi Publications; seventeenth edition (2016)
2) Advanced Surveying: Total Station, GPS, GIS & Remote Sensing by Pearson 2017 by Gopi Satheesh, R.Sathikumar, N. Madhu

R**eference books :**

1) Surveying Vol.I & II, S. K. Duggal, McGraw Hill Education; Fourth edition (2017)
2) Surveying and Leveling, R. Subramanian , second edition, 2012, Oxford University Press;

3) Engineering Surveying, Schofield and Breach, 6th edition, Butterworth-Heinemann (Elsevier publication, 2007)
4) Surveying , A Banister, S Raymond, R Baker, 7th edition, Pearson , New Delhi

E-learning:

1) NPTEL courses

SEE paper pattern:

Student shall answer FIVE **full** questions selecting one from each unit.

UNIT 3 & unit 4 have internal choice.

LABORATORY EXPERIMENTS

1. Study of various instruments used for surveying, namely chain, tape, Compass,
2. Dumpy level, Auto-level, Theodolite, Tacheometer, Total station and GPS. To find the distance between two points shown in the field using method of pacing, chaining and taping.
3. To set regular geometric figures (Hexagon and Pentagon) using chain tape and accessories.
4. To set regular geometric figures (Hexagon and Pentagon) using prismatic compass, given the bearing of one line.
5. Study of use of Dumpy level and to determine the different in elevation between two points by differential leveling using Dumpy level
6. To find the true difference in elevation between two points situated far apart by using Reciprocal leveling.
7. Trigonometrical leveling: Single plane method and Double plane method 7 Measurement of horizontal angle using theodolite by:
   i) Method of Repetition and ii) Reiteration method.
8. Setting simple circular curve-Instrumental method,
9. Setting compound curve using theodolite
10. Plane table : Setting, orientation, radiation, intersection
    i) Demo: Total station, GPS

	COURSE : GEODESY									**CODE: 19CV3PCGDY**					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			-									1	1	1
CO2	3	3	-	-	-								1	1	1
CO3	3	3		-	2								1	1	1
CO4	3	3	-	3	2	-	-	-	3	3	-	2	1	1	1

Course	MECHANICS OF FLUIDS	Course Code	19CV3PCMOF	SEE Duration Theory	3 hrs
Credits	**04**	**L:T:P**	3:1:0	**CIE + SEE marks**	50+50
LECTURE hours	48	**CIE THEORY marks**	50	**CIE lab marks**	Nil

COURSE OBJCTIVES :
To enable students gain knowledge on basic concepts of fluid mechanics and their applications to Civil Engineering.

COURSE OUTCOMES:
An ability to

CO1 Explain physical properties of a fluid and their applications in fluid mechanics.

CO2 Apply concepts of total pressure and center of pressure to problems related to fluid structure interactions.

CO3 Identify fundamental kinematics of a fluid element.

CO4 Apply concept of fluid measurement and pipe flows in Engineering problems.

UNIT-1 INTRODUCTION:
Definition of fluid, distinction between solid, fluid & gases, concept of fluid continuum
Fluid Properties: Mass density, specific volume, specific weight, specific gravity- Definitions, units and dimensions, Viscosity, Newton's law of viscosity, Newtonian & non-Newtonian fluids, ideal & real fluids, Compressibility, Vapor Pressure, Surface tension, and Capillary.

9 Hours

FLUID PRESSURE & ITS MEASUREMENT:
Definition of pressure, types of pressures, Pressure at a point in a static fluid, Pascal's law, Hydrostatic pressure law.
Measurement of fluid pressure- Simple & Differential manometers and Mechanical gauge.

6Hours

UNIT-2 HYDROSTATICS:
Definition of total pressure, center of pressure, Total pressure & center of pressure on vertical plane surface, inclined & curved plane surfaces, Pressure diagram, Practical applications- Dams & Gates.

8Hours

UNIT-3 KINEMATICS OF FLUID:

Description, Continuity equation in differential form, Velocity potential, Stream function, Equipotential line, Line of constant stream function, Flow net, Classification of fluid flow, Stream line, Streak line, Path line, Stream tube, Acceleration of flow in one dimensional flow, Types of accelerations. **11 Hours**

UNIT-4 DYNAMICS OF FLUID FLOW:

Concept of inertia force and other forces causing motion, Derivation of Euler's & Bernoulli's Equation, Applications of Bernoulli's Equation- Venturi Meter and Pitot Tube.

8 Hours

UNIT-5

FLOW MEASUREMENT:

Flow through orifices and mouth pieces, Flow over notches and weirs.

PIPE FLOW SYSTEMS:

Energy losses in pipes-Major and Minor losses. Pipes in series and parallel, equivalent pipe.

7 Hours

Text books:

1. Fluid Mechanics including Fluid Machines– P.N.Modi & S.M.Seth, Standard Book House, New Delhi, 20th Edition, 2015

Reference books:

1. Fluid Mechanics- Victor L Streeter & E. Benjamin Wylie, McGraw Hill Publications.
2. Fluid Mechanics- Frank M White, Sixth Edition, the McGraw Hill Companies.
3. Fluid Mechanics - Yunus Cengel & John Cimbala, Third edition, McGraw Hill Education.
4. Fluid Mechanics and Hydraulic Machines – K. Subramanya, McGraw Hill Education.
5. Fundamentals of Fluid Mechanics- Bruce R Munson & Donald F Young, John Wiley & Sons, Inc.
6. Fluid Mechanics- K.L. Kumar, S. Chand & Company Ltd, New Delhi.
7. Fluid Mechanics & Machinery – C.S.P. Ojha, R. Berndtsson & P.N. Chandramouli, Oxford University Press.
8. Fluid Mechanics- R.K. Bansal, Laxmi Publications, New Delhi.

E-learning resources: http://nptel.ac.in/courses/105101082/
http://elearning.vtu.ac.in/10CV35.html

SEE paper pattern:

Student shall answer FIVE full questions, selecting one from each unit. **Unit 1** and Unit 3 has internal choice.

	COURSE : Mechanics of Fluids **19CV3PCMOF**														**CODE:**
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3

Course	**Strength of Materials**	**Course Code**	**19CV3PCSOM**	**SEE Duration**	3 hours
Credits	04	**L: T: P**	3:1:0	**SEE+ CIE marks**	50+50
LECTURE hours	48	**CIE THEORY marks**	50	**CIE lab marks**	Nil

COURSE OBJECTIVE :

To enable students identify different materials physical and mechanical properties and their response to loadings in terms of stresses, strains, bending moment and shear force.

COURSE OUTCOME :	
CO1	Explain stress and strain at a point and their relations in a deformable material.
CO2	Apply force equilibrium conditions and concept of free body diagrams to determine internal forces, stresses and responses under different loading conditions.

UNIT-1

SIMPLE STRESSES AND STRAINS:

Introduction, Properties of Materials, Stress, Strain, Hooke's law, St. Venant's principle, Stress–Strain Diagram for structural steel and nonferrous materials, Principles of superposition, Deformation of uniform bars, bars of varying cross sections, tapering bars of circular and rectangular cross-sections, temperature stresses. Deformation due to self–weight (5 HRS)`

ELASTIC CONSTANTS:

Relationship among elastic constants, volumetric strain, Stresses in composite sections Thermal stresses (including thermal stresses in compound bars). (3 hrs)

TRANSFORMATION OF STRESSES: Introduction, Resolution of stresses on inclined planes, General two dimensional stress system, Principal planes and

Principle stresses, Plane stress and plane strain conditions, Mohr's circle of stresses (4HRS)

UNIT -2

BENDING MOMENT AND SHEAR FORCE IN BEAMS:

Introduction, Definitions-Bending moment and Shearing force in beam, Sign convention, Relationship between loading, shear force and bending moment, SFD and BMD with salient values for statically determinate beams(cantilever Beams, simply supported beams and overhanging beams) subjected to point loads, UDL, UVL and Couple

(8 HRS)

UNIT -3

BENDING STRESS IN BEAMS: Introduction – Bending stress in beam, Assumptions in simple bending theory, Pure bending derivation of Bernoulli's equation, Modulus of rupture, section modulus, flexural rigidity, Variation of bending stresses across the cross section of the beams

SHEAR STRESS IN BEAMS: Expression for horizontal shear stress in beam,

Shear stress diagram for rectangular, symmetrical 'I' and 'T' sections (12 HRS)

UNIT -4

ELASTIC STABILITY OF COLUMNS: Introduction–Short and long columns, Assumptions, Euler's theory on columns, Derivation of Euler's buckling load for a column with both ends hinged Effective length slenderness ratio, radius of gyration., Limitations of Euler's theory, Rankine's formula and problems.

(8 HRS)

UNIT -5 TORSION OF CIRCULAR SHAFTS:

Pure torsion, torsion equation of circular shafts, Strength and stiffness, Torsional Rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections. (4hrs)

THIN AND THICK CYLINDERS: Stresses in thin cylinder subjected to pressure, hoop, longitudinal and volumetric strains, Thick cylinders-Lame's

(4 HRS)

TEXT BOOKS:

1. Mechanics of Materials by Ferdinand P. Beer and E. Russel Johnston(jr)Publisher, 6th Edition, 2013
2. Strength of materials by L.S.Srinath, Prakash Desai and Ananth Ramu Publisher, 2nd Edition, 2009

REFERENCE BOOKS:

1. Elements of Strength of Materials, Timoshenko and Young, Affiliated East-West Press.
2. Mechanics of Materials, James M. Gere (5thEdition), Thomson Learning.
3. Strength of materials By I.B.Prasad, Khanna Publisher

E LEARNING: NPTEL

QUESTION PAPER PATTERN

* The question paper shall have SEVEN QUESTIONS from FIVE UNITS.
Maximum number of sub divisions in each main question is four.
* There shall be internal choice in questions from TWO units (**UNIT -1 & UNIT -3)** * Students to Answer FIVE FULL choosing at least one full question from each unit.

	COURSE : Strength of Materials									CODE: 19CV3PCSOM					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											2		
CO2	3	3											2		

****

Course Code	19IC3HSCPH / 19IC4HSCPH	Course Name	Constitution of India, Professional Ethics and Human Rights
Credits	01	L-T-P-S	1-0-0-0

Total Hours: 12 Course Objectives:

1. To educate students about the Supreme Law of the Land.
2. To value human dignity and to save the liberties of the people against discriminations.
3. To raise awareness and consciousness of the issues related to the profession and discuss the issue of liability of risks and safety at work place.

UNIT-1 [03 hours]

Introduction to Indian Constitution

Historical Background of the Indian Constitution. Framing of the Indian constitution: Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India, Fundamental Rights and its limitations. Fundamental Duties and their significance. Directive Principles of State Policy: Importance and its relevance. Case Studies

UNIT -2 [02 hours]

Union Executive and State Executive

The Union Executive – The President and The Vice President, The Prime Minister and The Council of Ministers. The Union Parliament – Lok Sabha & Rajya Sabha. The Supreme Court of India. State Executive – The Governors, The Chief Ministers and The Council of Ministers. The State Legislature – Legislative Assembly and Legislative Council. State High Courts.

UNIT -3 [02 hours]

Election Commission of India, Amendments and Emergency Provisions

Election Commission of India – Powers & Functions – Electoral Process in India. Methods of Constitutional Amendments and their Limitations. Important Constitutional Amendments – 42nd, 44th, 61st,74th, 76th, 77th,

86th and 91st. Emergency Provisions. Case Studies.

UNIT-4 [02 hours]

Special Constitutional Provisions/ Human Rights

Special Constitutional Provisions for Schedule Castes, Schedule Tribes & Other Backward Classes. Women & Children. Case Studies. Human Rights/values – Meaning and Definitions, Legislative Specific Themes in Human Rights and Functions/ Roles of National Human Rights Commission of India. Human Rights (Amendment Act)2006.

UNIT-5 [03 hours]

Professional Ethics

Scope and Aims of Engineering Ethics, Responsibilities of Engineers and impediments to responsibilities. Honesty, Integrity and Reliability; Risks – Safety and Liability in Engineering. Case Studies.

Course Outcomes:

Students will:

1: Understand and explain the significance of Indian Constitution as the Fundamental Law of the Land.

2: Analyse the concepts and ideas of Human Rights.

3: Apply the practice of ethical responsibilities and duties to protect the welfare and safety of the public.

At the end of the course, the student will have the ability to

CO1	Understand and explain the significance of Indian Constitution as the Fundamental Law of the Land.	**Remember**
CO2	Analyse the concepts and ideas of Human Rights.	**Analyse**
CO3	Apply the practice of ethical responsibilities and duties to protect the welfare and safety of the public.	**Application**

Text Books:

1. "An Introduction to Constitution of India and Professional Ethics" by Merunandan K.B. and B.R. Venkatesh, Meragu Publications, 3rd edition, 2011.
2. "Constitution of India & Professional Ethics & Human Rights" by Phaneesh K. R., Sudha Publications, 10th edition, 2016.

Reference Books:

1. "V.N. Shukla's Constitution of India" by Prof (Dr.) Mahendra Pal Singh (Revised), Eastern Book Company, Edition: 13th Edition, 2017, Reprint 2019.
2. "Ethics in Engineering" by Martin, W. Mike.,Schinzinger, Roland., McGraw-Hill Education; 4th edition (February 6, 2004) .

E-Book:

1. https://books.google.co.in/books/about/Constitution_of_India_and_Professional_E.html?id=VcvuVt

-d88QC
Constitution of India and Professional Ethics, by G.B. Reddy and Mohd Suhaib, I.K. International Publishing House Pvt. Ltd., 2006.

2. http://www.scribd.com/doc/82372282/Indian-Constitution-M-Raja-Ram-2009#scribd Indian Constitution, by M. Raja Ram, New Age International Pvt. Limited, 2009.

Course Outcomes and Programme outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						□						
CO2						□						
CO3								□				

SEE Exam Question paper format	constitution of india	
SEE	Online Examination	
Pattern	50 Multiple Choice Questions	Total Marks 50X2=100

Type of Assessment	Marks
AAT-1 (Assessment) AAT-2 (Assessment)	AAT-1 (5 Marks) AAT-2 (5 Marks)
Test 1,2 (Online Test) Multiple Choice Questions	Test 1 (20 Marks) Test 2 (20 Marks)

****

Course	**Environmental studies**	**Course Code**	**19NC3HSEVS**	**SEE Duration**	Nil
Credits	00	**L:T:P**	1: 0 : 0	**CIE marks**	50

Note: For Civil Engineering Students "Environmental Studies" is a non-credited mandatory Course .

COURSE OBJECTIVE:
The students will be able to develop a sense of responsibility about the environment, natural resources, their conservation and Understand the concept, structure and function of different ecosystems and the ill effects of pollution

COURSE OUTCOME : An ability to

CO1: Discuss the components and impacts of human activities on environment.
CO2: Apply the environmental concepts for conservation and protection of natural resources.
CO3: Identify and establish relationship between social, economic and ethical values from environmental perspectives.

Unit – I

Introduction to Environment: Definition, about Earth i.e Atmosphere, Hydrosphere, Lithosphere and Biosphere, Structure of Atmosphere, Internal structure of the Earth Ecosystem, Balanced ecosystem, types of Ecosystem Human activities - Food, Shelter, Economic & Social Security. Effects of Human activities on Environment: i) Agriculture ii) Housing iii) Industries iv) Mining and v) Transportation activities.
Environmental Impact Assessment (E I A) 03 Hours

Unit-II

Natural Resources:
i) Water resources, its availability, quality, water borne & water induced diseases ii) Mineral resources, iii) Forest resources Material cycles – Carbon, Nitrogen Sulphur cycles. 02 Hrs

Unit – III

Energy resources – Conventional and Non-conventional energy resources. Hydroelectric, Wind power, solar, Biogas, Fossil fuel based energy resources – Coal, Oil & Gas, Nuclear power, Hydrogen as an alternate future sources of energy

02 Hrs

Unit-IV

Environmental pollution Introduction, types, effects of pollutions, i) Water pollution, definition, types, sources, effects, control of water pollution, ii) Land pollution, definition, types, sources, effects, Solid waste management, iii) Noise pollution, definition, sources, effects & control of noise pollution

3 Hrs

Unit-V

Current environmental issues & importance –

Population growth effects & Control, Climatic changes, Global warming. Acid rain Ozone layer depletion & effects Environmental protection; Role of Government, Legal aspects. Environmental protection – initiatives by Non-Govt. Organizations Non –Govt. Organizations (NGOs) Environmental Education Women education

03 Hrs

TEXT BOOKS:

1. Environmental studies by - Dr. Geetha balakrishanan (Revised Edition)
2. Ecology by – Subramanyam (Tata McGraw Hill Publication)
3. Environmental studies by – Dr. J.P.Sharma (Third edition)
4. Environmental studies by – Smriti Srivastav

REFERENCES:

1. Environmental studies by – Benny Joseph
2. Environmental studies by – Dr. D.L.Manunath

LEARNING RESOURCES:

1. NPTEL (Open Sources / power point and visuals)
2. Ecological studies / IITR / Open Sources 3. Ministry of Environment and forest & wildlife.

MOOC's:

MOOCS – https://www.coursera.org / course / sustain

	COURSE : EVS												**CODE: 19NC3HSEVS**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	-	-	-	1	3	-				1		1	
CO2	1	-	-	-	-	1	3	-				1		1	-
CO3	1	-	-	-	-	1	3	3			-	1		1	

IV SEMESTER
CIVIL ENGINEERING
SYLLABUS

Course Title	**Engineering Mathematics - 4**	**Course Code**	**19MA4BSEM4**
Credits	**04**	**L – T – P**	**3 -1- 0**
Contact hours	**48 hours**		

Prerequisites: Complex numbers, multivariate calculus and basic concepts of Statistics and Probability.

Course Objectives: To prepare students with adequate knowledge in Probability and Statistics, Complex Analysis and develop computational skills using efficient numerical methods for problems in science and engineering.

UNIT-1

STATISTICS AND PROBABILITY [10 hours]

Curve fitting – Principle of least squares, fitting a straight line, fitting of a parabola, fitting of exponential curve of the form . Correlation and regression. Probability distributions: Discrete distribution - Poisson distribution. Continuous distribution- Normal distribution.

(8L + 2T)

UNIT-2

JOINT PROBABILITY AND MARKOV CHAIN [9 hours] Joint Probability Distributions:

Discrete random variables, Mathematical expectations, Covariance and Correlation.

Markov Chain:

Markov Chain, Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chain.

(7L + 2T)

UNIT-3

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS [9 hours]

Finite-Difference formulas to partial derivatives.

Applications: Solution of one-dimensional heat equation using 2-level formula and Schmidt explicit formula and Crank-Nicolson two-level implicit formula. Solution of one-dimensional wave equation using explicit three level formula and implicit scheme. **(7L + 2T)**

UNIT-4

COMPLEX ANALYSIS – 1 [10 hours]

Functions of a complex variable, limits, continuity and differentiability of a complex valued function, Analytic functions, properties of analytic functions, Cauchy-Riemann equations in Cartesian and polar form, construction of analytic functions by Milne-Thomson method. Conformal mapping:. Bilinear transformations. **(7L + 3T)**

UNIT-5

COMPLEX ANALYSIS - 2 [10 hours]

Complex integration: Line integral, Problems on line integral, Cauchy's theorem, Cauchy's integral formula.

Complex series: Taylor's, Maclaurin's and Laurent's series (without proof)-examples.

Zeros, Poles and Residues, Cauchy's residue theorem (without proof)-examples. **(7L + 3T)**

On completion of the course, student will have the ability to:

Course Code	CO #	COURSE OUTCOMES (CO)	PO
19MA4BSEM4	CO 1	Demonstrate an understanding of concepts of statistical analysis and probability distributions.	1
	CO 2	Apply Numerical techniques to solve partial differential equations arising in engineering.	
	CO 3	Demonstrate an understanding of analytic functions and their application to evaluate integrals.	

Text Books:

1. Numerical Methods for Engineering, R. P. Kanale and S. C. Chapra, 6th edition, McGraw Hill, Publishers.
2. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B. S. Grewal, 43rd edition, 2013, Khanna Publishers.

E books and online course materials:

1. https://www.coursera.org/learn/basic-statistics
2. http://wiki.stat.ucla.edu/socr/index.php/Probability_and_statistics_EBook
3. https://ocw.mit.edu/courses/mathematics/18-112-functions-of-a-complex-variable-fall2008/lecture-notes/
4. https://www.math.ubc.ca/~peirce/M257_316_2012_Lecture_8.pdf

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/111105090/ (Probability & statistics-Joint distribution, testing of hypothesis)
2. https://nptel.ac.in/courses/111103070/ (Complex Analysis - Analytic functions, Mobius transformation & Residue theorem)
3. https://nptel.ac.in/courses/111107056/ (Complex Analysis - Complex integration, conformal mapping)

Question Paper Pattern:

1. Five full questions to be answered.
2. one question in Units 1, 2, 3 and two questions each in unit 4 and unit 5.

****

Course	Structural Analysis	Course Code	19CV4PCSTA	SEE Duration	3 hours
Credits	03	**L:T:P**	2:1:0	**SEE+ CIE marks**	50+50
LECTURE hours	36	**CIE THEORY marks**	50	**CIE lab marks**	**Nil**

COURSE OBJECTIVE:

To enable the students to gain knowledge on the fundamentals of structural analysis by applying the knowledge gained through Engineering Mechanics and Strength of Materials. It enables to get the prerequisite for advanced analysis and design of structures.

COURSE OUTCOMES:

An ability to

CO1 Identify forms of structures and the associated indeterminacies

CO2 Apply the force equilibrium conditions and compatibility conditions to analyze simple structures like arches, cables and evaluate structural response.

CO3 Apply energy principles to analyze determinate structures.

UNIT -1

Introduction to Structural Systems

Classification of structures, Structural forms, Loads, Conditions of equilibrium, Compatibility conditions, statically determinate and indeterminate Structures, degree of Static and Kinematic indeterminacy.

Analysis of Cables and Three Hinged Arches – Distinction between arch and beam action. Types of Arches, Analysis of Three hinged arches (parabolic only) with supports both at same and different levels. Analysis of cables under point loads
and UDL (supports at same level and different level) (10 HRS)

UNIT -2

Deflection of Beams- Importance of deflection, Governing differential equation of elastic curve. Evaluation of deflection by Macaulay's double integration method, Moment Area method and Conjugate beam method. (8 HRS)

UNIT -3

Consistent Deformation method: Analysis of propped cantilevers

Analysis of Continuous beams - Chaperons' theorem of three moments. (6 HRS)

UNIT -4

Strain Energy Principle-Strain energy and complimentary strain energy. Strain energy due to axial load, bending moment and shear force. Theorem of minimum potential energy, principle of virtual work. Castigliano's theorems and their applications in the analysis of determinate beams and trusses. Maxwell – Betti's
theorem of reciprocal deflection. (6HRS)

UNIT -5

The Unit Load method: Deflection of determinate beams, rigid frames and pin jointed plane trusses by Unit load method (6 HRS)

TEXT BOOKS:

1. Theory of Structures Vol-1 by Pandit and Gupta, Tata McGraw Hill, New Delhi, 1 st Edition
2. Basic Structural Analysis by C S Reddy, Tata McGraw Hill, New Delhi, 3 rd Edition

REFERENCE BOOKS:

1. Elementary Structural analysis, Norris and Wilbur, International student edition, Tata McGraw Hill book Co, New York.
2. Structural Analysis by R C Hibler, 5th edition, Pearson Education

E LEARNING: NPTEL

QUESTION PAPER PATTERN

* The question paper shall have SEVEN QUESTIONS from FIVE UNITS. Maximum number of sub divisions in each main question is four.
* There shall be internal choice in questions from TWO units (Unit -2 and Unit-4).
* Students to Answer FIVE FULL questions Choosing one from each unit.

MAPPING SCALE 1 TO 3

	COURSE : Structural Analysis **19CV4PCSTA**														**CODE:**
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											1		
CO2	3	3											1		
CO3	3	3											1		

****

Course Name	CONCRETE TECHNOLOGY	Course Code	19CV4DCON	SEE Duration	3 hours
Credits	03	**L:T:P**	2:0:1	**SEE+ CIE marks**	50+50
LECTURE hours	24	**CIE THEORY marks**	25	**CIE lab marks**	**25**

COURSE OBJECTIVE:
To enable students to have the knowledge of the ingredients for concrete design and preparation, properties of concrete and the testing of concrete properties in accordance with the IS codes.

COURSE OUTCOME:
An Ability to
CO1 Discuss the influence of the properties of ingredients of concrete including the marginal materials
CO2 Explain the requirement of engineering properties of concrete for structural use
CO3 Apply fundamental principles, procedures and various specifications for designing concrete mixes.
CO4 Describe the causes of deterioration of concrete and the test methods
CO5 Conduct experiments to determine the properties of concrete

Unit-1

INTRODUCTION
Basic Concrete Ingredients: Hydraulic Cements: Manufacturing process, Chemical composition, types of cement, hydration of cement, micro structural development of Portland cement, testing of cement Aggregates: Properties, types of aggregates, classification of aggregates, importance of grading, specific gravity, bulking, moisture content, deleterious materials, testing of aggregates, interfacial transition zone. Water: qualities of water, use of sea water.

Unit-2

Use of Marginal materials: Influence on fresh and hardened properties by using seconda cementations materials like fly ash, slag, silica fume, rice husk ash. Effect on fresh properties of usi chemical admixtures like water reducers, accelerators retarders and air entraining admixtures. Effect
fresh properties and compressive strength of concrete by the use of construction and demolished wast

Unit 3

Fresh concrete and concrete Production: Properties of fresh concrete; Workability, Factor affecting workability, measurement of workability, slump, compacting factor, Vee-Bee consistometer and flow tests, Segregation and bleeding, shrinkage, Process of manufacture of concrete: Batching, mixing, transportation, placing and compaction and curing by different methods.

Unit 4

Mix Proportioning of Concrete: Concrete mix design: Concept of mix design, role of water to cement ratio, water content, other variables and exposure conditions, IS method, ACI method, concept of particle packing and rheology based method of mix design. Numerical problems using IS guidelines. (**8 Hours)**

Unit 5

Hardened Properties, Durability and In –situ testing of Concrete: Engineering properties of concrete; Compressive strength and the factors affecting the strength, tensile strength, bond strength, modulus of rupture, Elasticity, factors affecting modulus of elasticity, poisons ratio, creep, provisions of IS 456 in quality control Durability: Significance of durability, mass transport in concrete, carbonation, chloride ingress Sulphate attack, freezing and thawing. Non–destructive testing; rebound hammer, ultrasonic pulse velocity, penetration and pull out test, principle, applications and limitations, core extraction **(7hours)**

Text books:

Properties of Concrete – A M Neville (Pearson Education Asia Pvt ltd,), Fifth Edition, 2014.

