

**SCHEME OF EXAMINATION**

and

**SYLLABI**

for

**Bachelor of Technology  
Civil Engineering**

Offered by

**University School of Engineering and Technology****1<sup>st</sup> SEMESTER TO 8<sup>th</sup> SEMESTER****GURU GOBIND SINGH  
INDRAPRASTHA  
UNIVERSITY****Guru Gobind Singh Indraprastha University  
Dwarka, Delhi – 110078 [INDIA]  
[www.ipu.ac.in](http://www.ipu.ac.in)  
INDRAPRASTHA  
UNIVERSITY**

**BACHELOR OF TECHNOLOGY  
(COMMON TO ALL BRANCHES)  
FIRST SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETMA-101		Applied Mathematics-I	3	1	4	M
ETPH-103		Applied Physics-I	2	1	3	M
ETME-105		Manufacturing Processes	3	0	3	M
ETEE-107		Electrical Technology	3	0	3	M
ETHS-109		Human Values and Professional Ethics-I#	1	1	1	--
ETCS-111		Fundamentals of Computing	2	0	2	--
ETCH-113		Applied Chemistry	2	1	3	M
<b>PRACTICAL/VIVA VOCE</b>						
ETPH-151		Applied Physics Lab-I	-----	2	1	
ETEE-153		Electrical Technology Lab	-----	2	1	M
ETME-155		Workshop Practice	-----	3	2	M
ETME-157		Engineering Graphics Lab	-----	3	2	
ETCS-157		Fundamentals of Computing Lab	-----	2	1	--
ETCH-161		Applied Chemistry Lab	-----	2	1	--
		NCC/NSS*#	-----	-----	-----	--
<b>TOTAL</b>			<b>16</b>	<b>18</b>	<b>27</b>	

M: Mandatory for award of degree

#NUES (Non University Examination System)

\*#NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards. The camps/classes will be held either during Weekends/Holidays or Winter/Summer Vacations.

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**BACHELOR OF TECHNOLOGY  
(COMMON TO ALL BRANCHES)  
SECOND SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETMA-102		Applied Mathematics-II	3	1	4	M
ETPH-104		Applied Physics-II	2	1	3	
ETEC-106		Electronic Devices	3	0	3	M
ETCS-108		Introduction to Programming	3	0	3	M
ETME-110		Engineering Mechanics	2	1	3	--
ETHS-112		Communication Skills	2	1	3	--
ETEN-114		Environmental Studies	2	1	3	--
<b>PRACTICAL/VIVA VOCE</b>						
ETPH-152		Applied Physics Lab-II	-----	2	1	
ETCS-154		Programming Lab	-----	2	1	M
ETEC-156		Electronic Devices Lab	-----	2	1	M
ETME-158		Engineering Mechanics Lab	-----	2	1	--
ETEN-160		Environmental Studies Lab	-----	2	1	--
		NCC/NSS*#	-----	-----	-----	--
<b>TOTAL</b>			<b>17</b>	<b>15</b>	<b>27</b>	

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**BACHELOR OF TECHNOLOGY  
(CIVIL ENGINEERING)  
THIRD SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETMA-203		Numerical Analysis and Statistical Techniques	3	1	4	
ETCE-203		Strength of Material	3	1	4	M
ETCE-205		Fluid Mechanics	3	1	4	M
ETCE-207		Building Materials and Construction	3	0	3	
ETCE-209		Surveying	3	1	4	M
ETCE-211		Engineering Geology	3	0	3	
<b>PRACTICAL/VIVA VOCE</b>						
ETMA-253		Numerical Analysis and Statistical Techniques lab	0	2	1	
ETCE-253		Fluid Mechanics Lab	0	2	1	
ETCE-255		Civil Engineering Drawing using CAD Lab	0	2	1	
ETCE-257		Surveying Lab	0	2	1	
ETCE-259		Geology and Building Material Lab	0	2	1	
		NCC/NSS*#	-	-	-	
<b>TOTAL</b>			<b>18</b>	<b>14</b>	<b>27</b>	

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**BACHELOR OF TECHNOLOGY  
(CIVIL ENGINEERING)  
FOURTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETCE-202		Water Engineering	3	1	4	
ETCE-204		Structural Analysis	3	1	4	M
ETCE-206		Hydraulics and Hydraulic Machines	3	1	4	M
ETCE-208		Advanced Surveying	3	0	3	
ETCE-210		Soil Mechanics	3	1	4	M
ETCE-212		Design of Concrete Structure	3	1	4	M
<b>PRACTICAL/VIVA VOCE</b>						
ETCE-252		Cement and Concrete Testing Lab	0	2	1	
ETCE-254		Structure Lab	0	2	1	
ETCE-256		Hydraulics Lab	0	2	1	
ETCE-258		Advanced Surveying Lab	0	2	1	
ETCE-260		Seminar <sup>#</sup>	0	2	1	
ETSS-250		NCC/NSS <sup>*#</sup>	-	-	1	
<b>TOTAL</b>			<b>18</b>	<b>15</b>	<b>29</b>	

M: Mandatory for award of degree

\*NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards.

# NUES (Non University Examination System)

**Note:** Minimum of 2 week of Software Training related to Civil Engineering will be held after 4<sup>th</sup> Semester. However, weekly presentations and Viva Voce will be conducted in 5<sup>th</sup> Semester (ETCE-359).

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**BACHELOR OF TECHNOLOGY  
(CIVIL ENGINEERING)  
FIFTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETHS-301		Communication Skills for Professionals	2	0	1	
ETCE-303		Advanced Structural Analysis	3	1	4	
ETCE-305		Design of Steel Structure	3	1	4	M
ETCE-307		Engineering Hydrology	3	1	4	M
ETCE-309		Geotechnical and Foundation Engineering	3	1	4	M
ETCE-311		Wastewater Engineering and Reuse	3	1	4	
<b>PRACTICAL/VIVA VOCE</b>						
ETHS-351		Communication Skills for Professionals Lab	0	2	1	
ETCE-353		Geotechnical Engineering Lab	0	2	1	
ETCE-355		Water and Wastewater Analysis Lab	0	2	1	
ETCE-357		Seminar on Civil Engineering projects/Visits/ Case Studies <sup>#</sup>	0	2	1	
ETCE-359		Software Training <sup>^#</sup>	0	2	1	
<b>TOTAL</b>			<b>17</b>	<b>15</b>	<b>26</b>	

M: Mandatory for award of degree

<sup>^</sup>Minimum of 2 week of Software Training related to Civil Engineering was held after 4<sup>th</sup> Semester, however, weekly presentations and Viva Voce will be conducted in this semester (**ETCE-359**).

**Note:** Minimum of 2 week Surveying Camp (**ETCE 360**) will be held after 5<sup>th</sup> Semester, however, Viva-Voce will be conducted in the 6<sup>th</sup> Semester.

<sup>#</sup> NUES (Non University Examination System)

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**BACHELOR OF TECHNOLOGY  
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SIXTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETCE-304		Applications of Remote Sensing and GIS	3	0	3	
ETCE-306		Quantity Surveying and Cost Estimation	3	1	4	
ETCE-308		Open Channel, flow and Numerical Hydraulics	3	1	4	M
ETCE-310		Advance Structural Design	3	1	4	M
ETCE-312		Transportation Engineering -I	3	1	4	M
<b>GENERAL ELECTIVE –I(Choose any one)</b>						
ETEN-302		Environment System Optimization	3	1	4	
ETCE-302		Operation Research and Management	3	1	4	
ETIT-302		Decision Science	3	1	4	
<b>PRACTICAL/VIVA VOCE</b>						
ETCE-352		Transportation Engineering Lab	0	2	1	
ETCE-354		Applications of Remote Sensing Lab	0	2	1	
ETCE-356		Structures Design Lab	0	2	1	
ETCE-358		Seminar (topic should be linked to industrial training/Surveying Camp/ Soft skills learnt) <sup>#</sup>	0	2	1	
ETCE-360		Surveying Camp <sup>^</sup>	0	0	1	
<b>TOTAL</b>			<b>18</b>	<b>13</b>	<b>28</b>	

M: Mandatory for the award of degree

**Note:** Minimum of four weeks of Industrial Training related to Civil Engineering will be conducted after 6<sup>th</sup> Semester; however, viva-voce will be conducted in 7<sup>th</sup> semester (ETCE-457).

<sup>^</sup> Minimum of 2 week Surveying camp (ETCE-360) was held after 5<sup>th</sup> Semester; however, viva-voce is to be conducted in this semester.

<sup>#</sup> NUES [Non University Examination System]

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**BACHELOR OF TECHNOLOGY  
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SEVENTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits
<b>THEORY PAPERS</b>					
ETCE-401		Economics for Engineers	3	1	4
ETCE-403		Irrigation Engineering	3	0	3
ETCE-405		Transportation Engineering-II	3	1	4
<b>CORE ELECTIVE-1(Choose any one)</b>					
ETCE-411		Water Resource System Planning	3	1	4
ETCE-413		Earthquake Technology	3	1	4
ETCE-415		Geo-synthetics and Reinforced Soil	3	1	4
ETCE-417		Structure Repair and Rehabilitation	3	1	4
<b>GENERAL ELECTIVE-2(Choose any one)</b>					
ETCE-419		Data Analytics	3	0	3
ETEN-419		Planning and Design of Green Buildings	3	0	3
ETEC-421		Data Communication and Networks	3	0	3
ETHS-419		Sociology and Elements of Indian History for Engineers	3	0	3
ETCS 425		Database Management Systems	3	0	3
<b>PRACTICAL/VIVA VOCE</b>					
ETCE-451		Irrigation Engineering Design	0	2	1
ETCE-453		Economics of Infrastructure Projects: Case Studies	0	2	1
ETCE-459		Lab Based on Core and General Elective	0	2	1
ETCE-455		Minor Project+	0	6	3
ETCE-457		Industrial Training related to Civil Engineering ^	0	0	1
<b>TOTAL</b>			<b>15</b>	<b>15</b>	<b>25</b>

^ Minimum of 4 weeks Industrial Training related to Civil Engineering was conducted at the end of 6<sup>th</sup> Semester; however, weekly presentations and viva-voce is to be conducted in this semester.

**Imp:-** Elective Paper will be floated if one-third of the total students opt for the same. It is advised that the decision about the elective subject for 8<sup>th</sup> Semester is done before 15<sup>th</sup> November every year before end of seventh semester. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.

+ The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports.



**BACHELOR OF TECHNOLOGY  
(CIVIL ENGINEERING)  
EIGHTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits
<b>THEORY PAPERS</b>					
ETHS-402		Human Values and Professional Ethics-II	1	0	1
ETCE-404		Planning and Management of Construction Projects	3	1	4
ETCE-406		Analysis and Design of Bridges	3	0	3
<b>CORE ELECTIVE – I(Choose any one)</b>					
ETCE-410		Transportation, Planning and Management	3	1	4
ETCE-412		Ground Water Assessment, Development and Management	3	1	4
ETCE-416		Advanced Geotechnical Engineering	3	1	4
<b>GENERAL ELECTIVE–II(Choose any one)</b>					
ETCE-418		FEM in Structural Engineering	3	1	4
ETEN-418		Ground Water Contamination and Mitigation measures	3	1	4
ETCE-422		Environment Engineering	3	1	4
ETCE-424		Offshore structural Engineering	3	1	4
<b>PRACTICAL/VIVA VOCE</b>					
ETCE-452		Estimation of Projects using applicable software	0	2	1
ETCE-454		Lab based on Elective I or II	0	2	1
ETCE-460		Major Projects*	0	12	8
<b>TOTAL</b>			<b>13</b>	<b>19</b>	<b>26</b>

\*The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports. Seminar related to major project should be delivered one month after starting of Semester. The progress will be monitored through seminars and progress reports.

