JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For UG – R20

B. TECH - CIVIL ENGINEERING

(Applicable for batches admitted from 2020-2021)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

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III YEAR – I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PC501	Professional Core courses (STRUCTURAL ANALYSIS)	3	0	0	3
2	PC502	Professional Core courses (DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES)	3	0	0	3
3	PC503	Professional Core courses (GEOTECHNICAL ENGINEERING-1)	3	0	0	3
4	OE501	Open Elective Course/Job Oriented elective (OE-1)	3	0	0	3
5	PE501	Professional Elective courses	3	0	0	3
6	PC504	Professional Core courses Lab Survey Camp (Field work)	0	0	3	1.5
7	PC505	Professional Core courses Lab (GEOTECHNICAL ENGINEERING LAB)	0	0	3	1.5
8	PC501	Skill advanced course/ soft skill course* Design of Special Structure, Chimney, Hinge Tanks designs, spill ways etc.,	1	0	2	2
9	MC501	Mandatory Course (AICTE Suggested) Professional Ethics and Human Values	2	0	0	0
10	PR501	Summer Internship 2Months (Mandatory) after second year (to be evaluated during V semester)	0	0	3	1.5
		Total Credits				**21.5**
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			3	1	0	4

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III YEAR – II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PC601	Professional Core courses (DESIGN AND DRAWING OF STEEL STRUCTURES)	3	0	0	3
2	PC602	Professional Core courses (WATER RESOURCE ENGINEERING)	3	0	0	3
3	PC603	Professional Core courses (GEOTECHNICAL ENGINEERING-II)	3	0	0	3
4	PE601	Professional Elective courses	3	0	0	3
5	OE601	Open Elective Course/Job oriented elective (OE-2)	3	0	0	3
6	PC604	Professional Core courses Lab (ESTIMATION, COSTING AND CONTRACTS)	0	0	3	1.5
7	PC605	Professional Core courses Lab (REMOTE SENSING & GIS LAB)	0	0	3	1.5
8	PC606	Professional Core courses Lab CIVIL ENGINEERING PRACTICE	0	0	3	1.5
9	SC601	Skill advanced course/ soft skill course* Computational Tools	1	0	2	2
10	MC601	Mandatory course (AICTE) (EMPLOYABILITY SKILLS)	2	0	0	0
11	*PR601	Industrial/Research Internship (Mandatory) 2 Months	0	0	3	0
		Total Credits				**21.5**
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			3	1	0	4

***** At the end of III Year II semester, students shall complete summer internship spanning for 2 months at Industries / Higher Learning Institutions / APSSDC.

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IV YEAR – I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PE701	Professional Elective -III	3	0	0	3
2	PE702	Professional Elective -IV	3	0	0	3
3	PE703	Professional Elective -V	3	0	0	3
4	OE701	Open Elective Courses/ Job oriented elective (OE-III)	2	0	2	3
5	OE702	Open Elective Course/Job oriented elective (OE-IV)	2	0	2	3
6	HSC701	*Humanities and Social Science Elective	3	0	0	3
7	SC701	Skill advanced course/ soft skill course* Project planning, town planning,	1	0	2	2
8	PR701	Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester)	0	0	3	3
		Total Credits				**23**
Honors/ Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			3	1	0	4

***There is a provision for the Universities/Institutions to implement AICTE mandatory course "Universal Human Values 2: Understanding Harmony" under Humanities and social science Elective in seventh semester for 3 credits.**

IV YEAR – II SEMESTER

S.NO	CATEGORY	COURSE TITLE	L	T	P/D	C
1	Major Project	PROJ	-	-	-	12
		INTERNSHIP (6 Months)				
		Total Credits				**12**

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Professional Electives R20 (5 PE x 3 = 15 Credits)
(Department can offer Maximum 2 Subjects from Each PE, elected by the students)
Note: Student must choose subjects which were not opted earlier
PE starts from III-I

rofessional Elective-I	**Professional Elective-II**	**Professional Elective-III**	**Professional Elective-IV**	**Professional Elective-IV**
a) Construction Technology &Management	a) Advanced Structural Analysis	a) Advanced Structural Engineering	a) Ground Improvement Techniques	a) Design & Drawing of Irrigation Structures
b) Remote Sensing and GIS	b) Architecture and Town Planning	b) Bridge Engineering	b) Geo-Spatial Technologies	b) Earth & Rock fill Dams
c)Environmental Impact Assessment	c) Road Safety Engineering	c) Structural Dynamics	c) Disaster Management & Mitigation	c) Urban Hydrology
d) Low Cost Housing	d) Traffic Engineering	d)Urban Transportation Planning	d) Soil dynamics & Machine Foundations	SWAYAM / NPTEL /MOOCS COURSES (12 weeks duration)

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HONORS R20 (Starts from II-II)

(4 x 4 + 2 MOOCS/NPTEL x 2 = 20 Credits) for Civil Engg. Students
Note: Student must choose subjects which were not opted earlier
(Any FOUR courses may be chosen by the Student from each Pool)

Structural Engineering	**Geotechnical Engineering**	**Environment and Water Resource Engineering**	**Transportation Engineering**	**Construction Technology and Management**
Finite Element Methods	Reinforced Soil Structures	Urban Hydrology	Traffic Engineering	Construction Technology and Management
Matrix Analysis of Structures	Advanced Foundation Engineering	Water and Wastewater Management	Intelligent Transportation System	Architecture & Town Planning
Earthquake Resistant Design	Earth Retaining Structures	Water Resources Planning and Management	Railway, Harbor and Airport Engineering	Repairs and Maintenance of Structures
Pre-stressed concrete	Geoenvironmental Engineering	Environmental Impact Assessment	Pavement Management System	Disaster Management and Mitigation
Repair & Retro-fitting of Buildings	Earth & Rock Fill Dams	Air Pollution and Control	Urban Transportation Planning	Precast and Prefabricated Structures

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OPEN ELECTIVES R20
(4 OE x 3 = 12 Credits)

Note: Student must choose subjects which were not opted earlier.
(OE Starts from III-I)

Open Elective-I/ Open Elective-III (Offered in Odd Semesters)	**Open Elective-II/ Open Elective-IV (Offered in Even Semesters)**
a) Strength of Materials	a) Elements of Civil Engineering
b) Fluid Mechanics	b) Environmental Engineering
c) Surveying and Geomatics	c) Disaster Management
d) Highway Engineering	d) Water Resource Engineering
e) Safety Engineering	e) Hydraulics and Hydraulic Machinery
f) Environmental Management	f) Green Technologies
g) Urban Planning	g) Remote Sensing & GIS

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Minor R20 (Starts from II-II)
(4 x 4 + 2 MOOCS/NPTEL x 2 = 20 Credits)

Note: Student must choose subjects which were not opted earlier

Minor-I/Minor-III (Offered in Odd Semesters)	**Minor-II/Minor-IV (Offered in Even Semesters)**
a) Environmental Engineering and Management	a) Construction Technology and Infrastructure Management
b) Solid Mechanics	b) Seismology and Earthquake Engineering
c) Irrigation Engineering	c) Railways, Harbours and Docks
d) Geoinformatics	d) Architecture and Smart City

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III Year – I Semester	PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
PC 501 STRUCTURAL ANALYSIS					

Course Learning Objectives:

- To give preliminary concepts of assessment of bending moment and shear force in Propped cantilevers, fixed beams and continuous beams - due to various loading conditions.
- To impart concepts of Bending Moment and Shear force for beams with different boundary and loading conditions.
- The procedure for development of slope deflection equations and to solve application to continuous beams with and without settlement of supports.
- The concepts of moving loads and influence lines are imparted for assessment of maximum SF and BM at a given section when loads of varying spans rolling loads of Pratt and Warren trusses.

Course Outcomes:

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

- Distinguish between the determinate and indeterminate structures.
- Identify the behavior of structures due to the expected loads, including the moving loads, acting on the structure.
- Estimate the bending moment and shear forces in beams for different fixity conditions.
- Analyze the continuous beams using various methods -, three moment method, slope deflection method, energy theorems.
- Draw the influence line diagrams for various types of moving loads on beams/bridges.
- Analyze the loads in Pratt and Warren trusses when loads of different types and spans are passing over the truss.

Syllabus:

UNIT – I Propped Cantilever and Fixed beams

Propped Cantilevers: Introduction -Degree of Static and Kinematic indeterminacy of Beams, frames and trusses. Analysis of propped cantilevers-shear force and bending moment diagrams-Elastic curve - Deflection of propped cantilever beams.
Fixed Beams – Introduction to statically indeterminate beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending moment diagrams-Elastic curve - Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.

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UNIT – II Analysis of Continuous beams and Portal Frames

Slope-Deflection Method: Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway. Shear force and Bending moment diagrams, Elastic curve.

Moment distribution method: Application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway. Shear force and Bending moment diagrams, Elastic curve.

UNIT III Analysis of Pin-Jointed Plane Frames: Determination of Forces in members of plane pin-jointed (determinate) perfect trusses by (i) method of joints (ii) method of sections and (iii) Method of Tension coefficients. Analysis of various types of cantilever and simply supported trusses by method of joints, method of sections and Tension coefficients.

UNIT – IV Moving Loads And Influence Lines: Introduction maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single concentrated load, U. D load longer than the span, U. D load shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length.
Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a sections, single point load, U.D. load longer than the span, U.D. load shorter than the span- Influence lines for forces in members of Pratt and Warren trusses.

UNIT – V MATRIX METHODS OF ANALYSIS: Introduction to Flexibility and Stiffness matrix methods of analyses using 'system approach' up to three degree of indeterminacy– Analysis of continuous beams including settlement of supports using flexibility and stiffness methods - Analysis of pin-jointed determinate plane frames using flexibility and stiffness methods- Analysis of single bay single storey portal frames using only stiffness method - Shear force and bending moment diagrams - Elastic curve.

Text Books:

1. Structural Analysis by R.C. Hibbeler, Pearson, New Delhi.
2. Basic Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.

References

1. Indeterminate Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.
2. Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna
3. Publishers, New Delhi.
4. Mechanics of Structures Vol – II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
5. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.
6. Structural Analysis: A Matrix Approach, G.S.Pandit and S.P.Gupta, Mc Graw Hill Pvt. Ltd.

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III Year – I Semester	PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
PC502 DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES					

Course Learning Objectives:

The objective of this course is:

- Familiarize Students with different design philosophies
- Equip student with design of members in flexural and shear
- Understand bond and torsion
- Familiarize with design of compression members under different types of loading
- Understand different types of footings and design

Course Outcomes:

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

- Work on different types of design methods
- Carryout analysis and design of flexural members and detailing
- Design structures subjected to shear, bond and torsion
- Design different type of compression members and footings

SYLLABUS:

UNIT –I Design Methods

Working stress method: Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance - balanced, under-reinforced and over-reinforced sections. Design of singly and doubly reinforced beams, IS Code Provisions.

Limit State Design: Basic statistical principles –Characteristic strength – Characteristic loads - Partial load and safety factors – stress-strain curves for HYSD bars and MS bars. Assumptions – stress block parameters – Moment of Resistance.

All units i.e. from unit II to unit V are to be taught in Limit State Design.

UNIT –II Design for Flexure and Shear: Design of singly reinforced beams- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beams- Minimum depth - Minimum and Maximum Flexural Tension Reinforcement - Design of Flanged Sections (T & L) - Effective width of flange - Analysis and Design Problems.

Design for Shear and Torsion: Analysis and design of sections for shear and torsion – bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.

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UNIT – III Slabs and Serviceability: Classification of slabs, design of one - way slabs, one way continuous slab using IS Coefficients (Conventional) –Design of two - way slabs - simply supported slabs and slabs with various edge conditions using IS Coefficients. Design of Stair case **Limit state of serviceability:** Deflection, cracking and IS code provisions for beams and slabs.

UNIT – 1V Design of Compression members: Effective length, Braced and un-braced columns – IS Code provisions, Design of short and long columns under axial loads, uniaxial bending and biaxial bending (Demonstration using SP 16)

UNIT –V
Footings: Types of footings – Design of isolated footings – pedestal, square, rectangular and circular footings subjected to axial loads, uni-axial bending moment.

NOTE: All the designs to be taught in Limit State Method Following plates should be prepared by the students.

1. Reinforcement detailing of T-beams, L-beams and continuous beams.
2. Reinforcement detailing of columns and isolated footings.
3. Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Text Books:

1. Limit State Design, A. K.Jain, Nem Chand Brothers
2. Reinforced Concrete Structures, N. Krishna Raju & R. N. Pranesh, and New Age Publications.
3. Structural Design and Drawing by N.Krishna Raju, Universities Press

References:

1. R C C Design, B.C Punmia, A. K. Jain and A. K Jain. Lakshmi Publications
2. Reinforced Concrete Structures, S. Unnikrishna Pillai &Devdas Menon, Tata C.Graw Hill, New Delhi.
3. Design of Reinforced concrete Structures, N.Subrahmanian, and Oxford University Press.
4. Limit state design of reinforced concrete structures by P C Varghese, PHI Learning pvt. Ltd.

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III Year – I Semester	PROFESSIONAL CORE COURSE	L	T	P	C
		3	0	0	3
PC 503 GEOTECHNICAL ENGINEERING - I					

Course Learning Objectives:
The Objectives of this course are:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

Course Outcomes:
Upon the successful completion of this course

a. The student must know the definition of the various quantities related to soil mechanics and establish their inter-relationships.
b. The student should be able to know the methods of determination of the various index properties of the soils and classify the soils.
c. The student should be able to know the importance of the different engineering properties of the soil such as compaction, permeability, consolidation and shear strength and determine them in the laboratory.
d. The student should be able to apply the above concepts in day-to-day civil engineering practice.

UNIT – I

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density

Index Properties of Soils: Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

UNIT –II

Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability – Permeability of layered systems.

Geostatic Stresses: Total, neutral and effective stresses –quick sand condition Seepage: 2-D flow and Laplace's equation-Seepage through soils–Flow nets: Characteristics and Uses.

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UNIT – III

Stress Distribution In Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method.

UNIT – IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

Consolidation: Compressibility of soils –e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (c_v) - Over consolidated and normally consolidated clays.

UNIT – V

Shear Strength of Soils: Basic mechanism of shear strength -Mohr – Coulomb Failure theories – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions.

TEXT BOOKS:

1. Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age International Publishers.
2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", CBS publishers
3. M.Palani Kumar, "Soil Mechanics", PHI Learning

REFERENCES:

1. D.W.Taylor, "Fundamentals of Soil Mechanics", Wiley.
2. Holtz and Kovacs, "An introduction to Geotechnical Engineering" Prentice Hall
3. Donald P. Coduto, Man-chu Ronald Young and William A. Kitch.

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III Year – I Semester	PROFESSIONAL CORE COURSE LAB	L	T	P	C
		0	0	3	1.5
PC SURVEYING FIELD WORK – II					

List of Experiments

1. Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition method.

2. Theodolite Survey: Finding the distance between two inaccessible points.

3. Theodolite Survey: Finding the height of far object.

4. Tachometric Survey: Heights and distance problems using tachometric principles.

5. One Exercise on Curve setting.

6. One Exercise on contours.

7. Total Station: Introduction to total station and practicing setting up, leveling up and elimination of parallax error.

8. Total Station: Determination of area using total station.

9. Total Station: Traversing

10. Total Station: Contouring

11. Total Station: Determination of Remote height.

12. Total Station: distance between two inaccessible points.

Note: Any 10 field work assignments must be completed

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III Year – I Semester	PROFESSIONAL CORE COURSE	L	T	P	C
		0	0	3	1.5
PC GEOTECHNICAL ENGINEERING LAB					

Learning Objectives:
The objective of this course is:

- To determine the index properties for soil classification – Grain size distribution &Atterberg's limits.
- To determine the engineering properties – Permeability, Compaction, consolidation, shear strength parameters& CBR value.
- To find the degree of swelling by DFS test.

1. To impart knowledge of determination of index properties required for classification of soils.
2. To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
3. To teach how to determine shear parameters of soil through different laboratory tests.

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

a. Determine index properties of soil and classify them.
b. Determine permeability of soils.
c. Determine Compaction, Consolidation and shear strength characteristics.

SYLLABUS:

LIST OF EXPERIMENTS

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Permeability of soil - Constant and Variable head tests
6. Compaction test
7. Consolidation test (to be demonstrated)
8. Direct Shear test
9. Triaxial Compression test
10. Unconfined Compression test
11. Vane Shear test
12. Differential free swell (DFS)
13. Field Plate Load Test demo
14. Field CBR demo

At least **Eight** experiments shall be conducted.

LIST OF EQUIPMENT:

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrinkage limits
3. Field density apparatus for
   a) Core cutter method
   b) Sand replacement method

4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
5. Hydrometer
6. Permeability apparatus for
   a) Constant head test
   b) Variable head test
7. Universal auto compactor for I.S light and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity
11. One dimensional consolation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38 mm dia specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (range of temperature 50^0 - 150^0C)

References:

1. 'Determination of Soil Properties' by J. E. Bowles.
2. IS Code 2720 – relevant parts.