Reference books:

3) Concrete – microstructure, properties and materials – PK Mehta and Paulo JM Monteiro (ICI)
4) Concrete Technology – A R Santhakumar (Oxford – New Delhi)
5) Concrete Technology – Gambhir ML (Tata McGrawHill)
6) Concrete Mix Design – N Krishna Raju
7) Concrete Technology Theory and practice- MS Shetty (S Chand and Company) 8) Relevant codes
9) Current literatures e-learning : https://nptel.ac.in/courses/105102012/
http://elearning.vtu.ac.in/

SEE paper pattern:

Student shall answer FIVE full questions selecting one from each unit. UNIT I & UNIT V has internal choice.

LABORATORY EXPERIMENTS

Tests on Fine Aggregate:

1. Bulking of fine aggregate 2. Unit weight Percentage Voids **Tests on Coarse Aggregate:**

1. Unit weight and percentage Voids

Tests on Cement:

1. Consistency test on cement
2. Setting time test on cement
3. Specific gravity test
4. Fineness of cement
5. Compressive strength of cement **Tests on fresh concrete:**

1. Slump test
2. Compaction factor test
3. Vee-Bee Consistometer test 4. Flow table test

Tests on hardened concrete

1. Compressive strength of concrete cube
2. Compressive strength of Cylinder
3. Split tensile strength
4. Flexural strength of concrete beam

NDT tests

1. Pulse ultrasonic test
2. Rebound Hammer test

	COURSE : **CONCRETE TECHNOLOGY** CODE : **19CV4DCCON**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	-	-	-	1	-	-	-	-	-		1	
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	3	3	-	-	-	-	2	-	-	-	-	3		
CO4	3	3	2	-	-	-	-	-		-	-	-	1		
CO5	3	2	-	3	-	-	-	-	3	3	-	1			

Course	**GEOTECHNICAL ENGINEERING-1**	**Course Code**	**19CV4PCGTE**	**SEE Duration**	3 hours
Credits	04	**L:T:P**	3:0 :1	**SEE+ CIE marks**	50+50
LECTURE hours	36	**CIE THEORY marks**	25	**CIE lab marks**	**25**

COURSE OBJECTIVE:
To gain knowledge and skill about Index properties, Engineering properties of soil, their importance and methods to determine them experimentally. This course provides an insight to mechanics of soil as a foundation and construction material.

COURSE OUTCOME: An ability to

CO1 Explain fundamental concepts and theory related to different phases of soil, Index properties, Engineering properties, soil structure and soil water systems.
CO2 Derive functional relationships, **Calculate** Index properties, Engineering properties and **Classify** soils.
CO3 Conduct experiments on soil, analyze, interpret the data, comprehend and write reports.

Unit-1

INTRODUCTION
Definition, origin and formation of soil. Agents causing formation of soils. List of different soil types. Definition of mass, weight. Relation between mass and weight. Units of mass and weight in SI units. Phase Diagram, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their interrelationships -derivation.
Void ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Moisture content, Numerical problems: interrelationships, borrow area- embankment

(7 hrs)

Unit-2

INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION:
Index Properties of soils and their significance. Various index properties and their Laboratory determination, -Water content, Specific Gravity, in-situ density , Particle size distribution (Sieve analysis and Hydrometer analysis), Relative density, Consistency limits and their indices, , Activity of Clay, Thixotropy of clay. Soil Classification methods, IS classification; - Plasticity chart and its importance, Field identification of soils. Numerical problems-

(8 hrs)

Unit 3

CLAY MINERALOGY AND SOIL STRUCTURE:
Introduction, Types-Single grained honey-combed, flocculent and dispersed structures, Types of soil-Water, base-exchange capacity, Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

Effective Stress: Effective stress concept-Total pressure and Pore pressure, effect of water table, Numerical problems- with and without capillary water.

(6 hours)

Unit 4

PERMEABILITY OF SOILS
Introduction, Importance, Definition, Types-pervious, semi, impervious soils, Darcy's law-Assumption and validity, coefficient of permeability and its Laboratory determination, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, Numerical problems

Compaction of soils: Definition, Principle of compaction. Standard and Modified Proctor's tests and their compactive energy. Factors affecting compaction, Field compaction control, Numerical problems (**8 Hours)**

Unit 5

SHEAR STRENGTH OF SOILS:
Introduction, Shear parameters, Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional failure envelope. Total and effective shear strength parameters, Sensitivity of clay. Measurement of shear parameters-Direct shear test, unconfined compression test, and, Triaxial shear test., Types of drainage conditions, Numericals.
(7hours)

Text books:

1. Braja, M. Das (2017), "Principles of Geotechnical Engineering", Cengage India Private Limited; Ninth edition
2. Punmia B.C. ,Ashok kumar jain, Arun kumar Jain (2017), "Soil Mechanics and Foundation Engg.", 17th Edition, Laxmi Publications Co. , New Delhi.
3. Gopal Ranjan and Rao A.S.R. (2016), "Basic and Applied Soil
4. Mechanics", 3rd edition, New Age International (P) Ltd., New Delhi.

Reference books :

1. Arora.K.R (2009) "Soil Mechanics & Foundation Engineering ", Standard Publishers.
2. Murthy VNS (2015),"Textbook of Soil Mechanics and Foundation Engineering: Geotechnical Engineering series", CBS publishers
3. Craig R.F. (2004), "Soil Mechanics", 7th edition, Spon press, New York.
4. Head K.H., (1986), "Manual of Soil Laboratory Testing", Vol. I, II, III, Princeton Press, London.

e learning:

1. 1.http://www.myopencourses.com/subject/e-book-on-concepts-andtechniques-in-geotechnical-and-foundation-engineering
2. 2.http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104Page1.htm
3. nptel.ac.in/courses/105101084/
4. https://ay14-15.moodle.wisc.edu/prod/course/view.php?id=499

SEE paper pattern:

Student shall answer FIVE **full** questions selecting one from each unit. **UNIT 2 and Unit 4 has internal choice**.

LABORATORY EXPERIMENTS

Determination of index and engineering properties of soil :

1. Specific gravity by density bottle and pycnometer method
2. Water content by oven drying, pycnometer method
3. Particle size analysis by mechanical sieve analysis and hydrometer analysis
4. Field density by core cutter method, sand replacement method
5. Liquid limit by cone penetrometer method and shrinkage limit
6. Liquid limit by casagrande method and plastic limit by rolling thread method
7. Hydraulic conductivity by constant head and falling head permeameter method
8. Compaction characteristics by standard proctor method
9. Shear parameters by Direct shear test
10. Unconfined compressive strength test
11. Shear parameters by Triaxial shear test –UU test
12. Consolidation Test –Demo

	COURSE : GTE-1											**CODE: 19CV4PCGTE**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO1**	**PSO2**	**PSO3**
CO1	3	3		-									1		
CO2	3	3	2	-									2		-
CO3	3	3	-	3	-	-	-	-	3	3	-	1	3		

****

Course	Hydraulics and Hydraulic Machines	Course Code	19CV4PCHYM	SEE/Practical Duration	3 hrs/2hrs
Credits	04	**L: T: P**	3:0:1	**SEE+ CIE Marks**	50+50
LECTURE HOURS	36 hrs	**CIE theory Marks**	**25**	**CIE lab marks**	**25**

COURSE OBJECTIVES:

- To enable the students to gain knowledge in the fundamentals of hydraulics and functioning of hydraulic machine.
- Expose the students to experimental techniques in hydraulics and evaluations of hydraulic machines.

COURSE OUTCOMES:

An ability to

CO1 Analyze uniform & non uniform flows in open channels.

CO2 Apply impulse momentum principle to compute impact of jet on fixed and moving plates

CO3 Explain working of pumps and turbines and apply the basic principles to study the performance of these machines.

CO4 Conduct experiments, interpret data and arrive at conclusions related to fluid mechanics, hydraulics and hydraulic machines.

UNIT-1

FLOW IN OPEN CHANNELS:

Definition of open channel, difference between pipe and open channel flow, classification, types of flows, geometric properties of open channels.

3 Hours

Uniform flow in open channels, Chezy's & Manning's formula, Most economical open sections- rectangular, trapezoidal, circular sections- derivations. Specific energy, Specific energy curve, Condition for maximum discharge & minimum specific energy, Critical flow in rectangular sections, Specific force.

6 Hours

UNIT-2

FLOW IN OPEN CHANNELS (NON-UNIFORM FLOW):

Definition, Types of non-uniform flows.

Gradually varied flow- Derivation & problems, Classification of channel bottom slopes. Hydraulic jump- Types & applications, Hydraulic jump in a horizontal rectangular channel.

6 Hours

UNIT-3

IMPACT OF JET ON VANES:

Introduction to impulse momentum equation, Force exerted by a jet of water on fixed and moving plates- vertical, inclined, symmetrical and unsymmetrical curved plates, series of curved vanes, velocity triangles, work done & efficiency.

7 Hours

UNIT-4

TURBINES:

Definition and classification

Pelton turbine: Theory, Equation for work done and efficiency, Numerical problems Francis turbine: Theory, Work done and efficiency, Numerical problems, Specific speed, Unit quantities, Characteristic curves. Kaplan turbine: Working principle

8 Hours

UNIT-5

PUMPS:

Definition and classification

Centrifugal pumps: General principle, Priming, Heads, Work done and efficiency, Numerical problems, Minimum starting speed, Pumps in series and parallel.

6 Hours

Text books:

1. Hydraulics & Fluid Mechanics – P.N. Modi & S.M. Seth, Standard Book House, New Delhi, 20th Edition, 2015

Reference books:

1. Open Channel Hydraulics- V.T. Chow, Mc-Graw Hill Publications.
2. Flow through Open Channels , Subramanya K, TMH Publications
3. Flow through Open Channels- Ranga Raju, K.G., T.M.H. 2nd edition
4. Text book of Hydraulic Machines- R.K. Rajput, S. Chand Technical
5. Fluid Mechanics- R.K. Bansal, Laxmi Publications, New Delhi.
6. Fluid Mechanics- K.L. Kumar, S. Chand & Company Ltd, New Delhi.
7. Fluid Mechanics through Problems- Garde, R.J., New Age International Publications, New Delhi.
8. Experimental Fluid Mechanics - Asawa, G.L., Vol.1, Nem Chand and Bros.,

E-learning resources:

- http://nptel.ac.in/courses/105103096
- http://nptel.ac.in/courses/105107059/
- http://elearning.vtu.ac.in/P6/enotes/CV44/Flw_OpenCh-NB.pdf

SEE paper pattern:
Student shall answer **FIVE** full questions selecting one from each unit.
Unit 1 and Unit 4 has internal choice.

LABORATORY EXPERIMENTS

EXPERIMENTS:

1. Hydrostatic Bench experiments: Fluid properties, Reynold's apparatus, Hele-shaw apparatus and Bernoulli's apparatus
2. Study on major and minor losses in pipes
3. Coefficient of discharge of a Venturimeter
4. Coefficient of discharge of an Orifice & Mouth Piece
5. Coefficient of discharge of a V- Notch
6. Coefficient of discharge of an Ogee weir
7. Study the impact of jets on vanes
8. Study on hydraulic jump 9 Study on Pelton wheel
9. Study on Francis turbine
10. Study on multi-stage centrifugal pump

COURSE: Hydraulics and Hydraulic Machines CODE: 19CV4PCHYM															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	-	3	-	-	-	-	1	1	-	1	1	-	3

Course	Water Supply Engineering	**Course Code**	**19CV4PCWSE**	**SEE Duration**	3 hours
Credits	**03**	**L: T: P**	3: 0 :0	**SEE+ CIE marks**	50+50
LECTURE HOURS	36 hrs.	**CIE theory Marks**	**50**	**CIE lab marks**	**Nil**

COURSE OBJCTIVE

To provide fundamental knowledge to students about water demand, sources, conveyance, quality, treatment, conservation and its distribution

COURSE OUTCOME:

An ability to

CO1	Describe and design various parameters of collection and conveyance of water.
CO2	Evaluate water quality parameters through water quality standards
CO3	Describe basic structure of drinking water supply systems, conservation and design the component systems of water treatment facilities

UNIT-1

Introduction: Human activities and environmental pollution, requirement of water for various beneficial uses, Need for protected water. **02 hours**

Demand of Water: Types of water demands-domestic demand, institutional and commercial, public uses, fire demand. Per capita consumption-factors affecting per capita demand, population forecasting, different methods with merits and demerits-variations in demand of water, estimation of fire demand using various formulas, peak factors, design period and factors governing the design periods

07 hours

UNIT-2

Sources, Collection and Conveyance of Water: Surface and

Subsurface sources-suitability with regard to quality and quantity. Intake structures-different types of intakes; factors for selection and location of intakes. Pumps-Necessity, types-Power of pumps; factors for the selection of a pump. Pipes-Design of the economical diameter of rising main; Nomograms-Use; Pipe appurtenances. **07Hours**

Unit 3

Quality of Water: Objectives of water quality management. Concept of safe water, Whole someness& palatability, water borne diseases. Examination of water: Objectives-physical, chemical, microbiological and radiological Examinations, (BIS 3025 and BIS 1622) using analytical and instrumental techniques. Drinking water standards BIS and WHO guidelines. Health significance of Fluoride, Nitrate and heavy metals like mercury, cadmium and Arsenic. Sampling water for examination **09 Hours**

Unit 4

Water Treatment methods: Objectives- Treatment flow-chart.

Aeration-Principles, types of Aerators.

Sedimentation: Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test, chemical feeding, flash mixing and clariflocculator. **08 Hours**

Unit5

Filtration and Disinfection; Mechanism-theory of Filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design-excluding under drainage system, back washing of filters. Operational problems in filters. Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV rays. Treatment of swimming pool water. **08Hours**

Water conservation and Management

Rain water harvesting, Roof top harvesting, Ground water recharge, check dams, works, Fluoridation and Deflouridation, bio-organic based water treatment techniques RO and membrane technique.

05 Hours

Activity:

1.Site Visit: Water Treatment plant, Rain water roof top harvesting site 2. Report and Presentation of water related issues in and around Bangalore or Karnataka state.

Text books:

1. Water supply Engineering-S.K.Garg ,Khanna Publishers, 2017
2. Water supply engineering-B.C.Punmia,Arihantpublicatoions,2017

Reference books :

1. Elements of Public health engineering-K.N.Duggal,S.Chand& Co
2. Manual of water supply and treatment-CPHEO publication
3. Water and Waste water Technology-Mark.J.Hammer,John wiley and sons.
4. Water supply and sewerage-E.W.Steel and T.J.Mc.Ghee,Mc.Graw hill publication

E learming:

1. https://nptel.ac.in/courses/105104102/
2. http://dasta.in/wp-content/uploads/2015/04/CB_Code_2002.pdf

SEE paper pattern:

Student shall answer FIVE full questions selecting one from each unit.
Unit 3 and Unit 5 has internal choice

	COURSE: Water supply Engineering Course Code: 19CV4PCWSE														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											2		
CO2	3	3	2											2	
CO3	3	3	2			1	1	1	2	1		2			2

Course Name	**Building Planning & Drawing**	Course Code	**19CV4PCBPD**	SEE Duration	SEE+CIE
Credits	**02**	L-T-P	**1:0:1**	**4 Hours**	**50+50**

COURSE OBJECTIVES:

To enable students to gain drafting knowledge, visualize the various components of a building and design a building. This will enable students to design and draw the various types of buildings based on the given functional requirements.

COURSE OUTCOMES:

CO1: Develop drawings from given line diagram.

CO2: Prepare drawings of various components of buildings.

CO3: Design and draw the various types of buildings as per requirements and develop drawings showing the interconnectivity of functional components of buildings along with service layouts.

Unit-1

INTRODUCTION: Scales, definition of various terms used in building drawings. Specifications for residential, office and public buildings. Building bye-laws of BDA and BBMP. The setback distances, calculation of carpet area, plinth area and floor area ratio. **DRAWINGS;** Development of plan, elevation, section and schedule of openings for the given line diagram of residential buildings such as;

i) Single bed room single story buildings,

ii) Two bed room single story buildings and

iii) Two storied buildings (Only for Practice)

8 hours

Unit- 2

BUILDING COMPONENTS; To prepare geometrical drawing of various component of buildings such as i) Stepped wall footings, ii) Isolated and combined RCC column footings, iii) RCC dog legged and open well stair cases, iv) Doors & windows (Fully paneled doors & glazed windows), v) King post and Queen post wooden trusses and vi) Steel truss.

4 hours

Unit- 3

DESIGN; Functional design of buildings using inter connectivity diagrams (bubble diagram), development of line diagram of residential buildings, public buildings such as Primary Health Centre, office buildings and school buildings.

SERVICES; Preparation of water supply, sanitary and electrical layouts for a given single line diagram.

4 hours

Text Books:

1. **"Building Drawing"**, by Shah M. H. And Kale C. M., Tata McGraw Hill Publishing Co. 2002

REFERENCE BOOKS:

1. **"A Course in Civil Engineering Drawing"**, by V. B. Sikka, S. K.Kataria & Sons.
2. **"Building Construction"**, Gurucharan Sing, Standard publication
3. **IS:962-** Code of practice for architecture and building drawing National Building code, BIS, New Delhi

Question Paper Pattern

Unit-1: one compulsory question of 60 marks.
Unit-2: one questions of 20 marks with internal choice.
Unit-3: one questions of 20 marks with internal choice.

	COURSE: Building Planning & Drawing CODE: 19CV4PCBPD														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	2	-	3	-	1	3	-	3
CO2	3	3	1	-	-	-	-	3	-	3	-	1	3	-	1
CO3	3	3	3	-	-	-	-	3	-	3	-	1	3	-	3

Course Name	**Project work -1**	Course Code	**19CV4PC PW1**	SEE+CIE	50+50
Credits	**02**	L-T-P (CREDITS)	**0:0:2**	**Contact hrs/ week**	**1**

Students are required to take up mini project work during IV semester as a team work. The list of team members will be notified by the Department.

Evaluation: Each batch shall prepare and submit a project report in prescribed format along with Presentations and viva.

Both CIE and SEE is conducted.

The topic is to be decided in consultation with the concerned faculty preferably related to courses already studied.

Student shall be evaluated for :

1) Inquisitiveness about the mini project; contribution and involvement in Team work.
2) Level of understanding the given Topic along with its application and significance in current scenario.
3) Presentation & communication skills.

IV Semester	Civil Engineering	2018 Admission batch onwards	
Course Code	**19NC4HSPDC**	**Course Name**	**Personality Development and Communication**
Credits	00	L-T-P	1-0-0
Contact Hours	01	CIE	50 Marks

Course Objectives:

1. To familiarize the students with personality and issues related to the same.
2. To equip them with better interpersonal and intrapersonal skills.
3. To improve their communication skills.
4. To improve their etiquettes to succeed in their profession

UNIT – I

Personality Development: Meaning, need, Introduction to personality, Definition and Determinates- Personality Traits – Ways of developing positive personality traits, Self – awareness, Habits – Ways of forming good habits. Self- discipline

Attitude: Definition, Components, Determinants and Types – Building and Types – Building and Maintaining PMA (Positive Mental Attitude).

Suggested Reading: Seven habits of highly effective people, By Stephen R Covey Suggested Activity 1: Assessment Test – Big Five Model (Sheet to be provided).

UNIT – 2

Self Esteem: Introduction, Definition and Types – Faces of low self – esteem – steps to improve low self –esteem. Self – Motivation: Definition – Ways of Building self – motivation. Leadership: Key Elements of Leadership – Types of Leaders, Traits of an effective leader. Teams: Difference between a team and a group – stages of Team development (The Five – Stage Model), Team effectiveness.

Suggested Activity 1: Lost at sea

Suggested Activity 2: Team building Exercise

UNIT – 3

Time Management: Benefits – Effective Time Management techniques.

Stress Management: Introduction – Understanding Stress – Stressors – Strategies to deal with Stress.

Suggested Activity: One-minute activities

UNIT-4

Communication: Introduction, Meaning, Types, Purpose and Definition – Communication Process (The Linear Concept, Shannon – Weaver Model) – 7Cs of Communication – Barriers to Effective Communication

Oral Communication: Principles of Successful oral Communication,
Written Communication: Purpose, Principles of effective writing, 3X3writing process Non-verbal Communication and Meta Communication

Suggested Activity 1: Distorted Message – Chinese Whisper, Cliff Hanger Suggested Activity 2: Silent role plays

UNIT- 5

Application of Oral and Written Communication, Negotiation Skills, Assertiveness, Presentation Skills, Impact of Technological Advancement on Business Communication, Workplace Communication: Business letter: Types, Layouts, Structure.
Reports: Purpose, Type, Structure.
Employment Communication: Resume and cover letter, Group Discussions and Employment Interviews

Suggested Activity 1: Extempore
Suggested Activity 2: Students are expected to write a one page resume – Block format letter.

Course outcomes: Ability to

1. Develop better people skills.
2. Improve their behavioural dimensions that have far reaching significance in the direction Of organizational effectiveness.
3. Improve the functional effectiveness through better communication skills.
4. Improve managerial capabilities through team building and group dynamics.

Text Books:

1. Business Communication – P. D Chaturvedi & Mukesh Chaturvedi, Pearson Education.
2. Personality Development – Harold R. Wallace – Ft. Collins Co Ph. D. Ann Masters, Harold R. Wallace. Ann Masters, Cengage Learning.

Reference Books:

1. The Skills of Communicating – Bill Scott – Jaico Books.
2. Writing, Speaking, Listening – Helen Wilkie – Jaico Books.

CIE PATTERN:

Final one test for 50 marks: 30 marks MCQ; 20 marks theory. (Online mode) Mandatory course. No SEE.

****

V SEMESTER
CIVIL ENGINEERING
SYLLABUS

AY 2020-21

(NEW SCHEME w.e.f AUG 2020)

Course Name	Design of RC structures and CAD	Course Code	20CV5PCDRC	SEE Duration	03 Hours
Credits	04	L-T-P Credits	2:1:1	Theory + LAB CIE	25 + 25 M
Contact Hours	36 Hrs	Lab Contact Hours	2 Hrs / week	CIE + SEE	50 + 50 M

COURSE OBJECTIVE:
To provide fundamental knowledge of concrete and steel reinforcement used for reinforced concrete design, Knowledge of design methodologies for different load conditions and to develop skill in computer aided drafting.

COURSE OUTCOMES: Students will develop the ability to	
CO1	Apply basic fundamental principles, procedures, Indian code design specifications, Strain compatibility equilibrium concepts to determine the strength of RC members
CO2	Design RC structural components as per IS Codal Specifications.
CO3	Prepare plan and elevation, drawings of various structural components and detailing using AUTOCAD.

Unit 1:

Introduction to Basic Design Concept: Introduction, Objectives of Design of Reinforced Concrete Structures, Methods of Design, Design Loads, codal provisions for concrete and reinforcements.
Philosophies of Design: Principles of Working stress method (no numerical examples)and limit state method, Stress block parameters for limit state of collapse for flexure, flexural strength of singly, doubly reinforced and flanged sections, related numerical problems. Concepts of bond strength, development length, anchorage and shear resistance.

06 Hrs.

Unit 2:

Design of Beams: Design philosophy, Practical requirements, Size of beam, cover to reinforcement, and spacing of bars. Design procedures for critical sections for bending moment, shear and torsion. Anchorages of bars and check for development length. Reinforcement requirements and Slenderness limits for beams to ensure lateral stability. Problems on simply supported, Cantilever and continuous beams (analysis using coefficients in IS 456), flanged sections. Serviceability.

07 Hrs.

Unit 3:

Design of Slabs: General consideration of design of slabs, Rectangular slabs spanning one direction, Rectangular slabs spanning in two directions for various boundary conditions. Design of cantilever slab, one way two way simply supported and continuous slabs.

Serviceability limit states: General aspects of serviceability, Deflection limit as in IS: code, Calculation of deflection (Theoretical method) cracking in structural concrete members, Calculation of deflections and crack width.

07 Hrs.

Unit 4:

Design of Columns: General aspects, cover, development length, Effective length of column, Loads on columns, Slenderness ratio for columns, Minimum eccentricity, additional moments due to eccentricity. Design of short columns under axial compression, Design of short columns under compression with uniaxial bending, Design of short and long columns under compression with biaxial bending. Using SP–16 charts. (Rectangular and circular sections only)

08 Hrs.

Unit 5:

Design of Footings: Introduction, load for footings. Design basis for limit state method, Design of isolated rectangular footing for axial load, axial load and uniaxial moment.

Design of Stair cases: General features, Types of stair case, loads on stair cases, effective span as per IS code provisions, Distribution of loading on stairs, Design of Open Well & Dog Legged Stair case

08 Hrs.

CAD Laboratory:

List of Experiments:

1	Prepare the drawings of building components of (i)Doors and Windows (Fully paneled door and Glazed window)
2	Drawing of Plan, Elevation, Section and schedule of openings of single bed room house, two bed room houses
To prepare detailed RCC structural component drawing and its specification of:	
3	Isolated RCC Column Footing
4	RC beam and Slabs
5	Stair Case (Dog legged)

Note: Question paper pattern:

1. Total 7 questions are to be framed of 20 marks each and students have to answer 5 full questions.
2. The choice of questions is to be given in unit 1 and unit 3 only.

TEXT BOOKS

1. Limit State design of reinforced concrete by PC Verghese, PHI-Learning Pvt. Ltd, New Delhi, 2nd edition (2012)
2. Reinforced Concrete Design – S. Unnikrishnan Pillai and Devadas Menon, tata McGrawHill Publishing Company Limited, New Delhi., 3rd edition 2009

REFERENCE BOOKS

1. Limit State design of reinforced concrete – BC Punmia, Ashok Kumar Jain and Arun Kumar Jain- Laxmi Publications, New Delhi
2. Reinforced concrete structures - Park and Paulay- John Wiley and sons, Singapore
3. Limit state design of reinforced concrete structures – P Dayaratnam, Oxford and IBH Publishing company Pvt ltd., New Delhi
4. Design of Reinforced concrete structures – N. Krishna Raju, CBS Publishers, New Delhi
5. "A Course in Civil Engineering Drawing", by V. B. Sikka, S. K.Kataria & Sons.
6. "Building Construction", Gurucharan Singh, Standard publication IS: 962- Code of practice for architecture and building drawing National Building code, BIS, New Delhi

CO-PO MAPPING SCALE 1 TO 3

COURSE : Design of RC structures and CAD								**CODE: 20CV5PCDRC**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3					3							
CO2	3	3	3					3							
CO3	3				3			1							

COURSE : Design of RC structures and CAD					**CODE: 20CV5PCDRC**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	**WASTE WATER TREATMENT**	**Course Code**	**20CV5PCWWT**	**SEE Duration**	3 hours
Credits	04	**L:T:P**	3:0:1	**Theory + lab CIE Marks**	25+25
Contact Hours	**36 Hrs**	**Lab Contact Hours**	**2 Hrs / week**	**CIE + SEE**	**50 + 50**

COURSE OBJCTIVES : To introduce to students the knowledge about waste water characteristics, their disposal, treatment methods and to design sewers

COURSE OUTCOMES: An ability to	
CO1	Describe strength of waste water and select appropriate treatment and disposal methods
CO2	Explain the concepts of sewage systems and design sewers
CO3	Describe and design various components of waste water treatment facilities

UNIT-1

Introduction: Necessity for sanitation, methods of domestic waste water disposal, types of sewage systems and their suitability. **2 hours**

Design of Sewers: Hydraulic formulae for velocity, effects of flow variations on velocity, selfcleansing and non-scouring velocities, design of hydraulic elements for circular sewers flowing full and flowing partially full. (No derivations) **4 hours**

UNIT-2

Materials of Sewers: Sewer materials and Types , shapes of sewers, laying of sewers, joints & testing of sewers, ventilation & cleaning of sewers, Methods of Plumbing works.