**Imp:-** Elective Paper will be floated if one-third of the total students opt for the same. It is advised that the decision about the elective subject is done before 15<sup>th</sup> November every year before end of seventh semester. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.

**NOTE:**

1. The total number of the credits of the B.Tech. (CIVIL) Programme = 215.
2. Student shall be required to appear in examinations of all courses. However, to award the degree a student shall be required to earn a minimum of 200 credits including mandatory papers (M).

**FOR LATERAL ENTRY STUDENTS:**

1. The total number of the credits of the B.Tech. (CIVIL) Programme = 161.
2. Each student shall be required to appear for examinations in all courses Third Semester onwards. However, for the award of the degree a student shall be required to earn a minimum of 150 credits, including mandatory papers (M).

**NOMENCLATURE OF CODES GIVEN IN THE SCHEME OF**

**B.TECH AND M.TECH**

1. **ET** stands for Engineering and Technology.
2. **PE** stands for Power Engineering.
3. **ME** stands for Mechanical Engineering.
4. **MT** stands for Mechatronics.
5. **AT** stands for Mechanical and Automation Engineering.
6. **EE** stands for Electrical and Electronics Engineering.
7. **EL** stands for Electrical Engineering.
8. **IT** stands for Information Technology
9. **CS** stands for Computer Science and Engineering
10. **CE** stands for Civil Engineering
11. **EC** stands for Electronics and Communications Engineering.
12. **EN** stands for Environmental Engineering
13. **TE** stands for Tool Engineering
14. **MA** stands for Mathematics
15. **HS** stands for Humanities and Social Sciences
16. **SS** stands for Social Services



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**NUMERICAL ANALYSIS AND STATISTICAL TECHNIQUES**

**Paper Code: ETMA-203**

**L T/P C**

**Paper: Numerical Analysis and Statistical Techniques**

**3 1 4**

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** To develop numerical ability and to impart knowledge in Statistical methods and Probability theory and their applications in Engineering to enable them to apply that for solving real world problems.

**UNIT I**

Probability Theory: conditional probability, Baye's theorem, Random variable: discrete probability distribution, continuous probability distribution, expectation, moments, moment generating function, skewness, kurtosis, binomial distribution, Poisson distribution, normal distribution, Curve Fitting: Principle of least square Method of least square and curve fitting for linear and parabolic curve .

[T1,T2][No. of Hrs. 11]

**UNIT II**

Correlation Coefficient, Rank correlation, line of regressions and properties of regression coefficients, ANOVA, Sampling distribution: Testing of hypothesis, level of significance, sampling distribution of mean and variance, Chi-square distribution, Student's T- distribution, F- distribution, Fisher's Z- distribution.

[T1,T2][No. of Hrs. 11]

**UNIT III**

Numerical Methods: Solution of algebraic and transcendental equations using bisection method, Regula-Falsi method and Newton – Raphson method. Solution of linear simultaneous equations using Gauss-Jacobi's iteration method and Gauss-Seidal's iteration methods. Finite differences: Forward differences, backward differences and Central differences. Interpolation: Newton's interpolation for equi-spaced values. Stirling's central difference interpolation formula, Divided differences and interpolation formula in terms of divided differences, Lagrange's interpolation formula for unequi-spaced values.

[T1,T2][No. of Hrs. 11]

**UNIT IV:**

Numerical Differentiation, maxima and minima of a tabulated function. Numerical Integration: Newton-Cote's quadrature formula, Trapezoidal rule, Simpson's one-third rule and Simpson's three-eighth rule .Numerical solution of ordinary differential equations: Picard's method, Taylor's method, Euler's method, modified Euler's method, Runge-Kutta method of fourth order.

[T1,T2][No. of Hrs. 11]

**Text Books:**

- [T1] R.K. Jain and S.R.K. Iyengar, "Numerical methods for Scientific and Engineering Computation", New Age.  
 [T2] N.M. Kapoor, "Fundamentals of Mathematical Statistics", Pitambar Publications

**Reference Books:**

- [R1] E. kresyzig, "Advance Engineering Mathematics", Wiley publications  
 [R2] P. B. Patil and U. P. Verma, "Numerical Computational Methods", Narosa  
 [R3] Partial Differential Equations "Schaum's Outline Series", McGraw Hill.  
 [R4] Michael Greenberg, "Advance Engineering mathematics", Pearson.  
 [R5] Schaum's Outline on Fourier Analysis with Applications to Boundary Value Problem, TMH  
 [R6] B.S. Grewal., "Numerical Methods in Engg. And Science", Khanna Publications.  
 [R7] Miller and Freund, "Probability and statistics for Engineers", PHI  
 [R8] Gupta and Kapoor, "Fundamentals of Mathematical Statistics" Sultan Chand and Sons.

**STRENGTH OF MATERIAL**

**Paper Code: ETCE-203**  
**Paper: Strength of Material**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: To develop knowledge of mechanics and to have in-depth understanding of material responses to load.*

**UNIT I**

**Simple stresses and strains :** Definition, types of stresses and strains; Hooke's law, Modulus of elasticity, various elastic constants and their relationship, stress strain curve for ductile materials, deformation of bars under axial loads, temperature stresses, bars of varying cross sections and composite sections, Poisson's ratio, volumetric strain, Strain rosette.

**Analysis of plane stress and plane strain:** General case of plane stress, Principle stresses due to combined bending and torsion, Analysis of strain, Mohr's circle for 2 dimensional stresses and strain, and Elementary concepts of theories of failure.

[T1,T2][No. of Hrs. 12]

**UNIT II**

**Shear force and bending moment:** Different types of beams and loads, shear force and bending moment diagrams for cantilever and simply supported beams with and without overhangs subjected to different kinds of loads, relation between loading, shear force and bending moments.

**Bending and shear stresses in beams:** Theory of simple bending, moment of resistance, modulus of section, calculation of bending stresses in beams for different loads and different types of structural sections. Shear stress and its distribution on different types of cross sections of beams.

[T1,T2][No. of Hrs. 11]

**UNIT III**

**Combined direct and bending stresses:** Middle third rule, core of a section, stresses due to wind, water and earth pressure in structures like retaining walls, dams, chimneys, walls etc.

**Slope and deflection of beams:** Relation between slope, deflection and radius of curvature, deflection and slope of statically determinate beams; moment area method, double integration method, conjugate beam method, dummy load method, Maxwell's law of reciprocal deflection, Betti's law and Castigliano's theorem and their applications.

[T1,T2][No. of Hrs. 11]

**UNIT IV**

**Torsion:** Torsion of hollow and solid circular shafts, torsion equation, torsional rigidity, modulus of rupture, power transmission by shafts, importance of angle of twist and various stresses in a shaft, comparison of solid and hollow shafts, torsional resilience.

**Columns and struts:** Columns and struts of uniform section, crippling/buckling load, Euler theory and concept of equivalent length, Rankine's formula and other empirical formulae, Secant formula.

[T1,T2][No. of Hrs. 10]

**Text Books:**

- [T1] James M Gere," Strength of Materials", Cengage Publication  
 [T2] Timoshenko, Stephen, Elements of Strength of Materials Part-2, CBS publication

**References:**

- [R1] Mechanics of Materials, Popov E.P., Prentice Hall of India  
 [R2] Solid Mechanics, S.M.A Kazmi  
 [R3] Structures, Schodek, Pearson Education  
 [R4] Strength of Materials, Nash, W.A., Tata Mc Graw Hill Publications  
 [R5] Basic Structural Analysis, Reddy, Mc Graw Hill Publications  
 [R6] B.S. Basavarajaiah, P. Mahadevappa, "Strength of Materials", 3<sup>rd</sup> Edition, University Press.



**FLUID MECHANICS**

**Paper code: ETCE-205**  
**Paper: Fluid Mechanics**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: To develop knowledge of properties, movement and behavior of fluid (water) under various flowing conditions. At the end of the course, students will have in-depth knowledge of fluid mechanics, measurement of fluid flow.*

**UNIT I**

**Introduction:** Fluid properties, Ideal and real fluids, Concept of viscosity, surface tension and compressibility; thermodynamic (isothermal, isobaric and adiabatic) properties.

**Fluid Statics:** Fluid pressure and its measurement, types of manometers, Total pressure and centre of pressure, Evaluation of pressure force on dams, lock gates, curved surfaces, pressure distribution in liquid subjected to constant horizontal/vertical acceleration, principles of equilibrium, buoyancy, centre of buoyancy, meta centre, stability conditions of floating and submerged bodies, Experimental and analytical method of determination of meta-centric height.

[T1,T2][No. of Hrs. 12]

**UNIT II**

**Fluid Kinematics:** Variation of flow parameters in space and time, Lagrangian and Eulerian concepts in fluid motion, Types of fluid flow: steady and unsteady, uniform and non uniform, rotational and irrotational, Laminar and turbulent, one, two and three dimensional flow, streamline, pathline and streakline, Continuity equation in Cartesian and polar co-ordinates and its applications, Velocity potential and stream function, Cauchy-Riemann equation, flownet.

**Types of motion:** Linear translation, linear deformation, Angular deformation, Rotation, Vorticity, Free and forced vortex flow.

[T1,T2][No. of Hrs. 12]

**UNIT III**

**Fluid Dynamics :** Reynolds's, Navier-Stokes and Euler's equations of motion, Derivation of Bernoulli's equation from Euler's equation and its limitations, Applications of Bernoulli's equations-Orifice, Venturimeter, Mouth piece, Weir and notch, Pitot's tube, Siphon, etc; hydraulic gradient and total energy lines and their Engineering significance. Momentum equation, Moment of momentum equation- Assumptions and limitations, applications, impact of jets and forces in bends.

[T1,T2][No. of Hrs. 11]

**UNIT IV**

**Dimensional and Model Analysis:** Dimensional homogeneity, methods of dimensional analysis, Buckingham's  $\pi$  theorem, selection of Repeating variables, Forces acting on moving fluid, Dimensionless numbers and their Engineering significance, Model analysis, Geometric, Kinematic and Dynamic similarity, Model testing of partially submerged bodies, scale ratios for distorted models.

[T1,T2][No. of Hrs. 10]

**Text Books:**

- [T1] R.J. Garde, "Fluid Mechanics through Problems", New Age Publications  
 [T2] A.K. Jain, "Fluid Mechanics and Fluid Machines", Khanna Publishers, New Delhi

**References:**

- [R1] Victor Streeter, "Fluid Mechanics", International Edition, Tata McGraw Hill Publications  
 [R2] Hughes and Brighton, "Fluid Mechanics", Tata McGraw Hill  
 [R3] Shames, "Mechanics of Fluids", Tata McGraw Hill  
 [R4] Neville, "Fluid Mechanics", Pearson Education  
 [R5] A. James, Fay, "Introduction to Fluid Mechanics", PHI Publications

**BUILDING MATERIALS AND CONSTRUCTION****Paper Code: ETCE-207****Paper: Building Materials and Construction**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: In this course, students will learn about different types of materials that are used in the construction industry to create buildings and structures.*

**UNIT I**

**Building Materials:** Properties and uses of common types of stones, bricks, tiles and hollow building blocks, Pozzolonic Material, Cement, lime and mortar, Properties, types and applications of other building materials like timber, protective coverings [Paints and varnishes], rubber, bitumen, tar and asphalt, glass, plastics and polymers, refractory materials etc.  
Plastering, Pointing, Painting, distempering, white washing, damp proofing, ventilation and air conditioning, Concept of thermal insulation, sound insulation, fire protection.