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III Year – I Semester	Skill advanced course/ soft skill course	L	T	P	C
		1	0	2	2
SC- DESIGN OF SPECIAL STRUCTURES					

Course Objectives

- Equipping students with the professional knowledge in the design and construction of Industrial chimneys and Water tanks
- To get the professional knowledge in the design of service reservoir and Estimation of drains for village
- To understand the design of spillway for low and medium height dams
- To estimate the concrete roads and rain water harvesting ponds

1. Design of Industrial Chimney
2. Design of water tank for apartment
3. Design of service reservoir for village
4. Design of spillway for low and medium height dams.
5. Design and estimate of Concrete Roads
6. Design and estimate of Rainwater harvesting ponds
7. Design and estimate of drains for a village

Reference Books

1) Tall Building Structures: Analysis and design, B. S. Smith and A. Coull, Wiley India Pvt Ltd., New Delhi, 2011.
2) Tall Chimneys: Design and Construction, S. N. Manohar, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.
3) IRC SP 042: Guidelines on Road Drainage. Indian Roads Congress, 2014.
4) Handbook of Applied Hydrology, Vijay P. Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
5) Dam Engineering, B. N. Asthana, Deepak Khare, Capital Publishing Company, 2019.
Concrete Roads and Pavements, Edward Smith Hanson, Nabu Press, 2013
6) Rainwater Harvesting and Conservation Manual, Central Public Works Department, Government of India (Available in public domain), 2002.
7) Design of Road Drainage System, S. N. Sachdeva, Createspace Independent Publishing Platform, 2018

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III Year – I Semester	Mandatory course	L	T	P	C
		2	0	0	0
MC (501) PROFESSIONAL ETHICS AND HUMAN VALUES					

Course Objectives: To give basic insights and inputs to the student to inculcate Human values to grow as responsible human beings with proper personality. Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties.

UNIT I: Human Values:

Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

Principles for Harmony:
Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights –Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT II: Engineering Ethics and Social Experimentation:

History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments — Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

UNIT III: Engineers' Responsibilities towards Safety and Risk:

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk –Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/s Immediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT IV: Engineers' Duties and Rights:

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality –Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining –Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes- Industrial Espionage Price Fixing-Whistle Blowing.

UNIT V: Global Issues:

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

- Related Cases Shall is dealt where ever necessary.

Course Outcomes: It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.

It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

TEXT BOOKS:

1. Professional Ethics by R. Subramanian – Oxford Publications, New Delhi.

2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill –

2003.

REFERENCE BOOKS:

3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi

Publications.

4. Engineering Ethics by Harris, Pritchard and Rabin's, Cengage Learning, New Delhi.

5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd.,

Noida.

6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumarPHI Learning Pvt. Ltd – 2009.

7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M.

Jayakumaran – University Science Press.

8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013

Human Values and Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand

Publication.

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DEPARTMENT OF CIVIL ENGINEERING

PROFESSIONAL ELECTIVE	PE-501	L	T	P	C
		3	0	0	3
I a) CONSTRUCTION TECHNOLOGY &MANAGEMENT					

Course Learning Objectives:

The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. to introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. to introduce the importance of safety in construction projects

Course Outcomes:

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

1. appreciate the importance of construction planning
2. understand the functioning of various earth moving equipment
3. know the methods of production of aggregate products and concreting
4. apply the gained knowledge to project management and construction techniques

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	2	-	-	3	2	2	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	3	2	2	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	3	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT- I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT -II

Project evaluation and review technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT- III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers – graders – scrapers– draglines - clamshell buckets

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UNIT -IV
Concreting equipment — concrete mixers – Batching plants, mobile using plants like "Ajax" etc. mixing and placing of concrete – consolidating and finishing.

UNIT -V
Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering.
BIM for Civil Engineers (Building Information Modelling)

TEXT BOOKS:
1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha (2011), Pearson.
3. 'Construction Technology' by Subir K. Sarkar and Subhajit Sarasvati, Oxford University press

REFERENCES:
1. 'Construction Project Management - An Integrated Approach' by Peter Fewings , Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning

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DEPARTMENT OF CIVIL ENGINEERING

PROFESSIONAL ELECTIVE	PE-501	L	T	P	C
		3	0	0	3
I b) REMOTE SENSING AND GIS					

Course Learning Objectives:
The course is designed to,

1. Introduce the basic principles of Remote Sensing and GIS techniques.
2. Learn various types of sensors and platforms.
3. Learn concepts of visual and digital image analysis.
4. Understand the principles of spatial analysis.
5. appreciate application of RS and GIS to Civil Engineering

Course outcomes
At the end of the course the student will be able to

a. Be familiar with ground, air and satellite-based sensor platforms.
b. Interpret the aerial photographs and satellite imageries.
c. Create and input spatial data for GIS application.
d. Apply RS and GIS concepts for application in Civil Engineering.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	2	-	-	2	-	-	-	2	-	-	2	3	2	3	2
CO 2	2	1	1	3	2	2	2	1	1	3	2	2	2	2	2	1
CO 3	-	1	1	2	2	-	2	2	2	2	2	2	2	-	3	2
CO 4	-	2	3	3	2	3	3	3	2	3	3	2	2	2	2	2

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT – I

Introduction to Remote sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, characteristics of remote sensing systems, types of resolutions - advantages & limitations, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT & Recent satellite.

UNIT – II

Image analysis: Introduction, elements of visual interpretations, digital image processing- image pre-processing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT – III

Geographic Information System: Basic Principles, components, application areas of GIS, map projections. Data entry and preparation: spatial data structures, raster and vector data formats, data inputs,

data manipulation, data retrieval, data analysis and data display.

UNIT – IV

Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing.

UNIT – V

RS and GIS applications: Land cover and land use, agriculture, forestry, geology, geomorphology, urban & transportation, Hydrology and Water Resources: Flood zoning and mapping, groundwater prospects, groundwater quality monitoring and potential recharge zones, watershed management of application with case studies.

TEXTBOOKS:

1. 'Remote Sensing and GIS', by Bhatta B, Oxford University Press, (2011) 2nd Edition'.
2. 'Remote Sensing and Image Interpretation, by Lille sand, T.M, R.W. Kiefer and J.W. Chipman, Wiley India Pvt. Ltd., (2015), 7th Edition.
3. 'Remote Sensing - Models and Methods for Image Processing' by Robert A Schowenger, Elsevier publishers, (2009).
4. 'Fundamentals of Remote Sensing' by George Joseph, Universities Press, (2013) 3rd Edition.
5. 'Fundamentals of Geographic Information Systems' by Michael N. Demers, Wiley India Pvt. Ltd, (2012) 4th Edition.

REFERENCES:

1. 'Remote Sensing and its Applications' by Narayan LRA, Universities Press, 2012.
2. 'Concepts and Techniques of Geographical Information System' by Chor Pang Lo and Albert K.W. Yeung, Prentice Hall (India), (2016) 2nd Edition.
3. 'Introduction to Geographic Information Systems' by Kang Tsung Chang, McGraw Hill Higher Education, (2020) 9th Edition.
4. 'Basics of Remote sensing & GIS' by S. Kumar, Laxmi Publications, New Delhi, 2005.
5. 'Principals of Geographical Information Systems' by Burrough P A and R.A. McDonnell, Oxford University Press, 2006.

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PROFESSIONAL ELECTIVE	PE-501	L	T	P	C
		3	0	0	3
I c) ENVIRONMENTAL IMPACT ASSESSMENT					

Course Learning Objectives:

The objective of this course is:

1. To impart knowledge on different concepts of Environmental Impact Assessment
2. To know procedures of risk assessment
3. To learn the EIA methodologies and the criterion for selection of EIA methods
4. To know pre-requisites for ISO 14001certification
5. To know the procedures for environmental clearances and audit
6. To appreciate the importance of stakeholder participation in EIA

Course Learning Outcomes

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

a) Prepare EMP, EIS and EIA report, estimate cost benefit ratio of a project
b) Selection of an appropriate EIA methodology
c) Evaluation of impacts on environment
d) Evaluation of risk assessment
e) Know the latest acts and guidelines of MoEF & CC

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	2	2	1	2	2	2	2	1	2	2	-	-	1	-	-
CO2	1	2	2	1	2	2	2	2	2	1	-	-	-	-	2
CO3	1	2	2	1	2	1	2	2	1	-	-	1	-	-	1
CO4	1	2	2	2	3	2	3	1	3	1	2	1	-	-	1
CO5	1	2	2	2	3	2	3	1	3	1	2	1	-	-	1

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT-I:

Basic concepts of EIA: Elements of EIA-factors affecting EIA-Initial environmental Examination- life cycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA, Environmental economics, Cost/benefit Analysis - EIS and EMP. Identification of activities- application of remote sensing and GIS for EIA.

UNIT-II:

EIA Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods.

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area.

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DEPARTMENT OF CIVIL ENGINEERING

UNIT-III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, generalized approach for assessment of Air pollution Impact.

UNIT-IV: Assessment of Impact of development Activities on Vegetation and wildlife, Environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT-V EIA: MoEF&CC Acts, Notifications and Guidelines: Provisions in the EIA notification, procedure for environmental clearance, and procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Environmental compliance reports. Case studies and preparation of EIA statement for various Industries.

Text Books:

1. Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.

References:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke Prentice Hall Publishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. Katania& Sons Publication, New Delhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Date: 05th & 06th March 2022

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DEPARTMENT OF CIVIL ENGINEERING

PROFESSIONAL ELECTIVE	PE-501	L	T	P	C
		3	0	0	3
I d). LOW-COST HOUSING					

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	2	-	-	1	3	-	-	-	-	2	2	-	3	-
CO2	-	-	3	2	-	3	3	-	-	-	-	2	1	2	3	-
CO3	-	2	3	3	-	2	3	-	-	-	-	2	3	2	3	1
CO4	-	-	3	-	-	3	3	-	-	-	-	2	1	2	3	1
CO5	-	2	3	3	-	2	3	-	-	-	-	2	3	2	3	1

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS

UNIT – I

Housing Scenario Status of urban housing- Status of Rural Housing,
Housing Finance: Introducing- Existing finance system in India- Government role as facilitator Status at Rural Housing Finance- Impedimental in housing finance and related issues

UNIT- II

Land Use and Physical Planning for Housing:
Planning of urban land- Urban land ceiling and regulation act- Efficiency of building bye laws - Residential Densities

Housing the Urban Poor: Living conditions in slums- Approaches and strategies for housing urban poor

UNIT-III

Development and Adopt on of Low-Cost Housing Technology
Adoption of innovative cost effective construction techniques- Adoption of precast elements in partial prefabrication- Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems- Economical wall system- Single Brick thick loading bearing wall- 19cm thick load bearing masonry walls- Half brick thick load bearing wall-Fly ash, gypsum thick for masonry- Stone Block masonry- Adoption of precast R.C. plank and join system for roof/floor in the building

Alternative Building Materials for Low Cost Housing: Substitute for scarce materials- Ferro cement- Gypsum boards- Timber substitutions- Industrial wastes- Agricultural wastes

UNIT- IV

Low Cost Infrastructure Services
Present status- Technological options- Low cost sanitation's- Domestic wall- Water supply energy

Rural Housing: Introduction- traditional practice of rural housing continuous- Mud Housing technology- Mud roofs- Characteristics of mud- Fire resistant treatment for thatched roof- Soil

stabilization- Rural Housing programs

UNIT-V

Housing in Disaster Prone Areas

Earthquake- Damages to houses- Traditional Houses in disaster prone areas Type of Damages and Railways of non-engineered buildings- Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions- Requirements of structural safety of thin precast roofing units against - Earthquake forces- Status of R&D in earthquake strengthening measures- Floods- cyclone- future safety

TEXT BOOKS:

1. Building materials for low –income houses – International council for building research studies and documentation.
2. Modern trends in housing in development countries – A.G. Madhava Rao, D.S. Ramachandra Murthy & G. Annamalai
3. Light weight concrete- Academic Kiado- Rudhai. G – Publishing home of Hungarian Academy of Sciences 1963.

REFERENCE BOOKS:

1. Building Systems for Low Income Housing, Ashok Kumar Jain; Management Publishing House, 1992
2. Hand book of low-cost housing - by A. K. Lal – New age international publishers.
3. Low Cost Housing in Developing Countries, Guru Charan Mathur; For Centre for Science & Technology of the Non-Aligned and Other Developing Countries, Oxford & IBH Publishing Company, 1993

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DEPARTMENT OF CIVIL ENGINEERING

OE- I/III	OPEN ELECTIVE	L	T	P	C
		3	0	0	3
(a) STRENGTH OF MATERIALS					

Course Learning Objectives:

To impart preliminary concepts of Strength of Material and Principles of Elasticity and Plasticity Stress conditions and to develop diagrams of variation of various stresses across the length.

To give concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections.

The concepts above will be utilized in measuring deflections in beams under various loading and support conditions.

To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure.

Course Outcomes:

The student will be able to understand the basic materials behaviour under the influence of different external loading conditions and the support conditions.

The student will be able to draw the diagrams indicating the variation of the key performance features like bending moment and shear forces.

The student will have knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loading conditions.

The student will be able to assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using Lame's equation.

SYLLABUS:

UNIT – I:

Simple Stresses and Strains:

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

UNIT – II:

Shear Force and Bending Moment:

Definition of beam – Types of beams – Concept of shear force and bending moment – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

UNIT – III:

Flexural and shear Stresses in beams:

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$, Neutral axis – Determination bending stresses – section modulus of rectangular

and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple

beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, I, T Angle sections.

UNIT – IV:

Deflection of Beams:

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic curve of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr's theorems – Moment area method – application to simple cases of cantilever.

UNIT – V:

Thin and Thick Cylinders:

Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick cylinders: Introduction: Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses.

TEXTBOOKS:

A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, New Delhi

Strength of materials by R. K. Bansal, Lakshmi Publications.

REFERENCES:

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers
2. Mechanics of Solids – E P Popov, Prentice Hall.
3. Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3rd Edition, Universities
4. Mechanics of Structures Vol – I by H.J. Shah and S.B. Junnarkar, Charotar Publishing House Pvt.

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DEPARTMENT OF CIVIL ENGINEERING

OE- I/III	OPEN ELECTIVE	L	T	P	C
		3	0	0	3
(b) FLUID MECHANICS					

Course Learning Objectives:

The course is designed to make the students,

1. To understand the properties of fluids and fluid statics
2. To derive the equation of conservation of mass and understand its applications.
3. To solve kinematic problems such as finding particle paths and streamlines
4. To apply important concepts of Bernoulli's equation and Momentum equation
5. To analyse laminar and turbulent flow
6. To understand the various flow measuring devices
7. To study in detail about boundary layers theory

Course Outcomes:

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

1. Understand the various properties of fluids and their influence on fluid motion and analyze a variety of problems in fluid statics and dynamics.
2. Calculate the forces that act on submerged planes and curves.
3. Analyse various types of flow problems through closed conduits.
4. Measure the quantities of fluid flowing in pipes and channels.
5. Understand the concepts of Boundary layer and solve problems on boundary layer.

SYLLABUS:

UNIT I:

Introduction: Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures- measurement of pressure. Pressure gauges, Manometers: Differential and Micro Manometers.

Hydrostatics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure.

UNIT – II:

Fluid Kinematics: Description of fluid flow, Streamline, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and ir-rotational flows – Equation of continuity for one, two, three dimensional flows – stream and velocity potential functions, flow net analysis.

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a streamline - Momentum equation and its application – forces on pipe bend.

UNIT – III:

Laminar Flow and Turbulent Flows: Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen - Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydro-dynamically smooth and rough flows.

Closed Conduit Flow: Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Pipe network problems, Hazen-William's formula, Hard-Cross Method,

UNIT – IV:

Measurement of Flow: Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trapezoidal and stepped notches, Broad crested weirs and Ogee weirs.

UNIT – V:

Boundary Layer Theory: Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarman momentum integral equation, laminar and turbulent Boundary layers (no deviations)- BL in transition, separation of BL, Control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

Textbooks:

Modi P.N and Seth S.M. (2018), "Fluid mechanics", Standard book house, New Delhi
A text of Fluid mechanics and hydraulic machines, R.K. Bansal – Laxmi Publications (P) ltd., New Delhi

References:

K. Subramanian, Fluid mechanics and hydraulic machines Mc graw hill education, II edition
Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education. Principle of fluid mechanics and fluid machines III edition, university press

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OE- I/III	OPEN ELECTIVE	L	T	P	C
		3	0	0	3
(c) SURVEYING & GEOMATICS					

Course Outcomes:
At the end of this course the student will be able to
1. Describe the function of surveying and work with survey instruments, take observations, and prepare plan, profile, and cross-section and perform calculations.
2. Calculate, design and layout horizontal and vertical curves.
3. Operate a total station and GPS to measure distance, angles, and to calculate differences in Elevation. Reduce data for application in a geographic information system.
4. Relate and apply principles of photogrammetry for surveying.
5. Apply principles of Remote Sensing and Digital Image Processing for Civil Engineering problems.