3 Hours

Sewer Appurtenance: Catch basins, manholes, flushing tanks, oil and grease traps, drainage traps. Basic principles of house drainage. Typical layout plan showing house drainage connections, maintenance of house drainage. **4 Hours**

UNIT-3

Waste Water Characteristics: Sampling, significance, techniques and frequency. Physical, chemical and biological characteristics, Aerobic and anaerobic activity, CNS cycles. BOD and COD. Their significance problems. **4 Hours**

Disposal of Effluents: Disposal of effluents by dilution, self-purification phenomenon. Oxygen sag curve, Zones of purification, sewage farming sewage sickness, effluent disposal standards for land, surface water & ocean. Numerical problems on disposal of effluents. Streeter Phelps equation. **5 hours**

UNIT-4

Treatment of Waste Water: Flow diagram of municipal waste water treatment plant.

Preliminary & primary treatment: Screening, grit chambers, skimming tanks, and primary sedimentation tanks, design criteria & design examples **5 Hours**

Secondary Treatment Suspended growth and fixed film bioprocess. Tricking filter–theory and operation, types and designs. Activated sludge process – principle and flow diagram, modifications of ASP, F/M ratio. Design of ASP. **5 Hours**

UNIT-5 Tertiary Treatment of Wastewater:

Fundamental Tertiary methods like Ion exchange, Membrane separation Techniques: Brief description of MF, UF, NF membranes. Reverse osmosis principle. **4 Hours**

NOTE: Study of In-House Treatment plant/ Site visit to sewage Treatment plant

List of Laboratory Experiments:

1. Determination of pH for the given sample
2. Determination of Turbidity for the given sample
3. Determination of Acidity for the given sample
4. Determination of Total Hardness for the given sample
5. Determination of Alkalinity for the given sample
6. Determination of Calcium and Magnesium hardness for the given sample
7. Determination of Dissolved oxygen for the given sample
8. Determination of Chlorides for the given sample
9. Determination of Sulphates for the given sample
10. Determination of Total solids, Suspended solids, dissolved solids and settleable solids for the given sample

Text Books:

1. Sewage disposal and air pollution engineering. S.K. Garg, Khanna publishers, 2015
2. Sewage disposal and engineering. B.C. Punmia, Arihant publications, 2016

Reference Books:

1. Water and waste water engineering vol-II: Fair, Geyer and Okun: John Willey Publishers, New York.
2. Waste water treatment, disposal and reuse: Metcalf and Eddy Inc: Tata McGraw Hill Publication
3. Manual on waste water treatment: CPHEEO, ministry of urban development, Delhi.
4. BIS code for Plumbing: https://law.resource.org/pub/in/bis/S03/is.sp.35.1987.pdf
5. BIS code for sewer materials https://law.resource.org/pub/in/bis/S03/is.1742.1983.pdf

Question paper pattern:

1. Unit III and Unit IV have internal choice
2. Unit I, Unit II, Unit V has one question each.

CO-PO MAPPING SCALE 1 TO 3

COURSE : WASTE WATER TREATMENT														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2							2						
CO2	3	2	2												
CO3	3	3	2			3	1		3		2				

COURSE : WASTE WATER TREATMENT					
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2	✓				
CO3	✓				

Course	Geotechnical Engineering-II	Course Code	20CV5PCGTE	SEE Duration	3 hours
Credits	03	**L:T:P**	2:1:0	**SEE+ CIE Marks**	50+50
Contact hours	24L +12 T	**CIE**	50 marks	**Lab**	Nil

COURSE OBJECTIVES: The course enables the students

- To apply basic concepts of soil mechanics for evaluating Consolidation characteristics, slope stability, bearing capacity of soils, stresses beneath loaded area, and lateral earth pressure on retaining walls
- To understand various methods of exploring the subsoil and carry out detailed geotechnical investigation in the field.

COURSE OUTCOMES: An ability to	
CO1	Compute consolidation and settlement characteristics of soils.
CO2	Determine lateral Earth pressure for safe design of retaining structures
CO3	Analyze stability of existing slopes and also design a slope for a desired factor of safety
CO4	Estimate the stress below any type of loaded area; Suggest suitable soil exploration technique/s, and interpret the results obtained.
CO5	Evaluate bearing capacity of soil to design a shallow foundation

UNIT-1 CONSOLIDATION OF SOILS:

Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations. Consolidation characteristics of soil (Cc, av, mv and cv), Time rate of consolidation, Numerical problems. Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by: Casagrande's method and log e–log p-method. Laboratory one dimensional consolidation test, determination of consolidation characteristics of soils: compression index, and coefficient of consolidation.

Determination of coefficient of consolidation by Taylor's square root of time (□-□t) fitting method, Casagrande's logarithmic of time (□-log t) fitting method, consolidation settlement, numerical problems.

4L+2T Hours

UNIT-2 LATERAL EARTH PRESSURE:
Introduction, retaining walls and its importance. Active and passive earth pressures, Earth pressure at rest, Earth pressure coefficient and their range. Safe depth of excavation without

lateral support, Numerical problems. Earth pressure theories- Rankine's and Coulomb's – assumptions and limitations, Graphical solutions for active earth pressure (cohesionless soil only) –Culmann's and Rebhann's methods, Lateral earth pressure in cohesive and cohesionless soils, Earth pressure distribution.

4L + 2T Hours

UNIT-3 STABILITY OF EARTH SLOPES:
Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of finite and infinite slopes- Method of slices. Friction Circle method, Fellenius method of locating centre of critical slip circle, Taylor's stability number, Numerical problems.

4L + 3T Hours

UNIT-4 SUBSURFACE EXPLORATION:
Importance of exploration program, Methods of exploration: Trial pits, Boring. Number and depth of borings for buildings and dams, Types of samples- undisturbed, disturbed and representative samples, Types of samplers, sample disturbance, Design features of a good sampler: area ratio, Recovery ratio, RQD, inside and outside clearance, Stabilization of boreholes – Typical boring log. Sounding tests – Standard penetration test and Cone penetration test, Geophysical methods-Electrical resistivity and Seismic refraction methods, Numerical problems. Typical soil exploration report. Modern Instruments and techniques (Ground Penetrating Radar)

4L +1T Hours

STRESSES IN SOILS:
Boussinesq's theory for concentrated, line loads, strip loads, circular and rectangular loading (No derivation of equations to be asked in the examination) Newmark's chart, concept of pressure bulb, significant depth. Approximate methods: Equivalent point load method and 2:1 distribution method, numerical problems. Westergaard's theory, Contact pressure.

4L + 2T Hours

UNIT-5 Bearing Capacity of soils: Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's bearing capacity equation-assumptions and limitations bearing capacity of footing subjected to vertical loading. Meyerhof's bearing capacity analysis, assumptions and limitations, determination of bearing capacity of footings of different shapes (no eccentric loads), Effect of ground water table on bearing capacity. Plate load test: graphical method and Housel method to determine bearing capacity. Modulus of subgrade reaction, definition and application. Types of settlement: immediate and consolidation settlement, numerical problems Correlation of Standard penetration test N-values and cone penetration resistance with bearing capacity of soil.

4L+ 3T Hours

Text book/Codes:

1. Punmia B.C., Jain A.K., and Jain A.K. (2019), 'Soil Mechanics and Foundation Engineering.", 17th Edition, Laxmi Publications Co., New Delhi.
2. Relevant B.I.S codes, ASTM and BS codes **Reference books:**
    1. Bowles J.E. (1996), "Foundation Analysis and Design" 5th Edition, McGraw Hill Pub. Co. New York.
    2. Braja M. Das (2018), "Principles of Geotechnical Engineering", 7th Edition, Cengage Learning.
    3. Craig R.F. (2004), "Soil Mechanics", 7th edition, Spon press, New York.
    4. Gopal Ranjan and Rao A.S.R. (2000), "Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.
    5. Terzaghi, K., Peck, R. B., & Mesri, G. (1996). Soil mechanics in engineering practice. John Wiley & Sons.

E-learning resources:

https://nptel.ac.in/courses/105/103/105103097/
https://nptel.ac.in/courses/105/105/105105176/
https://ocw.mit.edu/courses/civil-and-environmental-engineering/
http://www.myopencourses.com/subject/e-book-on-concepts-and-techniques-in-geotechnicaland-foundation-engineering

Note: SEE paper pattern:

Student shall answer FIVE full questions, selecting one from each unit.
UNIT 1 & UNIT 4 have internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE: GEOTECHNICAL ENGINEERING-II															**CODE: 20CV5PCGTE**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	2	-	-	-	-	2	-	-	-	2	-	-	3

COURSE: GEOTECHNICAL ENGINEERING-II					**CODE : 20CV5PCGTE**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓		
CO5	✓	✓	✓	✓	

Course	**TRANSPORTATION ENGINEERING - I**	**Course Code**	**20CV5PCTRE**	**SEE Duration**	3 hours
Credits	04	**L:T:P**	3:0:1	**Theory + Lab Marks**	25 +25 = 50
Contact hrs	36 hrs	**Lab marks**	25	**CIE+SEE**	50+50 =100

COURSE OBJECTIVES:

To provide knowledge of highway materials and methods for design and construction of highways

COURSE OUTCOMES: An ability to	
CO1	Identify and Prioritize highway proposals for road development
CO2	Fix the horizontal and vertical alignments of roads and design the elements.
CO3	Identify and test the properties of pavement materials.
CO4	Design and construction of flexible and rigid pavements.
CO5	Identify probable causes of distress of pavements and suggest remedial measures

UNIT-1

INTRODUCTION: Role of Transportation Engineering, Characteristics of Road Transport, Scope of highway engineering.

02 Hours

HIGHWAY PLANNING: Necessity of highway planning, Classification of Roads, Road patterns, Planning Surveys-Interpretation of Plans-Preparation of Master Plans-Phasing of plan, Lucknow Road Development Plan-Problems, Road Development Plan: Vision, Rural Road Development Plan: Vision.

04 Hours

HIGHWAY ALIGNMENT SURVEYS: Requirements and factors controlling alignment of roads - Engineering surveys for highway location

02 Hours

UNIT-2

HIGHWAY GEOMETRICS: - Pavement surface characteristics - Camber and width requirements - Sight distances - stopping and overtaking sight distances, overtaking zone requirements - Design of horizontal alignment -speed, radius, super elevation, methods of providing

super elevation, extra widening at curves, transition curves - Design of vertical alignment - gradient, grade compensation, summit curves and valley curves – No derivations, Numerical problems.
Introduction to Traffic Engineering: Definition, objectives and scope of Traffic Engineering, factors affecting road traffic; Concepts of passenger car units for mixed traffic flow.

08 Hours

UNIT-3

PAVEMENT MATERIALS AND DESIGN: Desirable properties and testing of highway materials: road aggregates, bituminous materials and subgrade soil; Factors influencing the design of pavements - Design of flexible and rigid pavements - IRC guidelines; Introduction to Mechanistic Empirical Pavement Design. Numerical Problems on design of flexible and rigid pavements **07 Hours**

UNIT-4

HIGHWAY CONSTRUCTION: Historical development of road construction - Construction of earth roads, WBM roads, WMM roads,stabilized roads (CTB & CTSB), bituminous pavements, cement concrete roads and joints in cement concrete roads

06 Hours

UNIT-5

HIGHWAY MAINTENANCE - Types and causes of distresses in flexible & rigid pavements – Remedial measures. Highway drainage – Object & Requirements - Surface and Sub-Surface Drainage - Design of Surface Drainage System-Problems.

03Hours

HIGHWAY ECONOMICS AND FINANCE: Introduction to Highway user benefits, Economic Analysis and Highway Finance in India-A Case Study.

04Hours

LABORATORY EXPERIMENTS/EXERCISES

1. **Tests on Sub grade Soil:**
    a. Compaction Test
    b. California Bearing Ratio Test

2. **Tests on Road Aggregates:**
    a. Aggregate Impact Test
    b. Los Angeles Abrasion Test
    c. Aggregate Crushing Value Test
    d. Specific Gravity Test and Water Absorption Test
    e. Shape Tests
        i. Flakiness Index
        ii. Elongation Index
        iii. Angularity Number
3. **Tests on Bituminous Materials:**
    a. Penetration Test

b. Ductility Test
c. Softening Point Test
d. Specific Gravity Test
e. Viscosity Test
f. Flash and Fire Point Test

4. Tests on Bituminous Mixes

a. Marshall Stability Test

Text books:

1. Khanna, S.K.,and Justo, C.E.G., Highway Engineering, Nemchandand Bros, 2015, Roorkee.
2. Kadiyali, L.R.,andLal, N.B., Principles and Practices of Highway Engineering, Khanna Publishers, 2013.
3. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Materials and Pavement Testing", Revised 5th Edition, Nem Chand and Bros, Roorkee, 2013.

Reference books:

1. O' Flaherty, C.A., Highway-Traffic Planning and Engineering, Edward Arnold., 1986 2. Yoder and Witczak, Principles of Pavement Design, John Wiley and Sons, 1975
3. IRC: 37, Guidelines for the Design of Flexible Pavements.
4. IRC: 58, Guidelines for the Design of Rigid Pavements.
5. IRC:15, Standard Specifications and Code of Practice for Construction of Concrete Roads
6. Ministry of Road Transport and Highways Specifications for Roads and Bridges.
7. David Croney, The Design and Performance of Road Pavements, McGraw Hill, 1997
8. Paul H. Wright and Karen Dixon, Highway Engineering, Wiley, 2003

E-learning resources:

http://nptel.ac.in/courses

Note: SEE paper pattern:

Student shall answer FIVE full questions, selecting one from each unit.
UNIT (2) & unit (3) has internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE: TRANSPORTATION ENGINEERING - I CODE: 20CV5PCTRE														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**3**											3		
CO2	**3**	**3**	**2**					**1**					3		
CO3	**3**	**3**		**2**		**1**		**1**					3		
CO4	**3**	**2**						**1**					3		
CO5	**3**	**3**				**1**	**1**						3		

COURSE: TRANSPORTATION ENGINEERING - I CODE: 20CV5PCTRE					
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓		✓	✓	
CO3	✓				
CO4	✓	✓	✓	✓	
CO5	✓	✓			

Course	**Indeterminate Structural Analysis**	**Course code**	**20CV5PCISA**	**SEE Duration**	3hours
Credits	**03**	**L:T:P**	**2:1:0**	**SEE+ CIE Marks**	50+50
Contact hrs	**24L + 12T**	**CIE**	**50 marks**	**Lab**	Nil

COURSE OBJCTIVE:

The present course enables students to analyze statically indeterminate structures from the knowledge of fundamentals and basic concepts of structural analysis.

COURSE OUTCOMES: An ability to	
CO1	Develop relevant equations for displacement method and apply the same for analysis on structures for different loading and boundary conditions
CO2	Develop conditions for force method and apply the same for analysis on structures with different load and boundary conditions.
CO3	Analyze indeterminate structures using principles of strain energy.
CO4	Analyze determinate beams, indeterminate beams and plane pin jointed trusses using influence lines.

UNIT-1

SLOPE DEFLECTION METHOD: Fixed beam, Fixed end moment for point load, udl and support sinking (No problems).Introduction, development of slope-deflection equations, analysis of beams, with and without support sinking, orthogonal rigid plane frames (non-sway and sway) with kinematic redundancy up to three, non-orthogonal rigid plane frames. (Members to be axially rigid).

8 Hours

UNIT-2 MOMENT DISTRIBUTION METHOD:

Introduction, Distribution factor, Carry over factor. Development of method. Analysis of beams orthogonal rigid plane frames with and without sway with degree of redundancy up to three, Non-orthogonal rigid frames (members to be axially rigid)

8 Hours

UNIT-3

KANI'S METHOD OF MOMENT DISTRITBUTION:

Introduction to the method, basic concepts (rotation factor, carry over factor, displacement factor), analysis of continuous beams with and without support sinking, analysis of symmetrical portal frames (sway and non-sway), multistory frames without sway.

8 Hours

UNIT-4 STRAIN ENERGY METHOD:

Castigliano's second theorem, analysis of two hinged parabolic arch, continuous beams and rigid frames with redundancy not exceeding two. Analysis of internally and externally redundant plane trusses.

6 Hours

UNIT-5 MOVING LOADS AND INFLUENCE LINES:

Load and Influence Lines: moving load analysis for simply supported beams for several point loads and UDL. Influence line diagram for reaction, SF and BM at a given section for the cases mentioned above, use of influence line diagrams for analysis of plane trusses and Muller- Breslaw principle, influence line diagram for reaction, SF and BM in continuous beams.

6 Hours

Text books:

1. "Basic Structural Analysis", by C.S Reddy, Third Edition, Tata McGraw Hill Publication Company Ltd. 2010
2. "Theory of Structures Vol. 2", by S.P. Gupta, G.S. Pandit and R. Gupta, I Edition, Tata McGraw Hill Publication Company Ltd. 1999

Reference books

1. J. Sterling, Kinney "Indeterminate Structural Analysis", Addison – Wesley publishers
2. Noris C.H., Wilbur J.B., "Elementary Structural Analysis", Mc Graw Hill International Book Edition.
3. C.K.Wang, "Intermediate Structural Analysis", Mc Graw Hill Publications.
4. V.N Vazirani & M.M Ratwani, '' Analysis of Structures, VOL II, Khanna Publishers, Delhi.
5. Ashok k Jain, "Advanced Structural Analysis", Nem Chand & Bros, Roorkee, India. **E-resource**: nptel.ac.in/courses/105101086/-NPTEL **Note: SEE paper pattern:**

Student shall answer FIVE full questions, selecting one from each unit. Unit 4 & Unit 5 have internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE: Indeterminate Structural Analysis CODE: 20CV5PCISA														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	-	
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	-	

COURSE: Indeterminate Structural Analysis					**CODE: 20CV5PCISA**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		
CO4	✓	✓	✓		

HSS COURSES

Course	Management & Entrepreneurship	Course code	20CV5HSMAE	SEE Duration	3hours
Credits	02	L:T:P	2:0:0	SEE+ CIE Marks	50+50
Contact hrs	24L	CIE	50 marks	Lab	Nil

COURSE OBJCTIVE:
To prepare students with broad understanding of business as well as more focused learning in key management areas. The course also equips the students to think like entrepreneurs

COURSE OUTCOMES: An ability to	
CO1	Discuss the importance of management and its approaches.
CO2	Explain the various features and environment of management process
CO3	Summarize types, characteristics, schemes, and policies of entrepreneurship
CO4	State various funding support available to entrepreneurs

UNIT-1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Evolution of Management Thought. Management as a science or art of profession. Scope and functional areas of management.

5 Hours

UNIT-2

Functional areas of Management: **Planning -** Nature, Planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization – Types of organization - Depart mentation - Committees – Centralization Vs. Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing.

5Hours

UNIT-3

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Communication - Meaning and importance –Coordination, meaning and importance and Techniques of Co -ordination. Meaning and steps in controlling - Essentials of a sound control system.

5 Hours

UNIT-4

ENTREPRENEUR: Entrepreneurship- definition. Types of Entrepreneur, Intrapreneur. Growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry

5 Hours

UNIT-5

LAWS CONCERNING ENTREPRENEUR: partnership laws, business ownership, sales and income taxes and workman compensation act. 5 Role of various national and state agencies which render assistance to small scale industries.

6 Hours

RECOMMENDED BOOKS:

1. Principles of Management – P.C. Tripathi, P.N. Reddy – Tata McGraw Hill, 2007.
2. Dynamics of Entrepreneurial Development & Management – Vasant Desai:, Himalaya Publishing House, 2007.
3. Management Fundamentals Concepts, Application, Skill Development – Robert Lusier – Thompson, 2007.

REFERENCE BOOKS:

1. Entrepreneurship Development – Poornima M Charanthimath Pearson Education 2006.
2. Entrepreneurship and management - Shashi k Gupta- Kalyani publishers, Latest edition.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Management & Entrepreneurship										**CODE: 20CV5HSMAE**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3

COURSE: Management & Entrepreneurship					**CODE: 20CV5HSMAE**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓	✓		
CO4	✓	✓	✓		

Course	**Basics of Marketing & Sales**	**Course code**	**20CV5HSBMS**	**SEE Duration**	3hours
Credits	**02**	**L:T:P**	**2:0:0**	**SEE+ CIE Marks**	50+50
Contact hrs	**24**	**CIE**	**50 marks**	**Lab**	Nil

COURSE OBJCTIVE:
To prepare students with basic knowledge in Marketing and Sales

COURSE OUTCOMES: An ability to	
CO1	Outline the basic principles of marketing and sales
CO2	Discuss strategies and types of marketing and pricing of new products
CO3	Explain concepts of sales management and role of sales manager
CO4	Demonstrate knowledge of online marketing with relevant case studies

UNIT-1

Introduction to Marketing: Definitions of market, marketing, Marketing Management Orientation- production, product, selling, marketing and societal marketing, marketing environment, marketing research.

5 Hours

UNIT-2

Customer driven Marketing strategy& mix: Market Segmentation- bases, Market targeting- strategies, Positioning, basics of Marketing mix – product- levels, Individual product and service decisions, price- broad categories of new product pricing, place- channel member tasks and channel levels, promotions- the promotion mix.

7 Hours

UNIT-3

Introduction to sales Management: Meaning, Importance, Personal selling, Trends in Sales management**,** qualities and responsibilities of a sales manager, selling skills, selling process.

6 Hours

UNIT-4

Online Marketing & Selling on the Internet: Marketing and the Internet, Online Marketing Domains, Online Marketing Presence, internet based selling- Internet trading in India

6 Hours

UNIT-5

Case studies: Case studies pertaining to Indian and global contest

2 Hours

TEXT BOOKS

1. Marketing Management: A South Asian Perspective, Kotler , Keller, Koshy & Jha, 13/e, , 2012, Pearson.

2. Sales Management, Tapan Panda & Sunil Sachdev, 6/e, 2003, Oxford University Press.

REFERENCE BOOKS:

1) Marketing Management: A Strategic Decision Making Approach, RamaswamiNamakumari, 5/e, 2013, McGrawHill Education

2) Marketing, Etzel, Stanton, Walker&Pandit, 14/e, 2009, McGraw Hill Education

3) Principles of Marketing Management, Kotler, Armstrong, Agnihotri, Haque, 13/e, 2010, Pearson

4) Sales Management: Teamwork, Leadership and Technology, Charles, Futurell, 6/e, 2001, Thomson South Western

5) Sales & Distribution Management, Havaldar and Cavale, 2/e, 2011, McGraw Hill Education **SEE paper pattern:**

Student shall answer FIVE full questions, selecting one from each unit.

Unit 1 & Unit 3 HAVE INTERNAL CHOICE.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Basics of Marketing and Sales										**CODE: 20CV5HSBMS**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3

COURSE : Basics of Marketing and Sales	**CODE : 20CV5HSBMS**				
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓	✓		
CO4	✓	✓	✓		

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	**Economics for Engineers**	**Course code**	**20CV5HSEFE**	**SEE Duration**	3hours
Credits	**02**	**L:T:P**	**2:0:0**	**SEE+ CIE Marks**	50+50
Contact hrs	**24**	**CIE**	**50 marks**	**Lab**	Nil

COURSE OBJCTIVE:
To familiarize students with of the basic concepts of economics, understand and apply them in the Civil Engineering profession.

COURSE OUTCOMES: Students will develop the ability to	
CO1	Comprehend basic principles of Economics in Engineering
CO2	Understand the fundamental concepts of supply and demand and apply them for functioning of a firm and industry in civil engineering
CO3	Perform cost and production analysis, assess profits, calculate BEP and Payback period for decision-making
CO4	Discuss concepts of macroeconomics and identify indicators to evaluate the economics in construction industry

Unit 1

Introduction to Economics: Economics – Meaning, Nature, Scope and Significance, Micro and Macro Economics, the three problems of Economic Organization.

4 Hrs

Unit 2

Fundamental Concepts, Supply and Demand: Opportunity Cost, Equi-Marginal Principle, Time perspective, Incremental Concept, Time Value of Money, The Demand Schedule, Supply, Equilibrium, Law of Demand, Elasticity of Demand, Law of Supply, Factors Affecting Demand and Supply.

6 Hrs

Unit 3

Cost Analysis: Concepts, Types of cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve.

4 Hrs

Unit 4

Production Function: Production Concepts, production function with one variable input - Law of Variable Proportions. Production functions with 2 variable inputs and Laws of returns to scale, Indifference Curves, ISO-Quants & ISO-Cost line, Economies of scale, Diseconomies of scale. Break Even Analysis – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions.

6 Hrs

Unit 5

Macro Economics and Economic growth: Concepts, Aggregate Demand and Supply, Measuring Economy, GDP, Money Supply, Interest Rates, Consumption, Savings, Investment, Business Cycles, phases. Population Growth and Development, Unemployment.