**[T1,T2][No. of Hrs. 10]****UNIT II**

**Concrete:** Cement, Sand, aggregates and water, Batching of concrete by weight and volume, Batching plant and equipment, workability, mix proportions and grades of concrete, types of mixers, transportation, pumping, placing and compacting of concrete. Admixtures, Formwork for RCC structures, Ready mix concrete, Pre-cast concrete.

**Types of concrete:** Special concrete, light weight concrete, high density concrete, vacuum concrete, shotcrete – steel fiber reinforced concrete, polymer concrete, Ferro cement, high performance concrete, self compacting concrete.

**[T1,T2][No. of Hrs. 12]****UNIT III**

**Building construction:** Components of building, shallow and deep foundations, Stone and brick masonry, type of bonds, load bearing walls, cavity wall, partition walls, finishing/coating materials for Roofs/floors/walls, construction and expansion joints, Introduction to Green building and LEED Classifications.

**[T1,T2][No. of Hrs. 12]****UNIT IV**

**Stairs, lintels, trusses, arches, domes, doors and windows:** Introduction, classification, types, material of construction.

**Special Materials and Systems:** Smart materials and structures, geosynthetics, nano-materials and bio-materials, Fire resistant materials, Sound Insulation.

**[T1,T2][No. of Hrs. 10]****Text Books:**

- [T1] M.L.Gambhir and Neha Jamwal, "Building Materials", Tata McGraw Hill.  
[T2] Shushil kumar, "Building Construction", Standard Publication

**References Books:**

- [R1] Building Materials, P.C.Varghese, PHI Publications  
[R2] Building construction, P.C.Varghese, PHI Publications  
[R3] Engineering materials S.C. Rangwala, Charotar Publishing House  
[R4] Building Materials, Duggal, New Age Publication  
[R5] Building and Construction Materials, M.L. Gambhir and Neha Jamwal, Mc-Graw Hill



**SURVEYING****Paper Code: ETCE-209****Paper: Surveying**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The successful completion of the course will enable the students to understand angle and distance measurement; differential, profile, cross-section, and topographic leveling procedures using conventional equipments and use of GPS and DGPS and apply them to field conditions.*

**UNIT I**

**Linear Measurement:** Introduction, Principles of chain survey, use and adjustment of various instruments employed in chain survey, chaining on sloping grounds, Offsets and error in offsets, Obstructions in chaining, chaining angles, Errors and sources of error, Introduction to advance linear measuring instruments, Field book.

**Compass Survey:** Use and adjustment of prismatic and surveyor's compass, Methods of surveying with a compass, Magnetic declination, local attraction, Errors in prismatic survey, plotting of compass survey, distribution of closing error.

**Leveling:** Definition and working principles of a leveling instrument and its various parts with reference to the bubble tube and the telescope, Use and adjustment of dumpy and tilting levels, Establishment of Bench Marks by leveling, Longitudinal leveling, Cross section leveling, fly leveling and reciprocal leveling, Methods of booking and reduction of levels. Errors in leveling, Curvature and refraction correction, Advanced leveling instruments.

**[T1,T2][No. of Hours: 12]****UNIT II**

**Theodolite Survey:** Study of theodolite, Temporary and permanent adjustments, Measurement of horizontal angles, methods of repetition and reiteration, Measurement of vertical angles, advanced electronic and laser theodolites.

**Contouring:** Definition of contours, contour interval, characteristics of contours, Direct and indirect methods of contouring, uses of contours, Estimation of volumes of the earthwork by means of contour lines and section, Grade contours, Topographic maps.

**[T1,T2][No. of Hours: 10]****UNIT III**

**Tacheometric Surveying:** Stadia system, Fixed and movable hair methods, staff held vertical and normal, Instrument constants, Analytic lens, Tangential system, direct reading tachometer, subtense bar.

**Plane Table Survey:** Instruments employed in plane table survey, Use and adjustment of these instruments including simple alidade. Working operations like fixing, leveling, centering and orientation, Methods of orientation, various methods of plane table survey. Three point and two point problems. Errors in plane table survey, Contouring using clinometer, Advantages and disadvantages of plane tabling.

**[T1,T2][No. of Hours: 10]****UNIT IV**

**Triangulation:** Principal, selection of base line and stations, order of triangulation, triangulation figures, scaffold and signals, marking of stations, Intervisibility and heights of stations, satellite stations, base line measurement and corrections, Introduction to adjustment of observations.

**Curves:** Types of curves, Elements of a curve, Simple curves, different methods of setting out, Introduction to compound, reverse, transition and vertical curves. Introduction to modern surveying Instruments /Techniques like Total station, GPS etc

**[T1,T2][No. of Hours: 12]****Text Books:**

- [T1] Plane Surveying, A.M. Chandra., New Age International Publications  
 [T2] Punmia B.C., Jain A.K. and Jain A.K., "Surveying", Volume I and II, Laxmi Publications (P) Ltd., New Delhi.

**References:**

- [R1] K.R. Arora, Surveying Vol. I and II Standard Book House, New Delhi  
[R2] Surveying, Arthur Bannister, Pearson Education  
[R3] Surveying, Mimi Das Saikia, Madan Mohan Das, PHI Publications  
[R4] Fundamentals of Surveying, S.K. Roy, PHI Publications  
[R5] Surveying and Leveling, T. P. Kanetkar and Kulkarni, Standard Publishers  
[R6] C. Venkatramaiah, "Textbook of Surveying", 2<sup>nd</sup> Edition, University Press.



**ENGINEERING GEOLOGY**

**Paper Code: ETCE-211**  
**Paper: Engineering Geology**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objectives: To expose various geological formations and processes involved such as weathering, erosion etc. Further the concepts of structural geology and photogeology have been discussed for their relevance in the field of Civil Engg. This subject also includes causes, effects and measurement of earthquakes and seismic zoning map of India. The course aims at identifying appropriate sites for civil engineering projects such as Dams, Bridges, Tunnels etc., based on geological factors.*

**UNIT I**

**Introduction:** Definition and scope of geology, its importance to Civil Engineers, Interior of earth, earth movement.

**Rocks and minerals:** Physical properties of minerals and their occurrence and uses, Classification and occurrence of rocks, Building and ornamental stones.

**Geological processes:** Weathering of rocks, agents of weathering, products of weathering, soil formation, soil profile, Erosion by running water, winds and glaciers.

[T1,T2][No. of Hours: 11]

**UNIT II**

**Structural Geology:** Stratification, Altitude of formation, dip, strike, apparent dip, Faults, folds, joints and their engineering importance.

[T1,T2][No. of Hours: 10]

**UNIT III**

**Hydrogeology:** Definition, source of ground water, ground water storage and circulation. Quality of ground water, hot water springs.

**Introduction of Engineering Seismology:** Earthquakes and its causes and effects, waves generated, basic terminology, Earthquakes and its measurements, Distribution of earthquakes in the World and in India, Seismic Zoning map of India.

[T1,T2][No. of Hours: 11]

**UNIT IV**

**Photogeology:** Aerial photographs, their importance in the field of civil engineering, stereoscope and its use.

**Dams and Reservoirs:** Geological investigations for dams and reservoirs. Examples of dam failures due to geological causes, Geological study for selecting site for dam and reservoir.

**Bridges, highways and buildings:** Geological investigations.

**Tunnels through rocks:** Definition. Purposes for tunneling, Geological background for selecting a site for a tunnel.

**Landslides:** Definition, causes and effects. Types of landslides, Preventive measures.

[T1,T2][No. of Hours: 12]

**Text Books:**

- [T1] D. Vankat Reddy, "Engineering Geology", Vikas Publications  
 [T2] P.C.Varghese, "Engineering Geology for Civil Engineers", PHI Publications

**References Books:**

- [R1] Bangar, "Principles of Engineering Geology", Standard Publishers and distributors  
 [R2] Kesavulu, "Textbook of Engineering Geology", Macmillan India Ltd  
 [R3] Dona, Mineralogy, Willey Eastern Limited, 1992  
 [R4] Hries and Watson, "Engineering Geology",  
 [R5] Tirifethen Van, "Geology of Engineering", Nebard  
 [R6] Kanithi, "Engineering Geology", University Press

**NUMERICAL ANALYSIS AND STATISTICAL TECHNIQUES LAB**

**Paper Code: ETMA-253**

**L T/P C**

**Paper: Numerical Analysis and Statistical Techniques Lab**

**0 2 1**

**List of experiments:-**

1. Solution of algebraic and transcendental equation.
2. Algebra of matrices: Addition, multiplication, transpose etc.
3. Inverse of a system of linear equations using Gauss-Jordan method.
4. Numerical Integration.
5. Solution of ordinary differential equations using Runge-Kutta Method.
6. Solution of Initial value problem.
7. Calculation of eigen values and eigen vectors of a matrix.
8. Plotting of Unit step function and square wave function.

It is expected that atleast 12 experiments be performed, including the above specified 8 experiments which are compulsory. The remaining experiments may be developed by faculty and students based on applications of Mathematics in Real Life problem.

**Text Books:**

[T1] B.S. Grewal., “Numerical Methods in Engg. And Science”, Khanna Publications

[T2] P. Dechaumphai and N. Wansophark, “Numerical Methods in Engg.: Theories with Matlab, Fortran, C and Pascal Programs”, Narosa Publications

**Reference Books:**

[R1] P.B. Patil and U.P. Verma, “Numerical Computational Methods”, Narosa Publications

[R2] John C. Polking and David Arnold, “Ordinary Differential Equations using MATLAB”, Pearson Publications

[R3] Rudra Pratap, “Getting Started With MatLab” Oxford University Press

[R4] Byrom Gottfried, “Programming With C” Shaum’s Outline

[R5] Santosh Kumar, “Computer based Numerical and Statistical Techniques”, S. Chand Publications.

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**FLUID MECHANICS LAB**

**Paper code: ETCE-253**  
**Paper: Fluid Mechanics Lab**

L	T/P	C
0	2	1

**Course Outline:**

Based on theory 8-10 experiments are to be performed. The list is provided below:

**LIST OF EXPERIEMNTS:**

1. Determination of metacentric height
2. Calibration of a venturimeter
3. Determination of frictional losses in pipes of different diameters.
4. Determination of minor losses in pipes
5. Calibration of a, V- notch and rectangular notch
6. Reynolds dye experiment for flow characterization
7. Determination of  $c_e$ ,  $c_v$  and  $c_d$  of an orifice
8. Verification of Bernoulli's theorem
9. Calibration of orifice meter
10. Verify the impulse momentum equation [impact of jet]

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

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**CIVIL ENGINEERING DRAWING USING CAD LAB****Paper Code: ETCE-255****Paper: Civil Engineering Drawing using CAD Lab**

L	T/P	C
0	2	1

**Course Outline:**

Drawing work using CAD: Plan, elevation, section and views of residential buildings, different types of roofs, sanitary and water supply works, road works, culverts, bridges, wells, and irrigation works, etc.