SYLLABUS:

UNIT - I

Introduction to Surveying: Definition, Classification, Principles, Survey stations and Survey lines; Introduction to measurement of distance, direction and elevation; Ranging and it methods, Meridians and Bearings, Methods of levelling, Booking and reducing levels, Reciprocal levelling, distance of visible horizon, Profile levelling and cross sectioning, Errors in levelling; Introduction to methods of plane table surveying; Contouring: Characteristics, methods, uses, computation of areas and volumes. Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Methods of horizontal and vertical control, Triangulation: Figures or systems, Signals, Satellite station, Baseline and its importance, corrections, Trigonometric levelling: Accessible and inaccessible objects. [8 Hours]

UNIT - II

Curves: Elements of simple circular curves, Theory and methods of setting out simple circular curves, Transition curves- types, characteristics and equations of various transition curves; Introduction to vertical curves. [8 Hours]

UNIT - III

Modern Field Survey Systems: Principle and types of Electronic Distance Measurement systems and instruments, Total Station- its advantages and applications; Global Positioning Systems Segments, working principle, errors and biases. Geographic Information System: Concepts and data types, data models, data acquisition. GIS applications in civil engineering. [8 Hours]

UNIT - IV

Photogrammetric Survey: basic principles, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, stereoscope and stereoscopic views, parallax equations. Introduction to digital photogrammetry.
[8 Hours]

UNIT - V

Remote Sensing: Concepts and physical basis of Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics. Remote sensing systems, spectral signatures and characteristics spectral reflectance curves. Salient features of some of Remote Sensing satellites missions. Digital image processing: Introduction, image rectification and restoration, image enhancement, image transformation, image classification. Applications of remote sensing to civil engineering. [8 Hours]

Books and References:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House.
7. Punmia BC et al: Surveying Vol. I, II, Laxmi Publication
8. Chandra AM and Ghosh SK: Remote Sensing and Geographical Information System, Alpha Science
9. Ghosh SK: Digital Image Processing, Alpha Science
10. Lillesand T M et al: Remote Sensing & Image Interpretation, John Wiley & Sons
11. Bhatta B: Remote Sensing and GIS, Oxford University Press, 2008

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DEPARTMENT OF CIVIL ENGINEERING

OE- I/III	OPEN ELECTIVE	L	T	P	C
		3	0	0	3
d) HIGHWAY ENGINEERING					

Course Learning Objectives:
The objectives of this course are:
- To impart different concepts in the field of Highway Engineering.
- To acquire design principles of Highway Geometrics and Pavements
- To acquire design principles of Intersections

Course Outcomes:
Upon the successful completion of this course, the students will be able to:
1. Plan highway network for a given area.
2. Determine Highway alignment and design highway geometrics.
3. Design Intersections and prepare traffic management plans.
4. Judge suitability of pavement materials and design flexible and rigid pavements

SYLLABUS:
UNIT I Highway Planning and Alignment: Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans– First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment-Engineering Surveys – Drawings and Reports.

UNIT – II Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical Alignment-Gradients- Vertical curves.

UNIT – III Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals – Webster Method –IRC Method.

UNIT – IV Highway Materials: Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties — Tests on Bitumen - Bituminous paving mixes: Requirements – Marshall Method of Mix Design

UNIT – V Design of Pavements: Types of pavements; Functions and requirements of different components of pavements; Design Factors
Flexible Pavements*:* Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements.
Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses –Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

TEXTBOOKS:
Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee.
Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi.

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REFERENCES:

Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi
Principles of Transportation Engineering, Partha Chakraborty and Animesh Das, PHI Learning Private Limited, Delhi

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OE- I/III	OPEN ELECTIVE	L	T	P	C
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e). ROAD SAFETY ENGINEERING					

Course Objectives:

1. This module on the fundamental of traffic engineering & some of the statistics methods to analysis the traffic safety.
2. The accident interrogations & risk involved with measures to identity the causes are dealt.
3. The role of road safety in planning the urban infrastructures design is discussed.
4. The various traffic management systems for safety & safety improvement strategies are dealt.

Course Outcomes:

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

a) To understand fundamental of Traffic Engineering
b) To investigate & determine the collective factors & remedies of accident involved.
c) To design & planning various road geometrics.
d) To massage the traffic system from road safety point of view.

SYLLABUS

UNIT I:
Introduction to Road Safety:
Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

UNIT II:
Statistical Interpretation and Analysis of Crash Data:
Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

UNIT III:
Road Safety Audits:
Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

UNIT IV:
Crash Reconstruction:
Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

UNIT V:
Mitigation Measures:
Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law.

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TEXT BOOKS:

1 Institute of Transportation Engineers (ITE), the Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999.
2 Towards Safe Roads in Developing country, TRL – ODA, 2004.

REFERENCES:

1 Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997 (Digitized 2008)
2 Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
3 Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, CRC Press, 2016.

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OE- I/III	OPEN ELECTIVE	L	T	P	C
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(f) ENVIRONMENTAL MANAGEMENT					

Course Learning Objectives:
The course will address the following:

1. Outline planning and the design of water supply systems for a community/town/city
2. Provide knowledge of air pollution control with various methods
3. Impart understanding of importance of protection of water source quality and enlightens the efforts involved in converting raw water into clean potable water.
4. Selection of valves and fixture in water distribution systems
5. Impart knowledge on Industrial Wastewater management
6. Visit at least one Water and Wastewater Treatment Plant and supply system.

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

a. Plan and design the water and wastewater systems
b. Identify the source of emissions and select proper control systems
c. Design & estimation of water supply system for a city
d. to get knowledge about various environmental aspects
e. Selection of suitable treatment flow for raw water treatments

SYLLABUS:
UNIT I
Energy and Environment: Definition- Energy demand – Energy resources and generation of electricity – conservation and management of energy resources – Oil pollution – Impact of oil pollution on marine and costal ecosystems – Management of oil pollution - case study of oil pollution.

UNIT II
Agriculture and Environment: Definition -Composition of soils **–** soils for plant growth **–** difference between sandy and clayey soils **–** macro and micro nutrients for plant growth – different types of agriculture – Impact of agriculture on environment and people – causes for soil erosion – management of soil erosion

UNIT III
Water Management: Water cycle – global water distribution – fresh water supply system – water usage in different ways – water quality and availability - water pollution and its sources – impact of water pollution – managing pollution of fresh water – managing water related diseases.
UNIT IV
Atmospheric Pollution: Definition – atmosphere – structure and composition of atmosphere – natural greenhouse effect – atmospheric pollution and its causes like smog, acid rain – ozone layer depletion – enhanced greenhouse effect – urban heat islands – impact of atmospheric pollution on humans, plants – managing of atmospheric pollution.

UNIT V
Management of natural hazards: definition – hazard and disaster – Earth quake and volcanoes – Flooding – drought – impact of natural hazards – managing the impacts of natural hazards – opportunities presented by natural hazards.
Text Books:

1. KVSG Murali Krishna, “Environmental studies”, VGS Publications, Vijayawada, 2016.
2. Jacobson, M.Z. “Atmospheric Pollution: History, Science and Regulation”, Cambridge University Press.

3. Masters, G.M. "Introduction to Environmental Engineering and Science", PHI.

.**References:**

1. Jacobson, M.Z. "Fundamental of Atmospheric Modeling", Cambridge University Press.

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OE- I/III	OPEN ELECTIVE	L	T	P	C
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(g) URBAN PLANNING					

Course Learning Objectives:
The objectives of this course are:

1 To appreciate urban transportation problems and procedures for travel demand estimation
2 To appreciate data collection techniques for OD data.
3 To estimate trip generation, trip distribution, mode choice and traffic assignment.
4 To develop alternative urban transport network plans

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

A Estimate travel demand for an urban area
B Plan the transportation network for a city
C Identify the corridor and plan for providing good transportation facilities.
D Evaluate various alternative transportation proposals

SYLLABUS:

UNIT -I

Urban Transportation Problems & Travel Demand: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT -II

Data Collection and Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT -III

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

UNIT -IV

Mode Choice Analysis: Mode Choice Behaviour, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation.

Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment.

UNIT -V

Corridor Identification, Plan Preparation & Evaluation: Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies.

TEXT BOOKS:

1 'Introduction to Urban System Planning' by Hutchinson, B.G., McGraw Hill.

2 'Transportation Engineering - An Introduction' by Khisty C.J., Prentice Halls

3 'Fundamentals of Transportation Planning' by Papa Costas, Tata McGraw Hill

REFERENCES:

1 'Urban Transportation Planning: A Decision Oriented Approach' by Mayer M and Miller E, McGraw Hill

2 'Introduction to Transportation Planning' by Bruton M.J., Hutchinson of London.

3 'Metropolitan Transportation Planning' by Dicky, J.W., Tata McGraw Hill

4 'Traffic Engineering and Transportation Planning' by Kadiyali L.R., Khanna Publishers, New Delhi.

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OE-II / IV	**DEPARTMENT OF CIVIL ENGINEERING OPEN ELECTIVE**	**L**	**T**	**P**	**C**
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(a) ELEMENTS OF CIVIL ENGINEERING					

COURSE OBJECTIVES:

The objectives of this course are to make students to learn about

1. basics of Civil Engineering concepts
2. the surveying, elevations and mapping
3. the construction materials and elements
4. water resource development

COURSE OUTCOMES:

At the end of the course the student is familiar

a) basics of Civil Engineering concepts
b) the surveying the elevations and mapping
c) the construction materials and elements
d) water resource development and
e) overall infrastructure development

SYLLABUS:

Unit-I:

Scope of Civil Engineering: Introduction: Impact of Infrastructural Development on the Economy of a Country, Role of Civil Engineers, Importance of Planning, Scheduling and Construction Management.

Surveying:

Introduction: Surveying and leveling, object and uses, Primary divisions, Fundamental principles, Classification of surveying, Plans and maps, Scales, Units of measure.

Unit II:

Compass surveying:

Types and uses of compass, Bearings, Whole Circle Bearings, and Reduced Bearings, Computation of angles; Meridians; declinations and dip of needle.

Elevation measurements:

Leveling, object and uses, terms used in leveling, leveling instruments, methods of leveling.

Unit -III:

Construction Materials:

Requirement, types, uses, properties and importance of Civil Engineering materials like Stone, Bricks, Lime, Cement, Ferrous and Non Ferrous Metals, Ceramic Materials, Timber, Sand, Aggregate, Mortar and Concrete, Paints and Varnishes, Glass and Plastic.

Unit -IV:

Planning:

Elementary principles and basic requirements of a building planning, layout of residential & industrial buildings.

Construction:

Classification of buildings based upon occupancy and structure, Design Loads, Common building components, their functions, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

Unit –V:
Water Resources Development
Elementary Hydrology, Sources of water, Watershed Development, water requirements and its conservation, Hydraulic Structures of Storage.

Books:

1. Surveying Vol. I&II, Dr. B. C Punamia Laxmi Publications, Delhi
2. Building Construction, Dr. B. C Punamia Laxmi Publications, Delhi
3. Engineering Materials, Dr. S. C Rangwal, Charotar Pub, House
4. Irrigation Engineering and Hydraulics Structures, Santosh Kumar Garg: Khanna Publishers Delhi.
5. Civil Engineering Materials, Jakson and Dhir, ELBS Publishing London
6. Civil Engineering Drawing, S.C Rangwal, Charotar Pub, House Anand.
7. Elements of Civil Engineering (IV Edition) by S.S. Bhavikatti, New Age International Publisher, New Delhi, 3rd edition

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(b) ENVIRONMENTAL ENGINEERING					

Course Learning Objectives:
The course will address the following:

1 Outline planning and the design of water supply systems for a community/town/city
2 Provide knowledge of water quality requirement for domestic usage
3 Impart understanding of importance of protection of water source quality and enlightens the efforts involved in converting raw water into clean potable water.
4 Selection of valves and fixture in water distribution systems
5 Impart knowledge on design of water distribution network
6 Visit at least one Water Treatment Plant and supply system.

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

A Plan and design the water and distribution networks and sewerage systems
B Identify the water source and select proper intake structure
C Design & estimation of water supply system of an apartment
D Select the appropriate appurtenances in the water supply
E Selection of suitable treatment flow for raw water treatments

SYLLABUS:

UNIT–I

Introduction: Importance and Necessity of Protected Water Supply systems, Water borne diseases, Planning of public water supply system, components of public water supply systems. Per capita demand and factors influencing it, types of water demands and its variations, factors affecting water demand, Design Period, Factors affecting the Design period, estimation of water demand for a town or city, Population Forecasting.

UNIT-II

Sources of Water: Various surface and subsurface sources considered for water supply and their comparison-Capacity of storage reservoirs, Types of subsurface water bearing formations, Yields from wells and infiltration galleries. Conveyance of Water from the source to the point of interest: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, selection of pipe materials, Pipe joints.

UNIT-III

Quality and Analysis of Water: Characteristics of water and their measurement or estimation or analysis: Physical, Chemical and Biological characteristics. Water quality criteria for different uses- Rural, Municipal, Industrial and Agricultural uses. Drinking water quality standards: IS and WHO guidelines.

UNIT-IV

Treatment of Water: Typical treatment flow of a municipal water treatment plant, Unit operations of water treatment: Theory and Design of Sedimentation, Coagulation, flocculation, Filtration, Water conditioning and softening, Disinfection, Removal of color and odours – Removal of Iron and manganese – Fluoridation and deflouridation –Ion Exchange - Ultra filtration- Reverse Osmosis.

UNIT–V

Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods – Appurtenances of water distribution system–Laying and testing of pipe lines. Ideal water supply system.

TEXT BOOKS

1. Environmental Engineering – Howard S. Peavey, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.
2. Water Supply Engineering. Dr. P.N. Modi, Standard Book House, Delhi.
3. Rural, Municipal and Industrial Water management, KVSG Murali Krishna, Reem Publications, New Delhi, 2012

REFERENCES

1. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd., New Delhi.
2. Water Supply Engineering. – Dr. B.C. Punmia, A.K. Jain and A.K. Jain. Laxmi Publications (P) Ltd., New Delhi.
3. Water Supply and Sanitary Engineering – G.S.Birdie and J.S.Birdie

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(c) DISASTER MANAGEMENT					

Course Learning Objectives:
The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.'
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

a. Affirm the usefulness of integrating management principles in disaster mitigation work
b. Distinguish between the different approaches needed to manage pre- during and post- disaster periods
c. Explain the process of risk management
d. Relate to risk transfer

SYLLABUS:

UNIT-I

Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II

Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III

Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV

Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges-mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V

Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Punblishers & Distributors Pvt. Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

REFERENCE BOOKS:

1. 'Disaster Management' edited by H K Gupta (2003), Universities press.
2. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universities press.
3. R. Nishith, Singh AK, "Disaster Management in India : Perspectives, Issues and strategies" New Royal Book Company."

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(d) WATER RESOURCES ENGINEERING					

Course Learning Objectives:
The course is designed to make the students,

1 Estimate irrigation water requirements.
2 Design irrigation canals
3 Understand hydrologic cycle and its relevance to Civil engineering.
4 Learn physical processes and their interactions in hydrology.
5 Learn measurement and estimation of the components of hydrologic cycle.
5 Have an overview and understanding of Hydrographs.

Course Outcomes:
At the end of the course the students are expected to

A Have a thorough understanding of the theories and principles governing the hydrologic processes.
B Be able to quantify hydrologic components and apply concepts in hydrologic design of water resources projects.
C Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
D Develop design storms and carry out frequency analysis.
E Develop flow mass curve and flow duration curve, apply hydrograph analysis in the design of water resources projects.
F Develop unit hydrograph and synthetic hydrograph.

SYLLABUS:

UNIT – I

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT-II

Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

Diversion Head Works: Types of diversion head works, weirs and barrages, layout of diversion head works, components. Causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT-III

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, introduction to radar measurement of rain fall, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data,

frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), Design storm.

UNIT-IV

Abstractions: Initial abstractions, Evaporation: factors affecting, measurement, estimation, reduction, Evapotranspiration: factors affecting, measurement, estimation, control, Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

Runoff: Factors affecting runoff, components, empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

UNIT-V

Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, dimensionless unit hydrograph, synthetic unit hydrograph, introduction to IUH.

TEXTBOOKS:

1 'Irrigation and Waterpower Engineering' by Punmia B C, P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi
2 'Irrigation Water Resources and Waterpower Engineering' by Modi P N (2011), Standard Book House, New Delhi
3 'Engineering Hydrology' by Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013), New Delhi.
4 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
5 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
6 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications, (2011).