6 Hrs

TEXT BOOKS

1. Economics, Samuelson and Nordhaus, 19th edition, 2010, McGraw Hill Education – India
2. Indian Economy, Datt and Mahajan, 64th revised edition, 2012, S.Chand

REFERENCE BOOKS:

1. Principles of Economics, Mankiw Gregory N., 2002, Thompson Asia
2. Managerial Economics, V. Mote, S. Paul, G. Gupta, 2004, Tata McGraw Hill
3. Indian Economy, Misra, S.K. and Puri, 2009, Himalaya
4. Textbook of Business Economics, Pareek Saroj, 2003, Sunrise Publishers

Note: Question Paper Scheme

- Students will have to answer 5 questions for 100 marks.
- Questions to be framed from all 5 units. Units 2 and 4 to have internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE: **Economics for Engineers** CODE: **20CV5HSEFE**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1											2				
CO2											3				
CO3											3				
CO4							2								

COURSE: Economics for Engineers			**CODE: 20CV5HSEFE**		
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	

V SEMESTER DEPARTMENT ELECTIVES

Course	**Advance Concrete Technology**	**Course Code**	**20CV5PEACT**	**SEE Duration**	3 hrs
Credits	3	**L-T-P**	3:0:0	**SEE + CIE**	50+50
Contact Hours	36 hrs	**CIE**	50 marks	**LAB**	Nil

COURSE OBJECTIVES: To introduce to students the

- Convention Concrete and its relevance to the present construction challenges, Concrete with composite cements and waste materials.
- Need for Self-compacting Concrete, Mix design, important properties compared with conventional concrete, Rheological properties of Concrete.
- To study the Fiber Reinforced Concrete, Light weight Concrete, High Density concrete & Geo polymer concrete

COURSE OUTCOMES: Students will develop the ability to	
CO1	Explain conventional concrete and their constituents
CO2	Analyze different types of special concretes and mix design procedures

UNIT-1

Conventional Concrete to Advanced concrete: Brief Introduction of Concrete including composite cement and properties, Ready mixed concrete concrete-Quality aspects. Sustainable Materials in Concrete: Introduction to waste material including construction and demolition waste, glass, plastic, rubber and recycled concrete. Requirement of concrete for pumping.

6 hrs

UNIT-2

Self-Compacting Concrete: Brief history of development, Definition, Fresh property requirements, Tests as per EFNARC and ASTM, Mix design procedures, Comparison of hardened properties with conventional concrete, Applications, Economical aspects

Rheology of Concrete: Introduction, Factors affecting the rheology of fresh concrete, constitute equation for measuring the rheological properties and the measuring instruments. **8hrs**

UNIT-3

Fiber Reinforced Concrete: Fibers, types, characteristics, Fiber distribution, orientation and interfacial bond. Mechanical properties of FRC mix design of FRC, behavior of hardened FRC under compression, tension flexure and impact, SIFCON, Ductal Concrete.

8hrs

UNIT-4

High Performance Concretes: Concept, materials selection, mineral admixture, proportioning, strength, and durability aspects, Construction & economic Aspects, codal provisions, Applications and their performance. Light Weight and High-Density Concrete: Definition, Proportioning, Properties and Applications. **8hrs**

UNIT-5
Geo-polymer Concrete: Brief history of development, Definition, Reaction chemistry, material characterization, mixes proportioning, properties and applications. **6 hrs**

Reference Books:

1. Fiber Reinforced cement composites, by Perumalsamy.N Balaguru and surendra P.Shah, McGraw Hill International edition, Civil Engineering series.
2. Concrete technology and Design-vol.1& 2: New concrete materials by R N swamy.
3. Self-Compacting Concrete by Geert De Schutter, Peter J.M.Bartos and Peter Domone, Whittles Publishing.
4. Current Literatures
5. Concrete Technology by Dr. Aminul Islam Laskar, University Science Press.
6. Advanced Concrete Technology –Process by John Newman and Ban Seng Choo, ISBN 0 7506 5105 9, Elsevier Ltd.
7. Properties of Concrete, A.M.Neville, Pearson Education (Singapore) Pte. Ltd.,
8. Concrete Microstructure, Properties, and Materials, by P.Kumar Mehta and Paulo J.M.Monteiro.

E-learning resources: http://nptel.ac.in/courses

SEE paper pattern:

Student shall answer FIVE full questions, selecting one from each unit.

UNIT 2 & **UNIT 4** have internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Advance concrete technology															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	1	3	-	1	2	2	1	1	2	2	2	-	-	2

COURSE : Advance concrete technology					
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓	✓	✓	

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	Air Pollution	Course Code	20CV5PEAPL	SEE Duration	3 hours
Credits	3	**L-T-P**	3:0:0	**SEE + CIE**	50+50
Contact Hours	36 hrs	**CIE**	50 marks	**LAB**	Nil

COURSE OBJCTIVES : To introduce to students the

 characteristics and effects of air and noise pollution
The methods of controlling air pollution.
 Inventory and control mechanism.

COURSE OUTCOMES: An ability to	
CO1	Classify and analyze different types of air pollutants , explain their dispersion and effects on environment
CO2	Analyze particulates control by different methods
CO3	Explain air quality management, relevant standards and regulations
CO4	Discuss causes, effects and control of noise pollution

UNIT-1

SOURCES AND EFFECTS OF AIR POLLUTANTS

Classification of air pollutants – Particulates and gaseous pollutants –Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles, numerical problems **8 Hours**

UNIT-2

DISPERSION OF POLLUTANTS

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate- Atmospheric stability and turbulence – Plume rise – Dispersion models – Applications **8 Hours**

UNIT-3

AIR POLLUTION CONTROL

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries, Numerical problems. **8 Hours**

UNIT-4

AIR QUALITY MANAGEMENT

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

8 Hours

UNIT-5

Atmospheric quality analysis and prediction

Continuity and Energy Equation: Derivation of generalized continuity equation for compressible fluid (air) and constituents (gas, particle) suspended in a compressible fluid, examples of wind driven circulation, thermodynamic energy equation; Momentum equation: Co-ordinate transformation

8 Hours.

Site visits

Text Books

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2015
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 2015
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 2015

REFERENCES

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New York, 2015
2. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 2015
3. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi,2015.
4. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi.

SEE paper pattern:

1. Unit IV and Unit V have internal choice
2. Unit I, Unit II, Unit III has one question each.

CO-PO MAPPING SCALE 1 TO 3

COURSE: **Air Pollution** CODE: **20CV5PEAPL**															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	-	
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	-	

COURSE: Air Pollution **CODE: 20CV5PEAPL**					
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		
CO4	✓	✓	✓		

Course Name	Disaster Management and mitigation	Course Code	20CV5PEDMM	SEE Duration	3 hours
Credits	**03**	**L-T-P**	**3:0:0**	**CIE+SEE marks**	**50+50**
Contact Hours	36 hrs	**CIE**	50 marks	**LAB**	Nil

Course objective:
The objective of the course is to make the students learn basic concepts of disaster management, planning, mitigation and its importance in current scenario.

COURSE OUTCOMES: Students will develop the ability to	
CO1	Classify types of disasters; explain causes of disasters, and concepts of disaster management.
CO2	Describe various components of disaster management cycle
CO3	Explain disaster management policy & Acts
CO4	Discuss environmental issues and challenges faced

Unit-1

Introduction to disaster management: Concepts of disaster, Definition of terms- Hazard, vulnerability, risk, capacity, mitigation, prevention, Risk management, capacity building; Impacts of disaster- ecological, physical, social effects, Disaster Management- objectives and components, Hazard-Vulnerability analysis, identification of crisis situation.

Type of Disaster Classification: Based on i) Levels of disaster, ii) Approaches to disaster management ,iii) General:-Natural and man-made disasters, iv)HPC classification, v) classification based on disaster management information system- DesInventar**;** Agencies for overall coordination of Disaster Management in India.

3 hours

Unit-2

Characteristics, causes and general measures for disasters:
Natural disasters:
Causes, characteristics, general measures and challenges - Floods, landslides, forest fire, cyclone and tsunamis, Earth quake, drought, volcanoes, soil erosion. **Manmade disasters**:
Causes, characteristics, counter measures, prevention and management of – chemical or Industrial hazards, nuclear hazard, soil degradation, biological disasters, Traffic accidents, Fire hazards. Urban flooding. **10 hours**

Unit -3

Disaster management cycle: Components of DM, organizational structure of disaster management agencies in India,

Disaster preparedness*:* Introduction Principles, mapping, zoning, organization setup for managing disasters in India, Team building, community relations, warning systems.

Disaster mitigation: Introduction, measures, structural and non- structural measures, Mitigation measures adopted for --Flood, landslide, Earth quake, epidemic, Environmental Management Plan, Risk analysis: Qualitative and quantitative Methods, Tools.

Disaster Response & Recovery: Objectives, control process, evacuation, firstaid, restoring essential service, search and rescue, ICT, Different stages of recovery, systematic frame work for planning recovery, capacity building for reconstruction and rehabilitation, compensation.

10 hours

Unit-4

Disaster management in India: Disaster profile of India – floods, draughts, cyclone, earthquake, tsunami, landslide. Disaster Management Act 2005, National Policy, Environmental Acts, guidelines, Role and responsibilities of local, state bodies, Agencies, stakeholders, media.

7hours

Unit -5

Environmental Issues and Challenges in Disaster Management:

Environmental Issues: Global warming: Kyoto protocol; Greenhouse effect, Ozone layer depletion -Earth summit, environmental Degradation- land and pollution

Challenges**:** Education, research, Public awareness, public health system, Training, charting hazard map, community building, ethics and culture issue; International efforts on environmental protection.

6hours

TEXT BOOKS

1. S.C. Sharma,“ Disaster Management” Khanna book publishing co;, (2018, reprint 2019) ISBN 978-93-86173-38-6
2. Dr. Mrinalini Pandey, “Disaster management”, Wiley India pvt, (2014, reprint 2016)
3. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN- 10:9380386427 ISBN13:978-9380386423
4. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN -10:1259007367, ISBN 13:978-1259007361]

REFERENCES

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.
3. Various e-learning, www.ndmaindia.nic.in
4. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
5. Kapur Anu, "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.
6. Pradeep sahni, Alka Dhameja, Uma Medury, "Disaster mitigation experiences and reflection", PHI
7. Nick Carter.W, "Disaster management, Handbook", ADB,2008, Phillipines.

NOTE: SEE paper pattern: Answer Total five full questions.
Internal choice: UNIT 2 & UNIT 3

CO-PO MAPPING SCALE 1 TO 3

COURSE: Disaster Management and mitigation												**CODE: 20CV5PEDMM**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO1**	**PSO2**	**PSO3**
CO1	3	2											1		
CO2	3	2											1		
CO3	3	2									2	3	1		
CO4	3	2					3					3	1		

COURSE: Disaster Management and mitigation					**CODE: 20CV5PEDMM**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		
CO4	✓	✓	✓		

Course Name	Alternate Building Materials	Course Code	20CV5PEABM	SEE Duration	3 hours
Credits	**03**	**L-T-P**	**3:0:0**	**CIE+SEE marks**	**50+50**
Contact Hours	36 hrs	**CIE**	50 marks	**LAB**	Nil

Course objective:
To introduce the students to the concept of sustainable buildings using alternative building materials and technologies

COURSE OUTCOMES: Students will develop the ability to	
CO1	Quantify embodied energy of various building components
CO2	Reckon the engineering properties of a variety of alternative building materials and technologies for a variety of components and compare the relative advantages
CO3	Propose sustainable materials and technologies for different components of a building and substantiate the same

Unit I

Energy and materials: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Concepts of Sustainable materials and building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture, Green building ratings – IGBC and LEED manuals

8 hours

Unit II

Alternative technologies load-bearing walls: Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks: mud blocks, steam cured blocks, Fal-G Blocks, stone masonry block, Equipment used for production of stabilized blocks, monolithic walls

8 hours

Unit III

Use of agro based materials, industrial by-products and manufactured aggregates: Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications, Different materials used as alternatives such as C&D waste, Crumb Rubber, Fibre Reinforced Polymer, Crushed stone aggregates (manufactured aggregates), Lime-pozzolana cements- Raw materials, Manufacturing process, Properties and uses

8 hours

Unit IV

Ferrocement, Micro-concrete (Ferroconcrete) and Fibre reinforced concrete: Properties, Ferrocement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications

Fibre Reinforced Concrete - Matrix materials, Fibers: metal and synthetic, Properties and applications, Fibre reinforced plastics, Matrix materials, Fibers: organic and synthetic, Properties and applications

8 hours

Unit V

Alternative materials and technology for roofing: Rigid roofs and flexible joint floors/roofs, membrane type roofs, alternatives to sloped roof and pitched roofs, flat roofs and floors - concepts of composite T-beam roof, Jack-arch roof, filler slabs, ribbed and channelled roof, corrugated roof, domes, vaults, pre-cast technologies, Masonry vaults and domes

8 hours

Text book:

1. "Alternative Building Materials and Technologies", KS Jagadish, BV Venkatarama Reddy and KS Nanjunda Rao, New Age International publications 2014

Reference books:

1. Sustainable Building Technologies", Edited by Jagadish KS, IK International Publishing and BMTPC, New Delhi
2. "Building materials in Developing Countries", RJS Spence and DJ Cook, Wiley pub. 1983
3. IGBC and GRIHA green building manuals **Question paper pattern:**

Answer any five full questions, at least one from each unit with internal choice in any two units.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Alternate building materials and technology CODE: 20CV5PEABM

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**3**	2	-	-	3	3	-	-	-	-		**2**	-	
CO2	**3**	**3**	2	-	-	-	-	-	-	-	-		**2**	-	
CO3	**3**	**3**	2	-		3	3	-	-	-	-		**2**	-	

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course Name	**Theory of Elasticity**	Course Code	**20CV5PETOE**	**SEE Duration**	**3 hours**
Credits	**03**	**L-T-P**	**3:0:0**	**CIE+SEE marks**	**50+50**
Contact Hours	36 hrs	**CIE**	50 marks	**LAB**	Nil

Course objective: This course will enable students to

1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials in to more general, two and three-dimensional problems.
2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
3. Introduction to the stress–strain relationship, basic principles and mathematical expressions involved in continuum mechanics. Solution for 2D linear elasticity problems and help students to take Finite Element Analysis.

COURSE OUTCOMES: Students will develop the ability to	
CO1	Apply knowledge of mechanics and mathematics to model elastic bodies as continuum
CO2	Formulate boundary value problems; and calculate stresses and strains
CO3	Comprehend constitutive relations for elastic solids and compatibility constraints.
CO4	Solve two-dimensional problems (plane stress and plane strain) using the concept of stress function

Unit I

Analysis of Stress: Rigid and deformable bodies, body and surface forces, concepts of stress at a point and stress tensors, Equilibrium equations, Cauchey's stress formula, stress transformation, principal stresses and principal planes, stress invariants, Maximum Shear stresses and their planes (3D problems), Octahedral stress, Hydrostatic and Deviatoric stress tensors, Numerical problems. **8 hours**

UNIT II

Analysis of Strain: Concepts of strain at a point and strain tensor, Transformation of strains, strain invariants, Principal strains, Maximum strains and their planes, Octahedral strains, Compatibility equations, Strain Rosettes, Numerical problems. **7 Hours**

UNIT III

Constitutive Equations: Generalized Hooke's Law, Constitutive Laws, Relationships between Elastic Moduli, Stress – Strain relations, Strain – Displacement relations, Plane-stress and Planestrain conditions, Numerical problems.

7 Hours

UNIT IV

Two-Dimensional classical elasticity Problems: Compatibility equations in terms of stresses, Airy's stress function, Stress function for Plane-stress and Plane-strain cases, Investigation of Airy's stress function for simple beams by the use of polynomials, bending of a narrow cantilever beam of rectangular cross section under edge load, Bending of simply supported beam under UDL.

7 Hours

UNIT V

Axisymmetric stress distribution: Axisymmetric stress distribution - Rotating discs, Lame's equation for thick cylinder, Thick-walled cylinder subjected to internal and external pressures, Numerical Problems. Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

10 Hours

NOTE: There will be 5 full questions from each unit and students will have the choice in questions only from unit-5.

REFERENCE BOOKS:

1. Theory of Elasticity – Timoshenko & Goodier – McGraw Hill
2. Theory of Elasticity – Sadhu Singh – Khanna Publishers
3. Applied Stress Analysis – Sadhu Singh – Khanna Publishers
4. Applied Elasticity – Sitharam T.G and Govindaraju – Interline Publishers

CO-PO MAPPING SCALE 1 TO 3

COURSE: Theory of Elasticity													**CODE: 20CV5PETOE**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	12	**PSO1**	**PSO2**	**PSO3**
CO1	3	2		1											
CO2	3	3	1	1											
CO3	3	3	1	1											

COURSE: Theory of Elasticity					**CODE: 20CV6PEDMM**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		

Course	**Project work- 2**	**Course Code**	**20CV5PCPW2**	**CIE + SEE**	**50 + 50**
Credits	02	**L:T:P**	**0:0:2**		

- Students shall take up mini project work mandatorily in V semester as a team work.
- Some recommended areas that may be selected are:
  1. Design and drawing of various types of buildings (Drafting)
  2. Geotechnical engineering related projects.
  3. Hydraulics related projects
  4. Any other related projects apart from those mentioned above.
- Evaluation: Students are expected to prepare a project report in prescribed format and attend evaluation by viva voce.
- The topic is to be decided in consultation with the concerned faculty.

****

VI SEMESTER
CIVIL ENGINEERING
SYLLABUS

AY 2020-21

w.e.f Jan 2021 11-8-2020

Course	**Design of Steel Structural Elements & Software Applications Lab**	**Course Code**	**20CV6PCDSS**	**SEE Duration**	**3 Hours**
Credits	**04**	**L:T:P**	**2:1:1**	**Theory + LAB CIE**	**25 + 25 M**
Contact Hours	**36 Hrs**	**Lab Contact Hours**	**2 Hrs / week**	**CIE + SEE**	**50 + 50 M**

COURSE OBJECTIVES:
To teach the students, the method of design of various steel structural members and their connections.

COURSE OUTCOMES: An ability to

CO1: Understand steel structures and limit state design.
CO2: Analyze and design structural steel bolted and welded joints.
CO3: Analyze and design structural steel members subjected to tension, compression and bending.
CO4: Utilize commercial software packages to simulate practical problems.
CO5: Ability to develop computational code by using MATLAB.

UNIT -1

Introduction: Structural systems. Mechanical properties of steel. Various uses of steel in civil engineering. Advantages and disadvantages of steel structures. various loads and their combinations. Design considerations, Limit state method of design, failure criterion of steel, codes of steel, rolled structural steel sections and specifications. Elastic modulus, Partial safety factors, load factor, working loads and ultimate loads. **04 Hours**

UNIT – 2

Bolted Connections: Introduction. Terms used in bolted connections. Types of bolted connections. Behavior of bolted joints, Design of axially loaded joints with ordinary black bolts and High strength Friction Grip (HSFG) bolts. Design of eccentric bolted connections (type1 and type2).

06 Hours

Welded Connections: Introduction, Welding process, Advantages of welding, Types and properties of welds, Types of welded joints, Weld specifications, Effective areas of welds, Design of welds, Design of Simple joints, Moment resistant connections (moment parallel and

perpendicular to the plane of joint).

04 Hours

UNIT-3

Design of Tension Members: Introduction, Types of tension members, lug angles (no design), slenderness ratio, behavior of axially loaded tension members, failure modes of tension members, Factors affecting the strength of tension members, Design of axially loaded tension members with bolted and welded connections.

06 Hours

UNIT-4

Design of Compression Members: Introduction, Behavior of compression members, rolled steel sections used for compression members. Effective length of compression members. Design of compression members using single section. Design of built up compression members with lacing.
Design of simple slab base and gusseted base.

10 Hours

UNIT-5

Design of beams: Introduction, sections used for beams, types of beams, factors affecting lateral stability and behavior of simple rolled steel beams in bending. Design of laterally supported and laterally unsupported rolled steel beams.

06 Hours

Text books:

1. Design of steel structures-N Subramanian,Oxford publishers, Published: 2011
2. Limit state design of steel structures-Duggal,Tata- Mcgraw Hill Publishers, 2nd Edition

Reference books:

1. Limit state design of steel structures (Based on IS-800-2007 in SI Units)- Dr.Ramchandra and Virendra Gehlot, Scientific Publishers
2. Design of steel structures by Limit state method-S.S.Bhavikatti, I.K.International publishers.
3. Steel structures-Design and practice by N. Subramanian, oxford university press

E-learning resources:

http://nptel.ac.in/courses/105106112/

SEE paper pattern:
Set one question each in Units 1, 3, 5 and two questions each in Units 2 and 4. Students has to answer **Five** questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

SOFTWARE APPLICATION LABORATORY

List of Experiments:

1. Writing computational program using MATLAB to calculate Shear Force and Bending Moment and also to draw SFD and BMD for simple determinate beams with different loadings – simply supported and cantilever beams subjected to UDL and point loads.
2. Writing computational program using MATLAB for the design of singly reinforced beams using limit state method.
3. Analysis and design of structural elements using standard software package tools.
   a) Continuous beams with different kinds of loading and support conditions.
   b) 2D Portal Frames with different kinds of loading and support conditions.
   c) 3D Structural system with different loads (DL, LL and WL).
   d) Roof trusses.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Design of Steel Structures and Software application Laboratory														**CODE: 20CV6DCDSS**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	1	-	3	-	-	-	-	-	-	2	-	-	3

COURSE: Design of Steel Structures and Software application Laboratory					
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓	✓		
CO4	✓	✓	✓		
CO5		✓	✓	✓	

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	Irrigation and Water Resources	Course Code	20CV6PCIWR	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	Theory	50 M
Contact Hours	36 Hrs	Lab Contact Hours	-	CIE + SEE	50 + 50 M

COURSE OBJCTIVES :

To introduce to students the basic concepts of Hydrology, Hydrological cycle and estimate the runoff from a given catchment for a known storm and measuring the discharge in a stream. To Introduce types of irrigation, methods of applying water to the fields and planning irrigation scheduling.

COURSE OUTCOMES: An ability to

CO1 : Describe hydrologic cycle and analyse the rainfall data.
CO2 : Compute the losses from precipitation and estimate the runoff from a watershed.
CO3 : Explain methods for measurement of stream flow.
CO4 : Identify the various systems and methods of irrigation.
CO5 : Estimate the water requirements of a crop.

UNIT-1

INTRODUCTION: Hydrologic Principles: Introduction, Hydrologic cycle, Importance of Hydrology, Global water availability, India's water availability, Practical applications of Hydrology, Hydrologic cycle (Horton's qualitative and engineering representations).

3 Hours

PRECIPITATION: Forms and types of precipitation, Measurement of rainfall, Optimum number of rain gauge stations, Consistency of rainfall data (double mass curve method), Computation of mean rainfall arithmetic average, Thiessen polygon and Isohyet methods, Estimation of missing rainfall data (Arithmetic average, normal ratio), Rainfall hyetographs.

5 Hours

UNIT-2

LOSSES FROM PRECIPITATION:

Evaporation: Process, factors affecting evaporation, Measurement using IS Class A Pan, Estimation using empirical formulae.

Infiltration: Factors affecting infiltration capacity, Measurement (double ring infiltrometer), Horton's infiltration equation, Infiltration indices.

5 Hours

RUNOFF: Concept of catchment/ watershed, Water budget equation, Components, Factors affecting runoff, Rainfall-runoff relationship using simple regression analysis, Hydrographs, Unit Hydrograph method.

5 Hours

UNIT-3
STREAM FLOW MEASUREMENT: Measurement of stage, Measurement of discharge by area–velocity method and slope area method, Simple stage-discharge relation. **5 Hours**
UNIT-4
IRRIGATION- INTRODUCTION: Definition, Need, Purpose, Benefits, Ill effects and Scope of irrigation, Seasons across the country, Sources of water for irrigation – surface and ground water, Systems of flow irrigation and lift irrigation, Methods of application of irrigation water. **4 Hours** **RESERVOIRS:** Definitions, Investigation for reservoir site, Storage zones. **2 Hours**
UNIT-5
IRRIGATION AND WATER REQUIREMENT OF CROPS: Definition of consumptive use, Duty, Delta and Base period, KOR depth, Factor affecting duty of water, Definition of gross command area, Culturable command area, Intensity of irrigation, Time factor, Crop factor, Irrigation efficiencies, Irrigation required, Frequency of irrigation. **7 Hours**

Text books:

1. A Text Book of Hydrology- K Subramanya, Tata McGraw- Hill Publications.
2. Irrigation, Water Resources and Water Power Engg- Modi P.N., Standard book house New Delhi

Reference books:

1. Hand Book of Hydrology- Ven Te Chow , Mc Graw Hill Publications.
2. Hydrology and Water Resources Engineering- R.K. Sharma and Sharma. Oxford and IBH, New Delhi.
3. Applied Hydrology- Linsley, Kohler and Paulhus, Wiley Eastern Publication, New Delhi.
4. Irrigation Engg. And Hydraulic. Structures - S.K. Garg, Khanna publications, New Delhi
5. Irrigation and Water power Engg. – Punmia and Pandey Lal Lakshmi Publications, New Delhi.

E-learning resources:

http://ocw.tudelft.nl/courses/watermanagement/hydrology-of-catchmentsrivers-

anddeltas/lectures http://nptel.ac.in/syllabus/105107129

http://nptel.ac.in/syllabus/105101002/

SEE paper pattern:

Student shall answer FIVE full questions, selecting one from each unit.

Unit 2 & Unit 5 has internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Irrigation and Water Resources														**CODE: 20CV6PCIWR**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3

COURSE : Irrigation and Water Resources					**CODE: 20CV6PCIWR**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓			
CO4	✓	✓			
CO5	✓	✓	✓		

Course	TRANSPORTATION ENGINEERING-II	Course Code	20CV6PCTRE	SEE Duration	3 hours
Credits	04	L:T:P	4:0:0	Theory	50 M
Contact Hours	48 Hrs	Lab Contact Hours	-	CIE + SEE	50 + 50 M

COURSE OBJECTIVES:

To provide students with the basic knowledge of components of permanent way, types of rails and its components, design of rail geometrics, understand the layout of an airport and its classification and design of runway and taxiways, concepts of harbor and tunnel engineering.

COURSE OUTCOMES: An ability to

CO1: Understand, identify and explain the components of railway engineering, airport engineering, harbor and tunnel engineering.
CO2: Design geometric aspects of railway system, runway and taxiway.
CO3: Understand the fundamentals of Harbor and Tunnel Engineering.

UNIT – 1

RAILWAY ENGINEERING

Introduction to Railways in India: Role of railways in transportation, Indian Railways in National Development, Railways for Urban Transportation, Modern developments – LRT & MRTS. Alignment – basic requirements and selection of routes.

04 hours

Permanent way: Introduction, requirements for an ideal permanent way, typical cross sections of single and double line B.G. tracks – in cutting , embankment. Concept of Gauges, Coning of wheels and tilting of rails, Creep in rails, Rails – Types of Rails, functions, requirements, types of rail sections.

04 hours

UNIT – 2

Ballast and Sleepers: Functions, requirements, types, Rail Fastenings and track fittings. Calculation of quantity of materials needed for laying a track.

Traction and tractive resistances: Introduction, Tractive power, Hauling capacity, Problems.