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SURVEYING LAB

Paper Code: ETCE-257

Paper: Surveying Lab

L	T/P	C
0	2	1

**Based on theory courses ETCE 209 (10- 12 experiments)**

1. Linear measurement using tape, chain and tacheometric methods.
2. Levelling using Autolevel
3. Plotting of the area using radiation, intersection and linear measurement.
4. Solution to three point problem using Plane table.
5. Measurement of horizontal and vertical angles by Vernier Theodolite.
6. Measurement of horizontal and vertical angles using Electronic Theodolite.
7. Preparation of close traverse of about 1km periphery using Total Station.
8. Adjustment of close traverse.
9. Adjustment of angles of a given triangulation network.
10. Use of DGPS for drawing a map of roads covering an area of about 5 sq. kms.
11. Traverse computation using appropriate softwares like Autoplotter.
12. Computation of missing side/ angle of a polygon (triangle/ quadrilateral) and error estimation.
13. Laying out of simple curve.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**


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**GEOLOGY AND BUILDING MATERIAL LAB**

**Paper Code: ETCE-259**

**Paper: Geology and Building Material Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

Based on theory 8-10 experiments are to be performed. The list is provided below:

**ENGINEERING GEOLOGY**

1. Study of Geological map and section of local area
2. Study the various properties of igneous rocks, sedimentary and metamorphic through rocks samples.
3. Study the various properties of different minerals and mineral ores through samples.
4. Study the various types of folds and faults.
5. Physical properties of minerals such as, hardness, colour, streak, etc.
6. Numerical Problems related to Dip and Strike
7. Study of different geological features through models
8. Field visit

**BUILDING MATERIALS**

1. Assessment of physical properties of bricks, such as, absorption, shape and size, structure, soundness, hardness, presence of soluble salts.
2. Hardness, impact and water absorption test etc for stones
3. Study on different types of bonds for bricks and stones
4. Study on defects in timber

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

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**WATER ENGINEERING**

**Paper Code: ETCE-202**  
**Paper: Water Engineering**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: To familiarize the students with the basics of water quality and its treatment methods, importance of planning, analysis and design of modern water supply schemes.*

**UNIT I**

**Demand of water:** Domestic, commercial and public requirements, Factors affecting demand fluctuations, Estimate of prospective population, fire demand requirements and other allowances.

**Sources of water:** Estimating the quantity of water from various sources, surface and underground sources, such as, impounded, perennial stream, shallow wells artesian wells, deep wells, infiltration galleries, intake works from different sources.

**Water quality:** Suspended solids, turbidity, colour, taste odour, temperature, Total dissolved solids, pH, acidity, alkalinity, hardness, nitrates, chlorides, fluorides, metals, organics, nutrients, and Pathogens.

**In-stream standards:** Potable water standards, waste water / effluent standards, standards for receiving wastes in natural streams / sewer / sea, Bio-monitoring of streams and lakes Groundwater quality, chemical/ biological remediation of ground water.

[T1][No. of Hours: 12]

**UNIT II**

**Water purification processes in natural system:** Water pollutants and their sources, Physical processes: Dilution, sedimentation and re-suspension, filtration, gas transfer, heat transfer, Chemical processes, metabolic processes, role of micro-organisms in natural water systems. Stream water quality changes due to waste disposal, Streeter-Phelps D.O. model, and water quality management of rivers having multiple discharges, lakes and estuaries.

[T2][No. of Hours: 11]

**UNIT III**

**Analysis and Design [as per CPHEEO manual etc] of Engineered systems for water purification:** Water treatment process and design, economic construction in water works design, solids separation by aeration, settling operations, coagulation, softening, mixing and flocculation, sedimentation.

**Analysis and design of other system for water purification:** Filtration, disinfection, [Residual chlorine, chlorine demand and break point chlorination] adsorption, membranes, Water plant waste management, Pump drive units and analysis of pumping systems.

[T2,T3][No. of Hours: 12]

**UNIT IV**

**Distribution system:** Methods of distributing water, distribution reservoirs, stand pipes and water tanks, design of pumping mains, use of nomograms, appurtenances, distribution systems and their components, capacity and pressure requirements, design of distribution systems, hydraulic analysis of distribution systems.

[T1][No. of Hours: 10]

**Text Books:**

- [T1] S.K. Garg, "Water Supply Engineering", Khanna Publishers.  
 [T2] Davis and Cornwell, "Introduction to Environmental Engineering", McGraw Hill  
 [T3] Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw Hill

**References:**

- [R1] Henry and Heinke, "Environmental Science and Engineering", Prentice Hall India  
 [R2] Venugopala Rao, "Principles of Environmental Science and Engineering", Prentice Hall India  
 [R3] Gilbert M. Masters, "Introduction to Environmental Engineering" Prentice Hall India.  
 [R4] Kiely, Gerardd "Environmental Engineering" Tata McGraw Hill  
 [R5] Hammer, Hammer "Water and Wastewater Technology" PHI Learning Pvt. Ltd  
 [R6] Qasim, Motley, Zhu "Water works engineering" PHI Learning Pvt. Ltd.  
 [R7] C.D.Gupta, V.K.Gupta "Water Supply Handbook" Jain Brothers

**STRUCTURAL ANALYSIS**

**Paper Code: ETCE-204**  
**Paper: Structural Analysis**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** (i) To identify determinate, indeterminate, stable and unstable structures (ii) To analyze indeterminate trusses, beams and frames using method of consistent deformation, slope deflection method, moment distribution and Kani's method (v) to construct influence lines and be able to use them.

**UNIT I**

**Columns and Struts:** Columns and struts of uniform section, crippling/buckling load, Euler theory and concept of equivalent length, Rankine's formula and other empirical formulae, Secant formula. Combined direct and bending stresses: Middle third rule, core of a section, stresses due to wind, water and earth pressure in structures like retaining walls, dams, chimneys, walls etc.

**Thin cylinders:** Thin cylinders subjected to internal fluid pressure, wire wound thin cylinders. Thin cylindrical shells, circumferential and hoop stresses, longitudinal stresses, Maximum shear stress.

[T1][No. of Hours: 11]

**UNIT II**

**Moving loads and Influence lines :** Introduction to moving loads, concept of equivalent UDL, absolute maximum bending moment and shear force, concept of influence lines, influence lines for reaction, shear force, bending and deflection of determinate beams, Influence line diagram [ILD] for forces in determinate frames and trusses, analysis for different types of moving loads, single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than span, Application of Muller Breslau Principle for determinate structures.

[T2,T3][No. of Hours: 12]

**UNIT III**

**Indeterminate Structures:** Indeterminacy, choice of unknowns, Castigliano's second theorem and its applications. **Method of consistent deformation:** Analysis of indeterminate beams and frames upto two degree of indeterminacy, settlement effects, analysis of pin jointed trusses, externally and internally redundant trusses, effects of settlement and prestrains.

**Slope Deflection Method:** analysis of continuous beams, analysis of rigid frames, frames with sloping legs, gabled frames, frames without sway and with sway, settlement effects.

[T1,T2][No. of Hours: 11]

**UNIT IV**

**Moment distribution and Kani's method:** Analysis of beams and frames.

**Approximate methods of analysis of multistorey frames:** Analysis of vertical load, substitute frames, loading condition for maximum positive and negative bending moment in beams and maximum bending moment in columns, analysis for lateral load, portal method, cantilever method and factor method.

[T3][No. of Hours: 11]

**Text Books:**

- [T1] G.S. Pandit, "Structural Analysis", CBS Publication.  
 [T2] Bhavikatti, "Structural Analysis (Vol.I and II)", Vikas Publication  
 [T3] C.K.Wang, "Statically Indeterminate Structures", Mc Graw Hill

**References Books:**

- [R1] C.S. Reddy, "Basic Structural Analysis", Tata McGraw Hill  
 [R2] R.C. Hibbler, "Structural Analysis", Pearson Education  
 [R3] Schodek, "Structures", Pearson Education  
 [R4] Vaidyanathan and P Perumal, "Comprehensive Structural Analysis", Laxmi Publications  
 [R5] Sujit kumar Roy, "Fundamental of Structural Analysis", S. Chand Publication.  
 [R6] D.S. Prakash Rao, "Structural Analysis", University Press.



**HYDRAULICS AND HYDRAULIC MACHINES**

**Paper Code: ETCE-206**

**Paper: Hydraulics and Hydraulic Machines**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

***Objective:** To get knowledge about characteristics of different flow types, flow through pipes, forces on submerged bodies and the working of hydraulic machinery. At the end of course the student will have the knowledge regarding various theories dealing with the flow phenomenon of fluid in pipes and understanding of basics of the hydro-machinery and the components function and use of different types of turbines and pumps.*

**UNIT I**

**Laminar Flow :** Flow through circular pipe and parallel plates, Kinetic energy correction factor, Momentum correction factor; Loss of head due to friction; determination of coefficient of viscosity.

**Boundary Layer:** Concept and development of boundary layer, Laminar and turbulent boundary layers and their analysis, boundary layer thickness; Critical Reynolds number; Boundary layer separation and control.

**Turbulent flow:** Shear stress, velocity distribution in smooth and rough pipes, Resistance of smooth and rough pipes.

[T1,T2,T3][No. of Hours: 11]

**UNIT II**

**Forces on submerged bodies :** Forces exerted by flowing fluid, Concept and expression for Drag and lift; Pressure drag and friction drag; Stream line and bluff body; Drag on sphere and cylinder, Terminal velocity of a body, Lift on a circular cylinder, Drag force acting on a rotating cylinder, Development of lift on Airfoil

**Flow through pipes:** Loss of head / energy in pipes - Major losses-friction loss by Darcy Weisbach formula, Chezy's formula; Types of minor losses; Hydraulic gradient and total energy line, Flow through siphon, Pipes in series, concept of equivalent pipe, flow through parallel and branched pipes; Water hammer in pipes, sudden and gradual closure of valve; Analysis of Pipe network using Hardy Cross method; Use of EPANET software for pipe flow analysis.

[T1,T2,T3][No. of Hours: 12]

**UNIT III**

**Hydraulic machines:** General layout of hydroelectric power plant, classification of hydraulic turbines, Pelton turbine and its main parts, Analysis and design of Pelton turbine for jet diameter, wheel diameter, width, depth and number of buckets; Hydraulic, mechanical and overall efficiencies of turbine, Introduction to other turbines like Francis and Kaplan turbines, Specific speed and its significance, characteristic curves of turbines.

[T2,T3][No. of Hours: 11]

**UNIT IV**

**Centrifugal pumps:** Main parts; Head, efficiencies and work done computations, minimum speed for starting a centrifugal pump, specific speed, centrifugal pump; Cavitations in turbines and centrifugal pumps and their effects and precautions, Computation for maximum suction lift.

**Reciprocating pumps:** Main parts of Reciprocating pump, discharge, work done and power required to drive a double acting pump, Velocity and acceleration in suction and delivery pipes, Indicator diagram and its utility, Air vessels.