REFERENCES:

1 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
2 'Irrigation Engineering' by Sharma R.K. and Sharma, T. K (2012), S. Chand & Co Publishers.
3 'Water Resources Engineering' by Satyanarayana Murthy Challa (2008), New Age International Publishers.

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(e) HYDRAULICS AND HYDRAULIC MACHINERY					

Course Learning Objectives:

- To study about uniform and non-uniform flows in open channels
- To introduce dimensional analysis for fluid flow problems
- To understand the working principles of various types of hydraulic machines and Pumps.

Course Outcomes:

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

- Solve uniform and non-uniform open channel flow problems.
- Apply the principals of dimensional analysis and similitude in hydraulic model testing.
- Select suitable pumps and turbines.

SYLLABUS:

UNIT – I:

UNIFORM FLOW IN OPEN CHANNELS:

Types of channels –Types of flows - Velocity distribution – Energy and momentumcorrection factors – Chezy's and Manning's formulae for uniform flow – Most Economicalsections, Critical flow: Specific energy-critical depth – computation of critical depth

UNIT II:
NON-UNIFORM FLOW IN OPEN CHANNELS:
Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

UNIT – III:
HYDRAULIC SIMILITUDE:
Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

UNIT – IV:
IMPACT OF JETS:
Hydrodynamic force of jets on stationary and moving flat, inclinedand curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle.
CENTRAIFUGAL-PUMPS: Pump installation details-classification-work done- Manometric head-minimum starting speed-losses and efficiencies-specific speed, multistage pumps-pumps in parallel and series - performance of pumps-characteristic curves- NPSH- Cavitation.

UNIT – V:
HYDRAULIC TURBINES – I:
Layout of a typical Hydropower installation– Heads and efficiencies - classification of turbines. Pelton wheel - Francis turbine – Kaplan turbine - working, working proportions, velocity diagrams, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Governing of turbines- surge tanks-unit and specific quantities, selection of turbines, performance characteristics-geometric similarity-cavitation.

Text Books:

1. Open Channel flow, K. Subramanya, Tata McGraw Hill Publishers
2. Flow through Open channels by K.G. Ranga Raja, Tata Mc Graw Hill Publishers
3. Fluid Mechanics, and hydraulic machine, Rajput, S chand Publications.
4. Hydraulics and Fluid Mechanics including Hydraulic machinery By P.N. Modi, S.M Seth, Standard

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book house.

References:

1. Open channel hydraulics by Ven Te Chow. Mc Graw Hill Companies
2. Fluid Mechanics by V.L. Streeter, Mc Graw Hill Companies

Fluid Mechanics by K.L. Kumar, S. Chand publications.

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f) GREEN TECHNOLOGY

Course Learning Objectives:

The objective of this course is:

1. To present different concepts of green technologies.
2. To acquire principles of Energy efficient technologies.
3. To impart knowledge on the methods of reducing CO2 levels in atmosphere.
4. To gain knowledge of the importance of life cycle assessment
5. To learn the importance of green fuels and its impact on environment.

Course Learning Outcomes

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

- Enlist different concepts of green technologies in a project
- Understand the principles of Energy efficient technologies
- Estimate the carbon credits of various activities
- Identify the importance of life cycle assessment
- Recognize the benefits of green fuels with respect to sustainable development.

SYLLABUS:

UNIT- I

Introduction: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology. Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion-Barriers – Role of Industry,

UNIT- II

Cleaner Production Project Development and Implementation:
Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies.
Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- III

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling

UNIT -IV

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.

UNIT- V

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economic and social impacts- public policies and market-driven initiatives.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

TEXT BOOKS:

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.

2. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and Mandar Parasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok
3. 'Non-conventional Energy Sources' by Rai G.D.

REFERENCES:

1. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.
2. 'Handbook of Organic Waste Conversion' by Bewik M.W.M.
3. 'Energy, the Solar Hydrogen Alternative' by Bokris J.O.
4. 'Solar Energy' by Sukhatme S.P.

'Waste Energy Utilization Technology' by Kiang Y. H.

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OE-II / IV	OPEN ELECTIVE	L	T	P	C
		3	0	0	3
g) REMOTE SENSING & GIS					

Course Learning Objectives:

The course is designed to,

1. Introduce the basic principles of Remote Sensing and GIS techniques.
2. Learn various types of sensors and platforms.
3. Learn concepts of visual and digital image analysis.
4. Understand the principles of spatial analysis.
5. Appreciate application of RS and GIS to Civil Engineering

Course outcomes

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

A. Be familiar with ground, air and satellite-based sensor platforms.
B. interpret the aerial photographs and satellite imageries.
C. create and input spatial data for GIS application.
D. apply RS and GIS concepts for application in Civil Engineering.

SYLLABUS:

UNIT – I

Introduction to Remote sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, characteristics of remote sensing systems, types of resolutions - advantages & limitations, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT & Recent satellite.

UNIT – II

Image analysis: Introduction, elements of visual interpretations, digital image processing- image pre-processing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT – III

Geographic Information System: Basic Principles, components, application areas of GIS, map projections. Data entry and preparation: spatial data structures, raster and vector data formats, data inputs, data manipulation, data retrieval, data analysis and data display.

UNIT – IV

Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing.

UNIT – V

RS and GIS applications: Land cover and land use, agriculture, forestry, geology, geomorphology, urban & transportation, Hydrology and Water Resources: Flood zoning and mapping, groundwater

prospects, groundwater quality monitoring and potential recharge zones, watershed management of application with case studies.

TEXTBOOKS:

1. 'Remote Sensing and GIS', by Bhatta B, Oxford University Press, (2011) 2nd Edition'.
2. 'Remote Sensing and Image Interpretation, by Lillesand, T.M, R.W. Kiefer and J.W. Chipman, Wiley India Pvt. Ltd., (2015), 7th Edition.
3. 'Remote Sensing - Models and Methods for Image Processing' by Robert A Schowenger, Elsevier publishers, (2009).
4. 'Fundamentals of Remote Sensing' by George Joseph, Universities Press, (2013) 3rd Edition.
5. 'Fundamentals of Geographic Information Systems' by Michael N. Demers, Wiley India Pvt. Ltd, (2012) 4th Edition.

REFERENCES:

1. 'Remote Sensing and its Applications' by Narayan LRA, Universities Press, 2012.
2. 'Concepts and Techniques of Geographical Information System' by Chor Pang Lo and Albert K.W. Yeung, Prentice Hall (India), (2016) 2nd Edition.
3. 'Introduction to Geographic Information Systems' by Kang Tsung Chang, McGraw Hill Higher Education, (2020) 9th Edition.
4. 'Basics of Remote sensing & GIS' by S. Kumar, Laxmi Publications, New Delhi, 2005.

'Principals of Geographical Information Systems' by Burrough P A and R.A. McDonnell, Oxford University Press, 2006

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IV YEAR – II SEMESTER **Major Project-12, Internship-6 Months, Total-12**

L	T	P/D	C
-	-	-	12

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DEPARTMENT OF CIVIL ENGINEERING

Honors R20 (Starts from II-II)

(4 x 4 + 2 MOOCS/NPTEL x 2 = 20 Credits) for Civil Engg. students

Note: Student must choose subjects which were not opted earlier.

(Any FOUR courses may be chosen by the Student from each Pool)

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HC (SE)	DEPARTMENT OF CIVIL ENGINEERING HONOR COURSE (SE)	L	T	P	C
		3	1	0	4
a) FINITE ELEMENT METHOD					

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

CO1	Develop finite element formulations of 1 degree of freedom problems and solve them
CO2	Understand any Finite Elements of twaretoper form stress, thermal and modal analysis
CO3	Compute the stiffness matrices of different elements and system
CO4	Interpret displacements, strains and stress resultants
CO5	Analyze planar structural systems using finite element modeling

Mapping of Course Outcomes with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	1	3	-	-	-	-	1	-	-	-	-	-	-	2
CO 2	-	-	2	3	-	-	-	1	-	-	-	-	-	-	2
CO 3	-	-	2	3	-	-	-	1	-	-	-	-	-	-	2
CO 4	-	-	3	2	-	-	-	1	-	-	-	-	-	-	3
CO 5	-	-	2	3	-	-	-	1	-	-	-	-	-	-	2

1. **Slightly2.Moderately3.Substantially**

Detailed Syllabus:

UNIT: I

Introduction: Review of stiffness method- Principle of Stationary potential energy-Potential energyofanelasticbody-Rayleigh-Ritzmethodoffunctionalapproximation-variational approaches-weighted residual methods

UNIT: II

Finite Element formulation of truss element: Stiffness matrix-properties of stiffness matrix –Selectionofapproximatedisplacementfunctions-solutionofaplanetruss-transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports- Galerkin's methodfor1-Dtruss–Computation of stress in a truss element.

UNIT: III

Finite element formulation of Beam elements: Beam stiffness-assemble a geof beam stiffness matrix-Examples of beam analysis for concentrated and distributed loading-Galerkin's method - 2-D arbitrarily

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DEPARTMENT OF CIVIL ENGINEERING

oriented beam element – inclined and skewed supports – rigid plane frame examples

UNIT: IV

Finite element formulation for plane stress, plane strain and axi symmetric problems- Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems-comparison of CST and LST elements–convergence of solution-interpretation of stresses

UNIT: V

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element-shape functions, evaluation of stiffness matrix, consistent modal load vector-Gauss quadrature-appropriate order of quadrature–element and mesh instabilities–spurious zero energy modes, stress computation-patch test.

TEXT BOOKS

1. A first course in the Finite Element Method–DarylL. Logan, Thomson Publications.
2. ConceptsandapplicationsofFiniteElementAnalysis–Robert D.Cook, Michael E Plesha, JohnWiley&Sons Publications

REFERENCES:

1. Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D. Belgunda, PHI publications.
2. FiniteElementMethods(ForStructuralEngineers)WailNRifaie,AshokKGovil,New Age International(P)Limited

HC (SE)	HONOR COURSE (SE)	L	T	P	C
		3	1	0	4
b) MATRIX ANALYSIS OF STRUCTURES					

Pre-Requisites: None

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

CO1	Perform the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent displacements, force and equilibrium

	Methods
CO2	Perform structural analysis using the stiffness method
CO3	Solve multiple degree of freedom two and three dimensional problems involving trusses, beams, frames and plane stress
CO4	Understand basic finite element analysis

UNIT: I

Introduction of matrix methods of analysis – Static and kinematic indeterminacy – Degree of freedom– Structure idealization-stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element- Element force- displacement equations.

UNIT: II

Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames

UNIT: III

Stiffness method for Grid elements – development of stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams

UNIT: IV

Additional topics in stiffness methods–discussion of bandwidth–semi bandwidth–static condensation – sub structuring –Loads between joints-Support displacements- inertial and thermal stresses-Beams on elastic foundation by stiffness method.

UNIT: V

Space trusses and frames - Member stiffness for space truss and space frame– Transformation matrix from Local to Global – Analysis of simple trusses, beams and frames

TEXT BOOKS

1. Matrix analysis of structures- Robert E Sennet- Prentice Hall-Englewood cliffs-New Jercy
2. Advanced structural analysis-Dr. P. Dayaratnam- Tata McGraw hill publishing company limited.

REFERENCES

1. Indeterminate Structural analysis- C K Wang, Amazon Publications
2. Analysis of Tall buildings by force — displacement — Method M. Smolira Mc. Graw Hill.
3. Foundation Analysis and design – J.E. Bowls, 5e, Amazon Publications.
4. Structural Analysis Matrix Approach - Pandit and Guptha, Mc Graw Hil Education

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HC (SE)	HONOR COURSE (SE)	L	T	P	C
		3	1	0	4
c) EARTHQUAKE RESISTANT DESIGN					

Pre-Requisites: Soil Mechanics, Advanced Soil Mechanics, foundation Engineering-I Course

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

CO1	To learn the fundamentals of seismology and basic earthquake mechanisms, Tectonics types of ground motion, and propagation of ground motion.
CO2	Understand qualitative and quantitative representations of earthquake magnitude
CO3	Determinethenaturalfrequencyofasingledegreeoffreedomdynamicsystem For given mass, stiffness and damping properties.
CO4	Determinethemaximumdynamicresponseofanelasticvibratingstructuretoa given forcing function
CO5	Learn the fundamentals of building code based structural design

Detailed Syllabus:

UNIT: I

Engineeringseismology–reboundtheory–platetectonics–seismicwaves-earthquake size and various scales–local site effects–Indian seismicity–seismic zones of India– theory of vibrations–near ground and far ground rotation and their effects

UNIT: II

Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration–pounding effects– mass and stiffness irregularities–torsion in structural system-Provision of seismic code (IS1893&13920)–Building system–frames–shear wall–braced frames–layout design of Moment Resisting Frames(MRF)–ductility of MRF– Infill wall–Non-structural elements

UNIT: III

Calculation of EQ load–3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing of shear walls

UNIT: IV

Cyclic loading behavior of RC, steel and pre-stressed concrete elements-modern concepts- Base isolation–Adaptive systems–case studies.

UNIT: V

Retrofitting and restoration of buildings subjected to damage due to earthquakes-effects of earthquakes–factors related to building damages due to earthquake-methods of seismic retrofitting-restoration of buildings

TEXT BOOKS

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish ShriKhande, Prentice–Hall of India, 2007, New Delhi.
2. EarthquakeResistantDesignofStructures-S.K.Duggal,OxfordPublications

REFERENCE

1. Bullen K.E. Introduction to the Theory of Seismology, Great Britain at the University Printing houses, CambridgeUniversityPress1996.
2. Earthquake Resistant Design and Risk Reduction-David Dowrick
3. IS4326-1998:EarthquakeResistantDesignandConstructionofBuildings
4. IS1893(Part1to5)-2002:GeneralProvisionsandBuilding
5. IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction of Buildings
6. IS13920-1997:CodeofPracticeforDuctileDetailingofReinforcedConcreteStructures subjected to Seismic Forces
7. IS13935-1993:GuidelinesforRepairandSeismicStrengtheningofBuilding

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HC (SE)	HONOR COURSE (SE)	L	T	P	C
		3	1	0	4
d) PRE-STRESSED CONCRETE					

Course Learning Objectives:

The objective of this course is to:

- Familiarize Students with concepts of pre stressing
- Equip student with different pre stressing systems and devices
- Understand losses of pre stress including short and long-term losses
- Familiarize students with analysis and design of pre stressed concrete members under flexure, shear and torsion

Course Outcomes:

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

- Understand different methods of pre stressing
- Estimate effective pre stress including short and long-term losses
- Analyse and design pre stressed concrete beams under flexure and shear
- Understand the relevant IS Code provisions for pre stressed concrete

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	1	-	-	1	-	-	2	1
CO2	-	3	1	-	-	1	-	1	-	-	1	-	-	-	3
CO3	1	2	3	-	-	1	-	1	-	-	1	-	-	-	2
CO4	-	1	3	2	-	1	-	1	-	-	1	-	-	-	3
CO5	-	-	2	3	-	1	-	1	-	-	1	-	-	-	3

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT-I Introduction &Methods and Systems of pre stressing Historic development- General principles of pre stressing pre tensioning and post tensioning- Advantages and limitations of Pre stressed concrete- General principles of PSC- Classification and types of pre stressing- Materials- high strength concrete and high tensile steel their characteristics. Pre tensioning and Post tensioning methods and systems of pre stressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system

Flexure: Analysis of sections for flexure- beams pre stressed with straight, concentric, eccentric, bent and parabolic tendons, Line of Thrust – Pressure Line, Load Balancing Concept.

UNIT-II Losses of Pre-stressing- Loss of Pre-stress in pre-tensioned and post tensioned members - Elastic shortening, shrinkage, and creep of concrete; Relaxation of steel, slip in anchorage, and frictional losses- Total loss and allowable loss of pre stress for design.

UNIT-III Design for Flexure - Types of failure – Code procedures - Design for flexure using IS Code (IS 1343 -2012) Cable profile in two span continuous members.

UNIT-IV Design for Shear and Torsion- Shear and Principal Stresses- Design of Shear Reinforcement-Code Provisions- Design for Torsion, Design for combined bending, shear and torsion.

UNIT-V

Deflections: Importance of control of deflections- Factors influencing deflections – Short term deflections of Un cracked beams- prediction of long time deflections- IS code requirements.

Applications adopting pre stressing concepts (only concepts): Poles, Pipes, Piles, Slabs & Railway Sleepers.

Text Books: -

1. Pre stressed Concrete by N.Krishna Raju, 6e Tata Mc Graw Hill Bookco.
2. Pre stressed Concrete by K.U.Muthu PHI Learning Pvt.Ltd.