08 hours

UNIT – 3

Geometric Design of Railway track: Necessity of Geometric Design of railway track, gradient and

types of gradient, Compensation of gradients, Speed of train, horizontal curve, transition curve, super elevation, cant deficiency, negative cant, Problems.

11 hours

UNIT – 4
AIRPORT ENGINEERING

Introduction: Introduction to Airport Engineering, Layout of an airport with component parts and functions of each, Aircraft Characteristics, Airport Classifications, Criteria for airport site selection.

03 hours

Runway Design: Orientation of runway by using wind rose diagram, runway configurations, problems on basic length of the runway – corrections to runway length by ICAO and FAA specification, Geometric design of runways.

06 hours

Taxiway Design: Factors affecting the layout of the taxiway, geometrics of taxiway, design of Exit taxiways as per ICAO Specifications. Problems.

05 hours

UNIT – 5
TUNNEL & HARBOUR ENGINEERING

Tunnels: Introduction, types of tunnels, advantages and disadvantages, tunneling methods in soils.

04 hours

Harbour: Introduction, Definition of Basic Terms, Planning and Design of Harbours, requirements classification, natural phenomenon affecting the design of harbour viz. wind, wave, tide and currents. Harbour layout with component parts.

04 hours

Text books:

1. Saxena and Arora, “A Text Book of Railway Engineering”, Dhanpat Rai and Sons, New Delhi.
2. Khanna, Arora and Jain, “Airport Planning and Design”, Nemchand Roorkee.
3. Srinivasan R., “Harbour, Dock & Tunnel Engineering”, Charotar Publishing House.
4. Kadiyali, L.R. `Traffic Engineering and Transport Planning', Khanna Publishers

Reference books:

1. Chandra S., and Aggarwal, “Railway Engineering”, M.M. Oxford University Press, New Delhi.
2. J. S. Mundrey, “Railway Track Engineering”, McGraw Hill Publishing Co.

3. C Venkatramaiah, "Transportation Engineering, Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels", Universities Press.
4. Horenjeff, R. and McKelvey, F., "Planning and Design of Airports", McGraw Hill Company, New York.
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.
6. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co.,

E-learning resources:
https://nptel.ac.in/courses/105/107/105107123/

SEE paper pattern:
Student shall answer FIVE full questions, selecting one from each unit.
UNIT – 3 & Unit – 4 HAS INTERNAL CHOICE.

CO-PO MAPPING SCALE 1 TO 3

	COURSE : TRANSPORTATION ENGINEERING – 2 CODE: 20CV6PCTE2														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	1	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	1	-	-	-	-	-	3	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-

COURSE : TRANSPORTATION ENGINEERING – 2 CODE: 20CV6PCTE2					
Taxonomy levels and COs	Remember/ Understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2	✓	✓		✓	
CO3	✓				

Course	**Law for Engineers**	**Course Code**	**20CV6HSLFE**	**SEE Duration**	**3 hours**
Credits	**02**	**L:T:P**	**2:0:0**	**Theory**	**50 M**
Contact Hours	**24 Hrs**	**Lab Contact Hours**	**-**	**CIE + SEE**	**50 + 50 M**

COURSE OBJCTIVES:
To familiarize students with basic knowledge of laws that would be of utility in their profession, to examine and review the laws complying with environment, health and safety, and to create awareness regarding civil and criminal liability of Engineers.

COURSE OUTCOMES: An ability to

CO1 : Apply the principles of sustainable development.
CO2 : Demonstrate professional affairs in ethical manner valuing the safety, health and welfare of the public.
CO3 : Understand the significance of various legislations and legal responsibilities in engineering practice.

UNIT-1

Environmental Law : Origin of Environmental Law, Concept of Pollution – Sources of Pollution, Types of Pollution, and Effects of pollution. Nature and Scope of Environmental Law – Importance. Case Study.

5 Hours

UNIT-2

Labour Law : Provisions of various labor laws – Industrial Disputes Act, 1947; Workmen's Compensation Act 1923; The Factories Act, 1948; Minimum wages act, 1948; Payment of Wages Act, 1936; Employees Insurance Act, 1948.

5 Hours

UNIT-3

Indian Penal Code: A brief introduction to criminal liability of Engineers as per the Indian Penal Code.

5 Hours

UNIT-4

IPR: Concept of Intellectual Property. Kinds of Intellectual Property. Economic importance of Intellectual Property

5 Hours

UNIT-5

Law of Torts: Definition, categories of torts, Breach of Duty and Damages.

4 Hours

Text books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. Ratanlal and Dhirajlal&: The Law of Torts.
3. S. Shantha Kumar- Introduction to Environmental Law.
4. Madhavan Pillai - Labour and Industrial Laws.
5. Bare Acts referred to above

Reference books:

1. VR.Krishna Iyer-Environmental pollution and the law.
2. Suresh Jain and Vimal Jain- Environmental law in India.
3. Goswami VG- Labour and Industrial law.
4. Indian law Institute- Law and labour management relations in India.
5. Avtar Singh- The law of torts.

SEE paper pattern:

Student shall answer FIVE full questions, selecting one from each unit. **Unit (1) & Unit (2) Has Internal Choice.**

E-learning resources: https://www.aminotes.com/2016/12/study-materials-law-for-engineers.html

https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

CO-PO MAPPING SCALE 1 TO 3

	COURSE : Law for Engineers									**CODE: 20CV6HSLFE**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-

	COURSE : Law for Engineers			**CODE : 20CV6HSLFE**	
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		

VI SEMESTER DEPARTMENT ELECTIVES

Course Name	Matrix Method of Structural Analysis	Course Code	20CV6PEMMA	SEE Duration	3 Hours
Credits	03	L-T-P	3-0-0	Theory	50 M
Contact Hours	36 Hrs	Lab Contact Hours	-	CIE + SEE	50 + 50 M

Course Objectives: To enable students to gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple structural elements.

Course Outcomes:

1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
4. Evaluate secondary stresses.

UNIT -1

Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements.

6 Hours

UNIT -2

Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams and trusses.

8 Hours UNIT -3

Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

8 Hours UNIT -4

Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3. 6 hours

UNIT -5

Direct Stiffness Method: Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam, rigid frames and truss elements, analysis of continuous beams, rigid frames and trusses.

8 Hours

Textbooks:

1. Weaver W and Gere J H, "Matrix Analysis of Framed Structures", CBS publications, New Delhi.
2. Rajasekaran S, "Computational Structural Mechanics", PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, "Matrix and Finite Element Analysis of Structures", Ane Books Pvt. Ltd.

Reference Books:

1. Godbole P N et.al, "Matrix Method of Structural Analysis", PHI ltd, New Delhi. 2.
Pundit and Gupta, "Theory of Structures Vol II", TMH publications, New Delhi
3. A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee.
4. Manikaselvam, "Elements of Matrix Analysis and Stability of Structures", Khanna Publishers, New Delhi.
5. H C Martin, "Introduction to Matrix Methods in Structural Analysis", International textbook company, McGraw Hill.

Alternate assessment tool (AAT) for CIE: Utilization of direct stiffness method to develop computational code by using MATLAB.

Scheme of Examination: Answer any **Five** full questions out of **six** questions. **Note:** At least one question from each units.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Matrix Method of Structural Analysis												**CODE: 20CV6PEMMA**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3			-	-	3	-	-	-	-	-	-	2	1	-	-

COURSE: Matrix Method of Structural Analysis			**CODE: 20CV6PEMMA**		
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓		✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		✓

Course	**Ground Improvement Techniques**	**Course Code**	**20CV6PEGIT**	**SEE Duration**	**3 hours**
Credits	**03**	**L:T:P**	**3:0:0**	**Theory**	**50 M**
Contact Hours	**36 Hrs**	**Lab Contact Hours**	**-**	**CIE + SEE**	**50 + 50 M**

COURSE OBJECTIVES:

To introduce to students the need for ground improvement and apply various alternate ground improvement techniques to suit the field requirements.

COURSE OUTCOMES: An ability to

CO1 : Identify the need for ground improvement and the factors affecting ground improvement.
CO2 : Classify various ground improvement techniques and identify the principle involved in each method.
CO3 : Apply suitable ground improvement/modification techniques to suit field requirements**.**

UNIT-1

GROUND IMPROVEMENT: Historical development, Objectives of soil improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. Influence of soil formation on the choice of ground improvement technique.

MECHANICAL MODIFICATION: Type of mechanical modification, Aim of modification, compaction, Principle of modification for various types of soils.

CONVENTIONAL COMPACTION: Evolution of compaction theories-Lubrication theories by Proctor and Hogentogler; Pore water and Pore air pressures theory by Hilf; Microstructure theory by Lambe. Effect of grain size distribution on compaction for various soil types. Effect of compaction on engineering properties like compressibility, swelling and shrinkage, Shear strength, stress-strain characteristics and Hydraulic conductivity.
8 Hours UNIT-2

INTELLIGENT COMPACTION: Principles, benefits, design considerations, design parameters and procedure, construction, quality assurance.
FIELD COMPACTION: Shallow and deep compaction. Static compaction, dynamic compaction, dynamic consolidation impact type rollers, impact type compacters, vibratory typeVibro-flotation, vibro-replacement. Effect of saturation on compaction.Specifications of compaction-End product specification and Method specification. Tolerance of compaction.
8 Hours UNIT-3

Hydraulic Modification: Definition, aim, principle, techniques. Methods of lowering of water

table: sumps and ditches, well point system-Single stage, multistage well point, deep well point system, Robert's diagram, spacing of well points, vacuum dewatering, Electroosmotic dewatering.

Preloading: Preloading, vertical drains, sand drains. Assessment of ground condition for preloading.

7 Hours UNIT-4

Chemical Modification: Definition, aim, special effects, and methods. Admixtures, cement stabilization. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage. Criteria for cement stabilization. Stabilization using Fly ash. Lime stabilization – suitability, process, special effects, criteria for lime stabilization Other chemicals, chlorides, hydroxides, lignin, hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization. Soil stabilisation using enzymes.

6 Hours UNIT-5

Grouting: Introduction, Effect of grouting. Chemicals and materials used. Types of groutingInjection grouting, hydraulic fracturing, compaction grouting, and Jet grouting: Single fluid, double fluid and triple fluid jet grouting. Grouting procedure. Applications of grouting.

Method of Confinement: Crib walls, gabions and Mattresses, concepts of reinforced earth and soil nailing- Applications, advantages and disadvantages, case studies

Miscellaneous methods: Concepts thermal methods- Ground Freezing and heating, advantages and disadvantages.

7 Hours

Text book/Codes:

1. Ground Improvement Techniques- Purushothama Raj P. (1999) Laxmi Publications, New Delhi.
2. Construction and Geotechnical Method in Foundation Engineering- Koerner R.M. (1985) - Mc Graw Hill Pub. Co., New York.

Reference books:

1. Engineering principles of ground modification- Manfred Haussmann (1990) - Mc Graw Hill Pub. Co., New York.
2. Principles and practices of ground improvement – Jie Han (2015) – Wiley and Sons
3. Methods of treatment of unstable ground- Bell, F.G. (1975) Butterworths, London.
4. Expansive soils- Nelson J.D. and Miller D.J. (1992) -, John Wiley and Sons.
5. Soil Stabilization; Principles and Practice- Ingles. C.G. and Metcalf J.B. (1972) - Butterworths, London.

E-learning resources:

https://nptel.ac.in/courses/105/108/105108075/

SEE paper pattern:

Student shall answer FIVE full questions, selecting one from each unit.

UNIT 2 & UNIT 5 has internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE : GROUND IMPROVEMENT TECHNIQUES															
CODE: 20CV6PEGIT															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	2	-	-	-	-	2	-	-	-	2	-	-	3

COURSE: GROUND IMPROVEMENT TECHNIQUES					**CODE : 20CV6PEGIT**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓	✓	✓	

Course	Solid Waste Management	Course Code	20CV6PESWM	SEE Duration	3 Hrs
Credits	**03**	**L-T-P**	3-0-0	**Theory**	**50 M**
Contact Hours	**36 Hrs**	**Lab Contact Hours**	**-**	**CIE + SEE**	**50 + 50 M**

COURSE OBJECTIVES: To introduce to students the quantification and characteristics of solid waste, engineering remedies and processing methods, techno-legal and community requirements.

COURSE OUTCOMES : An ability to

CO1 : Describe the fundamentals of characterization and quantification.
CO2 : Explain the mechanisms of providing engineering remedies to disposal issues.
CO3 : Illustrate the process of safety, legal and societal needs.

Unit-I

INTRODUCTION: Definition, land pollution-scope and importance of solid waste management, functional elements of solid waste management. Sources, Classification and characteristics-Municipal, Commercial & Industrial. Methods of quantification.

4 hours

COLLECTION AND TRANSPORTATION: System of collection, Collection equipment, garbage chutes, transfer stations-bailing and compacting, route optimization techniques and problems.

5 hours

Unit-II

TREATMENT/PROCESSING TECHNIQUES: Components of separation, volume reduction, size reduction, chemical reduction and biological processing problems.

INCINERATION: process-3T's, factors affecting incineration process, incinerators –types, prevention of air pollution, pyrolysis, design criteria for incineration.

7 hours

Unit-III

COMPOSTING: Aerobic and Anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes, vermin composting

7 Hours

Unit-IV

SANITARY LAND FILLING: Different types, Trench method area method, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas control methods, geosynthetic fabrics in sanitary landfills

7 hours

UNIT V

Advanced techniques in SWM: Surface complexation: surfaces and reactions; Surface complexation modelling: double-layer, constant capacitance, and triple-layer models. Experimental techniques for solid-phase investigations; Diffraction Principle of XRD, Bragg's law, Fundamentals of crystal structures- unit cells, lattice planes and Miller indices, important structure types, phase identification, Scherer equation. Microscopy: Principles and applications of SEM, TEM and associated energy dispersive X-ray spectroscopy (EDXS). Spectroscopy: Principles and applications of X-ray Fluorescence (XRF), Vibrational (IR and Raman), Absorption (XANES, EXAFS).

6 Hours

TEXT BOOKS:

1 Integrated solid waste management: Tchobanoglous: M/c Graw Hill, 1993
2. Solid waste management in developing countries Bhide and sundearashan, 1983

REFERENCE BOOKS:

1. Hand Book on solid waste disposal: pavonij.L
2. Environmental engineering; peavey and Techobanoglou.3. Biomedical waste handling rules -2000

Question paper pattern:

1. Unit I and Unit V have internal choice 2. Unit II,
Unit III, Unit IV has one question.
3. Unit I and Unit V have internal choice 4. Unit II, Unit III, Unit IV has one question.

Course	PAVEMENT MATERIALS AND CONSTRUCTION	Course Code	20CV6PEPMC	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	Theory	50 M
Contact Hours	36 Hrs	Lab Contact Hours	-	CIE + SEE	50 + 50 M

COURSE OBJECTIVES: To provide knowledge of highway materials and methods of construction of different types of flexible and rigid pavements.

COURSE OUTCOMES: An ability to

CO1 : Analyze the different types and characteristics of various pavement materials.
CO2 : Design Bituminous mixes as per specifications.
CO3 : Describe equipments used for the construction of different pavement layers with their advantages**.**
CO4 : Understand the specifications and methods of Flexible and Rigid pavement construction.

PAVEMENT MATERIALS

UNIT-I

Aggregates: Origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation-design gradation, maximum aggregate size, aggregate blending Methods

04 Hours

UNIT-II

Binders and Modified Binders: Types-Origin, preparation, properties and composition of bituminous road binders; requirements-tests-uses

03 Hours

Bituminous Emulsions and Cutbacks: Types, properties, tests and uses.

02 Hours

Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion

02 Hours

UNIT-III

Bituminous Mixes: Introduction- - Mechanical properties, dense and open textured mixes,

bituminous mix, design methods using Rothfuch's Method only and specification using different criteria - Marshall Mix Design, properties-Voids in Mineral Aggregates, Voids in total mix, Density, Flow, Stability, Percentage Voids filled with Bitumen, Problems on above. (No Hveem Stabilometer & Hubbard-Field Tests) Superpave Mix – necessity-Applications.

08 Hours

PAVEMENT CONSTRUCTION
UNIT-IV

Equipments in Highway Construction: Various types of equipment for Excavation, Grading and Compaction, working principle, advantages and limitations. Bituminous mixers and Pavers

05 Hours

Subgrade: Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests.

03 Hours

UNIT-V

Flexible Pavements: Specifications of materials, construction and field control checks for various types of flexible pavement layers. White topping

05 Hours

Cement Concrete Pavements: Specifications and method of cement concrete pavement construction; Quality control tests; Construction of various types of joints. Type of concrete used for construction of rigid pavement

04 Hours

REFERENCES

Text Books:

1. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Engineering", Revised 10th Edition, Nem Chand and Bros, Roorkee, 2014.
2. Sharma, S.C., `Construction Equipment and its Management', Khanna Publishers

Reference Books:

1. R. Srinivasa Kumar, "Textbook of Highway Engineering", Universities Press (India) Private Ltd., 2012.
2. S. P. Bindra, "A Course in Highway Engineering", Dhanpat Rai Publications, 5th Revised Edition, 2013.
3. Hand book by MORTH, 5th Edition, Published by Indian Roads Crongress, New Delhi.

MOOCs:

1. https://www.nptel.ac.in/

SEE paper pattern:

- Students to answer any FIVE full questions choosing one question from each Unit
- Units I, II and IV have ONE compulsory question
- Units III and V have TWO questions each wherein the candidate has to answer ONE question each from these two units.
- Choice has to be given in Unit III and Unit V only.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Pavement Materials and Construction														**CODE: 20CV6DEPMC**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO 3**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-

COURSE: Pavement Materials and Construction					**CODE: 20CV6DEPMC**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓		✓		
CO2	✓			✓	
CO3	✓	✓			
CO4	✓		✓		

Course Name	Structural Masonry	Course Code	20CV6PESMA	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	Theory	50 M
Contact Hours	36 Hrs	Lab Contact Hours	-	CIE + SEE	50 + 50 M

Course Objectives: Students are expected to understand the strength and elastic properties of masonry and its constituent materials and failure modes and shall be introduced to the design of load bearing masonry buildings.

Course outcome : An ability to

CO1: Recognize the strength and elastic properties of masonry and its constituent materials.
CO2: Comprehend the interaction between masonry constituents.
CO3: Analyse and design load bearing masonry components and systems as per BIS codes.

UNIT 1

Introduction, Masonry units, Materials and types: Characteristics of bricks, stone, clay block, concrete block, stabilized mud block masonry units-strength ,modulus of elasticity and water absorption. Masonry materials –classification and properties of mortars, selection of mortars. Masonry arches.

7 hours

UNIT 2

Strength of masonry in compression: Behavior of masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

7 hours

UNIT 3

Masonry Bond strength: Bond between masonry unit and mortar, tests for determining flexural and shear bond strength, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength

7 hours

UNIT 4

Introduction to reinforced masonry: Concepts for vertical and horizontal reinforcement schemes for masonry, construction process, BIS code provisions-, historical buildings, construction procedure

6 hours

UNIT 5

Design of load bearing masonry buildings: Permissible stresses, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels. Wall carrying axial loads with different eccentricity ratios, wall with openings, free standing walls. Design of load bearing masonry for buildings up to 3 to 8 story using BIS codes**.**

12 hours

Text books:

1. Structural masonry by K.S.Jagadish

Recommend reference Texts:

1. Brick and reinforced brick structures, Dayarathnam. P, Oxford and IBH,1987
2. Structural masonry: Hendry A.W.-Macmillan Education Ltd
3. Design of masonry structures-Sinha B.P & Davis-S.R.E & FN Spoon
4. Design of reinforced and Prestressed Masonry-Curtin-Thomas Telford
5. Structural Masonry-Sven Sahlin-Prentice Hall
6. Alternative building materials and technologies-K.S. Jagadish,Venkatarama Reddy B.V and Nanjunda Rao K.S-New age International, New Delhi and Bangalore

IS 1905 (1993 and revised ed.) BIS, New Delhi.

SP 20 (S &T) –BIS, New Delhi

Question paper pattern: Set one question each in Units 1, 2, 3 and 4 two questions from Unit 5. Students has to answer Five questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for each question).

CO-PO MAPPING SCALE 1 TO 3

	COURSE : Structural Masonry CODE: 20CV6PESMA														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	2	-	-	-	-	-	-	-	3

Course Name	EARTH RETAINING STRUCTURES	Course Code	20CV6PEERS	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	Theory	50 M
Contact hours	36 hours	Lab Contact Hours	-	SEE+ CIE Marks	50+50 M

Course objective: The objective of this course is to provide students the fundamentals needed for the design and stability analysis of earth structures (Dams) and earth retaining structures (Conventional Retaining walls, MSE walls, Cantilever and Anchored sheet pile walls, Braced cuts and Coffer dams).

Course Outcomes: Upon completion of the course, the student should be able to

CO1: Identify different causes of failure and seepage control measures for embankment dams.
CO2: Analyze earthen dams for their stability.
CO3: Identify and explain various earth retaining structures.
CO4: Design and analyze different earth retaining structures.

UNIT 1

EARTHEN DAMS: Introduction about earthen dams - different types of earthen dams with sketches and their suitability. Hydraulic fill and rolled fill methods of construction – causes of failure of earth dam – Design criteria of earth dams – Selection of suitable preliminary section of dams- Stability analysis of earthen dams – Seepage control in earthen dams - Role of Filters in Earth Dam Design, Numericals.

ROCK FILL DAMS - Origin and usage of rock fill dams, Different parts of rock fill dams.

9 Hours

UNIT 2

RETAINING WALLS: Introduction, types, failure of retaining walls by sliding, overturning and bearing - Stability analysis and Principles of the design of retaining walls – Gravity retaining walls, cantilever retaining walls, counter fort retaining walls (no structural design) – Other modes of failure of retaining walls – Drainage from the backfill.

7 Hours

UNIT 3

REINFORCED EARTH RETAINING WALLS: Introduction – cross section of walls, components of reinforced earth walls, functions of components, Types ,Backfill and Reinforcing Materials – Construction of RE walls –, Design considerations –Design methods of walls – Stability of RE walls : External Stability of walls, internal stability – Problems on stability of geogrid and geotextile walls. Concept of soil nailing.

6 Hours

UNIT 4

Cantilever sheet pile walls: Introduction - Types of sheet pile walls – Free cantilever sheet pile - cantilever sheet pile in cohesion-less soils – cantilever sheet pile penetrating in clay.

Anchored Sheet Pile Walls: Anchored sheet pile with free earth support in cohesion-less and cohesive soil- Bulkheads with fixed earth support method – Analysis using equivalent beam method, Problems**.**

7 hours

UNIT 5

BRACED CUTS: Introduction, Lateral earth pressure on sheeting's - Different types of sheeting and bracing systems – design principles of various components of bracings.

COFFER DAMS & CELLULAR COFFER DAMS: Introduction – types of coffer dams - Design method of cellular coffer dams on rock by Tennessee Valley Authority (TVA) method, – safety against sliding, slipping, overturning, vertical shear and stability against bursting,

7 Hours

Text Books:

1. Soil Mechanics and Foundation Engineering: Dr. K.R. Arora, Pub: Standard Publishers & Distributors, 5th edition, 2005
2. Irrigation Engineering and Hydraulic Structures: S.K. Garg, Pub: Khanna Publishers.2006

Reference Books:

1. Soil Mechanics and Foundation Engineering: Dr. V.N.S. Murthy, Pub: CBS Publishers & Distributors.
2. Soil Mechanics and Foundations: Dr. B.C. Punmia, Pub: Laxmi Publications (P) Ltd. Designing with Geosynthetics: Robert M. Koerner, Pub: Xlibris.
3. Numerical Examples, Problems and Objective Questions in Geotechnical Engineering: A.V. NarasimhaRao& C. Venkataramaiah, Pub: Universities Press.
4. Irrigation and Water Power Engineering: Dr. B. C. Punmia, Dr. Pande B BLal, Ashok Kumar Jain and Arun Kumar Jain, Pub: Laxmi Publications (P) Ltd.
5. Geotechnical Engineering: Dr. C. Venkataramaiah, Pub: New age publications.
6. Soil Mechanics & Foundation Engineering: P. Purushotam Raj, Pub: Dorling Kindersley (India) Pvt. Ltd

SEE paper pattern: Answer five full questions. **Unit (1**) & **Unit (4)** has internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Earth retaining structures													CODE: 20CV6PEERS		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	-	-		-	-	-	-	-	-	-	2	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	-	-

COURSE : Earth retaining structures					CODE: 20CV6PEERS
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2	✓	✓	✓	✓	
CO3	✓				
CO4	✓	✓	✓	✓	

Course	**PAVEMENT DESIGN**	**Course Code**	**20CV6PEPAD**	**SEE Duration**	3 **hours**
Credits	**03**	**L:T:P**	**3:0:0**	**Theory**	**50 M**
Contact hours	**36 hours**	**Lab Contact Hours**	**-**	**SEE+ CIE Marks**	**50+50 M**

COURSE OBJECTIVES : To enable students understand terminology and concepts of pavement engineering, different types of pavements, understand the design concepts of flexible and rigid highway pavements, and conduct analysis of rigid pavements for stresses, strains, and deflections.

COURSE OUTCOMES: An ability to

CO1 : Describe fundamental theory of design of flexible and rigid pavements
CO2 : Design flexible pavement and rigid pavement as per IRC specifications
CO3 : Analyse the stresses in rigid pavements

UNIT-1

INTRODUCTION: Types of Pavement, Comparison of Flexible and Rigid Pavements, Components and Functions of sub-grade, sub base – Base course – surface course, Difference between Highway pavement and Air field pavement.

03 Hours

DESIGN FACTORS: Pavement design factors, loads – axle load distribution, ESWL, EWL, VDF due to varying loads and CSA, Problems.

05 Hours

UNIT-2

FUNDAMENTALS OF DESIGN OF PAVEMENTS: Design life, Traffic factors, climatic factors, Evaluation of Subgrade soil strength, Plate load Test, CBR Test, Stresses and deflections, Boussinesq's Elastic Theory – principle, Assumptions – Limitations and Problems using vertical stress charts and deflection charts

08 Hours

UNIT-3

FLEXIBLE PAVEMENT DESIGN: Assumptions, Empirical, Semi-empirical and Analytical Methods – Group Index Method, CBR method, McLeod Method, CSA Method using IRC 37-2018, AASHTO Method, Burmister theory – Assumptions, Problems.

08 Hours

UNIT-4

STRESSES IN RIGID PAVEMENT: Components and their functions, Design factors, General properties of concrete affecting design, Analysis of stresses, Assumptions, Westergaard's Analysis, Modified Westergaard equations, Critical stress Locations, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations) – Problems.