[T1,T2][No. of Hours: 10]

**Text Books:**

[T1] Victor Streeter, "Fluid Mechanics", International Edition, Tata McGraw Hill Publications

[T2] R.K.Bansal, "Fluid Mechanics",

[T3] Hughes and Brighton, "Fluid Mechanics", , Tata McGraw Hill

**Reference Books:**

[R1] Vijay Gupta, Santosh K Gupta, "Fluid Mechanics and its Application", New Age Publications.

[R2] R.J.Garde, "Fluid Mechanics through Problems", New Age Publications.

[R3] Douglas, Gasiorek, Swaffield and Jack, "Fluid Mechanics", Pearson Education.

[R4] Fay A. James, "Introduction to Fluid Mechanics", PHI Publications

[R5] Kothandaraman and Rudramoorthy, "Fluid Mechanics and Machinery", New Age Publication

**ADVANCED SURVEYING**

**Paper Code: ETCE-208**  
**Paper: Advanced Surveying**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: In this course students will learn the advanced topics of surveying such as, trigonometric leveling, field astronomy, and photogrammetric survey.*

**UNIT I**

**Trigonometric leveling:** Observations for heights and distances Heights and distances, accessible and inaccessible base of the object, Geodetical observations, Terrestrial refraction, correction for refraction and curvature, eye and object correction, determination of difference of elevation by single and reciprocal observations.

**Survey Adjustments and Theory of Errors :** Types of errors, law of errors, law of weights, distribution of error and field measurements, Probability cures, method of lest squares, determination of most probable value by normal adjustment and method of correlates, most probable error. Triangulation adjustments: Adjustment of geodetic quadrilateral with and without central station.

**[T1,T2,T3][No. of Hours: 10]****UNIT II**

**Setting out works:** Setting out of buildings, culverts, roads, pipelines, sewers, underground tunnels and centre line of dams, bridge survey, mine survey.

**Route surveying:** Reconnaissance, preliminary and location surveys for road, railway, canal and pipe alignments longitudinal and cross sections, computation of earthwork and mass haul curve.

**Introduction to Hydrographic surveying:** Shore line survey, soundings, tide and its characteristics, tide gauges, mean sea level as datum.

**[T1,T2,T3][No. of Hours: 10]****UNIT III**

**Photogrammetric Survey:** Basic principles, elevation of a point, determination of focal length of lens, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, scale of a tilted photograph, tilt distortion, relief displacement of a tilted photograph, combined effects of tilt and relief, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, location of principal points, transfer image from photograph to map, stereoscope parallax, parallax in aerial stereoscopic views, parallax equations.

**[T1,T2,T3][No. of Hours: 12]****UNIT IV**

**Field Astronomy:** Co-ordinate systems, latitude and longitude, spherical trigonometry, relation between degrees and hours of time, conversion of local time to standard time, conversion of mean time interval to sidereal time interval, to find local sidereal time (LST) at local mean midnight for given Greenwich sidereal time (GST) at greenwich Mean midnight (GMN), determination of LST from LMT at any instant, determination of LMT of transit of a known star across the meridian for given GST of GMN, Local sidereal time of elongation of star, interpolation of values, instrumental and astronomical correction to observed altitude to the azimuth, observation for time by meridian transit of star and by meridian transit of Sun. Azimuth by observation on Polaris and ex-meridian observation on stars, determination of latitude, calculation of true altitude, declination, latitude, polar distance, determination of longitude.

**[T1][No. of Hours: 12]****Text Books:**

- [T1] Surveying ,B.C. Purnimia-II/III, Laxmi Publication  
 [T2] Higher Surveying,A.M. Chandra,New age Publication  
 [T3] Surveying Vol.2, Duggal, McGraw Hill Education (I) Pvt.Ltd.



**Reference Books:**

- [R1] Higher surveying. Norman Thomas,
- [R2] Surveying Vol. II, Dr. K.R. Arora, Standard Book House, New Delhi
- [R3] Advanced Surveying: Total Station, GIS and Remote Sensing, Gopi, Pearson Education
- [R4] Surveying, Saikai et al, PHI Publications
- [R5] Surveying, Bannister, Raymond and Baker, Pearson Education



**SOIL MECHANICS****Paper Code: ETCE-210****Paper: Soil Mechanics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** To explain the methods of classifying the soils, to analyze the flow of water through soils, to estimate the stress distribution in the soil mass and compaction characteristics, compressibility characteristics, settlements and to assess the shear strength of the soils.

**UNIT I**

**Soil formation, properties:** Origin of soils, soil formation, geographical distribution of major soils in India, composition of soil, particle size and shapes, interparticle forces, soil minerals / structure and their effect on basic soil properties. Three phase diagram and relationships among void ratio, specific gravity, dry density, porosity, water content, unit weights and degree of saturation.

**Laboratory and field identification of soil:** Determination of water content, specific gravity and grain size distribution for coarse grained and fine grained soils, Atterberg limits and indices, visual identification by simple field test, field density by core cutter and sand, replacement methods.

**Classification of soils:** Necessity, principles, Indian and unified classification, plasticity charts.

**[T1,T2][No. of Hours: 11]****UNIT II**

**Permeability and seepage:** Concept of pore water pressure, Total, effective and neutral stresses. Darcy's law, laboratory and field permeability tests, factors affecting permeability, surface tension and capillary phenomenon in soil, shrinkage and swelling of soil, seepage forces, Laplace equation and its significance, Flow potential, Flow nets and their properties, seepage through earth dams, exit gradient and uplift pressure, mechanics of piping, methods of dewatering, design of filters.

**Stress distribution in soil:** Stress at a point, Mohr's circle, stresses due to force of gravity, Point, line and uniformly distributed loads, Influence charts, contact pressure distribution, Boussineque's and Westerguard's equation for vertical pressure due to point loads and uniformly distributed loads.

**[T1,T2,T3][No. of Hours: 11]****UNIT III**

**Compaction of soils:** Definition, consolidation and compaction, objectives, compactive effort, Laboratory compaction, Standard Proctor test, Modified Proctor test, IS compaction tests [light / heavy], Field compaction and equipment, Concept of optimum moisture content and zero air voids line, Factors influencing compaction, Effect of compaction on soil properties, Compaction specifications and field control.

**Consolidation and settlement:** Consolidation test and compressibility characteristics, Terzaghi's theory of one dimensional consolidation, types of clay deposits, Normal/over/consolidated clays, determination of pre-consolidation pressure and its significance, time factor and coefficient of consolidation, fitting methods, settlement analysis, secondary compression, consolidation settlement and its rates, acceleration of consolidation by sand drains.

**[T1,T2][No. of Hours: 12]****UNIT IV**

**Shear strength of soil:** Stress strain curve, Mohr-coulomb failure criteria, Peak and residual shear strengths, Laboratory and field measurement of shear strength of soil, Direct, Triaxial and Unconfined compression tests, vane shear tests. Determination of shear strength parameters for different drainage and stress conditions, measurement of pore pressure, choice of test conditions, Shear strength of soils, Pore pressure coefficients, Sensitivity of cohesive soils, use of various types of shear parameters in design.

**[T1,T2][No. of Hours: 11]****Text Books:**

[T1] Basic And Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, New age international Ltd

[T2] Soil Engineering, Alam singh, CBS Publication

[T3] Geotechnical Engg, Gulati and Dutta, McGrawHill Education (I) Pvt. Ltd

**Reference Books:**

- [R1] Soil Mechanics and Foundation Engg., Purushothama Raj, Pearson Education  
 [R2] Geotechnical Engg, Venkataramaiah, New Age International Publishers  
 [R3] GeoTechnical Engineering [Principles and Practices], P. Donald, Coduto, PHI Publications  
 [R4] Soil mechanics in engineering practice by Karl Terzaghi, Ralph Brazelton Peck, Gholamreza Mesri, Wiley.  
 [R5] Geotechnical engineering: principles and practices of soil mechanics and foundation engineering, by V. N. S. Murthy, Marcel Dekker  
 [R6] Soil mechanics by Lambe and Whitman Wiley edition



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**DESIGN OF CONCRETE STRUCTURE**

**Paper Code: ETCE-212**  
**Paper: Design of Concrete Structure**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: To provide basic understanding of concrete making materials and their properties, mix design concepts and to make them understood various properties of the hardened concrete. The course also aims at designing of basic elements of structures such as beam, column, slab and foundation.*

**UNIT – I**

**Concrete making materials** – Cement, mineral additives, aggregates, water, admixtures. Types of structural steel and their properties. Batching plant and equipment, types of mixers, transportation, pumping and placing of concrete, nominal mixes and design mixes, Design codes and handbooks.

**Properties of hardened concrete:** Effects of water cement ratio, compaction, age, curing on strength of concrete. Compressive strength, grades of concrete, bond strength, shrinkage and creep, durability, chemical attack, sulphate attack, resistance to abrasion, resistance to fire, marine atmosphere.

**Structural Masonry:** Behavior of Load bearing Masonry Wall, Introduction of Reinforced Masonry and analysis of lintel beams.

[T1,T2][No. of Hours: 12]

**UNIT – II**

Reinforced concrete design philosophies, Working stress design, Concept of limit states. Limit states design, partial safety factors. Codal recommendations. Characteristic and design values, Factored loads, design stress strain curves.

**Limit state of Collapse:** Flexure, Shear, bond and torsion, Compression, Limit state of Serviceability.

[T1,T2][No. of Hours: 11]

**UNIT – III**

Analysis and design of singly and doubly reinforced simply supported cantilever and continuous beams and flanged beam section, lintels, Design principles of retaining walls.

Design of simply supported, cantilever slabs, one way and two way slabs.

[T1,T2][No. of Hours: 11]

**UNIT – IV**

Design of short and slender columns under axial load, under uniaxial and biaxial bending and shear force.

Design of isolated footing for vertical load and Moment, Design of combined footings.

[T1,T2][No. of Hours: 11]

**Text Books:**

- [T1] Sinha S.N., “ Handbook of Reinforced Concrete Design”, McGraw Hill Publishing Company., New Delhi.
- [T2] Gambhir M.L., “Fundamentals of Reinforced Concrete Design”, PHI Learning (P) Ltd., New Delhi.

**Reference Books:**

- [R1] Jain A.K., “Limit State Design of Reinforced Concrete Structures”, Nem Chand Publishers, Roorkee.
- [R2] Shetty M.S., “Concrete Technology, Theory and Practice”, S.Chand and Co., New Delhi.
- [R3] Raju K., “Reinforced Concrete”, New Age International (P) Ltd., New Delhi.
- [R4] Varghese P.C., “Limit State Design of Reinforced Concrete”, PHI (P) Ltd., New Delhi
- [R5] SanthaKumar A.R., “Concrete Technology”, Oxford Publications., New Delhi
- [R6] Unikrishna Pillai S., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi.