References:

1. Design of pre stress concrete structures by T.Y. Lin and Burn, John Wiley, New York.
2. Pre stressed Concrete by N. Rajagopalan Narosa Publishing House.
3. Pre stressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi. 4. IS1343:2012

HC (SE)	HONOR COURSE (SE)	L	T	P	C
		3	1	0	4
e) REPAIR AND REHABILITATION OF STRUCTURES					

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

CO1	Recognize the mechanisms of degradation of concrete structures and to design durable Concrete structures
CO2	Conduct field monitoring and non-destructive evaluation of concrete structures.
CO3	Design and suggest repair strategies for deteriorated concrete structures including Repairing with composites.
CO4	Understand the methods of strengthening methods for concrete structures
CO5	Assessment of the service ability and residual life span of concrete structures by Visual inspection and in situ tests

Mapping of Course Outcomes with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 31
CO 1	3	3	2	2	1	-	1	-	2	2	-	1	-	2	-
CO 2	2	2	1	3	3	-	-	-	2	-	-	2	-	-	2
CO 3	2	1	1	-	-	-	2	1	1	-	1	1	-	3	2
CO 4	3	1	2	1	1	-	-	1	1	1	1	2	-	1	2
CO 5	3	3	2	2	1	-	1	-	2	2	-	1	-	2	-

1. **Slightly2.Moderately3.Substantially**

Detailed Syllabus:

UNIT: I

Materials for repair and rehabilitation-Admixtures-types of admixtures-purposes of using admixtures-chemical composition-Natural admixtures-Fibers-wraps-Glass and Carbon fiber wraps-Steel Plates-Nondestructive evaluation :Importance-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –Visual investigation- Acoustical emission methods-Corrosion activity measurement- chloride content–Depth of carbonation-Impact echo methods-Ultra sound pulse velocity methods- pull out tests.

UNIT: II

Strengthening and stabilization-Techniques-design considerations-Beam shear capacity strengthening-Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening-Connection stabilization and strengthening, Crack stabilization.

UNIT: III

Bonded installation techniques-Externally bonded FRP-Wet layup sheet, bolted plate, near surface mounted FRP, fundamental de bonding mechanisms-intermediate crack de bonding- CDC de bonding-plate end de bonding-strengthening of floor of structures

UNIT: IV

Fiber reinforced concrete-Properties of constituent materials-Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete-Applications of fiber reinforced concretes-Light weight concrete-properties of light weight concrete-No fines concrete-design of light weight concrete-Fly ash concrete-Introduction-classification of fly ash-properties and reaction mechanism of fly ash-Properties of fly ash concrete in fresh state and hardened state-Durability of fly ash concretes

UNIT: IV

High performance concretes-Introduction-Development of high performance concretes- Materials of high performance concretes-Properties of high performance concretes-Self Consolidating concrete-properties-qualifications.

TEXT BOOKS

1. MaintenanceRepairRehabilitation&MinorworksofBuildings-P.C.Varghese,PHI Publications
2. RepairandRehabilitationofConcreteStructures—P.I.Modi,C.N.Patel,PHIPublications
3. RehabilitationofConcreteStructures-B.Vidivelli,StandardPublishersDistributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation-V.K.Raina, Shroff Publishers and Distributors.

REFERENCE:

1. Concrete Technology Theory and Practice-M.S.Shetty, S Chand and Company
2. Concrete Repair and Maintenance illustrated-Peter HEmmons
3. Concrete Chemical Theory and Applications-Santa Kumar A.R.,Indian Society for Construction Engineering and Technology, Madras
4. Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

HC (GTE)	HONOR COURSE (GTE)	L	T	P	C
		3	1	0	4
a) REINFORCED SOIL STRUCTURES					

Course objectives:

1. To understand the history and mechanism of reinforced soil
2. To know the various types of geo-synthetics, their functions and applications.
3. To enable the design of reinforced soil retaining structures.

Expected Outcomes:

The students will

a) Understand the history and mechanism of reinforced soil
b) Become aware about situations where geo-synthetics can be used.
c) Know about various types of geo-synthetics and their functions
d) Be able to do dimple design of reinforced soil retaining walls and reinforced earth beds.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	2	1	1	-	-	-	-	1	3	-	1
CO2	3	2	1	3	2	1	1	-	-	-	-	1	3	-	1

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1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

Unit I:
Introduction -history –ancient and modern structures- Types of geo-synthetics, advantages, disadvantages. Functions of geo-synthetics and application areas where these functions are utilized such as in retaining walls, slopes, embankments, railway tracks, pavements etc. (general overview). Raw materials used for geo-synthetics, manufacturing process of woven and non-woven geotextiles, geo-membranes, geo-grids.

Unit II:
Properties of geo-synthetics. Creep and long term performance. Reinforced soil - Advantages and disadvantages. Fills, Types of facings, Factors affecting the performance and behavior of reinforced soil. Mechanism of reinforcement action - Equivalent Confining Stress Concept, Pseudo Cohesion Concept, Concept of Expanding soil mass. – Simple problems.

Unit III:
Design and analysis of vertically faced reinforced soil retaining walls- External stability and internal stability – Tie back wedge analysis and coherent gravity analysis with metallic strip and continuous geo-synthetic reinforcements. Assumptions, limitations and numerical problems. Construction methods of reinforced retaining walls. Geo-synthetics in pavements, function and benefits.

Unit IV:
Bearing capacity improvement using soil reinforcement – Binquet and Lee's analysis – Assumptions, failure mechanisms. Simple problems in bearing capacity. Geo-synthetics for short term stability of embankments on soft soils. Natural geotextiles, Advantages and disadvantages, functions, erosion control- types of erosion control products, installation methods.

Unit V:
Prefabricated vertical drains along with design principles and installation method Concept of Geo-cells, Gabion Walls, encased stone columns, geo-composites, soil nailing, geo-tubes, geo-bags (only basic concepts), Natural geotextiles using coir and jute with relative advantages and disadvantages, application areas, application in landfills.

Text Books:

1. Jones, C.J.F.P. (1985). Earth reinforcement and soil structures. Butterworth, London.
2. Rao, G.V. (2007). Geo-synthetics – An Introduction. Sai Master Geo-environmental Services Pvt. Ltd., Hyderabad

References:

1. Koerner, R.M. (1999). Designing with Geo synthetics, Prentice Hall, New Jersey, USA, 4th edition.
2. Rao, G.V., Kumar, S. J. and Raju, G.V.S.S. (Eds.). Earth Reinforcement – Design and Construction. Publication No. 314, Central Board of Irrigation and Power, New Delhi, 2012.

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3. Siva Kumar Babu, G.L. (2006). An introduction to soil reinforcement and geo synthetics. United Press (India) Pvt. Ltd.

HC (GTE)	HONOR COURSE (GTE)	L	T	P	C
		3	1	0	4
b) ADVANCED FOUNDATION ENGINEERING					

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

CO1	Understand classification of piles and determine the load carrying capacity of piles by various methods
CO2	Determine the load carrying capacity of pile groups
CO3	Evaluate the pull-out capacity of piles and down drag forces on piles due to negative skin friction
CO4	Determine the load carrying capacity of laterally loaded piles
CO5	Determine the load carrying capacity of piers and caissons

Syllabus:

Unit: I

Pile Foundations-Classification of Piles-Factors influencing - Choice- Load Carrying Capacity of Single Piles in Clays and Sands Using Static Pile Formulae- α - β - and λ - Methods –Dynamic Pile Formulae-Limitations-Monotonic and Cyclic Pile Load Tests.

Unit: II

Pile group's -Efficiency of Pile Groups- Different Formulae-Load Carrying Capacity of Pile Groups in Clays and Sands – Settlement of Pile Groups in Clays and Sands – Computation of Load on each Pile in a Group.

Unit: III

Pull-out resistance of piles -Meyerhof's, Vesic's equations and Coyle and Castello correlations for piles in sands (Elastic settlement of piles) - Pull out Resistance of piles - Negative skin friction in piles – Typical field situations – Estimation of down drag - Neutral point – Methods of minimizing down drag.

Unit: IV

Laterally loaded vertical piles - Modulus of subgrade reaction – Piles in granular soils and cohesive soils subjected to lateral loading - Matlock & Reese analysis for piles in sands - Davisson & Gill analysis for piles in clays, Broms' Analysis for piles in sands and clays.

Unit: V

Drilled pier and Caisson Foundations – Types of Drilled piers – Load carrying capacity of piers in clays and sands, Uplift capacity of piers, Caissons – Types – Pneumatic Caisson – Well Foundations – Design of components – Design of wells – Lateral stability of well foundations – Terzaghi's analysis.

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REFERENCE

1. Principles of Foundation Engineering - Braja M. Das
2. Foundation Analysis and Design – J.E. bowles, McGraw – Hill Publishing Co.,
3. Analysis and design of foundations and Earth Retaining Structures. –S. Prakash, Gopal Rajan and Swami Saran – Sarita Prakasan, Merut.
4. Foundation Design and Construction – M.J. Tomlinson, Pitman
5. Soil Mechanics and Foundation Engineering, Vol. II, Foundation Eng., - VNS Murthy
6. Pile Foundation Analysis & Design by Poulos and Davis.

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HC (GTE)	HONOR COURSE (GTE)	L	T	P	C
		3	1	0	4

c) EARTH RETAINING STRUCTURES

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

CO1	Quantify the lateral earth pressures associated with different earth systems
CO2	Evaluate the mechanical properties of geo synthetics used for soil reinforcement
CO3	Identify the merits and demerits of different earth retaining systems.
CO4	Select the most technically appropriate type of retaining wall for the application from a thorough knowledge of available systems
CO5	Design of retaining structures using appropriate design methods, factors of safety, earth pressure diagrams and field verification methods
CO6	Aware of current guidelines regarding the design of earth retaining structures.
CO7	Design retaining structures considering both external and internal stability aspects

Mapping of Course Outcomes with Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5
CO1	1	--	2	3	1
CO2	1	--	2	1	1
CO3	3	--	1	1	--
CO4	1	1	2	2	3
CO5	--	2	3	1	--
CO6	--	2	--	--	--
CO7	1	2	1	2	1

1. **Slightly 2. Moderately 3.Substantially**

Detailed Syllabus:

Unit: I

Earth pressures – Different types and their coefficients- Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb's Theory in active and passive conditions.

Unit: II

Retaining walls – different types - Type of Failures of Retaining Walls – Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

Unit: III

Sheet Pile Structures – Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and fixed earth support methods – Rowe's moment reduction method – Location of anchors and Design of Anchorage system.

Unit: IV

Soil reinforcement – Reinforced earth - Different components – their functions – Design principles of reinforced earth retaining walls.

Unit: V

Braced cuts and Cofferdams: Lateral Pressure in Braced cuts – Design of Various Components of a Braced

cut – Stability of Braced cuts – Bottom Heave in cuts. – Types of cofferdam, Suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects – FVA method and Cummins' methods.

REFERENCES

1. Principles of Foundation Engineering by Braja M. Das.
2. Foundation analysis and design – Bowles, JE – McGraw Hill
3. Soil Mechanics in Engineering Practice – Terzaghi, K and Rolph, B. peck 2nd Edn. – John Wiley & Co.,
4. Analysis and Design of Foundations and Retaining Structures, Prakash, S – Saritha Prakashan, Mearut.

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		3	1	0	4
d) GEOENVIRONMENTAL ENGINEERING					

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

CO1	Understand various ground contaminations, pollution transport phenomena.
CO2	Collect pollutant data
CO3	Apply principles to get the information about the transport through the unsaturated soil
CO4	Develop various models for contamination transport.

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5
CO1	2	--	1	--	1
CO2	1	--	3	1	1
CO3	1	1	2	1	2
CO4	--	2	2	1	2

1. **Slightly 2. Moderately 3. Substantially Detailed**

Syllabus:

Unit: I

Introduction- Ground water contamination, pollutant transport and ground water remediation. Sources and Types of ground water contamination – underground storage tanks, Landfills, surface impoundments, waste disposal injection wells, Septic system, Agricultural wastes, Land application, radioactive contamination, other sources of contamination.

Unit: II

Data Collection methods: Introduction, Geological data acquisition – Drilling methods – Solid flight auger drilling – Hollow stem auger drilling – Wet rotating drilling – Hand auger soil boring – sample collection – Soil core logging – Cone penetration testing – Geophysical methods; Hydrologic data acquisition – monitoring well construction – well material – Screen interval selection – Installation procedure – Survey specification – Protective casing requirements – Well development procedures; Acquisition of soil and Ground water quality data.

Unit: III

Contaminant Transport Mechanisms: Introduction – Advection process – Diffusion – Dispersion process – Diffusion – Mass transport Equations : Derivation of advection dispersion equation for solute transport; One Dimensional Models – Continuous source in one dimension – Instantaneous source in one dimension – Adsorption effects – Transport in one dimensional with first order decay – Sorption: The concept of sorption. Factors influencing sorption – Contaminant characteristics, Soil characteristics, Fluid media characteristics. Sorption Isotherm: Linear sorption Isotherm – Freundlich Sorption isotherm – Langmuir Sorption Isotherm, Sorption effects on fate and transport of pollutants.

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Unit: IV

Flow and Transport of Pollutants in Unsaturated zone: Capillarity, soil-water characteristic curves, Unsaturated Hydraulic conductivity, Governing equation for unsaturated flow, measurement of soil properties.

Unit: V

Non – Aqueous Phase Liquids (NAPLs): Introduction – Comparison of fate of dissolved mass versus NAPL mass- Types of NAPLs – LNAPL – DNAPL; NAPL Transport – general process – NAPL transport at the pore level - Downward Migration of DNAPLs in saturated zone – NAPL movement through Vadose zone – LNAPL behaviour at the water table – NAPL Transport at the site level – LNAPL conceptual models – DNAPL conceptual models, NAPL transport.

TEXT BOOKS:

1. Ground water Contamination (Transport and Remediation) By Philip. B. Bedient, Hanadi, S. Rifai & Charles. J. Newell, Prentice Hall PTR, Upper Saddle River, NJ07458.

REFERENCES

1. Geo environmental Engineering by R. Krishna Reddy - John Wiley & Sons, Inc.
2. Geotechnical Engineering by Gulahati, S.K. and Datta, M. – Tata McGraw Hill Publishing Company
3. Geotechnical Engineering Principles and Practices by Coduto – Pearson Education (PHI)
4. Geo environmental engineering by Reddy, L.N and Inyang, I.H. – Marcel Drekker, 2000.
5. Environmental geo techniques by Sarsby, R. – Thompson Telford, 2000.Geotechnical Practices for Waste Disposal by Daniel, D.E., 1993

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		3	1	0	4
e) EARTH AND ROCKFILL DAMS					

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

CO1	Understand the basic concepts of earth-fill dams and rock-fill dams and identify the site topography and foundations conditions
CO2	Identify basic design requirements and causes of failures of dams, distinguish foundation types and the different fill materials
CO3	Estimate seepage through dam sections, foundations and select core and shell materials
CO4	Understand and design the methods to control seepage through different units of dams
CO5	Able to undertake slope stability analysis of dams
CO6	distinguish different types of instruments like piezometers, settlement gauges and inclinometers to install for performance studies of dams

Mapping of Course Outcomes with Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1	1	1
CO2	1	--	2	2	3
CO3	1	2	2	2	2
CO4	--	1	--	3	3
CO5	2	1	1	2	2
CO6	--	1	--	2	3

1. **Slightly 2. Moderately 3.Substantially**

Detailed Syllabus:

Unit: I

BASIC CONCEPTS AND MISCELLANEOUS TOPICS. Evolution – Types of Dams – Earth fill Dams – Rock fill Dams – Selection of Type of Dam – Site Topography – Foundation Conditions – Basic Design Requirements – Causes of Failure and Deterioration of Dams – Design Investigations – Fill Material – Foundations – Design Studies .

Unit: II

SEEPAGE THROUGH DAM SECTION AND ITS CONTROL: Estimation of Seepage through Dam Section and foundation – Considerations in selection and design of core and determination of shell material
Drains: – Pervious Downstream Shell – Chimney Drains – Rock Toe and Drains – Use of Geo-textiles as Filter Material.

Unit: III

CONTROL OF SEEPAGE THROUGH FOUNDATIONS: General Considerations – different types of cut off

walls – Provision of d/s aprons – relief wells

SLOPE PROTECTION – Necessity with respect to u/s and d/s slopes – u/s slope protection by Dumped Riprap- Hand-placed Riprap – Soil-Cement Slope Protection – Downstream Slope Protection by providing berms - grass turfing.

Unit: IV

STABILITY ANALYSIS OF SLOPES OF EARTH DAMS: Slope stability analysis techniques –Methods of Slices, Fellinious Method, Simplified Bishop method, Taylor's method, Simplified Janbu's Method; Stability of earth dam slopes – u/s slope during sudden drawdown, d/s slope during steady seepage, stability of u/s and d/s slopes during and after construction.

Unit: V

INSTRUMENTATION: – Purpose - Types of Instruments and Brief Description – Installation – piezometers -- Casagrande and Vibration wire -- Settlement gauges – Inclinometers.