08 Hours

UNIT-5

DESIGN OF RIGID PAVEMENT: Design of C.C. Pavement by IRC: 58 – 2015 for dual and Tandem axle load, Concept of White topping. Requirements of joints, Types of joints – Expansion joint – contraction joint – warping joint – construction joint – longitudinal joint, Design of joints – Problems. Design features of CRCP, SFRC and ICBP.

08 Hours

Text books:

1. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Engineering", Revised 10th Edition, Nem Chand and Bros, Roorkee.
2. R. Srinivasa Kumar, "Textbook of Highway Engineering", Universities Press (India) Private Ltd.,

Reference books:

1. E. J. Yoder and M. W. Witczak, "Principles of Pavement Design", Second Edition, John Wiley and Sons, Inc, 1975.
2. Relevant IRC codes

SEE paper pattern: Student shall answer FIVE full questions, selecting one from each unit.

UNIT – 3 & Unit – 5 HAS INTERNAL CHOICE.

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

CO-PO MAPPING SCALE 1 TO 3

COURSE : PAVEMENT DESIGN												CODE: 20CV6PEPAD			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-

COURSE : PAVEMENT DESIGN **CODE: 20CV6PEPAD**

Taxonomy levels and COs	Remember/ Understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	

Course	GEO SPATIAL SURVEYING	Course Code	20CV6PEGSS	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	Theory	50 M
Contact hours	36 hours	Lab Contact Hours	-	SEE+ CIE Marks	50+50 M

COURSE OBJCTIVES : To introduce to students the basic components and working principle of remote sensing, image enhancement and image processing, components and functions of GIS, and concept of spatial analysis in GIS.

COURSE OUTCOMES: An ability to

CO1: Explain the principles and components of remote sensing**.**

CO2: Apply the principles of image enhancement and digital image processing.

CO3: Explain the components and functions of GIS.

CO4: Demonstrate the application of remote sensing and GIS analysis to real world problems.

UNIT-1

REMOTE SENSING: Introduction, basic principle – Electromagnetic radiation, electromagnetic spectrum, different bands and their applications in remote sensing - Stages / components of remote sensing, ideal remote sensing system and real remote sensing system – Source of EMR – Energy interaction with the atmosphere and the surface features, reflection, absorption, scattering, atmospheric window, albedo, spectral reflectance curve - Types of remote sensing, classification based on platforms, energy sources, wavelength regions, number of bands – Satellite orbits, geosynchronous, near polar and sun synchronous orbits, swath, inclination, orbital period, repeat cycle, revisit period – Image format – Resolutions in remote sensing – Remote sensing applications – Characteristics of Indian Remote Sensing Satellites , sources of remote sensing data

8 Hours

UNIT-2

IMAGE RECTIFICATION AND ENHANCEMENT: Image geometric corrections, Ground control points, atmospheric corrections, color composites, Digital Image analysis, Image enhancement.

8 Hours

UNIT-3

IMAGE CLASSIFICATION: Classification methods, vegetation indices, band combinations, Users accuracy, producer accuracy and overall accuracy.

6 Hours

UNIT-4

GEOGRAPHIC INFORMATION SYSTEM: Definitions, components, functions of GIS, Spatial and attribute data, Data models: raster and vector data, topology, Sources of data and data structures, Geodatabase and metadata, Errors in GIS, GIS applications, link with remote sensing, introduction to webGIS, free and open source GIS tools.

7 Hours

UNIT-5

MAPS: Introduction to maps, components of maps, map projections and coordinate reference system.

Introduction to drone survey.

SPATIAL ANALYSIS : Introduction to spatial analysis, raster and vector operations, neighborhood analysis, spatial interpolation, DEM, generation of contours.

7 Hours

Text books:

1. Remote sensing and image interpretation- Lillesand TM, Keifer RW, Chipman JW, John Wiley and Sons
2. Remote Sensing and GIS – B Bhatta, Oxford Publications
3. Remote Sensing and GIS – M Anji Reddy, BSP Publication

Reference books:

1.Elements of Photogrammetry – Paul R Wolf, McGraw International
2.Principles of GIS – Peter A Burrough, Oxford Publications
3.GIS – Bemhardsen, Wiley Publications
4.Introductory Remote Sensing- Principles and Concepts - Gibson P.J, Routledge, London.

Web resources

NPTEL Lectures: Modern Surveying Techniques by Prof. Onkar Dikshit, IIT Kanpur
http://nptel.ac.in/courses/Webcourse-contents/IITKANPUR/ModernSurveyingTech/ui/TOC1.htm
NPTEL Lectures: Remote Sensing by Prof. D Nagesh Kumar, IISc Bangalore
http://www.nptel.ac.in/syllabus/105108077/

SEE paper pattern: Student shall answer FIVE full questions, selecting one from each unit. Unit 1 will have internal choice.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Advanced surveying												**CODE: 20CV5PEASY**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	1	-	-	-	-	-	-	-	1	1	1
CO2	3	-	-	-	1	-	-	-	-	-	-	-	1	1	1
CO3	3	-	-	-	1	-	-	-	-	-	-	-	1	1	1
CO4	3	1	-	-	1	-	-	-	-	-	-	-	1	1	1

COURSE : Advanced surveying					**CODE : 20CV5PEASY**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓			
CO4	✓	✓			

OPEN ELECTIVES FROM CIVIL ENGINEERING

Course	Mechanics of FRP composites	Course Code	20CV6OEMFC	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	Theory	50 M
Contact hours	36 hours	Lab Contact Hours	-	SEE+ CIE Marks	50+50 M

Course Objectives:

1. Understand the basic properties and manufacturing process along with their application in various industries for different types of composites.
2. Understand the behavior of constituents in the composite materials.
3. Develop the students skills in understanding the different manufacturing methods available for composite material.
4. Demonstrate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.

Course Outcomes: An ability to

CO1: Identify different composite materials based on the composition and structure of the composite
CO2: Analyze the composites for their mechanical properties based on macro-mechanical behavior
CO3: Formulate constitutive matrix in terms of coupling between extension- shear-bending and twisting terms of Composite laminates based on Kirchoff's hypothesis and propose different laminate types.
CO4: Develop computational programme by using MATLAB.

UNIT -1

Introduction to composite materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites.
Constituents of composite materials: Reinforcements, Matrix, Coupling agents, coatings & fillers.
Reinforcements: Introduction, Glass Fibers, Boron Fibers, Carbon Fibers, Organic Fibers, Ceramic Fibers, Whiskers, Other Non-oxide Reinforcements, Comparison of Fibers **Matrix Materials:** Polymers, Metals and Ceramic Matrix Materials.

8 Hours

UNIT -2

Micro mechanics of Composites: Introduction, Density, Evaluation of mechanical properties and prediction of elastic constants by using Rule of mixture, Numerical problems.

Macro mechanics of Composites: Introduction, Hooke's law for different types of materials, Number of elastic constants, two dimensional relationship of compliance and stiffness matrix

08 Hours

UNIT -3

Macro Mechanics of a FRP Lamina: Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Stress-Strain relations of lamina for any arbitrary orientation, Numerical problems.

08 Hours

UNIT -4

Macro Mechanical Analysis of Laminate: Introduction, Kirchoff hypothesis, constitutive matrix in terms of coupling between extension- shear-bending and twisting of Composite laminates (Detailed derivation), special cases of laminates.

08 Hours

UNIT -5

Composites strength Theories: Maximum stress theory, Maximum strain theory, Tsai-Hill theory, Tsai, Wu tensor theory.

07 Hours

Textbooks:

1. Mechanics of Composite Materials, Robert M Jones, 2 nd Edition, CRC Press, 1998.
2. Fiber Reinforced Composites, Materials, Manufacturing, and Design, P. K. Mallick, 3 rd Edition, CRC Press, 2007.

Reference Books:

1. Mechanics of composite materials, Autar K. Kaw, 2 nd Edition, 2005, CRC Press New York.
2. Composite Science and Engineering, K. K. Chawla, 3rd Edition, Springer Verlag 2012.
3. Composite materials hand book, Mel M Schwartz, 2 nd Edition, McGraw Hill Book Company, 1991
4. Principles of composite Material mechanics, Ronald F. Gibron. 3 rd Edition, McGraw Hill international, 2011.
5. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhya, University Press 2005.

E-Books:

1. http://www.ae.iitkgp.ac.in/ebooks/
2. http://nptel.ac.in/course.html

Scheme of Examination (SEE):

 Students to answer five full questions selecting one from each unit and sixth question will be the choice.

Alternate assessment tool (AAT) for CIE: Development of Computational code by using MATLAB to generate constitutive matrix for a laminate.

Scheme of Examination: Answer any **Five** full questions out of **six** questions. **Note:** At least one question from each units.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Mechanics of FRP composites														**CODE: 20CV6IEMFC**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2		-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	1	-	-	-	-	-	2	1	2	-
CO3	3	3	2	2		1	-	-	-	-	-	1	1	1	-
CO4					3				1			2	1	1	

COURSE: Matrix Method of Structural Analysis					
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓		✓		
CO2	✓	✓	✓		✓
CO3	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓

Course Name	Global Warming & Climate change	Course Code	20CV6OEGWC	SEE Duration	03 Hours
Credits	03	L-T-P	3:0:0	Theory	50 M
Contact hours	36 hours	Lab Contact Hours	-	SEE+ CIE Marks	50+50 M

OBJECTIVES

To know the basics, and importance of global warming, the concept of mitigation measures against global warming, and the concept of mitigation measures against global warming

COURSE OUTCOMES: An ability to:

CO1: Describe causes and effects of greenhouse gases

CO2: Explain causes and impact of climate change and global measures taken

CO3: Suggest mitigation techniques for climate change**.**

UNIT-1

EARTH'S CLIMATE SYSTEM: Role of ozone in environment-ozone layer-ozone depleting gases-Green House Effect, Radiative Effects of Greenhouse Gases-The Hydrological Cycle-Green House Gases and Global Warming – Carbon Cycle.

7 hours

UNIT-2

ATMOSPHERE AND ITS COMPONENTS: Importance of Atmosphere-Physical Chemical Charcterestics of Atmosphere- Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.

7 hours

UNIT-3

IMPACTS OF CLIMATE CHANGE: Causes of Climate change: Change of Temperature in the environment-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change –Risk of Irreversible Changes.

7 hours

UNIT-4

OBSERVED CHANGES AND ITS CAUSES: Climate change, Carbon foot print and Carbon credits- CDM- Initiatives in India-Kyoto Protocol- Intergovernmental Panel on Climate change-

Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India.

7 hours

UNIT-5

CLIMATE CHANGE AND MITIGATION MEASURES: Clean Development Mechanism – Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco-Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power –Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

8 hours

TEXT BOOK

1. Dash Sushil Kumar, "*Climate Change – An Indian Perspective*", Cambridge University Press India Pvt. Ltd, 2007.

REFERENCES

2. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
3. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of "*Climate Change and Climate Variability on Hydrological Regimes*", Cambridge University Press, 2003.

SEE paper pattern: Student shall answer FIVE full questions, selecting one from each unit.

UNIT 1 & **UNIT 5** HAVE INTERNAL CHOICE.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Global warming and climate change														**CODE: 20CV6OEGWC**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	3	3	1	1	1	1	1	-	-	1
CO2	3	-	-	-	-	3	3	1	1	1	1	1	-	-	1
CO3	3	-	-	-	-	3	3	1	1	1	1	1	-	-	1

COURSE : Global warming and climate change					**CODE: 20CV6OEGWC**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓			

VII SEMESTER SYLLABUS

Course	BIOLOGY FOR ENGINEERS	Course Code	21CV7BSBFE	SEE Duration	2 hours
Credits	02	**L:T:P**	2:0:0	**SEE+ CIE Marks**	50+50

Course Learning Objectives:

To provide the basic organization of organisms and knowledge about Biological Science for Engineers to understand biology for engineering problems

Course Outcome: An ability to

Explain the cellular make up and structure and functions of biomolecules
Outline the basic concepts in enzyme function, kinetics and modes of inhibition
Comprehend importance of microbiology and immunological science
Discuss the biological science related to the different disciplinary areas

UNIT - 1

INTRODUCTION TO LIFE **[3 Hours]**

Characteristics of living organisms, structure of prokaryotic and eukaryotic cell; Introduction to biomolecules: definition, general classification and important functions of carbohydrates, lipids, proteins, nucleic acids, vitamins and enzymes; concept of genes and chromosome

UNIT - 2

CONCEPTS OF ENZYMOLOGY **[2 Hours]**

Basic concepts in enzyme structure and function, cofactors, enzyme kinetics, modes of inhibition

UNIT – 3

IMMUNOLOGICAL SCIENCE **[2 Hours]**

Immune system and its types; Functional properties of antibodies; Helper T cells and T cell activation, Importance of Microbiology

UNIT – 4

IMPLEMENTATION OF BIO-NANO SCIENCE **[3 Hours]**

NanoBiomolecules and its various types; Principles and Application of Biosensor; Basics of Biochips, Bioinformatics and its applications

UNIT - 5

ADVANCES IN BIOLOGICAL SCIENCE **[3 Hours]**

Fundamentals of Bio mechanics, Neural Network, Stem Cell, Introduction to Genetics, Genetic Engineering and its Application.

Text Books:

Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

Dr. Sohini Singh and Dr. Tanu Allen, "Biology for Engineers", Vayu Education of India, New Delhi, 2014.

Lehninger Principles of Biochemistry by David L. Nelson and Michael M. Cox, 7th Edition, W. H. Freeman and Company, New York.

Reference Books:

Molecular Biology of THE CELL. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, , Garland Science; 5 edition

Simon O. Haykin, Neural Networks and Learning Machines (3rd Edition), Prentice Hall; 3 edition (November 28, 2008).

Online resources

www.bio12.com/ch3/RaycroftNotes.pdf

www.engineering.uiowa.edu/bme050/cvb-solids.pdf

www.biologyjunction.com/mendelian_genetics.html

Course	History of Indian Architecture	Course Code	21CV7HSHIA	SEE Duration	3 hours
Credits	03	**L:T:P**	3:0:0	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES: To understand the history and timelines of Indian architecture so as to appreciate the progress and advancements that have been achieved. This course will shed light on the crucial events, technologies and materials which paved way for phenomenal developments of Indian architecture and importance of conservation of Heritage structures and monuments.

COURSE OUTCOMES: An ability to	
CO1	Describe various types and features of ancient and modern architectural styles in India
CO2	Explain the significance and methods of conservation of heritage structures and monuments.

UNIT -1 : Introduction

Civilisations and early Buddist Architecture, Origin of Architecture, Indian perspective, architectural forms and construction details; Indus valley civilization- Harappan period, Early historic period: Buddhist and early temple architecture, Divine shelters, The Great temples. Case Studies: Great Bath.

6 **Hours**

UNIT-2 : Ancient Indian Architecture

Hindu / Temple Architecture: Important features and examples of Architecture of Indian temples and secular architecture under the following rulers: Pallavas, Cholas and Pandyas ; Rulers of Vijayanagar, Chalukyas, Rashtrakutas and Hoysalas; Jain architecture, Gupta style, Orissa style, Dravidian architecture, Indo Aryan style; Comparative study of all Indian styles. Case Study: Brihadeshwara Temple

9 hours

UNIT – 3 : Medieval Architecture

Islamic / Mughal Architecture: Salient features and examples of Indo-Islamic style, Monuments built by Moghuls, Forts, temples and mosques, Mughal architecture, regional kingdom, Maratha temples. Case studies: Gol Gumbaz, Ibrahim Roza, Taj Mahal, Qutub Minar, Indo Sarcenic Architecture - combination of Hindu & Islamic Arcitecture Case study: Mysuru Palace 7 **Hours**

UNIT-4 Colonial Architecture

Architecture of Princely states of India: palaces, Colonial architecture, International, Art Deco buildings,

modern Buildings: case studies, Architecture today, creativity and commerce. Monuments in cities of India: Delhi, Mumbai, Kolkata, Chennai, Bengaluru. Case study: Teracorevala Aquarium, Mumbai, New Empire Cinema Theatre, Mumbai. 7 **Hours**
UNIT-5 Heritage Conservation
Introduction, Need, purpose, approaches, ethics, concepts and definitions, UNESCO, ICCROM role in conservation, causes of decay of structures, assessment methods, methods to restore, documentation of heritage properties, maintenance and repair, Case studies for Conservation: Bomonjee Hormarjee Wadia Fountain and Clock Tower, Mumbai; Shish Gumbad, Delhi; Rani ki Vav, Gujrat 7 **Hours**

Text books:

1. Sir Banister Fletcher; edited by Dan Cruickshank, "History of Architecture", CBS Publishers and Distributors, 2003
2. Brown, P. (2010). Indian Architecture: Buddhist and Hindu period. Mumbai : D.B. Taraporevala Sons and Co.

Reference materials:

1. The Guide to the Architecture of the Indian Subcontinent - by Takeo Kamiya (Author), Geetha Parameshwaran (Translator)
2. INDIAN ARCHITECTURE, MODULE V, Chapter 13 : Painting, Performing Arts and Architecture - Indian Culture and Heritage Secondary Course
3. Maintaining and repairing old heritage buildings - John J. Cullinane, Wiley (2012)
4. Ancient Indian Architecture (From Blossom to Bloom)'', Sanjeev Maheswari and Rajeev Garg, CBS Publishers & Distributors, 2001.
5. Master Pieces of Traditional Indian Architecture'', Satish Grover, Om Books, 2004.
6. History of Indian Architecture Buddhist, Jain and Hindu Period – Sharmin Khan, CBS Publishers and Distributors Pvt Ltd (2017)
7. History of Islamic architecture : Delhi sultanate, Mughal and provincial period - Sharmin Khan, CBS Publishers and Distributors Pvt Ltd (2016)
8. Conservation of Historic Buildings - Bernard Feilden, Routledge Publishers (2003)

E learning Resources:

https://nptel.ac.in/courses/124/106/124106009/

https://nptel.ac.in/courses/124/105/124105003/ for heritage conservation

http://whc.unesco.org/en/statesparties/IN

SEE paper pattern:

To set ONE question each in Units 1, 3, 4, 5 and TWO questions in Units 2. Students to answer **five** questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

CIE format	
Type of Assessment	**Marks**
TEST 1, 2, 3 (best two)	20 Marks each
QUIZ 1 & 2 or AAT (activity)	5 Marks each Or 10 Marks

CO-PO MAPPING SCALE 1 TO 3

COURSE : History of Indian Architecture												**CODE: 21CV7HSHIA**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1						2						3	2		
CO2						3						3	2		

	COURSE : History of Indian Architecture				**CODE: 21CV7HSHIA**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2	✓				

****

Course	Contracts, Specification and Estimation	Course Code	21CV7PCCSE	SEE Duration	3 hours
Credits	03	**L:T:P**	2:1:0	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES:

1. To provide basic knowledge of estimation and analyze the methods of estimation for various Civil Engineering Works.
2. To understand Contract Management and Tendering process.

COURSE OUTCOMES: An ability to	
CO1	Estimate the material quantities of various Civil Engineering works
CO2	Apply Cost Estimate
CO3	Perform Rate analysis
CO4	Write specifications for various items, Demonstrate Contract Management and Tender Process.

UNIT -1

Principles of Estimation: Estimation, Terms used in estimation, Units of measurement, Geometry of various shapes, Approximate methods of estimation, Detailed methods of estimation, Cost of materials and labor. Methods of taking out quantities– Center line method, Long wall and Short wall method. Preparation of detailed and abstract of estimates for the common Civil Engineering works. Introduction and an overview of the Schedule of Rates(S R) **06 Hrs**

UNIT – 2

Estimation of Civil Engineering Structures: Typical RCC and Steel framed structures, masonry structures dealt in the present curriculum of the Civil Engineering Program. **14 Hrs**

UNIT – 3

EARTHWORK ESTIMATION:

Methods of earthwork estimation. Estimation of earthwork of roads by mid sectional area method, mean sectional area method, trapezoidal and Prismoidal formula methods. **8 Hrs**

UNIT-4

SPECIFICATIONS & ANALYSIS OF RATES

Introduction, Definition of specifications, Objectives of writing Specifications, Essentials in Specifications, General and Detailed specifications of common item of works in Buildings only.

Analysis of rates, Definition. Working out quantities and rates for the standard items of works **12 Hrs**

UNIT-5

CONTRACTS

Definition of Contract, Objectives of Contract, Requirements of a valid Contract, Overview of Indian Contract Act 1872. Types of Engineering Contract with advantages, disadvantages and their suitability. Tender and Tender Documents, Tender and its Process, Breach of Contract and Arbitration. **08 Hrs**

Text books:

1. Estimating and Costing in Civil Engineering by B. N. Dutta, UBS Publishers and distributors Pvt. Ltd, New Delhi.

2. *Estimating*, Costing, Specification & *Valuation* In Civil Engineering By M Chakraborti.

Reference books:

1. Quantity Surveying-P.L.Basin S. Chand: New Delhi.
2. Estimating & Specification – S.C. Rangwala: Charotar publishing house, Anand.
3. Text book of Estimating & Costing- G.S. Birde, Dhanpath Rai and sons : New Delhi.
4. A text book on Estimating, Costing and Accounts- D.D. Kohli and R.C. Kohli S. Chand : New Delhi.
5. Schedule of Rates published by Public Works Department.
6. E-learning resources.

http://nptel.ac.in/courses/105106112/

SEE paper pattern:

There are 7 questions. Students have to answer 5 questions. Unit2 and Unit 4 have choice. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Contracts, Specification and Estimation											**CODE: 21CV7PCCSE**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	2	-	-	-	1	2	1	1	1	-	1
CO2	3	2	-	-	2	-	-	-	1	2	1	1	1	-	1
CO3	3	2	-	-	2	-	-	-	1	2	1	1	1	-	1
CO4	3	1	-	-	-	2	1	1	1	2	-	-	1	-	1

COURSE: Contracts, Specification and Estimation					CODE: 21CV7PCCSE
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		
CO4	✓	✓			

****

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	Design and Drawing of RCC and Steel Structures	Course Code	21CV7PCDDG	SEE Duration	4 hours
Credits	03	L:T:P	2:0:1	SEE+ CIE Marks	50+50

COURSE OBJECTIVES: To provide knowledge of design and drafting of RCC and Steel Structural components

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

CO1	Design and prepare working drawings of RCC Structural components
CO2	Design and prepare working drawings of Steel Structural components

PART A: RCC Structures

Given data -Drafting only

1. Beam slab floor system consisting of one way and two-way slabs and continuous and cantilever beams (2- Sheets), **4Hrs**

Design and Drawing

1. Rectangular and Circular water tanks (1 – Sheets) **3 Hrs**
2. Rectangular combined footings(1 Sheet) **3 Hrs**
3. Cantilever and counterfort retaining walls (2 – Sheets) **6 Hrs**

PART B: Steel Structures

Given data -Drafting only

1. Beam to Beam and Beam to column (framed and seated), Bolted and welded connections. Slab and Gusseted base, Gantry girder (1- Sheet) (3- Sheets), **4 Hrs**

Design and Drawing

1.Design and drawing of Welded Plate Girder (1- Sheet) **5 Hrs**

2. Design and drawing of Simple Roof Truss (1- Sheet) **5Hrs**

TEXT BOOKS

1. N. Krishnaraju, Structural Design & Drawing Reinforced Concrete & Steel, University Press.
2. S. Krishnamoorthy, Structural Design and Drawing (Concrete Structures), CBS publishers, New Delhi. Tata McGraw publishers.
3. Negi, Design of Steel Structures, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. IS: 456-2000, IS: 800–2007, SP-16, SP-34, SP 6 (1) – 1984 or Steel Table.
2. B.C. Punmia, Reinforced Concrete Structures,Laxmi Publishing Co.
3. S.N.Sinha, Reinforced Concrete Design, McGraw-Hill Education
4. N. Subramanian, Design of Steel Structures, Oxford University, Press.

E-learning resources:

http://nptel.ac.in/courses/105106112/

Question paper Pattern
Answer two Questions choosing each from Part A and Part B
Part A (RCC):
i)Drafting only:
Given data the student shall draft the same :**10 marks**
ii)Design and Drafting:
Given data the student shall design and draft: **40 Marks**
Internal choice in each part

Part B (STEEL):
i)Drafting only:
Given data the student shall draft the same :**10 marks**
ii)Design and Drafting:
Given data the student shall design and draft: **40 Marks**
Internal choice in each part

CO-PO MAPPING SCALE 1 TO 3

COURSE : Analysis and Design of Pre Stressed Concrete Members													**CODE: 21CV7PCDDG**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

Analysis and Design of Pre Stressed Concrete Members					**CODE: 21CV7PCDDG**
Taxonomy levels and COs	Remember / understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	

Course	Analysis and Design of Pre Stressed Concrete Elements	Course Code	21CV7PEPSC	SEE Duration	3 hours
Credits	03	**L:T:P**	**3:0:0**	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES: To understand the fundamental concept of pre-stressing and its techniques, analyse and design simple PSC members.

COURSE OUTCOMES: At the end of the course, the student will be able to	
CO1	Learn pre-stressing concepts, techniques and pre stressing systems
CO2	Analyse and design flexural members (Rectangular and flanged sections only).
CO3	Design for anchorage zone stresses as per I.S. Code of practice

UNIT -1

Introduction, Materials of pre stressing, Pre stressing systems

Basic concepts of pre stressing, historical development, need for high strength steel and concrete, terminologies, advantages and applications. Tensioning devices, pre and post tensioning systems, thermo electric pre stressing, chemical pre stressing.

Analysis of pre stress; Basic assumptions, analysis of pre stress, resultant stresses at a section, Pressure line or Thrust line. Concept of load balancing.

10 hours

UNIT -2

Losses of pre stress:

Nature of losses of pre stress, losses due to elastic deformation, loss due to shrinkage, creep, relaxation of stresses in steel, friction, anchorage slips, total losses allowed for design.