**CEMENT AND CONCRETE TESTING LAB****Paper Code: ETCE-252****Paper: Cement and Concrete Testing Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**Note:** Based on theory 8-10 experiments are to be performed. The list is provided below:

**LIST OF EXPERIMENTS**

1. To determine the quantity of water for cement paste for normal consistency
2. To determine initial and final setting time of cement
3. To determine the fineness, specific gravity and unit weight of cement
4. Determination of tensile and compressive strength of cement
5. To determine fineness modulus of fine and coarse aggregate
6. To determine compressive strength of nominal mix concrete of a given grade
7. To determine the modulus of rupture of concrete
8. Workability of concrete by various methods
9. To determine the split tensile strength of concrete of given mix proportion
10. To determine the percentage bulking of fine aggregate
11. To determine soundness of given cement by Le-Chatelier method
12. Effect of water cement ratio on strength of concrete
13. Concrete mix design

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

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**STRUCTURE LAB**

**Paper Code: ETCE-254**  
**Paper: Structure Lab**

L	T/P	C
0	2	1

**Note:** Based on theory 8-10 experiments are to be performed. The list is provided below:

**LIST OF EXPERIMENTS**

1. To find the value of flexible stiffness EI for a given beam and comparison with theoretical value
2. To verify the moment area theorem
3. To study the behavior of different types of columns
4. To verify the Clark's Maxwell reciprocal theorem
5. To determine the horizontal thrust in a three hinged arch and verify it
6. To determine the elastic displacement of curved members and verify it
7. To obtain the influence line diagram for horizontal thrust in a three hinged arch and verify it
8. To find the value of torsional constant and compare it with theoretical value

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**



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**HYDRAULICS LAB**

**Paper Code: ETCE-256**  
**Paper: Hydraulics Lab**

L	T/P	C
0	2	1

**Note:** Based on theory 8-10 experiments are to be performed. The list is provided below:

**LIST OF EXPERIMENTS**

1. To study and compare the losses due to flow in smooth and rough pipes
2. To draw the performance characteristics of variable speed centrifugal pump
3. To draw the performance characteristics of single stage reciprocating pump
4. To determine operating characteristics of pelton wheel turbine
5. To determine operating characteristics of Francis turbine
6. To determine operating characteristics of Kaplan turbine
7. To determine the coefficient of impact for different types of vanes
8. Reynolds dye experiment for flow characterization
9. Model studies
10. Pipe analysis using EPANET software

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

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**ADVANCED SURVEYING LAB**

Paper Code: ETCE-258  
 Paper: Advanced Surveying Lab

L	T/P	C
0	2	1

Based on theory course ETCE 208, 8-10 experiments are to be performed.

NOTE:- At least 8 Experiments out of the list must be done in the semester.



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SEMINAR

**Paper Code: ETCE-260**  
**Paper: Seminar**

L	T/P	C
0	2	1

**Objective:** The objective is to assess and enhance the presenting capability of the students. Also to impart training to a student to face audience and present his ideas and thus creating in him self esteem and courage that are essential for an engineer. Individual students are required to choose a topic of their interest from the syllabus of second year (i.e. 3<sup>rd</sup> and 4<sup>th</sup> semester) and give a seminar on at least two topics for about 10 minutes. Seminar will be liberally attended by faculty present in college in conference hall and award marks to the students based on presentation (50% weightage) and Interjections by the candidates will be observed in assessment (50% weightage). Each student shall submit copy of a write up of the seminar topic.



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**COMMUNICATION SKILLS FOR PROFESSIONALS**

**Paper Code: ETHS-301**

**Paper: Communication Skills for Professionals**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>1</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: To develop communication competence in prospective engineers so that they are able to communicate information as well as their thoughts and ideas with clarity and precision. This course will also equip them with the basic skills required for a variety of practical applications of communication such as applying for a job, writing reports and proposals. Further, it will make them aware of the new developments in communication that have become part of business organisations today.*

**UNIT I**

**Organizational Communication:** Meaning, importance and function of communication, Process of communication, Communication Cycle - message, sender, encoding, channel, receiver, decoding, feedback, Characteristics, Media and Types of communication, Formal and informal channels of communication, 7 C's of communication, Barriers to communication, Ethics of communication (plagiarism, language sensitivity)

**Soft Skills:** Personality Development, Self Analysis through SWOT, Johari Window, Interpersonal skills -Time management, Team building, Leadership skills. Emotional Intelligence. Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, Career planning, Self esteem.

[T1,T2][No. of Hrs. 08]

**UNIT II**

**Introduction to Phonetics:** IPA system (as in Oxford Advanced Learner's Dictionary), Speech Mechanism, The Description of Speech Sounds, Phoneme, Diphthong, Syllable, Stress, Intonation, Prosodic Features; Pronunciation; Phonetic Transcription - Conversion of words to phonetic symbols and from phonetic symbols to words. British and American English (basic difference in vocabulary, spelling, pronunciation, structure)

**Non-Verbal Language:** Importance, characteristics, types – Paralanguage (voice, tone, volume, speed, pitch, effective pause), Body Language (posture, gesture, eye contact, facial expressions), Proxemics, Chronemics, Appearance, Symbols.

[T1,T2][No. of Hrs. 08]

**UNIT III**

**Letters at the Workplace** – letter writing (hard copy and soft copy): request, sales, enquiry, order, complaint. Job Application -- resume and cover letter

**Meeting Documentation**-- notice, memo, circular, agenda and minutes of meeting.

**Report Writing** - Significance, purpose, characteristics, types of reports, planning, organizing and writing a report, structure of formal report. Writing an abstract, summary, Basics of formatting and style sheet (*IEEE Editorial Style Manual*), development of thesis argument, data collection, inside citations, bibliography; Preparing a written report for presentation and submission. Writing a paper for conference presentation/journal submission.

[T1,T2][No. of Hrs. 08]

**UNIT IV**

**Listening and Speaking Skills:** Importance, purpose and types of listening, process of listening, difference between hearing and listening, Barriers to effective listening, Traits of a good listener, Tips for effective listening. Analytical thinking; Speech, Rhetoric, Polemics; Audience analysis. Telephone Skills - making and receiving calls, leaving a message, asking and giving information, etiquettes.

**Presentations:** Mode, mean and purpose of presentation, organizing the contents, nuances of delivery, voice and body language in effective presentation, time dimension.

**Group Discussion:** Purpose, types of GDs, strategies for GDs, body language and guidelines for group discussion.

**Interview Skills:** Purpose, types of interviews, preparing for the interview, attending the interview, interview process, employers expectations, general etiquettes.

[T1,T2][No. of Hrs. 07]

**Text Books:**

- [T1] Anna Dept. Of English. Mindscapes: English for Technologists and Engineers PB. New Delhi: Orient Blackswan.
- [T2] Farhathullah, T. M. Communication Skills for Technical Students. Orient Blackswan, 2002.

**References Books:**

- [R1] Masters, Ann and Harold R. Wallace. Personal Development for Life and Work, 10th Edition. Cengage Learning India, 2012.
- [R2] Institute of Electrical and Electronics Engineers. IEEE Editorial Style Manual. IEEE, n.d. Web. 9 Sept. 2009.
- [R3] Sethi and Dhamija. A Course in Phonetics and Spoken English. PHI Learning, 1999.
- [R4] Khera, Shiv. You Can Win. New York: Macmillan, 2003.



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**ADVANCED STRUCTURAL ANALYSIS**

**Paper Code: ETCE-303**

**Paper: Advanced Structural Analysis**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

***Objective:** This course covers advance topics such as structural response of arches, curved beams. The course also deals with use of basic principles of matrix method such as flexibility and stiffness method for analysis of structures. The course also involves introduction to FEM software package.*

**UNIT I**

**Arches :** Theory of arches, Eddy's theorem, Circular , parabolic and geometric arches, concept of radial shear force and axial thrust, analysis of three hinged and two hinged arches, Effect of yielding of supports, rib shortening and temperature changes, tied arches, ILD for 3 hinged arches.

**Curved Beams:** plan and elevation, beams on elastic foundations.

[T1][No. of Hours: 10]

**UNIT II**

**Basic Principles of Matrix Method:** Types of framed structures, Deformations, Equilibrium, Compatibility, Static and Kinematic Indeterminacy, Flexibility and Stiffness matrices, Equivalent joint loads, Energy concepts, Principle of virtual work.

**Matrix analysis of structures:** Force and displacement methods of analysis, definition of flexibility and stiffness influence coefficients.

[T2][No. of Hours: 11]

**UNIT II**

**Flexibility method:** Development of flexibility matrices by physical approach, Flexibility matrices for truss and frame elements, load transformation matrix, development of total flexibility matrix of the structure, analysis of simple structures, plane truss and plane frame, nodal loads and element loads, lack of fit and temperature effects.

**Stiffness method:** Development of stiffness matrices by physical approach, stiffness matrices for truss and frame elements, displacement transformation matrix, development of total stiffness matrix, analysis of simple structures, plane truss and plane frame, nodal loads and element loads, lack of fit and temperature effects.

[T1,T2][No. of Hours: 12]

**UNIT III**

**Direct stiffness method :** Introduction, element stiffness matrix, rotation transformation matrix, transformation of displacement and load vectors and stiffness matrix, equivalent nodal forces and load vectors, assembly of stiffness matrix and load vector, determination of nodal displacement and element forces, analysis of plane truss, plane frame [with numerical examples], analysis of grid, space truss and space frame [without numerical examples].

**Computer implementation:** A project on development of an analysis program using some of the above method is envisaged at this stage, Introduction to FEM package.

[T1,T2][No. of Hours: 12]

**Text Books:**

- [T1] S. Rajasekaran, "Computational Structural Mechanics", Prentice-Hall India.  
 [T2] Pandit and Gupta, "Structural Analysis a Matrix Approach" Tata Mc Graw Hill

**References:**

- [R1] C.K. Wang, "Matrix methods of structural analysis", International Textbook Company.  
 [R2] Przemieniecki, "Theory of Matrix structural Analysis", Mc Graw Hill.  
 [R3] Weaver and Gere, "Matrix Analysis of Framed structures", CBS Publishers.  
 [R4] S.S.Bhavikatti, "Structural Analysis-Vol-2, Vikas Publishing House.  
 [R5] Devadas Menon, "Structural Analysis", Narosa Publishing  
 [R6] Structural Analysis, Hibbeler, Pearson Education

**DESIGN OF STEEL STRUCTURE**

**Paper Code: ETCE-305**  
**Paper: Design of Steel Structure**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

***Objective:** To provide a basic understanding of use of steels in civil engineering, and to develop technical competence in the design of simple bolted and welded connections, tension and compression members, beams and plate girders. The course also deals with plastic analysis of structures.*

**UNIT I**

**Introduction:** Types of steel structures like industrial buildings, beams/truss/arch/ suspension bridges, Beam and column framing, Rolled steel section, Advantages of steel as a structural material. Introduction to working stress and limit state theories, Type of sections, Connections and frames.

**Riveted connections:** Analysis and design of various types of riveted connections, permissible stresses in rivets, Design criteria, Code requirements, Tacking rivets, rivet joints subject to moment, Stresses in rivets.

**Welded connections:** Advantage and disadvantages of welding, Design criteria, Code requirements, Analysis and design of Fillet and Butt weld, Fillet weld subjected to moment.

**Design of Tension members:** Analysis of trusses and design of axially loaded tension member, Lug angle, tension splice.

[T1][No. of Hours: 12]

**UNIT II**

**Design of compression members:** Modes of failure in column, Design of compression member, Lacing and battening for built up compression member. Compression member composed of two components back-to-back, column base and foundation, Roof trusses [including Purlins, bracings and connections].

[T1][No. of Hours: 11]

**UNIT III**

**Design of flexural members:** Beam, Plate girder, Gantry girder including lateral and flexural torsional building, design of structural elements.