REFERENCE:

1. Earth Dams by HD Sharma
2. Earth and Rock fill Dams HD Sharma & Bharat Singh

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		3	1	0	4

a) URBAN HYDROLOGY

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

CO1	Basic concepts of Urban Hydrological cycle and effect of urbanization on hydrology
CO2	Understanding the basic concepts of precipitation analysis
CO3	Knowledge about the methods of quantity estimation of storm water
CO4	Analyse the Infrastructure for storm water management
CO5	Explain about the Study the process of urbanization and its influence on urban hydrological processes and urban water supply system including, storm water modelling.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	-	2
CO2	3	3	3	-	2
CO3	-	3	3	1	2
CO4	-	1	3	-	2
CO5	3	3	3	-	2

1. Slightly 2. Moderately 3. Detailed

Syllabus:

Unit I:

Introduction: Urbanisation and its effect on water cycle – urban hydrologic cycle – trends in urbanisation – Effect of urbanisation on hydrology, need for urban drainage system, population forecasting.

Unit II:

Precipitation Analysis: Importance of short duration of rainfall and runoff data, methods of estimation techniques for urban drainage systems, Intensity-Duration -Frequency (IDF) curves, design storms for urban drainage systems.

Unit III:

Quantity Estimation of Storm Water: Factors Affecting the Quantity of Storm water, Methods for Estimation of Quantity of Storm Water, Time of Concentration, zoning and runoff coefficient, peak flow estimation approaches -Rational method, NRCS curve number approach, Empirical formulae.

Unit IV:

Infrastructure for Storm Water Management: conventional drainage systems, underground drains, sustainable drainage systems, Requirements for Urban Drainage Design, Operation and Maintenance, source control.

Unit V:

Analysis and Management: Storm water drainage structures, Sewer appurtenances, design of storm water network- Best Management Practices–detention and retention facilities, constructed wetlands, models available for storm water management, Water conservation systems

References:

- Urban Drainage, David Butler and John W. Davies, Spon press, reprint of Tylor & Francis, London and New York.
- Report on Storm water Management, Adrián Morales Torres IIAMA - Universitat Politècnica de Valencia, Sara Perales Momparler Green Blue Management
- National Disaster Management Guidelines, Management of Urban flooding , National Disaster Management Authority of India
- Design guidelines for storm water drainage system (Ministry of Housing and Urban Affairs Manual : Part A – Engineering, Part B – O&M, Part C – Management)

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		3	1	0	4
b) WATER AND WASTE WATER MANAGEMENT					

Course Learning Objectives:
The course will address the following:

1. Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
2. To impart knowledge on selection of treatment methods for industrial wastewater.
3. To know the common methods of treatment in different industries
4. To acquire knowledge on operational problems of effluent treatment plant.

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

1. Know the quality and quantity of water for various industries and Advanced water treatment methods
2. Learn the common methods of treatment of wastewaters and Biological treatment methods
3. Study of methods to reduce impacts of disposal of wasters into environment and CETPs.
4. Study of methods of treatment of wastewaters from specific industries like steel plants, refineries, and power plants, that imply biological treatment methods
5. Study of methods of treatment of wastewaters from industries like Aqua, dairy, sugar plants, and distilleries that imply biological treatment methods

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	1	3	1	1	-	-	-	1	2	-	3
CO 2	3	3	3	3	2	3	1	1	-	-	-	1	2	-	2
CO 3	3	3	3	3	2	3	3	2	-	-	-	1	1	-	2
CO 4	3	3	3	3	2	3	2	2	-	-	-	1	1	-	2
CO 5	3	3	3	3	1	3	2	2	-	-	-	1	1	-	2

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT – I

Industrial water Quantity and Quality requirements: Boiler, Cooling, Domestic/Canteen and Process waters for Textiles, Food processing, Dairy, Aqua industry, Sugar mills, Brewery and distillery Industries, Fertilizer industry, Power plants. Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, freezing, elutriation, Removal of Iron and Manganese, Removal of Colour and Odour. Use of Municipal wastewater in Industries.

UNIT – II

Basic theories of Industrial Wastewater Management: Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis - Wastewater characterization- Toxicity of industrial effluents- Common methods of Treatment of wastewaters - Unit operations and processes- Volume and Strength reduction –Neutralization – Equalization and proportioning- recycling, reuse and resources recovery. Miscellaneous Treatment: Biological treatment of sewage- Primary, secondary and Tertiary treatment of sewage.

UNIT – III

Industrial wastewater disposal management, Discharges into Sewers, Streams- Oxygen sag curve, Lakes-eutrophication and oceans and associated problems, Land treatment – sewage sickness, Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastewaters- Effluent Disposal Method.

UNIT – IV

Process and Treatment of specific Industries-1: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants. Case studies.

UNIT – V

Process and Treatment of specific Industries-2: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Aqua industry, Pharmaceutical Plants. Case studies.

TEXTBOOKS

1. Industrial Wastewater Treatment by KVSG Murali Krishna, Paramount Publishers, Visakhapatnam, 2019
2. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, New Delhi.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning, Delhi
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala,
5. Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rd Edition

REFERENCES

1. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc- GrawHill, Third Edition
2. Wastewater Engineering by Metcalf and EddyInc., Tata McGrawhillCo., New Delhi
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.
4. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard, Cengage Learning.

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		3	1	0	4

c) WATER RESOURCES PLANNING AND MANAGEMENT

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

CO1	Basic concept of Water Resources Planning process with detail
CO2	Explain briefly about the basic concept of water plans
CO3	Develop the various algorithms to solve linear as well as non-linear problems
CO4	Analyse the River basin modelling and requirements of reservoir storage
CO5	Explain about the Ground water management models
CO6	Develop the water quality management models

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	2	1	-	1	1
CO2	-	1	1	-	1	1
CO3	-	-	2	2	1	-
CO4	-	2	3	3	2	1
CO5	-	2	3	3	2	1
CO6	-	2	3	3	2	1

1. Slightly 2. Moderately 3. Detailed

Syllabus:

Unit I:
Introduction: Water resources planning process, multi-objective planning.

Unit II:
Evaluation of Water Plans: Basic concepts of engineering economics, welfare economics and economic comparison of alternatives.

Unit III:
Water Plan Optimization: Plan formulation, objective functions and constraint, analytical optimization, numerical optimization, linear programming, dynamic programming, simulation, planning under uncertainty.

Unit IV:
Deterministic River Basin Modelling: Stream flow modelling, estimation of reservoir storage requirements – dead storage, active storage for water supply/ irrigation / power generation, flood storage, optimal allocation.

Unit V:
Conjunctive Use/Groundwater Management Models: linear programming based conjunctive use modelling,

aquifer response models, link – simulation, embedded, matrix response based models, soft modelling.

Unit VI:

Water Quality Management Models: Basic water quality modelling, objectives of management, control alternatives, optimal plans

References:

- Hall, W.A. and Dracup, J.A., "Water Resources Systems Engineering", McGraw Hill Book Company. 1970
- Loucks, D.P., "Water Resource Systems Planning and Analysis", Prentice Hall. 1981
- Maass et al., "Design of Water-Resource Systems", Harvard University Press. 1962
- Vedula S. and Mujumdar, P.P., "Water Resources Systems", Tata McGraw Hill. 2005

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		3	1	0	4

d) ENVIRONMENTAL IMPACT ASSESSMENT

Course Learning Objectives:

The objective of this course is:

1. To impart knowledge on different concepts of Environmental Impact Assessment
2. To know procedures of risk assessment
3. To learn the EIA methodologies and the criterion for selection of EIA methods
4. To know pre-requisites for ISO 14001certification
5. To know the procedures for environmental clearances and audit
6. To appreciate the importance of stakeholder participation in EIA

Course Learning Outcomes

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

a) Prepare EMP, EIS and EIA report, estimate cost benefit ratio of a project
b) Selection of an appropriate EIA methodology
c) Evaluation of impacts on environment
d) Evaluation of risk assessment
e) Know the latest acts and guidelines of MoEF & CC

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2	2	1	2	2	-	-	1	-	-
CO2	1	2	2	1	2	2	2	2	2	1	-	-	-	-	2
CO3	1	2	2	1	2	1	2	2	1	-	-	1	-	-	1
CO4	1	2	2	2	3	2	3	1	3	1	2	1	-	-	1
CO5	1	2	2	2	3	2	3	1	3	1	2	1	-	-	1

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT-I:

Basic concepts of EIA: Elements of EIA-factors affecting EIA-Initial environmental Examination-life cycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA, Environmental economics, Cost/benefit Analysis - EIS and EMP. Identification of activities- application of remote sensing and GIS for EIA.

UNIT-II:

EIA Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods.

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area

UNIT-III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance,

Identification and Incorporation of mitigation measures - EPA with reference to surface water, Air and Biological environments. Methodology for the assessment of Impacts on surface water environment, generalized approach for assessment of Air pollution Impact.

UNIT-IV: Assessment of Impact of development Activities on Vegetation and wildlife, Environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT-V EIA: MoEF&CC Acts, Notifications and Guidelines: Provisions in the EIA notification, procedure for environmental clearance, and procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Environmental compliance reports. Case studies and preparation of EIA statement for various Industries.

Text Books:

1. Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.

References:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. Katania& Sons Publication. New Delhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

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e) AIR POLLUTION AND CONTROL

Course objective:

1.To evaluate the fundamentals of air pollution control
2.To design the operation of various air pollution control devices

Course outcome:

Course will familiarize the students with technologies available for the control of air pollution. After successful completion of this course, student will be capable to decide and design an appropriate air pollution control system based on the problem at hand

UNIT-I

Introduction: Definition - Sources and classification of Air Pollutants - Photochemical smog - Effects of air pollution on health of Human & Animals, vegetation & materials, air quality standards, Global effects of air pollution.

UNIT-II

Meteorology and Dispersion of air pollutants: Temperature lapse rates and Stability, Wind velocity and turbulence, Wind Rose, plume behavior, Measurement of meteorological variables. Dispersion of Air pollutants: Gaussian Dispersion model - Equations for the estimation of pollutant concentrations of emissions
- Plume Rise –Effective stack height and mixing depths.

UNIT-III

Sampling, Analysis and Particulate Pollution Control Methods: Ambient air quality monitoring -High volume sampler- stack monitoring train and stack monitoring - Principles and design aspects of different typesof particulate pollution control equipment– Settling chambers, Cyclone separators, Scrubbers, Filters and Electrostatic precipitators,

UNIT-IV

Gaseous pollution control methods and automobile pollution: Gaseous pollutants' sampling and analysis- Types of gaseous pollution control methods – absorption, adsorption and combustion processes. Automobile pollution, sources of pollution, composition of auto exhausts, Control methods.

UNIT V

Noise Pollution: Definitions – Significance - sources, measurement - effects and control measures, legislations

Reference Books:

1. Air Pollution by M. N. Rao, Tata McGraw Hill Publication.
2. "Air pollution and control by KVSG Murali Krishna, Laxmi Publications, New Delhi, 2016.
3. Air Pollution by H. C. Perkins.
4. Environmental Engineering by Peavy and Rowe, McGraw Hill Publication.
5. Air Pollution Control Engineering by N.D. Nevers, McGraw Hill Publication.
6. Air Pollution control engineering by Noel de Nevers, McGraw Hill Publication, and New York.
7. Fundamentals of Air Pollution by Richard W. Boubel et al, Academic Press, New York.
8. Air Pollution: Physical and Chemical Fundamentals by John H. Seinfeld, McGraw Hill bookCo. 1988.

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		3	1	0	4
a) TRAFFIC ENGINEERING					

Course Learning Objectives:
The objectives of this course are:

1. To determine various components and characteristics of traffic.
2. To apply various traffic control devices and principles of highway safety.
3. To understand the detrimental effects of traffic on environment
4. To carry out highway capacity and level of service analysis.
5. To learn about intelligent vehicle highway systems.

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

a. Determine traffic speed, volume, travel time and density.
b. Design traffic signals
c. Determine highway capacity and LOS

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	---	--	2	-	1	-	-	-	-	1	-	-	1
CO 2	3	3	-	2	2	1	1	-	-	-	-	1	1	-	3
CO 3	3	3	3	2	3	1	1	-	-	-	-	1	-	-	3
CO 4	3	3	3	3	2	2	2	-	-	-	-	1	1	-	3
CO 5	3	3	3	2	3	1	1	-	-	-	-	1	-	-	3

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT- I

Components of The Traffic System: Human-Vehicle–Environment System; characteristics of Road users, Vehicles, Highways and their classification; Traffic Studies: Inventories; Volume studies; Speed, Travel time and Delay studies; Intersection studies; Pedestrian studies; Parking studies; Accident studies.

UNIT- II

Traffic Characteristics: Microscopic and macroscopic flow characteristics: Time headways; Temporal, spatial and model flow patterns; Interrupted and Un interrupted traffic. Microscopic and macroscopic speed characteristics: Vehicular speed Trajectories; Speed characteristics – Mathematical distribution; Speed and travel time variations; Travel time and delay studies. Microscopic and Macroscopic density characteristics: Distance headway characteristics; Car-following theories; Density measurement techniques; Density contour maps

UNIT- III

Traffic Control Devices & Highway Safety: Traffic signs & Markings; Signal Warrants; Signal phasing and Development of phase plans; Fixed and Vehicle activated signals; Webster method; ARRB method; Drew's Method; IRC method; Signal coordination; Area Traffic control. Accident characteristics – Road – Driver – Vehicle; Accident recording and Analysis; Highway Safety Improvement Program; Safety Audit.

UNIT- IV

Environmental Considerations: Air pollution: Kinds of pollutants; Air pollution standards; Measures of air quality; modelling and control. Noise pollution: Measurement of sound levels; Acceptable limits, Prediction of noise levels, Traffic noise control, Air and Noise pollution mitigation measures.

UNIT- V

Highway Capacity and Level of Service: Capacity and level of service; Factors affecting Capacity and LOS; Capacity of Rural Highways, Capacity of Urban Roads; HCM and IRC standards.

Intelligent Vehicle – Highway Systems: Traffic surveillance and monitoring; IVHS programs, Role of IVHS, IVHS categories, Benefits and Costs of IVHS, Categories of ITS.

TEXT BOOKS

1 'Traffic Engineering: Theory and Practice' by Pignataro LJ., Prentice hall, Inc

2 'Traffic and Transport planning' by Kadiyali L.R., Khanna Publishers

REFERENCES:

1 'Traffic Engineering Hand Book' by Institute of Transportation Engineers, 4 Ed., Prentice Hall

2 'Traffic Engineering' by Mc Shane, WR and RP Roess, Prentice Hall

3 'Highway Traffic analysis and design' by Salter RJ and NB Hounsell, 3rd ed., Macmillan

4 'Traffic Planning and Engineering' by Hobbs FD., Pergamon press

5 'Traffic flow fundamentals' by May, AD., Prentice Hall

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b) INTELLIGENT TRANSPORTATION SYSTEMS					

Course Learning Objectives:

1. To know the fundamentals of ITS
2. To study sensor technologies and Data requirements of ITS
3. To know ITS functional areas and user services
4. To study various kinds of ITS architecture
5. To study ITS applications in various fields of transportation engineering

Course Outcomes:

a) Identify the benefits of ITS from various types
b) Determine various sensor applications and ITS data collection techniques
c) Identify ITS user services and functional areas
d) Determine various ITS models, evaluation methods and ITS planning.
e) Determine the suitable ITS technology and assess its effectiveness to solve transportation problems

SYLLABUS

UNIT-I

Fundamentals of ITS: Definition of ITS s, the historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS.

UNIT-II

Sensor technologies and Data requirements of ITS: Importance of telecommunications in the ITS system, Information Management, Traffic Management Centers (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centers; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection.

UNIT-III

ITS functional areas – Advanced Traffic Management systems (ATMS), Advanced Trav Information systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS).

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

UNIT-IV

ITS Architecture – Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment

planning and system design and operation, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS planning.

UNIT-V

ITS applications: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries

TEXT BOOKS:

1. Fundamentals of intelligent transportation systems planning By Mashrur A. Chowdhury, Adel Wadid Sadek
2. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

REFERENCES:

1. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
2. National ITS Architecture Documentation, US Department of Transportation, 2007

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DEPARTMENT OF CIVIL ENGINEERING

HC(TE)	HONOR COURSE (TE)	L	T	P	C
		3	1	0	4
(c) RAILWAY, HARBOUR AND AIRPORT ENGINEERING					

Course Learning Objectives:

The objectives of this course are:

1. To know various components and their functions in a railway track
2. To acquire design principles of geometrics in a railway track.
3. To know various techniques for the effective movement of trains.
4. To acquire design principles of airport runway geometrics and pavements.
5. To know the planning, construction and maintenance of Docks and Harbours.