06 hours

UNIT-3

Flexure and shear strength of pre stressed concrete sections:

Types of flexural failure, strain compatibility, code provisions Principal stresses, design of rectangular and flanged sections

10 hours

UNIT-4

Deflection of pre stressed concrete members:

Importance of control of deflection, factors influencing the deflections, Evaluation of short term and long term deflections, I.S code limitations **06 hours**

UNIT-5

Anchorage zone stresses

Introduction, stress distribution in end block, Transmission of pre stress, Analysis of anchorage zone stresses, anchorage reinforcement. Design as per IS Code of Practice

05 Hours

Recommend Texts:
1) Pre stressed concrete by N. Krishna Raju, 5th Edn. Tata Mcgraw-Hill Publishing company limited
2) Pre stressed concrete by P.Dayarathnam,4th Edn, Oxford &IBH Publishers

Reference books and IS Codes

1. Design of Prestressed Concrete Structures by T.Y. Lin, Wiley Publishers.

2. Pre stressed concrete by S.K.Maallik & A.P. Gupta, Oxford & IBH Publishing Co.

3. Pre stressed concrete bridges by V.N.Vazirani and S.P Chandola 3rd Edn. Khanna Publishers, New Delhi

4. Pre stressed concrete by G.S. Pandith & Gupta CBS Publishers, New Delhi

5. Pre stressed concrete, Analysis and Design Fundamentals by Antoine Ewaaman, Mcgraw hill Publshers

6. IS 1343: 2012 Indian standard **code** of practice for Prestressed Concrete Design

E-learning resources: http://nptel.ac.in/courses/105106112/
NOTE: Instructions to candidates: Pattern of SEE question paper
Answer FIVE FULL QUESTIONS Choosing ONE FULL question from each unit

UNITS 2, 4 and 5 have one question only
UNITS 1 and 3 have internal choice. Student can answer one full question

CO-PO MAPPING SCALE 1 TO 3

COURSE : Analysis and Design of Pre stressed Concrete Members													**CODE: 21CV7PCPSC**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	2	-	-

Analysis and design of Pre stressed concrete members					**CODE: 21CV7PCPSC**
Taxonomy levels and COs	Remember/ Understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	

****

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	Advanced Design of RC Structures	Course Code	21CV7PEADR	SEE Duration	3 hours
Credits	03	**L:T:P**	**3:0:0**	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES: To understand the concepts of advanced reinforced concrete design.

COURSE OUTCOMES: At the end of the course, the student will be able to	
CO1	Analyse and design flat stab, continuous beams and grid floor system
CO2	Analyse and design RCC bunkers and silos
CO3	Analyse and design circular overhead RC water tanks with staging
CO4	Analyse and design Raft foundation

UNIT -1

CONTINOUS BEAMS

Continuous beams, loads, concept of long span beams, redistribution of moments. **06 hours**

UNIT -2

FLAT SLABS:

Basic concepts of flat slab, parts of a flat slab, types of flat slab, analysis and design of a typical flat slab with and without drops **08 hours**

UNIT-3

GRID FLOORS:

Analysis and Design of grid floor **06 hours**

UNIT-4

OVER HEAD WATER TANK:

Forces to be considered in the analysis of RC circular overhead water tanks. Parts of a Circular overhead water tank and their Design

08 hours

UNIT-5

RAFT FOUNDATIONS:

Forces to be considered. Analysis and design of a simple raft foundation **04 Hours**

TEXT BOOKS

1. N. Krishnaraju, Structural Design & Drawing Reinforced Concrete & Steel, University Press.
2. S. Krishnamoorthy, Structural Design and Drawing (Concrete Structures), CBS publishers, New Delhi. Tata McGraw publishers.

REFERENCE BOOKS and IS Codes:

1. IS: 456-2000, IS: 800–2007, SP-16, SP-34, SP 6 (1) – 1984 or Steel Table.
2. B.C. Punmia, Reinforced Concrete Structures, Laxmi Publishing Co.
3. S.N. Sinha, Reinforced Concrete Design, McGraw-Hill Education

E-learning resources:

http://nptel.ac.in/courses/105106112/

Pattern of SEE question paper

TOTAL SEVEN QUESTIONS to be set covering all 5 units. Students shall Answer FIVE FULL QUESTIONS choosing ONE FULL question from each unit

UNITS 1, 3 and 5 shall have one question only
UNITS 2 and 4 shall have an internal choice.
All questions shall have maximum three sub questions.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Advanced Design of RC Structures												**CODE: 21CV7PEADR**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-

	Advanced Design of RC Structures				**CODE: 21CV7PEADR**
Blooms Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	

Course	**Advanced Foundation Design**	**Course Code**	**21CV7PEAFD**	**SEE Duration**	3 hours
Credits	03	**L:T:P**	3:0:0	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES: Understand the need for having foundation and their types to suit the practical requirements. Develop an understanding about the requirements of foundations for their satisfactory performance.

COURSE OUTCOMES: An ability to	
CO1	Classify and suggest foundation type for various field and loading conditions, understand the basic requirements of a satisfactory foundation and the determinants of foundation location and depth, and proportion shallow foundations.
CO2	Estimate individual vertical and lateral pile load capacity, pile group capacity, and pile group efficiency.
CO3	Explain the causes of expansive nature of clays, simple methods to assess the swelling potential and methods to prevent and overcome swelling of expansive clays.

UNIT -1

SHALLOW FOUNDATIONS

Introduction, Types of shallow foundations. Basic requirements of satisfactory foundation - Location and depth criterion, stability criterion, settlement criterion. Determination of foundation location and depth. Bearing capacity theories-Terzaghi, Meyerhof, Skempton, Vesic and Brinch Hansen.

10 Hours

UNIT – 2

FOUNDATION SETTLEMENTS AND PROPORTIONING OF FOOOTINGS

Settlement of shallow foundation, types-immediate, consolidation and differential settlements. Principles of design of footing, proportioning of isolated, combined rectangular and trapezoidal footings (proportioning only)

06 Hours

UNIT-3

PILE FOUNDATIONS

Introduction, Necessity of pile foundation, classification. Load carrying capacity by dynamic formula- Engineering News formulae and Hiley's formulae, static method, Correlations with SPT and CPT, Pile load test. Negative skin friction, pile groups, group action of piles in sand and clay, group efficiency,

08 Hours

UNIT-4

LATERALLY LOADED PILE FOUNDATIONS

Pile and pile groups subjected lateral loads. Batter piles, response to shear and moment loads, boundary conditions. Methods of design of laterally loaded vertical piles. Lateral load capacity by Reese and Matlock method (Elastic method) and Brom's method (plastic method).

07 Hours

UNIT-5

FOUNDATIONS ON EXPANSIVE SOIL

Introduction, Identification, Mineral structure, Index properties of expansive soils. Free swell test and free swell ratio as a simple and quick method of identifying principal clay mineral present in soil. Definition of swell pressure, swell potential and their determination. CNS layer, under reamed piles, foundation treatment for structures in expansive soils. Case studies

05 Hours

Text books:

1. Murthy V.N.S., (2007) "Advanced Foundation Engineering", 1st Edition, C.B.S Publishers, Bangalore
2. Varghese P.C., (2007) "Foundation Engineering"- Prentice hall of India, New Delhi

Reference books:

1. Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.
2. Braja, M. Das (2010), "Principles of Foundation Engineering", Seventh Edition, World Press.
3. Donald Coduto P (1994) "Foundation Design-Principles and Practices", Prentice Hall.
4. Relevant B.I.S codes.

E-learning resources:

http://nptel.ac.in/courses/105107120/

SEE paper pattern:

To set One question each in Units 2, 4, 5 and two questions each in Units 1 and 3. Students to answer **Five** questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

CO-PO MAPPING SCALE 1 TO 3

COURSE: Advanced Foundation Design													**CODE: 21CV7PEAFD**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	1	-	-	-	-	3	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	-	2	-

COURSE: Advanced Foundation Design					**21CV7PCAFD**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓		

Course	Geometric Design of Roads	Course Code	21CV7PEGDR	SEE Duration	3 hours
Credits	03	**L:T:P**	3:0:0	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES: To understand the design aspects of road geometrics to address the practical problems in highway engineering.

COURSE OUTCOMES: An ability to	
CO1	Define the basic principles and techniques of design of roads.
CO2	Design the alignment of roads, intersections and safety concerns.
CO3	Apply the principles and techniques to highway design problems.

UNIT -1

INTRODUCTION:

Importance and objectives of Geometric Design, Design Controls – Design Speed, Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service as per IRC standards and specifications. PCU Concepts, factors controlling PCU for different design purpose.

02 Hours

CROSS SECTIONAL ELEMENTS:

Pavement surface characteristics, Camber – objectives of camber, types of camber, Methods of providing camber in the field, Problems. Carriage way, Medians, Kerbs, Road margins, Roadway, Right of way and Land width, Typical cross section of roads, Design of Road humps as per IRC.

05 Hours

UNIT – 2

SIGHT DISTANCE:

Importance of Sight Distances for Horizontal and Vertical Curves, Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance, Criteria for Sight Distance requirements, Sight distance at uncontrolled intersection, factors affecting sight distance, IRC standards, Problems.

07 Hours

UNIT-3

HORIZONTAL ALIGNMENT:

Objective of horizontal curves, Design Speed, Horizontal Curves, Superelevation – Need for Super elevation, Method of computing super elevation, Methods of attainment of superelevation, Radius of Horizontal Curve, Extra widening on curves, Horizontal Transition Curves – objectives – Ideal requirements – Types of transition curve – Method of evaluating length of transition curve, Set-back distance on horizontal curve, Curve Resistance and problems.

08 Hours

UNIT-4

VERTICAL ALIGNMENT:

Gradients – Types of gradients – Design criteria of summit and valley curve – Design of vertical curves based on SSD – OSD – Night visibility considerations – Combination of Vertical and Horizontal Curves – problems on the above. **08 Hours**

UNIT-5

INTERSECTION DESIGN:

Types of Intersections; Design Principles for Intersections; Design of At-grade Intersections – Channelisation, Objective; Traffic Islands and Design standards; Rotary Intersection – Concept and Design, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

05 Hours

TRAFFIC SIGNS AND ROAD MARKINGS:

Types of Road Signs; Guidelines for the provision of Road Signs; Cautionary Signs, Regulatory Signs, Information Signs – Design standards; Road markings – Objective of Road Markings; Types of Road Markings; Role of Road markings in Road Safety and Traffic Regulation; Specification for Road Markings.

02 Hours

Text books:

1. 1. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Engineering", Revised 10th Edition, Nem Chand and Bros, Roorkee, 2014.
2. 2. R. Srinivasa Kumar, "Textbook of Highway Engineering", Universities Press (India) Private Ltd., 2012.

Reference books:

1. L. R. Kadiyali & N. B. Lal, "Principle and Practice of Highway Engineering", Khanna Publications, 2005.
2. C. Jotin Khisty & B. Kent Lall, "Transportation Engineering: An Introduction", 3rd Edition, Prentice-Hall of India Private Limited, New Delhi, 2006.
3. Relevant IRC Publications – IRC-3, IRC-35, IRC-38, IRC-64, IRC-65, IRC-66, IRC-69, IRC-73, IRC-86, IRC-99, IRC: SP-23, IRC: SP-41.

E-learning resources:

1.nptel.ac.in/downloads/105101087/
2.http://freevideolectures.com/Course/91/Introduction-to-Transportation-Engineering/23

SEE paper pattern:

To set One question each in Units 1, 2, 5 and two questions each in Units 3 and 4. Students to answer **Five** questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

CO-PO MAPPING SCALE 1 TO 3

COURSE : Geometric Design of Roads													**CODE: 21CV7PEGDR**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	3	-	-

COURSE : Geometric Design of Roads					**CODE: 21CV7PEGDR**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓		✓	
CO3	✓	✓		✓	

****

Course Name	Industrial Waste Water Treatment	Course Code	21CV7PEIWW	SEE Duration	SEE+CIE
Credits	03	L-T-P	3:0:0	3 Hours	50+50

Course Learning Objectives: The students will be able to	
1	apply the concepts on Industrial wastewater treatment and their effluents to be disposed of without danger to human health or unacceptable damage to the natural environment.
2	gain knowledge on the concept and application of industrial pollution prevention, cleaner technologies, industrial wastewater treatment and disposal of effluents.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the effects of industrial waste water on streams and treatment plants.
CO2	Explain the process of natural purification of streams and various pre-treatment methods.
CO3	Recognize sources, characteristics and treatment methods of industrial waste water.

UNIT-I

INTRODUCTION:

Importance of treatment of industrial waste water, Difference between domestic and industrial wastewater, effects on streams and on Municipal Sewage treatment plants, and receiving water bodies. **6 Hrs**

UNIT-II

NATURAL PURIFICATION STREAMS:

Stream quality, dissolved oxygen Sag curve in Streams, Stream sampling, effluent and stream standards and legislation to Control water pollution. Streeter-Phelps formulation, Numerical problems on DO prediction **6 Hrs**

UNIT – III

PRETREATMENT OF WASTE WATER:

Theories and practices: Volume reduction: classifying wastes, conserving waste water, changing production to decrease wastes; reusing both industrial and municipal effluents as raw water supplies and eliminating batch or slug discharges of process wastes. Concentration reduction: process changes, equipment modifications, segregation of wastes, equalization of wastes, by-product recovery and proportioning wastes, pre-treatment of industrial waste water neutralization: mixing of wastes and chemical treatment. Equalization and proportioning: objectives and methods **8 Hrs**

UNIT-IV

TREATMENT METHODS:

Removal of Inorganic, Organic solids, suspended and colloidal solids, Treatment and disposal of sludge Solids **6 Hrs**

UNIT-V

COMBINED TREATMENT METHODS:

Feasibility of combined treatment of industrial raw wastewater with Domestic Wastewater, Discharge of raw, partially treated and completely treated wastewaters to streams. **6 Hrs**

Case studies

Characteristics and Composition of waste water and Manufacturing processes of Industries like Paper and pulp, Cotton textile industry; Tanning Industry, cane sugar industry & distillery industry; Dairy industry; Steel and cement Industry, Pharmaceutical Industry

8 Hrs

Text Books	
1	M.N.RAO AND A.K.DATTA (2015) - Wastewater Treatment.
2	Nemerow N.L., (2006) – Industrial Wastewater Treatment- Contemporary New York. Practice and Vision for the Future, Elsevier Science and technology.
Reference Books	
1	Ross **R.D. (1968), "Industrial Waste Disposal", Reinhold Environmental Series,**
2	Mahajan (1984) –" Pollution control in Process industries". TMH, New Delhi.
3	G.L.KARIA AND R.A.CHRISTIAN (2008) - Wastewater Treatment-concepts and Design Approach PHI learning, New Delhi-110001.
4	Eckenfelder (2000), "Industrial Water pollution Control"- McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA.

Course Name	**Structural Dynamics**	Course Code	**21CV7PESDY**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P	**3:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES: The objective of the course is to teach the concept of structural dynamics and to understand time dependent response of linear systems. Also, to enable students to learn the physical behavior of vibrating systems through experimental modules.

COURSE OUTCOMES: An ability to	
CO1	Compute natural frequency and free vibration response of SDOF systems
CO2	Set-up the equation of motion and obtain the Dynamic magnification factor of SDOF systems subjected to harmonic inputs
CO3	Set-up equation of motion of free-vibration response of MDOF systems and continuous system, solve them to obtain natural frequencies (Eigen values) and mode shapes (Eigen vectors)
CO4	Conduct free vibration tests to obtain natural frequency and damping

Unit - 1

Introduction to Dynamical problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, energy principles, idealization of lumped SDOF system, springs-in-series and springs-in-parallel configuration, types of damping, natural frequency and free vibration response of un-damped SDOF systems.

Unit - 2

Free vibration response of viscously damped SDOF system, logarithmic decrement, critical damping, over-damped and under-damped system

Unit - 3

Forced vibration response of damped SDOF system - response to harmonic loading, support motion, evaluation of damping, vibration isolation, transmissibility, response to aperiodic forces - Duhamel integral

Unit - 4

Mathematical models of un-damped and damped MDOF systems, Free vibration of un-damped MDOF systems - Natural frequencies and mode shapes – orthogonality conditions, modal analysis – free and forced vibration with and without damping.

Unit - 5

Introduction to dynamics of continuous systems - free flexural vibration response uniform beams with various boundary conditions, Introduction to experimental dynamics: principle of vibration-measuring instruments–seismometer and accelerometer, free vibration tests on SDOF and MDOF systems to obtain natural frequencies and damping through logarithmic decrement

Text Books:

1. *Mario Paz* , Structural Dynamics – Theory and computation, 4th edition, , Kluwer publication
2. *William T Thomson* ,Theory of Vibrations with application, 5th edition, , Pearson publication

Reference Books:

Anil K. Chopra ,Dynamics of Structures - -Prentice Hall of India

R.W. Clough &J.Penzien ,Dynamics of Structures --McGraw Hill

John M Biggs ,Introduction to Structural Dynamics--McGraw Hill pub

Schaum's outline series – Machanical vibrations-S Graham Kelly-McGraw Hill, India
M Mukhyopadhyay, Structural Dynamics--CRC Press, India

SEE QUESTION PATTERN:
Scheme of Examination: Student shall answer **Five** full questions, selecting one from each unit. Unit 3 & Unit 4 have internal choice.

Course	Groundwater Hydrology	Course Code	21CV7PEGWH	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	SEE+ CIE Marks	50+50

COURSE OBJCTIVES :
The objective of this course is to understand the ground water availability, flow and storage with relevant techniques of practical relevance.

COURSE OUTCOMES: An ability to	
CO1	Explain the fundamental concepts of the occurrence and movement of groundwater
CO2	Estimate the ground water flow rate and flow direction using modelling techniques
CO3	Estimate the yield from a well and analyse the performance of a recharge well
CO4	Analyse the movement of pollutants in groundwater and explain the freshwater and groundwater interface
CO5	Explain various surface and subsurface groundwater investigation methods

UNIT-1

INTRODUCTION:
Groundwater utilization &historical background, groundwater in hydrologic cycle, groundwater budget, and groundwater level fluctuations

3 **Hours**

OCCURRENCE AND MOVEMENT OF GROUNDWATER:
Origin & age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration & saturation, aquifers and their characteristics/classification, groundwater basins & springs, Darcy's Law, permeability & its determination, Dupuit assumptions, Groundwater flow rates & flow directions, general flow equations through porous media, Groundwater Interaction with Streams and Lakes

9 Hours

UNIT-2

WELL HYDRAULICS:
Steady/ unsteady, uniform/ radial flow to a well in a confined/ unconfined /leaky aquifer, Partially penetrating/horizontal wells, testing for yield, Hydraulics of recharge wells.

7 Hours

UNIT-3

Concept & methods of artificial ground water recharge, wastewater recharge for reuse.

POLLUTION AND QUALITY ANALYSIS OF GROUNDWATER:
Sources of groundwater pollution, advection and dispersion, criteria & measures of ground water quality, ground water salinity, groundwater remediation

7 Hours

UNIT-4

SALINE WATER INTRUSION IN AQUIFERS:
Ghyben-Herzberg relation between fresh & saline waters, shape & structure of the fresh & saline water interface, upcoming of saline water, saline water intrusion control

6 Hours

UNIT-5

SURFACE/ SUB-SURFACE INVESTIGATION OF GROUND WATER:
Geological /geophysical exploration/ remote sensing / electric resistivity /seismic refraction based methods for surface investigation of ground water, test drilling & ground water level measurement, sub-surface ground water investigation

7 Hours

Text books:

1. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000.
2. K. R. Karanth, "Hydrogeology", Tata McGraw Hill Publishing Company.

Reference books:

1. Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000.
2. Bear J., Hydraulics of Groundwater, McGraw-Hill International, 1979.
3. Willis, R. and W.W.G. Yeh, Groundwater Systems Planning and Management, Prentice-Hall, 1987.
4. S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1993.

E-learning resources:
http://nptel.ac.in/courses/105101082/
https://nptel.ac.in/courses/105/103/105103026/

SEE paper pattern:
Student shall answer FIVE full questions, selecting one from each unit.
Unit (1) & Unit (2) HAS INTERNAL CHOICE.

CO-PO MAPPING SCALE 1 TO 3

COURSE : Groundwater Hydrology															**CODE: 21CV7PEGWH**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	2														

COURSE : Groundwater Hydrology					**CODE: 21CV7PEGWH**
Taxonomy levels and Cos	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓			
CO3	✓	✓	✓		
CO4	✓	✓	✓		
CO5	✓	✓			

****

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	Remote Sensing and GIS	Course Code	21CV7OERSG	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	SEE+ CIE Marks	50+50

COURSE OBJECTIVES: To introduce remote sensing and GIS as a Vital tool for faster decision making. The main aim of the course is to impart knowledge on the concepts and application of remote sensing and GIS for general and specific tasks.

COURSE OUTCOMES: An ability to	
CO1	Explain the principles of Geodatabase
CO2	Discuss the application of multicriteria decision analysis for various issues.
CO3	Recognize the various advances in GIS, Applications of Expert GIS

UNIT -1

Geodatabase: Types of geodatabase, Advantages of geodatabase, Basic geodatabase structure, Topology, Relational classes, geometric networks, raster data - Creating geodatabase, organizing data, defining databaseStructure - Understanding spatial reference in geodatabase - Modifying spatial domain, Simple feature creationin geodatabase, Creating and editing map topology , Types of geodatabase annotation - Adding behavior to a Geodatabase

10 hrs

UNIT – 2

Multi-Criteria Decision Analysis and SDSS: Elements of multi-criteria decision analysis, classification of decision problems, evaluation criteria, hierarchical decision alternatives and constraints, alternatives anddecision variables, deterministic variables, criteria weighting , estimation weights, ranking methods, decisionrules, multi-attribute decision rules, sensitivity analysis, multi-criteria spatial decision support systems (SDSS).Cartography

9 hrs

UNIT-3

Advanced GIS

Introduction to Geographic Resources Analysis Support System (GRASS) GIS Raster data handling Reclassification, recode map algebra Resampling and interpolation of raster data. Overlaying Spatial analysis Neighborhood analysis and cross-category statistics -buffering Cost surfaces --Terrain and watershed analysis –Modeling raster data-Vector data handling-Topological operations - Buffering –Overlay –Dissolve –clip, union intersect –Network analysis–Spatial

7 H r s

UNIT-4

Expert GIS: Introduction to concepts of Expert GIS, Data formats, Proprietary file formats, translator and Transfer formats, open formats, standards, metadata, standards gazetteer, XML and GML, Spatial databases, Relational databases, object databases, GIS and databases, advanced database technology, derived mapping.

7 hrs

UNIT-5

Enterprise GIS: User need assessment; old and new spatial database models, SDE layers, Geo database, Architecture design, capacity planning (Hardware), security planning, RDBMS software selection, GIS software selection, planning for migration. Enterprise GIS management, Case Studies

6 hrs

Text books:

1. GIS and Multi-criteria decision analysis by JacekMalczewski, John Wiley and sons.2015
2. Concepts and Techniques of Geographic Information Systems CP Lo Albert K WYeung, 2015 Prentice Hall of India.
Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc,New York, 2014

Reference books:

1. Remote sensing and Image interpretation by Thomas M. Lillesand and Ralph
W. Kiefer, JohnWiley and Sons Inc., New York, 2014
2. Geographical Information Systems – Principles and Applications, Volume I edited by David J. Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 2014
3. Geographical Information Systems – Principles and Applications, Volume II edited by David J. Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons.Inc., New York 2014.

E-learning resources:

nptel.ac.in/courses/105102015/50

www.gistutor.com › ESRI ArcGIS

SEE paper pattern:

1. Unit IV and Unit V have internal choice
2. Unit I, Unit II, Unit III has one question each

CO-PO MAPPING SCALE 1 TO 3

	COURSE : Remote Sensing and GIS									**CODE:** 16CV70ERSG					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**										**3**		2	
CO2	**2**	**3**	**2**					**2**	**2**	**2**	**2**			2	
CO3	**1**	**3**	**1**		**2**	**2**								2	

****

Course	Finite Element Analysis	Course Code	21CV7OEFEA	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	SEE+ CIE Marks	50+50

COURSE OBJECTIVES: The objective of the course is to teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues associated with solids and structures.

COURSE OUTCOMES: An ability to	
CO1	**APPLY** basics of Theory of Elasticity to continuum problems.
CO2	**FORMULATE** finite element like bar, truss and beam elements for linear static structural analysis.
CO3	**DEVELOP** finite element models for 2D elements.
CO4	**SOLVE** problems of limited complexity
CO5	**UTILIZE** finite element software to simulate practical problems.

UNIT -1

Fundamental concepts: Principles of Elasticity: Concept of stress – Stress at a point – equilibrium equations. Strain displacement relationships in matrix form – Constitutive relationships for plane stress and plane strain.

05 Hrs

Introduction to Finite element method (FEM), Different approximate methods, Basic concept, Historical background, Engineering applications, Classification of elements, Banded matrix and node numbering, Steps for solving problems using FEM. Commercial packages – Preprocessor, Solver and Post processor.

04 Hrs

UNIT – 2

One dimensional problems: Finite Element Modeling using two noded bar element– Definition of generalized coordinates and identification of degrees of freedom. Polynomial based interpolation model, Convergence criteria, Shape functions, Stiffness matrix by minimum potential energy principle, Properties of stiffness matrix, Global stiffness matrix, Consistent load vectors for traction and body force and Temperature effects. Numerical problems on simple bars subjected to forces and temperature change for displacements, reactions and stresses

08 Hrs

UNIT – 3

Analysis of Trusses and beams: Formulation of stiffness matrix for trusses. Hermite shape functions, Formulation of stiffness matrices for beams, Consistent load vectors for uniformly distributed load and triangular load. Numerical examples on beams and Trusses.

08 Hrs

UNIT-4

Two dimensional problems: Nodal displacement parameters, PASCAL's triangle – geometric isotropy. Shape functions in Cartesian and Natural coordinates for three noded triangular (CST) and four noded quadrilateral elements. Numerical examples to find stress and strain at a given point.

07Hrs

UNIT-5

Concept of isoparametric elements: Concept of isoparametric elements, Development of strain-displacement matrix and stiffness matrix, Jacobian matrix, consistent nodal load vector. Sub-parametric and Super-parametric elements and Numerical integration using gauss quadrature approach. Higher order elements – Serendipity and Lagrangian family of Finite elements.

07Hrs

TEXT BOOKS

1. Krishnamoorthy C.S., "Finite Element Analysis", 2nd ed., Tata-McGraw-Hill Education Pvt. Ltd., 2004.
2. Desai.Y.M.,Eldho.T.I., and Shah. A.H., "Finite Element Method with Applications in Engineering", Pearson publication, 2011.