[T2][No. of Hours: 11]

**UNIT IV**

**Plastic Analysis of structures:** Moment curvature relationship, shape factor, plastic hinges, upper and lower bounds.

**Analysis and Design of Steel Frames:** Analysis and Design of frames as per codal recommendations.

[T1,T2][No. of Hours: 11]

**Text Books:**

[T1] S.K. Duggal, "Limit State Design of steel structures", Tata Mc Graw Hill

[T2] L.S. Negi, "Design of steel structures", Tata Mc Graw Hill

**References**

[R1] N. Subramanian, "Design of steel structures", Oxford University Press.

[R2] Krishnamurthy, "Elementary Structural Design"-Vol-III, CBS Publishers

[R3] Elias G. Abu-Saba, "Design of steel structures", CBS Publication

[R4] John E. Lothers. "Design of steel structures", Prentice-Hall

**ENGINEERING HYDROLOGY**

**Paper Code: ETCE-307**  
**Paper: Engineering Hydrology**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:**

1. To introduce students to various methods of estimation and analysis, precipitation and abstraction from rainfall and stream flow.
2. Assessment of stream flow and design principles of Dams, Weirs and Barrage, estimation of all parameters and characteristics related to hydrological aspects of catchment studies.

**UNIT I**

**Introduction:** Importance of Hydrology in relation to water resources development, Hydrology cycle, climatic and meteorological aspects, Water budget equation, Applications of hydrology in engineering.

**Precipitation:** Types, measurements, rain gauges, errors in measurements, check for consistency, missing data, Areal mean, mass curves, intensity duration frequency curves, depth area duration curves, and rainfall distribution in India.

**Abstractions from Precipitation:** Evaporation, measurements, empirical equation and analytical methods for evaporation estimation, Reservoir evaporation and methods for its reduction, Transpiration, Evapo-transpiration, Interception, Depression storage, Infiltration process and measurements, Infiltration capacities, Horton's equation, Infiltration indices.

[T1,T2][No. of Hours: 12]

**UNIT II**

**Stream flow measurement:** Measurement of stage and velocity, Area velocity method, chemical and Tracer method, Electromagnetic and ultrasound method, indirect methods, Stage discharge relationships.

**Runoff :** Runoff characteristic of streams, Rainfall-runoff correlation, Empirical equations, flow duration curve, flow mass curve, calculation of storage / maintainable demand, Sequent peak algorithm, Droughts, causes and management.

[T1,T2][No. of Hours: 10]

**UNIT III**

**Hydrographs :** Hydrograph and its components, Factors affecting flood hydrograph, components of hydrograph, basic flow separation techniques, effective rainfall, Unit hydrographs, concept of time invariance and linear response, Applications and derivation of unit hydrographs, complex storm, Unit hydrograph of different durations, methods of superposition and S-curve, Synthetic unit hydrograph, dimensionless unit hydrograph, Instantaneous unit hydrograph, Uses and limitations of unit hydrographs.

[T1,T2][No. of Hours: 10]

**UNIT IV**

**Floods:** Computations of peak floods by empirical formulae, by rational method and by unit hydrograph method, CWC recommendations for design flood values, flood estimation by Gumbel's Method, flood routing principles, reservoir routing, Floods in major Indian rivers, Flood damage, causes and remedial measures

**Ground Water Hydraulics:** Sources of ground water, flow through porous media, Energy and momentum concepts applied to groundwater flow, groundwater storage and derivation of the mass balance equation, potential and stream functions, Characteristics of wells and their yield, recharging ground water.

[T2][No. of Hours: 12]

**Text Books:**

- [T1] K. Subramanya , "Engineering hydrology" , Tata Mc Graw Hill.  
 [T2] Elementary Engineering Hydrology, Deodhar, Pearson Education

**References Books:**

- [R1] Chow, Maidment and Mays, "Applied Hydrology", Mc Graw Hill.  
 [R2] D.K.Todd , "Gound water hydrology", John Wiley India Edition.  
 [R3] Manning, "Applied Principles of Hydrology", CBS.

- [R4] Wurbs, “Water Resource Engineering”, Prentice Hall India.  
[R5] H. M. Raghunath 2006, Hydrology: Principles, Analysis and Design, New Age International Publisher  
[R6] S.K. Garg, “Hydrology and Water Resources Engineering”, Khanna Publishers.





**GEOTECHNICAL AND FOUNDATION ENGINEERING**

**Paper Code: ETCE-309**

**Paper: Geotechnical and Foundation Engineering**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objectives: To help students understand analyzing the bearing capacity of soils, to design shallow and deep foundations, to estimate the settlements, to design the rigid and flexible retaining structures and to design cuts and excavations. Students will learn various sub surface exploration techniques and methods of ground improvement.*

**UNIT I**

**Sub surface exploration:** Types of soil and rock sample, Indirect, direct and semidirect methods of sub surface exploration; Routine field tests, Location, spacing and depth of borings.

**Bearing capacity of soils:** Bearing capacity criteria and factors affecting it, Modes of shear failure, Theories of Bearing capacity, Foundation Pressures, Permissible settlements, Allowable bearing pressure, Field tests to estimate bearing capacity

**Shallow foundations:** Types of shallow foundations, selection of type of foundation, location and depth of foundation, causes of settlement, settlement analysis, Design of shallow foundations, design of combined footings, Mat foundations.

[T1][No. of Hours: 12]

**UNIT II**

**Deep foundations :** Classification of Piles, Pile driving equipment, calculation of bearing capacity of a single pile, Under-reamed piles, Pile groups, Uplift and Lateral resistance of piles, Inclined loading of piles, pile cap.

**Drilled Piers:** Types and uses, bearing capacity, settlement, construction procedures

**Caissons:** Types, uses and construction procedures.

[T2][No. of Hours: 12]

**UNIT III**

**Lateral Earth Pressure :** Limit analysis and Limit Equilibrium methods, Earth pressure at rest, Rankine's states of Plastic equilibrium, Earth pressure theories, Graphical methods to determine magnitude and location of resultant earth pressure; Concept of Arching of soils and braced cuts.

**Earth retaining structures:** Gravity type retaining walls: Proportioning retaining walls, stability requirements, backfill materials and drainage; Joints in retaining walls; Cantilever and Anchored sheet pile walls, Braced excavations.

[T1,T2][No. of Hours: 11]

**UNIT IV**

**Stability of slopes:** Short and long term failures, causes of failure, Types of landslides and slope movements, factor of safety, Concept of slope stability analysis, Infinite and finite slopes and their analysis, Selection of shear strength parameters, slope protection measures.

**Soil improvement techniques:** Compaction, Drainage and vibration methods, Precompression and consolidation, grouting and injection; Chemical stabilization, Geomembranes and geotextiles.

**Environmental Geotechnology:** Environmental and Natural cycles, Environmental imbalance, contaminated soils, Load environment design criteria.

[T1,T2][No. of Hours: 10]

**Text Books:**

[T1] R. B. Peck and Terzaghi, "Soil Mechanics in Engineering Practice", John Wiley

[T2] V.N.S. Murthy, "Soil Mechanics and Foundation Engineering", CBS

**References Books:**

[R1] Shashi K. Gulati and Manoj Datta, "Geotechnical Engineering", Tata Mc Graw Hill [2008].

[R2] Donald P. Coduto, "Geotechnical Engineering", Prentice-Hall India.

[R3] J.E.Bowles, "Foundation Analysis and Design", Mc-Graw Hill

[R4] N.P. Kurian, "Design of foundation Systems, Principles and Practices" Norsa Publisher



- [R5] Braja M. Das, Principles of Foundation Engineering, Cengage Learning  
[R6] P.C. Verghese, "Foundation Engineering" PHI Learning Pvt. Ltd.  
[R7] Karuna Moy Ghosh, "Foundation Design in Practice" PHI Learning Pvt. Ltd.  
[R8] Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing House Pvt. Ltd.



**WASTEWATER ENGINEERING AND REUSE****Paper code: ETCE-311****Paper: Wastewater Engineering and Reuse**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** The course deals with planning of sewerage collection and treatment processes such as attached culture system, suspended culture system. The subject also deals with nutrient removal, sludge thickening, sludge digestion.

**UNIT I**

**Sewerage systems and their components:** Introduction to sewerage system, Estimation of sewerage and drainage discharge, Dry weather flow, capacity of sewers, self cleansing and non scouring velocities, calculations of sizes and grades, forms and cross sections of sewers, hydraulic characteristics of circular sewer sections, use of tables and monograms, egg shaped sewers, systems of drainage, separate, combined and partially combined systems.

**Quality and characteristics of sewage:** physical, chemical and biological characteristics of sewage, Aerobic and anaerobic decomposition of sewage, nitrogen, sulphur and carbon cycles, collection of sewage sample, bacteriological and virological testing.

**Sewage disposal:** Disposal of treated / untreated / partially treated effluents in natural water bodies, Standard for effluent disposal on land, Disposal by land treatment / sewage farming methods, sewage sickness and its preventive measures, Treatment standards for sewage effluents, Bangalore and Indore methods of disposal.

**[T1][No. of Hours: 12]****UNIT II**

**Engineered systems for waste water treatment:** Types of treatment units in preliminary, primary and secondary treatment, their functions and efficiencies, analysis and design of screening, grit chambers, detritus tanks, skimming tanks, design of septic tanks and Imhoff tanks.

**Ponds and lagoons:** Principle, operations, construction, design and detailing of Oxidation ponds, Aerated lagoons, Facultative ponds, Oxidation ditches, Anaerobic lagoons.

**Attached culture systems:** System microbiology, Contact beds, Principle, operations, Construction and design details of Trickling filters, Bio towers, Rotating biological contractors (RBC).

**[T1,T2][No. of Hours: 12]****UNIT III**

**Design of Suspended culture systems :** Activated sludge, concept of completely mixed and Plug flow reactors, process variation and design considerations, Aeration of activated sludge, Air diffusers and mechanical aerators, activated sludge clarifiers, Secondary clarifier design based on limiting flux rate.

**Advanced waste water treatment:** Nutrient removal, Nitrification and denitrification, Air stripping for ammonia removal, phosphorus removal, dissolved solids removal, Waste water reuse.

**Sludge thickening and sludge digestion:** Sludge characteristics, sludge volume and solids relationships, Aerobic and anaerobic digestion, Factors affecting sludge digestion and their control, disposal of digested sludge.

**[T1,T2][No. of Hours: 11]****UNIT IV**

**Sewage collection from houses and buildings:** General principles for design of sanitary plumbing system, Functions and types of traps, types of plumbing systems, one pipe / two pipe, single stack / partially ventilated single stack system, .

**Construction and maintenance of sewers:** Forces acting on sewer pipes, materials used in construction, laying and testing of sewer pipes, sewer appurtenances such as manholes, street inlets, gullies, catch basins, grease and oil traps, storm water overflows, inverted siphons, flushing and ventilation of sewers, Pumps for lifting sewage.