Course Outcomes:

At the end of course, Student will be able to

a. Design geometrics in a railway track.
b. Plan track layouts and control movement of trains
c. Design airport geometrics and airfield pavements.
d. Plan, construct and maintain Docks and Harbours.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	1	1	-	1	1	-	-	-	-	1	1	2	3
CO 2	3	3	1	2	-	1	1	-	-	-	-	1	2	1	3
CO 3	3	3	3	2	3	1	1	-	-	-	-	1	2	-	3
CO 4	3	3	3	3	2	2	2	-	-	-	-	1	-	1	3
CO 5	3	3	1	2	-	1	1	-	-	-	-	1	2	1	3

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

A. RAILWAY ENGINEERING

UNIT – I

Components of Railway Engineering: Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

UNIT – II

Geometric Design of Railway Track: Alignment – Engineering Surveys - Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves.

UNIT – III

Turnouts & Controllers: Track layouts – Switches – Design of Tongue Rails – Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing.

Signal Objectives – Classification – Fixed signals – Stop signals – Signalling systems – Mechanical signalling system – Electrical signalling system – System for Controlling Train Movement – Interlocking – Modern signalling Installations.

B. AIRPORT ENGINEERING

UNIT – IV

Airport Planning & Design: Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control.

Runway Design: Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements – Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage.

C. DOCKS & HARBOURS

UNIT – V

Planning, Layout, Construction and Maintenance of Docks and Harbours: Classification of ports – Requirement of a good port – classification of Harbours – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts; Quays – construction of Quay walls – Wharves – Jetties – Tides - Tidal data and Analysis – Break waters – Dredging – Maintenance of Ports and Harbours – Navigational aids.

TEXT BOOKS:

1. Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi
2. Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.
3. Docks and Harbour Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.

REFERENCES:

1. ‘Railway Engineering’ by Saxena & Arora - Dhanpat Rai, New Delhi.
2. ‘Transportation Engineering Planning Design’ by Wright P.H. & Ashfort N.J. - John Wiley & Sons.
3. ‘Airport Engineering’ by Virendra Kumar, Dhanpat Rai Publishers, New Delhi.
4. ‘Transportation Engineering’ by Srinivasa Kumar R, University Press, Hyderabad
5. ‘Highway, Railway, Airport and Harbour Engineering’ by Subramanian KP, Scitech Publications (India) Pvt Limited, Chennai

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HC(TE)	HONOR COURSE (TE)	L	T	P	C
		3	1	0	4
d) PAVEMENT MANAGEMENT SYSTEM					

Course Learning Objectives:

1. To know various components and functions of pavement management systems
2. To know various pavement serviceability concepts and deterioration models
3. To know various functional and structural evaluation methods
4. To study design alternatives, rehabilitation and maintenance of pavements
5. To study the role of expert systems in pavement management

Course Outcomes:

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

a) Understand the features and functions of pavement management systems
b) Asses pavement performance by observing different models
c) Evaluate the pavement functionally and structurally
d) Identify and select suitable design strategies and decide the maintenance and rehabilitation measures required for a given pavement
e) Acquire knowledge of expert systems for managing pavements

SYLLABU

S UNIT-I

PMS Concepts and Components: Definition -Components of Pavement Management Systems, Essential features. Pavement Management Levels and functions: Ideal PMS- Network and Project levels of PMS- Influence Levels- PMS Functions- Function of Pavement evaluation.

UNIT-II

Pavement Performance: Serviceability Concepts- roughness-Roughness Components-Equipment-IRI -modeling techniques, structural condition deterioration models, mechanistic and empirical models, HDM and other models, comparison of different deterioration models.

UNIT-III

Pavement Evaluation:

Functional Evaluation: Functional and Structural deterioration models, unevenness prediction models and other models, comparison, Case studies, Equipment.

Structural Evaluation: Basics- NDT and Analysis—Condition Surveys-Distress-Destructive Structural Analysis- Application in Network and Project Levels

UNIT-IV

Design Alternatives, Rehabilitation and Maintenance: Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, life cycle costing, analysis of alternate pavement strategies based on distress and performance, case studies. Equipment's, Identification of Alternatives-Deterioration Modeling- Priority Programming Methods.

UNIT-V

Expert Systems and Pavement Management: Role of computers in pavement management, applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge-based expert systems, case studies.

TEXT BOOKS:

1. Ralph Haas and Ronald W. Hudson, 'Pavement Management System', McGraw Hill Book Co. 1978
2. Ralph Haas, Ronald Hudson Zanieswki. 'Modern Pavement Management, Kreiger Publications.

REFERENCES:

1. Proceedings of North American Conference on Managing Pavement.
2. Proceedings of International Conference on Structural Design of Asphalt Pavements NCHRP, TRR and TRB Special Reports

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		L	T	P	C
HC(TE)	HONOR COURSE (TE)	3	1	0	4

e) URBAN TRANSPORTATION PLANNING

Course Learning Objectives:
The objectives of this course are:

1. To appreciate urban transportation problems and procedures for travel demand estimation
2. To appreciate data collection techniques for OD data.
3. To estimate trip generation, trip distribution, mode choice and traffic assignment.
4. To develop alternative urban transport network plans

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

a. Estimate travel demand for an urban area
b. Plan the transportation network for a city
c. Identify the corridor and plan for providing good transportation facilities.
d. Evaluate various alternative transportation proposals

SYLLABUS:

UNIT -I

Urban Transportation Problems & Travel Demand: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT -II

Data Collection and Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT -III

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

UNIT -IV

Mode Choice Analysis: Mode Choice Behaviour, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation.
Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment.

UNIT -V

Corridor Identification, Plan Preparation & Evaluation: Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies.

TEXT BOOKS:

1. 'Introduction to Urban System Planning' by Hutchinson, B.G., McGraw Hill.
2. 'Transportation Engineering - An Introduction' by Khisty C.J., Prentice Halls
3. 'Fundamentals of Transportation Planning' by Papacostas, Tata McGraw Hill

REFERENCES:

1. 'Urban Transportation Planning: A Decision Oriented Approach' by Mayer M and Miller E, McGraw Hill
2. 'Introduction to Transportation Planning' by Bruton M.J., Hutchinson of London.
3. 'Metropolitan Transportation Planning' by Dicky, J.W., Tata McGraw Hill
4. 'Traffic Engineering and Transportation Planning' by Kadiyali L.R., Khanna Publishers, New Delhi.

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DEPARTMENT OF CIVIL ENGINEERING

HC(CT&M)	HONOR COURSE (CT&M)	T	P	C
		3	1	0	4

a) CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Course Learning Objectives:
The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. to introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. to introduce the importance of safety in construction projects

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

1. appreciate the importance of construction planning
2. understand the functioning of various earth moving equipment
3. know the methods of production of aggregate products and concreting
4. apply the gained knowledge to project management and construction techniques

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	2	-	-	3	2	2	3	-	-	-	-	-	-	-
CO 2	-	-	-	-	3	2	2	3	-	-	-	-	-	-	-
CO 3	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-
CO 4	-	-	-	-	3	3	-	3	-	-	-	-	-	-	-
CO 5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:
UNIT- I
Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT -II
Project evaluation and review technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources introduction to softwares for construction management, project management using PRIMAVERA (or) equivalent.

UNIT- III
Construction equipment – economical considerations – earthwork equipment – Trucks and handling

equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers – graders – scrapers– draglines - clamshell buckets

UNIT -IV

Concreting equipment — concrete mixers – Batching plants, mobile using plants like "Ajax" etc. mixing and placing of concrete – consolidating and finishing.

UNIT -V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering.
BIM for Civil Engineers (Building Information Modelling)

TEXT BOOKS:

1. 'Construction Planning , Equipment and Methods' by Peurifoy and Schexnayder , Shapira, Tata Mcgrawhill
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha (2011), Pearson.
3. 'Construction Technology' by Subir K. Sarkar and SubhajitSaraswati, Oxford University press

REFERENCES:

1. 'Construction Project Management - An Integrated Approach' by Peter Fewings , Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning

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HC(CT&M)	HONOR COURSE (CT&M)	L	T	P	C
		3	1	0	4

b) ARCHITECTURE AND TOWN PLANNING

Course Learning Objectives:

The objectives of this course are:

1. Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
2. The salient features of Egyptian, Greek, Roman, Indian Vedic, and Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
3. Architectural design concepts, principles of planning and composition are imparted.
4. Enabling the student to understand town planning from ancient times to modern times.
5. To impart the concepts of town planning standards, land scaping and expansion of towns.

Course Outcomes:

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

a. Distinguish architectural styles of eastern and western world.
b. Understand the importance of Orders of architecture.
c. Compose spaces of buildings using design concepts, planning principles.
d. Understand the town planning standards, landscaping features and regulations controlling expansion of the towns and the cities.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	1		-	-	2		-	2	-	-
CO 2	2	2	3	3	3	-	2	-	-	2	2	-	1	-	-
CO 3	-	2	2	2	2	-	2	2	1	-	2	-	-	3	2
CO 4	2	1	-	2	2	2	-	-	2		2	2	-	2	2
CO 5	2	2	3	3	3	-	2	-	-	2	2	-	1	-	-

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT – I

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization.

Temples of religions: Buddhist period: Stambas, Stupas, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhubaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

UNIT - II

Principles of designing and Planning: Principles of planning a residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.

Post-classic Architecture: Introduction of post-classic architecture- contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping.

UNIT – III

Historical Back Ground of Town Planning: Town planning in India –Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjo-Daro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT – IV

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighborhood Planning.

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations.

UNIT – V

Land Scaping and Expansion of Towns: Land scaping for the towns, horizontal and vertical expansion of towns- garden cities, satellite towns-floating towns- sky scrapers-pyramidal cities.

TEXTBOOKS:

1. 'The great ages of World Architecture' by G.K.Hiraskar.
2. 'Planning and Design of Buildings by Section of Architecture' by Y. S.Sane.
3. 'Professional Practice' by G.K.Krishnamurthy, S.V.Ravindra, PHI Learning, New Delhi.
4. 'Indian Architecture – Vol. I & II' by Percy Brown, Taraporevala Publications, Bombay.
5. 'Fundamentals of Town Planning' by G.K.Haraskar.

REFERENCES:

1. 'Drafting and Design for Architecture' by Hepler, CengageLearning
2. 'Architect's Portable Handbook' by John Patten Guthrie – McGrawHill International Publications.
3. 'Modern Ideal Homes for India' by R. S.Deshpande.
4. 'Town and County Planning' by A.J.Brown and H.M.Sherrard.
5. 'Town Design' by Frederik Glbbard, Architectural press, London.

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HC(CT&M)	HONOR COURSE (CT&M)	T	P	C
	3	1	0	4

c) REPAIR AND MAINTENANCE OF STRUCTURES

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

CO1	Recognize the mechanisms of degradation of concrete structures and to design durable Concrete structures.
CO2	Conduct field monitoring and non-destructive evaluation of concrete structures.
CO3	Design and suggest repair strategies for deteriorated concrete structures including repairing with composites.
CO4	Understand the methods of strengthening methods for concrete structures
CO5	Assessment of the serviceability and residual life span of concrete structures by Visual inspection and in situ tests
CO6	Evaluation of causes and mechanism of damage
C07	Evaluation of actual capacity of the concrete structure Maintenance strategies

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	1	--	1	--	1	--
CO2	--	1	1	1	--	1	1
CO3	--	1	1	1	--	1	1
CO4	--	--	1	1	--	1	1
CO5	--	--	1	1	--	1	1
CO6	--	--	1	1	--	1	1
C07	--	--	--	2	--	1	1

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT: 1

Materials for repair and rehabilitation -Admixtures- types of admixtures-purposes of using admixtures-chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibrewraps-SteelPlates-Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms-moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull outtests.

UNIT: II

Strengthening and stabilization- Techniques- design considerations-Beam shear capacity strengthening-Shear Transfer strengthening-stress reduction techniques- Column strengthening- flexural strengthening-Connection stabilization and strengthening, Crack stabilization

UNIT: III

Bonded installation techniques- Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures.

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UNIT: III

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete-Introduction- classification of flyash- properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes

UNIT: V

High performance concretes- Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes- Self Consolidating concrete- properties- qualifications.

TEXT BOOKS:

1. Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures — P.I. Modi, C.N. Patel, PHI Publications
3. Rehabilitation of Concrete Structures- B. Vidivelli, Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, Shroff Publishers and Distributors.

REFERENCE:

1. Concrete Technology Theory and Practice- M.S. Shetty, S Chand and Company
2. Concrete Repair and Maintenance illustrated- Peter H Emmons
3. Concrete Chemical Theory and Applications- Santa Kumar A.R. , Indian Society for Construction Engineering and Technology, Madras
4. Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

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HC(CT&M)	HONOR COURSE (CT&M)	L	T	P	C
		3	1	0	4
d) DISASTER MANAGEMENT AND MITIGATION					

Course Learning Objectives:
The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre- disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.'
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

a. Affirm the usefulness of integrating management principles in disaster mitigation work
b. Distinguish between the different approaches needed to manage pre- during and post-disaster periods
c. Explain the process of risk management
d. Relate to risk transfer

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2	2	1	2	2	-	-	1	-	-
CO2	1	2	2	1	2	2	2	2	2	1	-	-	-	-	2
CO3	1	2	2	1	2	1	2	2	1	-	-	1	-	-	1
CO4	1	2	2	2	3	2	3	1	3	1	2	1	-	-	1
CO5	1	2	2	1	2	1	2	2	1	-	-	1	-	-	1

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT-I

Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II

Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

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UNIT-III

Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV

Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V

Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Publishers & Distributors Pvt. Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh-Rawat Publications
3. ‘Disaster Science & Management’ by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. ‘Disaster Management – Future Challenges and Opportunities’ by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

REFERENCE BOOKS:

1. ‘Disaster Management’ edited by H K Gupta (2003), Universities press.
2. ‘Disaster Management – Global Challenges and Local Solutions’ by Rajib shah & R R Krishnamurthy (2009), Universities press.
3. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, Issues and strategies” New Royal Book Company.”

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HC(CT&M)	HONOR COURSE (CT&M)	L	T	P	C
		3	1	0	4
e) PRECAST AND PREFABRICATED STRUCTURES					

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

CO1	Analyze the prefabricated load carrying members
CO2	Analyze the production technology of prefabrication
CO3	Design and detailing of precast UNIT for factories
CO4	Design single storied simple frames

Mapping of course outcomes with program outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	3	2	1
CO2	2	1	1	3	2	1
CO3	2	1	2	3	3	1
CO4	2	1	1	3	3	1

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT -I

Need for prefabrication – General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

UNIT -II

Prefabricated Load Carrying Members-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT -III

Joints - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

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UNIT -IV

Production Technology - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology – Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT -V

Applications - Designing and detailing of precast UNIT for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TEXT BOOKS

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994
3. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

REFERENCES

1. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L,(1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.

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MINOR COURSES – I/III

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MC -I/III	MINOR COURSE	L	T	P	C
		3	1	0	4
a) ENVIRONMENTAL ENGINEERING AND MANAGEMENT					

Course Learning Objectives:
The course will address the following:

1. Outline planning and the design of water supply systems for a community/town/city
2. Provide knowledge of air pollution control with various methods
3. Impart understanding of importance of protection of water source quality and enlightens the efforts involved in converting raw water into clean potable water.
4. Selection of valves and fixture in water distribution systems
5. Impart knowledge on Industrial Wastewater management
6. Visit atleast one Water and Wastewater Treatment Plant and supply system.

Course Outcomes:
Upon the successful completion of this course, the students will be able to:

1. Plan and design the water and wastewater systems
2. Identify the source of emissions and select proper control systems
3. Design & estimation of water supply system for a city
4. to get knowledge about various environmental spects
5. Selection of suitable treatment flow for raw water treatments

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	1	1	3	1	1	-	-	-	1	-	-	-
CO 2	3	3	3	1	2	3	1	1	-	-	-	1	-	-	2
CO 3	3	3	3	1	2	3	1	1	-	-	-	1	-	-	2
CO 4	2	1	1	1	1	3	2	1	-	-	-	1	-	-	-
CO 5	3	3	3	1	2	3	1	1	-	-	-	1	-	-	2

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT I

Industrial wastes and their sources: Various industrial processes, Sources and types of solid, liquid, gaseous wastes, Noise & radiation emissions. Sources of industrial water usages and various industrial processes requiring water use and required water quality. Green Audit, Introduction to ISO and ISO 14000. Green Audit

UNIT II

Processes responsible for deterioration in water quality, various waste water streams, Control and removal of specific pollutants in industrial wastewaters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radioactivity etc. Wastewater reuse & recycling, concept of zero discharge effluent.

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UNIT III

Control of gaseous emissions: Hood and ducts, Tall stacks, Particulate and gaseous pollutant control, Solid waste generation and disposal management. Hazardous wastes: Definitions, concepts and management aspects. Noise & radiation: Generation, control and management.