REFERENCE BOOKS

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", 2nd ed., Prentice Hall, India, 2003.
2. Zienkiewicz O.C., "The Finite Element Method – Basic & Fundamentals", 7th ed., Book-Aid International, 2013.
3. Reddy J.N., "An Introduction to the Finite Element Method", 3rd ed., McGraw-Hill, 2005.
4. Cook R.D., "Concepts and Applications of Finite Element Analysis", 4th ed., John Wiley & Sons, 2004.
5. Rajashekaran S., "Finite Element Analysis in Engineering Design", Wheeler Publishing, 2006.
6. Logan D.L., "First Course in the Finite Element Method", 4th ed., Cengage Learning, 2007.
7. Hughes T.J.R., The Finite Element Method: Linear Static and Dynamic Finite Element Analysis", 1st ed., Dover Publications, 2000

E-Books / Web References
http://nptel.ac.in/courses/112104115/

MOOCs

1. Finite Element Method (FEM) Analysis and Applications
   https://www.edx.org/course/finite-element-method-fem-analysis-tsinghuax-70120073x
2. A Hands-on Introduction to Engineering Simulations
   https://www.edx.org/course/hands-introduction-engineering-cornellx-engr2000x

Alternate assessment tool (AAT) for CIE: Utilization of finite element software to simulate practical problems – ABAQUS/ANSYS.
Scheme of Examination: Student shall answer **Five** full questions, selecting one from each unit. Unit 2 & Unit 3 have internal choice.

CO-PO MAPPING SCALE 1 TO 3

	COURSE : Finite Element Analysis											**CODE:** 21CV7OEFEA			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3				3								3		-

****

VIII SEMESTER SYLLABUS

Course	Construction Project Management, Economics and Professional Ethics	Course Code	21CV8HSCEP	SEE Duration	3 hours
Credits	02	L:T:P	2:0:0	SEE+ CIE Marks	50+50

COURSE OBJECTIVES: To provide basic knowledge of project management and economics, concepts of contract and ethics in Civil Engineering profession.

COURSE OUTCOMES: An ability to

CO1	Identify the organization structure of a project, provide an outline of project planning by drawing network diagram using CPM and PERT analysis
CO2	Develop resource plan, resource allocation and resource leveling for a construction project including estimation of time-cost trade–off in a construction project and to work in a team to develop construction schedules for real time projects

UNIT -1

Project Organization, Bar Charts, Work Breakdown Structure, Networking techniques, development of network

4 Hours

UNIT -2

Unit – II: CPM network & PERT network analysis **6 Hours**

UNIT-3

Resource planning, Time-cost trade-off, Cost control in construction, Materials management, Introduction to Construction management software & BIM. **4 Hours**

UNIT-4

Economics: Introduction, Time value of money, Capital budgeting, Working capital management, Construction accounting, Introduction to financial management & financial ratio's analysis.

6 Hours

UNIT-5

Professional ethics- Importance, motivation, impact of violation of professional ethics on society, remedies case studies

4 Hours

(12 weeks of semester = 12 X 2 hours= 24hours)

Text Books:

1. Project Planning and Control with PERT and CPM by B C Punmia and K K Khandelwal
2. Chitkara K K, "Construction Project Management, Planning, Scheduling and Controlling, McGraw Hill Education, 3rd Ed., 2014.

References:

1. Srinath L.S, "PERT and CPM", East West Press Pvt Ltd New Delhi.
2. Van Horne J.C, "Fundamentals of Financial Management" Prentice Hall, 2009
3. Blank L and Anthony T, " Basics of Engineering Economy", McGraw Hill Education, Indian Edition, 2013.
4. K G Krishnamurthy, S V Ravindra, "Professional Practice", PHI, 2014
5. Wueste, Daniel E, 'Introduction, Professional Ethics and Social responsibility', Rowman and Littlefield Publishers, Inc. London, 1994

E-Resources: Mooc:
https://onlinecourses.nptel.ac.in/noc17_mg01/preview
http://nptel.ac.in/courses/109104068/30

SEE paper pattern:
To set One question each in Units 1, 3, 5 and two questions each in Units 2 and 4. Students to answer **Five** questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

CO-PO MAPPING SCALE 1 TO 3

	COURSE : Construction Project Management, Economics and Professional Ethics CODE:21CV8HSCEP														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	-	1	1	3	3	2	2	1	2	-	2	-
CO2	3	3	2	-	1	1	3	3	2	2	1	2	-	2	-

	COURSE: Construction Project Management, Economics and Professional Ethics 21CV8HSCEP				
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		

Course	Sustainability and Lifecycle Assessment	Course Code	21CV8OESLA	SEE Duration	3 hours
Credits	03	**L:T:P**	3:0:0	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES:

The modern-day engineers are expected to give technological solutions to the broadly understood societal problems and enhance the well-being of the human society and the environment/ecology as a system. Knowing that human society and environment need to co-exist in a 'sustainable' manner, it has become imperative for engineers to understand the solution space beyond the conventional technical solutions. It is important to educate the graduating students to different aspects of 'sustainability' and engineering systems

COURSE OUTCOMES:	
CO1	Quantify the sustainable indices
CO2	Decide system boundaries for LCA and perform LCA
CO3	Relate engineering designs in sustainable parameters

UNIT -1 : Introduction to sustainability

Concept of Sustainability, Sustainable engineering and practices, Pillars of sustainability, Challenges to Sustainability, UNESCO sustainable development goals.

Hours : 6

UNIT-2 : Sustainability indicators

Sustainable development indices,Resources and energy consumption, waste management,GHG emissions and eco-indicators.

Hours : 7

UNIT – 3 : Materials and sustainability

Materials - understanding the properties beyond engineering parameters, Common materials' consumption and lifecycle patterns, Estimation of embodied energy of materials - Numerical and case studies.

Hours : 7

UNIT-4 Life-cycle analysis of products and systems

Components of lifecycle analysis and estimation, Estimation of lifecycle, End-of-life analysis - Numerical and case studies

Hours : 8

UNIT-5 Strategies for sustainable engineering

Impact assessment/ audit process, Selection of suitable alternatives-the 3R strategy and other

strategies, Choice of renewable forms, Lifestyle practices, Energy-cost relationships, Promotion of sustainability through incentives.

Hours : 8

Text books:

1. Materials and the Environment - Michael Ashby, Elsevier 2012

Reference book and codes:

1. National Building Code of India - 2016, part 2, BIS, New Delhi
2. Inventory of Carbon and Energy, University of Bath. Sustainable Energy Research Team
3. Engineering for sustainable Development : Guiding Principles, The Royal Academy of Engineering, 2005
4. Sustainable Construction - Green Building Design and Delivery, Charles J Kibert, 2013
5. Alternative building Materials and Technologies 2 - K S Jagadish, B V Venkatarama Reddy and K S NanjundaRao, , New Age International Ltd. Publishers, New Delhi, 2017.

SEE paper pattern:

To set One question each in Units 1, 2, 5 and two questions each in Units 3 and 4. Students to answer **Five** questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

CO-PO MAPPING

COURSE : Sustainability and Lifecycle Assessment												**CODE: 21CV8OESLA**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	✓	✓			✓	✓	✓								
CO2	✓	✓	✓	✓	✓	✓	✓					✓			
CO3						✓	✓					✓			

	COURSE: Sustainability and Lifecycle Assessment 21CV8OESLA				**CODE:**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓		

Course	Occupational Safety And Health Administration	**Course Code**	**21CV8OEOSH**	**SEE Duration**	3
Credits	**3**	**L:T:P**	3-0-0	**SEE+ CIE Marks**	50+50

COURSE OBJECTIVES: To introduce occupational safety and health as a vital tool for enforcing safe working conditions. The main aim of the course is to impart knowledge on the concept and application of safety and health issues at work environment.

COURSE OUTCOMES: An ability to	
CO1	Demonstrate the knowledge of principles of safety and Legislation
CO2	Explain accident Investigation and Reporting
CO3	Recognize the various hazards - Risk analysis. Illustrate the various Occupational health and Toxicology issues.

UNIT -1

Principles of safety:

History of Safety movement. Evolution of modern safety concept.- General concepts of management planning for safety for optimization of productivity. Productivity, quality and safety line and staff. Functions for safety -budgeting for safety. Safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, Safety sampling, evaluation of performance of supervisors on safety. Occupational safety and Health act, Guide lines, Occupational safety and Health administration, Right to know laws, EHS (environment, Health and safety) and its compliance. Safety gadgets and equipments. **10 Hrs**

UNIT – 2

Accident Investigation and Reporting

Concept of an accident, reportable and non-reportable accidents, reporting to statutory authorities principles of accident prevention accident investigation and analysis records for accidents, departmental accident reports, documentation of accidents unsafe act and condition, domino sequence –supervisory role –role of safety committee cost of accident. Recommended practices for compiling and measuring work injury experience –permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices. **9 Hrs**

UNIT-3

Fire prevention and control

Sources of ignition –fire triangle–principles of fire extinguishing–active and passive fire

protection systems–various classes of fires A, B, C, D, E–types of fire extinguishers–fire stoppers–hydrant pipes–hoses–monitors–fire watchers –lay out of stand pipes –fire station -fire alarms and sirens–maintenance of fire trucks–foam generators–escape from fire rescue operations–fire drills –notice -first aid for burns, PPE
8 Hrs

UNIT-4

Hazard risk analysis

Introduction, hazard, hazard monitoring -risk issue, group or societal risk, individual risk, voluntary and involuntary risk, social benefits Vs technological risk, approaches for establishing risk acceptance levels, Risk estimation.

Hazard assessment, procedure, methodology; safety audit, checklist analysis, what if analysis, safety review, preliminary hazard analysis(PHA), human error analysis, hazard operability studies(HAZOP),safety warning systems-Fault Tree Analysis and Event Tree Analysis, Logic symbols, methodology, Ergonomics
6 Hrs

UNIT-5

Occupational health and Toxicology

Health considerations at work place-Types of diseases and their spread, Health Emergency, Environmental Management plans for safety and sustainability **6 Hrs**

Text books:

1. Occupational safety and Health for Technologists, Engineers and Managers: Geotech. D.L.Prentice Hall publishing.
2. Essentials of safety management: Kaila and singh, Himalaya publishing house.
3. Fire safety in Buildings. V.K.Jain, New Age Publishers

Reference books:

1. National safety council of India, GOI Publication.
2. Loss prevention society of India publication
3. Industrial Accident prevention. Heinrich H.W. Mcgraw hill publication
4. Industrial accident prevention. Colling.D.A. Prentice hall publishing.

E-learning resources:

https://nptel.ac.in/courses/110/105/110105094/
https://nptel.ac.in/courses/103/107/103107156/

Question paper pattern:

1. Unit IV and Unit V have internal choice
2. Unit I, Unit II, Unit III has one question each

CO-PO MAPPING SCALE 1 TO 3

COURSE: Occupational Safety and Health Administration														**CODE: 21CV8OEOSH**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**										**3**		2	
CO2	**3**	**2**	**3**				**2**	**3**	**3**	**2**	**2**	**2**		2	
CO3	**3**	**3**	**2**		**3**	**3**				**2**	**2**			2	

****

Course Name	Environmental Impact Assessment	Course Code	21CV8PEEIA	SEE Duration	SEE+CIE
Credits	03	L-T-P	3:0:0	3 Hours	50+50

Course Learning Objectives: The students will be able to	
1	To introduce the methodology of environmental impact assessment (EIA) as a vital tool for sound environmental management and decision-making.
2	To study the principles, methodologies and techniques of Environmental Impact Assessment (EIA)
3	This course will explore the need for environmental impact assessments, the different types of assessments, and the regulatory and technical requirements of preparing an assessment.
4	To prepare EIA for specific case studies

UNIT-I	
INTRODUCTION: Definition, Evaluation of EIA in India, Development activity and Ecological factors, Relationship between EIA, EIS, and FONSI. Purpose and Need for EIA studies, Base line information.	**6 Hrs**
UNIT-II	
FUNDAMENTAL APPROACH TO EIA/ EIA PROCEDURES: Step- by- step procedure for conducting EIA, Advantages and Limitations of EIA. Hierarchy in EIA.Statutory Requirements in EIA, MoEF Guidelines in Siting Developmental Projects.	**6 Hrs**
UNIT – III	
METHODOLOGIES OF EIA: Contents of EIA. Methodologies and Evaluation Techniques of EIA, their selection for Specific Projects. Frame work of impact Assessment related to Indian conditions.	**6 Hrs**

UNIT-IV	
ENVIRONMENTAL ATTRIBUTES: Assessment and prediction of impacts on Attributes -Air, Water, Noise, Land, Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for development projects, Rapid and comprehensive EIA. **PUBLIC PARTICIPATION IN EIA:** Basic Definitions, Regulatory Requirements, Objectives, Advantages and Disadvantages, Selection of Public Participation Techniques.	**6 Hrs** **6 Hrs**
UNIT-V	
IMPACT QUANTIFICATIONS: EIA for Water resource developmental projects, Highway projects: Nuclear Power plant projects, Hazardous Waste disposal Sites, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.	**9 Hrs**

Course Outcomes: After completing the course, the students will be able to

CO1 Explain the major principles and mechanisms of Environmental Impact Assessment.]

CO2 Describe the different stages of Environmental Impact Assessment in India.

CO3 Illustrate the process of issues concerning societal, ethical and legislative needs.

Text Books

1 Environmental Impact Assessment –L.W.Canter (1996), McGraw Hill Inc.

2 Environmental impact Assessment methodologies - Anjaneylu.Y.

Reference Books

1 Environmental Impact analysis - Jain R.K, Urban & Stacey—Van No strand Reinhold Co

2 Guidelines for EIA of Developmental Projects. Ministry of Environment and Forests, Government of India.

E-BOOKS

1 http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104-Page1.htm

2 nptel.ac.in/courses/105101084/https://ay14-15

3 moodle.wisc.edu/prod/course/view.php?id=499.

Course	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	Course Code	21CV8PEERD	SEE Duration	SEE+CIE
Credit	**03**	**L-T-P**	**3:0:0**	**3hrs**	**50+50**

COURSE OBJECTIVES:

- The knowledge of structural dynamics shall be utilized to introduce the students to (a) engineering seismology and (b) concepts for earthquake resistant design
- Design and detailing aspects to achieve ductility in structures shall be emphasized

PRE-REQUISITE:

Structural Dynamics

Course outcomes;

CO1: Describe the fundamentals of engineering seismology

CO2: Characterize the Earthquake ground motions and prepare the basis for estimation of seismic forces

CO3: Analyse , design and detail , buildings for seismic resistance through concepts of ductility as per BIS codes

CO4: Identify and comprehend failure patterns of buildings during earthquake

Unit-01

Introduction to engineering seismology, seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments.

Unit-02

Seismic response of buildings, structures and sites, study of response of buildings and structures during past earthquakes.

The Response Spectrum – elastic and elasto-plastic spectra, tripartite plot, use of response spectrum in earthquake resistant design.

Unit-03

Dynamics of multi-storeyed buildings – natural frequencies and mode shapes, Analysis of multi-storeyed buildings, obtaining seismic forces using IS-1893.

Unit-04

Structural Configuration for earthquake resistant design, frames, shear walls and dual systems, Effect of infill masonry walls on frames, problems of the soft first-storey, Capacity design procedures.

Ductility and energy absorption in buildings, Reinforced concrete for earthquake resistance, confinement of concrete for ductility, ductility of columns and beams – codal provisions

Unit-05

Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, concepts for earthquake resistant masonry buildings.

TEXT BOOK AND CODES:

1. P Agarwal and M Shrikande, "Earthquake Resistant Design of Structures", Prentice Hall (India) Ltd, New Delhi, 2006.
2. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993

REFERENCE BOOKS:

1. D J Dowrick, "Earthquake Risk Reduction"- John Wiley and Sons, 2003
2. Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", McGraw Hill Pub.
3. G GPenelis and A J Kappos, "Earthquake Resistant Concrete Structures", Chapman and Hall, 1999
4. T Paulay and M J N Priestley, "Seismic Design of Reinforced Concrete and MasonryBuildings", John Wiley and Sons, 1992
5. S.K.Duggal, (2007), "Earthquake Resistant Design of Structures", OxfordUniversity Press, New Delhi 2007.
6. Steven L Kramer, "Geotechnical Earthquake Engineering", Pearson Education pub.
7. Anil K Chopra, "Dynamics of Structures – Theory and Application to Earthquake Engineering"- 2nd ed., Pearson Education pub.
8. Anderson,R.A., "Fundamentals of Vibrations"- McMillan
9. Clough and Penzien, "Dynamics of Structures"- McGraw Hill
10. Mukyopadhyaya, "Vibration and Structural Dynamics", Oxford &IBH
11. James Ambrose and Dimitry Vergun, "Design for Earthquakes"-avid Key, "Earthquake Design Practice for Buildings".

Scheme of Examination: Student shall answer **Five** full questions, selecting one from each unit. Unit 3 & Unit 4 have internal choice.

Course	Geosynthetics and Soil Reinforcement	Course Code	21CV8PEGSR	SEE Duration	3 hours
Credits	03	**L:T:P**	3:0:0	**SEE+ CIE Marks**	50+50

Course Objective: To provide an insight into fundamentals of Reinforced Earth structures, materials used, their properties, their design procedures and guidelines for construction of reinforced Earth structures.

COURSE OUTCOME: An ability to

CO1	Explain the basic principle and application of reinforced soil and classify various types of geosynthetics.
CO2:	Outline the testing method and desirable properties of geosynthetics.
CO3	Design a reinforced earth retaining wall.
CO4:	Explain requirements and guidelines for usage of geosynthetics in pavements, foundations, and as liners.

UNIT -1

INTRODUCTION:

Historical background, development of concept of reinforced soil, Principle and Mechanism of reinforced soil, advantages of reinforced earth structures over similar structures, their Potential areas of use – for filtration, drainage, reinforcement, and as separators.

MATERIALS FOR REINFORCEMENT:

Introduction and overview, Historical developments, Recent developments. Classification based on materials, Geosynthetics – geotextiles, geogrids, geomembranes, geocomposites, geonets and other products, geomats, geomeshes, geowebs, their basic functions.

Natural geotextiles: Classification, Factors governing their usage, Jute fibers, coir geotextile, Bamboo, their preservation, advantages and disadvantages. **07Hours**

UNIT-2

PROPERTIES, TESTING & EVALUATION OF GEOSYNTHETICS:

Physical properties- (type of structure, specific gravity, mass per unit area, thickness and stiffness). **Mechanical properties-** (index and performance properties)-tensile properties (grab tension test); compressibility property; seam strength; burst strength; tear strength and puncture strength; friction; pull out resistance. **Hydraulic properties-** porosity; percentage open area; apparent opening size; permittivity; transmissivity; soil retention. **Endurance properties-** Installation damage; creep and stress relaxation; abrasion and clogging; **07 Hours**

UNIT– 3

REINFORCED EARTH RETAINING WALL:

Introduction, Components of reinforced Earth structure: **Soil or fill-matrix**- choice of soil, backfill materials desirable properties. **Reinforcement**: Types and functions. **Facing Elements**- Types, functions, Principles of design, internal stability, external stability, Numerical: Retaining wall design using metallic strips.

Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken. **07 Hours**

UNIT-4

Geosynthetics for pavements and foundation:

Pavements : Introduction, Application of geosynthetics in roadways, benefits, Role of subgrade conditions, Giroud and Noiray approach, **Numericals** using Giroud and Noiray approach, Geotextile survivability.

Foundation: Improvement in bearing capacity, modes of failure, shear layer effect, confinement effect, surcharge effect, location of failure surface, tension failure and pull out resistance, length of tie and its curtailment,, guidelines on use of geogrids. **07 Hours**

UNIT -5

Geosynthetics for filtration, drainage and as barriers:

Filter & Drain – Introduction, Conventional granular filter design criteria, Geosynthetic filter design requirements, Boundary conditions, Drain and filter properties, Design criteria : soil retention, Geosynthetic permeability, anti logging, survivability and durability.

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Ministry of Environment and Forest guidelines for liner and cover systems in India, Barrier walls for existing landfills and abandoned dumps ,some issues in usage of geosynthetics. **08 Hours**

Text book:

1. **An Introduction to Soil Reinforcement and Geosynthetics** – G L Shiva Kumar Babu, Universities press (India) Pvt Ltd, 2006.
2. **Reinforced soil and its Engineering Applications** – Swami Saran., I.K. International Pvt. Ltd. Second edition, 2013

Reference books:

1. **Designing with Geosynthetics**- Robert .M. Koerner. - Prince Hall Publication, 2005.
2. **Earth reinforcement and Soil structure**- Jones CJEP- Butterworths, London, 1996.
3. **Reinforced Earth**- Ingold, T.S. - Thomas, Telford, London.1982
4. **Geosynthetics in Civil Engineering –** Edited by R.W. Sarsby, CRC Press, Boca Raton**.**
5. **Geosynthetics** - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.
6. **"Engineering with Geosynthetics",** Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, Tata McGraw Hill publishing Company Limited., New Delhi.,1990

E-learning resources:

Nptel courses: https://nptel.ac.in/content/storage2/courses/105106052

SEE paper pattern:

To set One question each in Units 1, 2, 4, and two questions each in Units 3 and 5. Students to answer **Five** questions by selecting one question from each Unit. All questions carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

CO-PO MAPPING SCALE 1 TO 3

	COURSE : Reinforced Earth Structures CODE: 21CV8PERES														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	
CO4	2	2	1	-	-	-	-	-	-	-	-	-	-	-	

	COURSE: Geosynthetics and Soil Reinforcement 21CV8PEGSR				
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2	✓				
CO3	✓	✓		✓	
CO4	✓	✓			

****

Course	Urban Transport Planning	Course Code	21CV8PEUTP	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	SEE+ CIE Marks	50+50

COURSE OBJECTIVES: To cover concepts of urban transportation planning, various modes, transit systems and their suitability and to provide knowledge of Land use planning and transportation interaction.

COURSE OUTCOMES: An ability to	
CO1	Design and conduct surveys to provide the data required for transportation planning.
CO2	Develop trip production and trip distribution models, compute trip attraction rates and calibrate using gravity model.
CO3	Build aggregate mode split models & analyze transportation network flows.

UNIT -1

INTRODUCTION:
Urbanization, urban class groups, transportation problems and identification, Characteristics of different modes of transportation, Importance, functions and characteristics of urban transportation planning.

TRANSPORTATION PLANNING PROCESS:
Interdependence of Land Use and Traffic, Systems Approach, Stages in Transport Planning.

08 Hours

UNIT – 2

TRANSPORT SURVEYS:
Study Area, Zoning, Planning of different types of surveys and interpretation, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Traffic surveys for mass transit system planning.

08 Hours

UNIT-3

TRIP GENERATION:
Trip Purpose, Factors governing Trip Production and Attraction, Methods of Trip generation, Trip Production Models, Category Analysis.

08 Hours

UNIT-4

TRIP DISTRIBUTION:
Methods of trip distribution, Application of gravity model, Calibration of gravity model, Problems. Opportunity models.

10 Hours

UNIT-5

MODAL SPLIT AND TRIP ASSIGNMENT:
Factors affecting modal split; Modal split in transport planning; Purpose of Trip Assignment, principles of traffic assignment; Assignment techniques.

06 Hours

Text books:

1. Kadiyali, L.R., 'Traffic Engineering and Transportation Planning' – Khanna Publication, 2011.
2. C. Jotin Khisty & B. Kent Lall, "Transportation Engineering-An Introduction, Prentice Hall of India Private Limited, Third Edition, New Delhi, 2006.

Reference books:

1. Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
2. Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
3. Papacostas,'Fundamentals of Transportation Planning', Tata McGraw Hill.

E-learning resources:

1. nptel.ac.in/courses/105107067/
2. nptel.ac.in/downloads/105106058/

SEE paper pattern:
To set One question each in Units 1, 2, 5 and two questions each in Units 3 and 4. Students to answer **Five** questions by selecting one question from each Unit. All questions should carry equal marks (20 marks for one full question). Each question should not have more than four subdivisions.

CO-PO MAPPING SCALE 1 TO 3

	COURSE : Urban Transport Planning												**CODE: 21CV8PEUTP**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-

COURSE : Urban Transport Planning					**CODE: 21CV8PEUTP**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓	✓			
CO2	✓	✓	✓		
CO3	✓	✓	✓		

****

B. M. S. COLLEGE OF ENGINEERING, BENGALURU
DEPARTMENT OF CIVIL ENGINEERING

Course	Integrated Watershed Management	Course Code	21CV8PEIWM	SEE Duration	3 hours
Credits	03	L:T:P	3:0:0	SEE+ CIE Marks	50+50

COURSE OBJECTIVES: Objective of this course is to understand fundamental concepts of watershed behavior, planning and management, various methods available to estimate runoff and quantify soil erosion. Also the course helps to understand the techniques for the assessment of management of flood and droughts, the concepts of conjunctive use of water resources for effective watershed management.

COURSE OUTCOMES: An ability to	
CO1	Explain the fundamental concepts of watershed behavior and watershed management and explain the application of modern techniques in watershed management
CO2	Apply different models to estimate runoff and soil erosion from a watershed
CO3	Identify the types and sources of water pollution
CO4	Apply various methods to assess / model flood and drought

UNIT -1

Introduction: Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making. **02 Hours**

INTEGRATED WATERSHED MANAGEMENT: Integrated water resources management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation; conjunctive use of water resources, rainwater harvesting, water conservation and recycling, Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Watershed Management Practices in Arid and Semiarid Regions, Case studies. **06 Hours**

UNIT – 2

WATERSHED MODELING: Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall-runoff process, subsurface flows and groundwater flow. Soil erosion, estimation of soil erosion **09 Hours**

UNIT-3

MANAGEMENT OF WATER QUALITY: Water quality and pollution, types and Sources of pollution, water quality modeling, environmental guidelines for water quality. **05 Hours**

UNIT-4

STORM WATER AND FLOOD MANAGEMENT: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage.

Drought Management: Drought assessment and classification, drought analysis techniques, drought mitigation planning. **09 Hours**

UNIT-5

USE OF MODERN TECHNIQUES IN WATERSHED MANAGEMENT: Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management **05 Hours**

Text books:

3. Vir Singh, Raj, Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

Reference books:

3. Allam, Gamal Ibrahim Y., Decision Support System for Integrated Watershed Management, Colorado State University, 1994.
4. Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991.
5. Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992.
6. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994.
7. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.
8. V.P. Singh & Donald K. Frevert "Watershed Models" Taylor & Francis
9. E.M. Tideman "Watershed management :Guidelines for Indian Conditions" Omega Scientific Publishers

E-learning resources:

1. https://nptel.ac.in/courses/105/101/105101010/
2. https://nptel.ac.in/content/storage2/courses/105101010/downloads/Lecture01.pdf

SEE paper pattern:

Units 2 and 4 will have choice.

CO-PO MAPPING SCALE 1 TO 3

	COURSE: Integrated Watershed Management												**CODE: 21CV8PEIWM**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	2	-	-	-	-	-	-	-	-	-	-	-	3

COURSE: Integrated Watershed Management					**CODE: 21CV8PEIWM**
Taxonomy levels and COs	Remember/ understand	Apply	Analyze	Design	Create or any other
CO1	✓				
CO2	✓	✓			
CO3	✓				
CO4	✓	✓	✓	✓	