UNIT IV

Recent trends in industrial waste management, Cradle to grave concept, Life cycle analysis, Clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc. Environmental audit: Definition and concepts, Environmental audit versus accounts audit, Compliance audit, relevant methodologies, various pollution regulations,

UNIT V

Study and significance of natural resources, Renewable biological resources, Wildlife conservation/ management, Fisheries, Forestry, Energy resources, Energy consumption, Scarcity and conservation. Acts and case studies

Text Books:

1. Metcalf & Eddy “Wastewater Engineering: Treatment & Reuse”, Tata Mc Graw Hill.
2. KVSG Murali Krishna “Industrial Wastewater Management”, Paramount Publications, Hyderabad.
3. Birdie GS & Birdie JS, “Water Supply and Sanitary Engineering”.
4. Environmental Engineering by Peavy Rowe, Tehobonoglous.

References:

Industrial Wastewater Treatment by MN Rao and AK Dutta, Oxford & IBH

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MC -I/III	MINOR COURSE	L	T	P	C
		3	1	0	4
b) SOLID MECHANICS					

Course Outcomes:
At the end of this course the student will be able to-
1. Describe the concepts and principles of stresses and strains
2. Analyze solid mechanics problems using classical methods and energy methods
3. Analyze structural members subjected to combined stresses
4. Calculate the deflections at any point on a beam subjected to a combination of loads
5. Understand the behavior of columns, springs and cylinders against loads.

SYLLABUS:
UNIT I : Simple stress and strains:
Concept of stress and strain, types of stresses and strains, Hook's law, stress and strain diagram for ductile and brittle metal. Lateral strain, Poission ratio, volumetric strain, elastic moduli and relation between them. Bar of varying cross section, composite bar and temperature stress. Strain energy for gradual, sudden and impact loading. Compound stress and strains: Normal stress and strain, shear stress and strain, stresses on inclines sections, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional state of stress & strain, equilibrium equations, generalized Hook's law-3D, Theories of failure and factor of safety. [8 Hours]

UNIT II: Shear force and bending moment diagrams
Shear force (SF) and Bending moment (BM) diagrams for simply supported, cantilevers, overhanging and fixed beams. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads. [8 Hours]

UNIT III : Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections. [8 Hours]

UNIT IV : Deflection of Beams:
Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams. Short Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules. [8 Hours]

UNIT V: Helical and Leaf Springs
Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs. Thin cylinders, Thick cylinders & Spheres: Introduction, difference between thin walled and thick walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain. Radial, axial and circumferential stresses in thick cylinders subjected to internal or

external pressures, compound cylinders. [8 Hours]

Books and References:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILL INDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Yσungs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson
8. Mechanics of material by Pytel, Cengage Learning
9. An Introduction to Mechanics of Solids by Crandall, MCGRAW HILL INDIA
10. Strength of Materials by Jindal, Pearson Education
11. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
12. Kazmi, S. M. A., “Solid Mechanics” TMH, Delhi, India

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MC -I/III	MINOR COURSE	L	T	P	C
		3	1	0	4
c) IRRIGATION ENGINEERING					

COURSE OUTCOMES:

Students will be able to

- CO1 Have knowledge and skills on crop water requirements.
- CO2 Understand the methods and management of irrigation.
- CO3Gain knowledge on types of Impounding structures
- CO4 Understand methods of irrigation including canal irrigation.
- CO5 Get knowledge on water management on optimization of water use.

OBJECTIVE:

- The student is exposed to different phases in irrigation practices and Planning and management of irrigation. Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.

UNIT I: CROP WATER REQUIREMENT

Need and classification of irrigation- historical development and merits and demerits of irrigation types of crops-crop season-duty, delta and base period- consumptive use of crops- estimation of Evapotranspiration using experimental and theoretical methods.

UNIT II: IRRIGATION METHODS

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Water distribution system- Irrigation efficiencies.

UNIT III: DIVERSION AND IMPOUNDING STRUCTURES

Types of Impounding structures - Gravity dam – Forces on a dam -Design of Gravity dams; Earth dams, Arch dams- Diversion Head works - Weirs and Barrages.

UNIT IV CANAL IRRIGATION

Canal regulations – direct sluice - Canal drop – Cross drainage works-Canal outlets – Design of prismatic canal-canal alignments-Canal lining - Kennedy's and Lacey's Regime theory-Design of unlined canal.

UNIT V WATER MANAGEMENT IN IRRIGATION

Modernization techniques- Rehabilitation – Optimization of water use-Minimizing water losses- On form development works-Participatory irrigation management- Water resources associations changing paradigms in water management-Performance evaluation-Economic aspects of irrigation.

TEXTBOOKS:

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

REFERENCES:

1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGrawHill Inc., New Delhi, 1997.
4. Sharma R.K.. "Irrigation Engineering", S.Chand & Co. 2007.
5. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 2008
6. Asawa, G.L., "Irrigation Engineering", NewAge International Publishers, New Delhi, 2000.
7. Basak, N.N, "Irrigation Engineering", Tata McGraw Hill Publishing Co. New Delhi1999 CE8604 HIGHWAY ENGINEERING L T P

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MC -I/III	MINOR COURSE	L	T	P	C
		3	1	0	4
d) GEO INFORMATICS					

COURSE OUTCOMES:
CO 1: Understand the basic of Geodesy and Indian Geodetic System
CO 2: Analyze and understand the basic of GPS. and data processing
CO 3: Analyze and understand the basic of Differential GPS (DGPS).
CO 4: Analyze and understand different application of GPS.
CO 5: Develop and execute GPS & DGPS related project.
SYLLABUS

UNIT I:
Introduction to Geodesy: Definitions and fundamentals of Geodesy, Earth, Geoid and Ellipsoid of rotation, Reference surface, Geodetic systems, Indian Geodetic System, Coordinate systems in Geodesy.

UNIT II:
Fundamentals of GPS: Introductions, Space segment, User segment and Control segments, Observation principle and signal structure, Orbit determination and representation, Intentional limitation of system accuracy, system development, Point positioning and relative positioning. GPS Receivers: Receiver Concepts and main receiver components, Examples of GPS receivers, Classical receivers, Examples of currently available geodetic receivers, Navigational receivers, Future developments.

UNIT III:
GPS Observables and Data Processing: Code and carrier phase observables, Linear combinations and derived observables, Concepts of parameterization, Solutions of ambiguity, Cycle slips, Receiver independent exchange data format-RINEX . Methods of surveying with GPS: Static, Pseudo-kinematic, Semi-kinematic and Kinematic positioning, Navigation with GPS.

UNIT IV:
Differential GPS: DGPS Concepts, Data Formats, Data Transmission, Real Time Kinematic GPS, Multiple reference stations. Erro Budget and Corrections: Basic considerations, Satellite geometry, Accuracy measures, Orbits and clocks, Signal propagation, Tropospheric and Ionospheric effects, Multipath, Summary and issue of integrity.

UNIT V:
GPS Applications: Setting up an observation plan, Practical aspects of field observations, Observation strategies, Network design, Geodetic control survey of zero 1st, 2nd, 3rd & 4th order. Height determination, Cadastral Surveying. GIS.

TEXT BOOKS:
1. Satellite Geodesy by GUNTER SEEBER, copy Right 2003 by WALTER DE GRUYTER 1993, ISBN: 3-11-017549-5.
2. Global Positioning system – Theory and Practice – Hofmann W.B, Lichtenegger. H, Collins. J-Springer Verlag Wein, New York.

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DEPARTMENT OF CIVIL ENGINEERING

MINOR COURSES – II/IV

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MC -II/IV	MINOR COURSE	L	T	P	C
		3	1	0	4
A) CONSTRUCTION TECHNOLOGY AND INFRASTRUCTURE MANAGEMENT					

Course Learning Objectives:

The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring.
2. To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery.
3. To introduce the importance of safety in construction projects.

Course Outcomes:

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

1. Appreciate the importance of construction planning.
2. Understand the functioning of various earth moving equipment.
3. Know the methods of production of aggregate products and concreting.
4. Apply the gained knowledge to project management and construction techniques.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	2	-	-	3	2	2	3	-	-	-	-	-	-	-
CO2	-	-	-	-	3	2	2	3	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	-	3	3	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT- I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT -II

Project evaluation and review technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources introduction to softwares for construction management, project management using PRIMAVERA (or) equivalent.

UNIT- III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers – graders – scrapers– draglines - clamshell buckets.

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UNIT -IV
Concreting equipment — concrete mixers – Batching plants, mobile using plants like "Ajax" etc. mixing and placing of concrete – consolidating and finishing.

UNIT -V
Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering.
BIM for Civil Engineers (Building Information Modeling)

TEXT BOOKS:
1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata Mcgrawhill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha (2011), Pearson.
3. 'Construction Technology' by Subir K. Sarkar and SubhajitSaraswati, Oxford University press.

REFERENCES:
1. 'Construction Project Management - An Integrated Approach' by Peter Fewings , Taylor and Francis.
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning.

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DEPARTMENT OF CIVIL ENGINEERING

MC -II/IV	MINOR COURSE	L	T	P	C
		3	1	0	4
b) SEISMOLOGY AND EARTHQUAKE ENGINEERING					

Course Learning Objectives:
The objective of this course is:
1. Familiarize Students with Engineering Seismology
2. Equip student with concepts of Structural Dynamics
3. Understand Concepts of Seismic Design
4. Familiarize with Design philosophies for Seismic loading
5. Familiarize students with various IS codal provisions for ductile design and detailing

Course Outcomes:
At the end of this course the student will be able to
a) Explain fundamentals of Engineering Seismology
b) Acquaint with the principles Structural dynamics
c) Solve SDOF Systems and suggest ductile design
d) Compute equivalent lateral seismic loads and carryout a seismic design as per IS codal provisions

SYLLABUS:

UNIT-I

Engineering seismology – rebound theory – plate tectonics – seismic waves - Earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects.

UNIT-II

Introduction to Structural Dynamics: Fundamental objective of Dynamic analysis – Types of prescribed loadings – Formulation of the Equations of Motion– Elements of a Vibratory system – Degrees of Freedom - Oscillatory motion – Simple Harmonic Motion – Free Vibrations of Single Degree of Freedom (SDOF) systems – Undamped and Damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor.

UNIT-III

Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames (MRF) – ductility of MRF – Infill wall – Non-structural elements.

UNIT-IV

Calculation of equivalent lateral force- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic weight- Response reduction factors- Seismic Coefficient Method.

UNIT-V

Design and ductile detailing of Beams and columns of frames -Concept of strong column weak beams, Ductility criteria for earthquake resistant design, Ductile detailing of flexural members as per IS 13920- Longitudinal reinforcement, Shear reinforcement, Anchorage of reinforcement Development length, Lap Splices. Seismic Analysis and design of simple 2-storied RC Building frame – Equivalent static lateral force method and response spectrum method.

TEXT BOOK

1. 'Earthquake Resistant Design of Structures' -Pankaj Agarwal and Manish ShriKhande, Prentice – Hall of India, 2007, New Delhi.
2. 'Earthquake Resistant Design of Building Structures' by Vinod Hosur, Wiley India Ltd.
3. 'Reinforced Concrete Design'by A. K. Jain.

REFERENCES

1. 'Introduction to the Theory of Seismology' by Bullen K.E., Great Britain at the University Printing houses, Cambridge University Press 1996.
2. Relevant code of practices.

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DEPARTMENT OF CIVIL ENGINEERING

MC -II/IV	MINOR COURSE	L	T	P	C
		3	1	0	4
c) RAILWAY, HARBOUR AND AIRPORT ENGINEERING					

Course Learning Objectives:

The objectives of this course are:

1. To know various components and their functions in a railway track
2. To acquire design principles of geometrics in a railway track.
3. To know various techniques for the effective movement of trains.
4. To acquire design principles of airport runway geometrics and pavements.
5. To know the planning, construction and maintenance of Docks and Harbours.

Course Outcomes:

At the end of course, Student will be able to

a) Design geometrics in a railway track.
b) Plan track layouts and control movement of trains
c) Design airport geometrics and airfield pavements.
d) Plan, construct and maintain Docks and Harbours.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	1	1	-	1	1	-	-	-	-	1	1	2	3
CO 2	3	3	1	2	-	1	1	-	-	-	-	1	2	1	3
CO 3	3	3	3	2	3	1	1	-	-	-	-	1	2	-	3
CO 4	3	3	3	3	2	2	2	-	-	-	-	1	-	1	3
CO 5	3	3	1	2	-	1	1	-	-	-	-	1	2	1	3

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

A. RAILWAY ENGINEERING

UNIT – I

Components of Railway Engineering: Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

UNIT – II

Geometric Design of Railway Track: Alignment – Engineering Surveys - Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves.

UNIT – III

Turnouts & Controllers: Track layouts – Switches – Design of Tongue Rails – Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing.

Signal Objectives – Classification – Fixed signals – Stop signals – Signalling systems – Mechanical signalling system – Electrical signalling system – System for Controlling Train Movement – Interlocking – Modern signalling Installations.

B. AIRPORT ENGINEERING

UNIT – IV

Airport Planning & Design: Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control.

Runway Design: Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements – Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage.

C. DOCKS & HARBOURS

UNIT – V

Planning, Layout, Construction and Maintenance of Docks and Harbours: Classification of ports – Requirement of a good port – classification of Harbours – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts; Quays – construction of Quay walls – Wharves – Jetties – Tides - Tidal data and Analysis – Break waters – Dredging – Maintenance of Ports and Harbours – Navigational aids.

TEXT BOOKS:

1. Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi
2. Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.
3. Docks and Harbour Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.

REFERENCES:

1. ‘Railway Engineering’ by Saxena & Arora - Dhanpat Rai, New Delhi.
2. ‘Transportation Engineering Planning Design’ by Wright P.H. & Ashfort N.J. - John Wiley & Sons.
3. ‘Airport Engineering’ by Virendra Kumar, Dhanpat Rai Publishers, New Delhi.
4. ‘Transportation Engineering’ by Srinivasa Kumar R, University Press, Hyderabad
5. ‘Highway, Railway, Airport and Harbour Engineering’ by Subramanian KP, Scitech Publications (India) Pvt Limited, Chennai

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MC -II/IV	MINOR COURSE	L	T	P	C
		3	1	0	4
d) ARCHITECTURE AND TOWN PLANNING					

Course Learning Objectives:

The objectives of this course are:

1. Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
2. The salient features of Egyptian, Greek, Roman, Indian Vedic, Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
3. Architectural design concepts, principles of planning and composition are imparted.
4. Enabling the student to understand town planning from ancient times to modern times.
5. To impart the concepts of town planning standards, land scaping and expansion of towns.

Course Outcomes:

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

a. Distinguish architectural styles of eastern and western world.
b. Understand the importance of Orders of architecture.
c. Compose spaces of buildings using design concepts, planning principles.
d. Understand the town planning standards, landscaping features and regulations controlling expansion of the towns and the cities.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	1		-	-	2		-	2	-	-
CO 2	2	2	3	3	3	-	2	-	-	2	2	-	1	-	-
CO 3	-	2	2	2	2	-	2	2	1	-	2	-	-	3	2
CO 4	2	1	-	2	2	2	-	-	2		2	2	-	2	2
CO 5	2	2	3	3	3	-	2	-	-	2	2	-	1	-	-

1 - Slightly 2 - Moderately 3 – Substantially

SYLLABUS:

UNIT – I

History of Architecture: Western Architecture:Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization.

Temples of religions: Buddhist period: Stambas, Stupas, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhuvaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF CIVIL ENGINEERING

UNIT - II

Principles of designing and Planning: Principles of planning a residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.

Post-classic Architecture: Introduction of post-classic architecture- contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping.

UNIT – III

Historical Back Ground of Town Planning: Town planning in India –Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT – IV

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighbourhood Planning.

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations.

UNIT – V

Land Scaping and Expansion of Towns: Land scaping for the towns, horizontal and vertical expansion of towns- garden cities, satellite towns-floating towns- sky scrapers-pyramidal cities.

TEXTBOOKS:

1. 'The great ages of World Architecture' by G.K.Hiraskar.
2. 'Planning and Design of Buildings by Section of Architecture' by Y. S.Sane.
3. 'Professional Practice' by G.K.Krishnamurthy, S.V.Ravindra, PHI Learning, NewDelhi.
4. 'Indian Architecture – Vol. I & II' by Percy Brown, Taraporevala Publications, Bombay.
5. 'Fundamentals of Town Planning' byG.K.Haraskar.

REFERENCES:

1. 'Drafting and Design for Architecture' by Hepler, CengageLearning
2. 'Architect's Portable Handbook' by John Patten Guthrie – McGrawHill International Publications.
3. 'Modern Ideal Homes for India' by R. S.Deshpande.
4. 'Town and County Planning' by A.J.Brown and H.M.Sherrard.
5. 'Town Design' by FederikGlbbard, Architectural press, London.