**[T1,T2][No. of Hours: 10]****Text Books:**

[T1] S.K.Garg, "Sewage Disposal and Air Pollution Engineering", Khanna Publishers

[T2] Venugopala Rao, "Principles of Environmental Science and Engineering", Prentice Hall India

**References:**

- [R1] Davis and Cornwell, "Introduction to Environmental Engineering", McGraw Hill  
 [R2] Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw Hill  
 [R3] Amal K. Dutta, "Introduction to Environmental Science and Technology", Oxford and IBH  
 [R4] Kiely, "Environmental Engineering" Tata McGraw Hill  
 [R5] Henry and Heinke, "Environmental Science and Engineering", Prentice Hall India



**COMMUNICATION SKILLS FOR PROFESSIONALS LAB**

<b>Paper Code: ETHS-351</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Communication Skills for Professionals Lab</b>	<b>0</b>	<b>2</b>	<b>1</b>

***Objective:** To develop communication competence in prospective engineers so that they are able to communicate information as well as their thoughts and ideas with clarity and precision. These activities will enhance students' communication skills with a focus on improving their oral communication both in formal and informal situations. They will develop confidence in facing interviews and participating in group discussions which have become an integral part of placement procedures of most business organisations today.*

**Lab Activities to be conducted:**

- Listening and Comprehension Activities** – Listening to selected lectures, seminars, news (BBC, CNN, etc.). Writing a brief summary or answering questions on the material listened to.
- Reading Activities** -- Reading different types of texts for different purposes with focus on the sound structure and intonation patterns of English. Emphasis on correct pronunciation.
- Conversation Activities**-- Effective Conversation Skills; Formal/Informal Conversation; Addressing higher officials, colleagues, subordinates, a public gathering; Participating in a video conference.
- Making an Oral Presentation**–Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language.
- Making a Power Point Presentation** -- Structure and format; Covering elements of an effective presentation; Body language dynamics.
- Making a Speech** -- Basics of public speaking; Preparing for a speech; Features of a good speech; Speaking with a microphone. Famous speeches may be played as model speeches for learning the art of public speaking. Some suggested speeches: Barack Obama, John F Kennedy, Nelson Mandela, Mahatma Gandhi, Jawahar Lal Nehru, Atal Bihari Vajpayee, Subhash Chandra Bose, Winston Churchill, Martin Luther King Jr.
- Participating in a Group Discussion** -- Structure and dynamics of a GD; Techniques of effective participation in group discussion; Preparing for group discussion; Accepting others' views / ideas; Arguing against others' views or ideas, etc.
- Participating in Mock Interviews** -- Job Interviews: purpose and process; How to prepare for an interview; Language and style to be used in an interview; Types of interview questions and how to answer them.

**Suggested Lab Activities:**

- Interview through telephone/video-conferencing
- Extempore, Story Telling, Poetry Recitation
- Mock Situations and Role Play; Enacting a short skit
- Debate (Developing an Argument), News Reading and Anchoring.

**Reference Books:**

- Patnaik, Priyadarshi. *Group Discussion and Interview Skills: With VCD*. Cambridge University Press India (Foundation Books), 2012 edition.
- Kaul, Asha. *Business Communication*. PHI Learning: 2009.
- Hartman and Lemay. *Presentation Success: A Step-by-Step Approach*. Thomson Learning, 2000.

**Note:** The Communication Skills Lab should be equipped with computers, microphones, an internet connection, overhead projector, screen, sound system, audio/video recording facilities, and seating arrangement for GDs and mock interviews. The student activities may be recorded and students may replay them to analyse and improve their pronunciation, tone, expressions, body language, etc.

Traditional language lab softwares are not mandatory and may be used by students to practice and enhance their language competence. Such softwares are usually elementary in nature and are mostly based on British/American English (pronunciation, accent and expression). They should preferably be in Indian English.

**GEOTECHNICAL ENGINEERING LAB****Paper Code: ETCE-353****L T/P C****Paper: Geotechnical Engineering Lab****0 2 1****Note:** Based on theory 8-10 experiments are to be performed. The list is provided below:**LIST OF EXPERIMENTS**

1. Moisture content determination by oven drying method, pycnometer method, and rapid moisture meter
2. Specific Gravity of soil particles by Pycnometer method and Density Bottle method
3. Particle size distribution of soils [Grain size analysis] by Sieve analysis and Hydrometer analysis.
4. Atterberg's limits [liquid Limit, Plastic Limit and Shrinkage Limit] tests
5. Field density tests of soils by Core cutter method and sand replacement method
6. Permeability tests of soils by Variable head method and Constant head method
7. Soil compaction test [Density moisture relations]
8. Consolidation test
9. Triaxial compression test
10. Unconfined compression test
11. Direct shear test
12. Plate load test

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**


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**WATER AND WASTEWATER ANALYSIS LAB**

**Paper Code: ETCE-355**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**Paper: Water and Wastewater Analysis Lab**

**Note:** Based on theory 8-10 experiments are to be performed. The list is provided below:

**LIST OF EXPERIMENTS**

1. To determine pH, turbidity, electrical conductivity of the given sample.
2. To determine the total hardness, calcium and magnesium in the given sample.
3. To find the amount of Fluoride, Sulfate, iron and manganese in the given sample.
4. To determine the optimum coagulant dose quantity for given sample of raw water.
5. To determine chlorine demand and residual chlorine.
6. To determine most probable number [MPN] of coli-forms of the given sample.
7. To determine the solids [total, suspended and dissolved] of the given sample
8. To find out total settle-able solids [by Imhoff Cone] in the given wastewater sample.
9. To estimate the amount of dissolved oxygen present in the given wastewater sample.
10. To estimate the value of biochemical oxygen demand [BOD] in the given water sample/sewage sample.
11. To find out chemical oxygen demand [COD] of the given wastewater sample.
12. Field visit of water/sewage treatment plant.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**



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**SEMINAR ON CIVIL ENGINEERING PROJECTS / VISITS / CASE STUDIES****Paper Code: ETCE-357****L T/P C****Paper: Seminar on Civil Engineering projects / Visits / Case Studies****0 2 1**

**Objective:** The objective is to assess and enhance the presenting capability of the students. Also to impart training to a student to face audience and present his ideas and thus creating in him self esteem and courage that are essential for an engineer. Students are required to give a seminar on Civil Engg. Projects/Visits/Case Studies for about 10 minutes. Seminar will be liberally attended by faculty present in college in conference hall and award marks to the students based on presentation (50% weightage) and Interjections by the candidates will be observed in assessment (50% weightage). Each student shall submit copy of a write up of the seminar topic.



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**SOFTWARE TRAINING**

**Paper Code: ETCE-359**  
**Paper: Software Training**

L	T/P	C
0	2	1

Minimum of two weeks model/software training related to Civil Engg., is to be held after 4<sup>th</sup> Semester. Further weekly presentations and viva-voce will be conducted in this semester.



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**APPLICATIONS OF REMOTE SENSING AND GIS**

**Paper Code: ETCE-304**

**Paper: Applications of Remote Sensing and GIS**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

***Objective:** To understand the principles of remote sensing and digital image processing, GIS, such as assessment of cyclone, rainfall, atmospheric humidity etc., and Gain experience in the use of image processing and GIS software.*

**UNIT I**

Introduction, concepts and physical basis of Remote Sensing, Electromagnetic spectrum, radiation laws, atmospheric effects, image characteristics.

Remote sensing systems; sources of remote sensing information, spectral quantities spectral signatures and characteristics spectral reflectance curves for rocks, soil, vegetation and water.

Introduction to Aerial and space borne platforms.

Global positioning system (GPS) photogrammetry – analog, analytical and digital photogrammetry, height and plan metric.

[T1][No. of Hours 11]

**UNIT II**

Optical, thermal and microwave sensors and their resolution, salient features of some of operating Remote Sensing satellites,

Digital image processing; introduction, image rectification and restoration, image enhancement, manipulation, image classification, fusion.

[T1,T2][No. of Hours 11]

**UNIT III**

GIS system : Definition terminology and data types, Map projection and Co-ordinate system, basic components of GIS software, data models, data acquisition, both raster based and vector based data input and data processing and management including topology, overlaying and integration and finally data product and report generation, principle of cartography and cartographic design.

GIS customization concepts, approaches of Multi-criteria decision making, concepts and applications of Geostatistics.

[T1][No. of hours 12]

**UNIT IV**

Application of Geo-spatial technology in Civil Engineering, assessment of cyclones, rainfall, atmospheric humidity etc., weather analysis, forecasting and modelling. Land use, inventory and monitoring, urban planning, snow and glaciers, coastal zone management, air and water pollution, commercially available remote sensing and GIS software.

[T2][No. of hours 11]

**Text Books:**

- [T1] Chang K.T., "Introduction to Geographic Information System", Tata McGraw Hill Education (P) Ltd.,  
 [T2] John R.Jensen, "Remote Sensing of the Environment", Pearson Education

**Reference Books:**

- [R1] Clarke K.C., Parks B.O., Crane M.P., "GIS and Environmental Modeling", PHI Learning (P) Ltd., ND  
 [R2] Lillesand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiley and Sons, NY  
 [R3] Lo C.P. and Yeung A.K.W., "Concept and Techniques of Geographic Information Systems", PHI  
 [R4] Chakraborty D. and Sahoo R.N., "Fundamentals of Geographic Information System", Viva Books, ND.  
 [R5] Joseph G., "Fundamentals of Remote Sensing", University Press (India) Ltd., Hyderabad.  
 [R6] L.R.A. Narayan, "Remote Sensing and its Applications", University Press.

**QUANTITY SURVEYING AND COST ESTIMATION**

**Paper Code: ETCE-306**

**Paper: Quantity Surveying and Cost Estimation**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** To learn the fundamentals of estimation of different types of civil engineering structures, analysis of rates and valuation concepts. The course also deals with different method of depreciation and valuation of properties including case studies.

**UNIT-1**

**Estimating Principle:** Method of estimating, Main items of work, Deduction for openings, R.C.C. and R.B. work, Estimation for Flooring, Roofing, Plastering, Pointing Cornice, Doors, Windows, Wood Work, Iron Work, Aluminum work and Lump sum items

**Earthwork Calculations:** Calculation of areas, Measurement of earthwork, Determination of Earthwork for reservoirs from contour map.

[T1][No. of Hours: 11]

**UNIT-II**

**RCC works and Structure:** Estimate of RCC Slab, beam, T beam, Column with foundation, staircase, retaining wall etc.

**Road Estimating:** Earthen, WBM and RCC roads, Premix carpeting, Stabilized soil road, Modernization of a road.

[T2][No. of Hours: 11]

**UNIT-III**

**Analysis of Rates for building work:** Purpose and principal factors affecting the rate of an item of work, overhead costs, Materials for brick masonry, stone masonry, cement concrete, cement mortar, Plastering, different types of flooring, floor finish, color washing, distemper, varnish, painting, items for sanitary work, wood work, preparing analysis of rates.

**Analysis of Rates for Road works:** Bituminous painting 1st and 2nd coats, Premix carpet, bituminous macadam, Laying and Consolidation of stone metal and Kankar material. Itemized rates as per DSR [Delhi Schedule of Rates.

[T1,T2][No. of Hours: 11]

**UNIT -IV**

**Depreciation:** Different methods of calculating depreciation-straight line method, declining balance method, sinking fund method, quantity Survey method, Depreciated Cost, Case Studies

**Valuation:** Cost of engineering services, rent fixation, valuation of properties, methods of valuation, book value, market value, profit and loss, scrap value, salvage value, Evaluation of projects, Annual cost method, rate of return method, benefit cost ratio method, Case Studies.

[T1,R5][No. of Hours: 12]

**Text Books:**

[T1] B. N. Dutta- Estimating and costing in Civil Engg, UPSPD.

[T2] M .Chakraborty, "Estimating costing and Specifications in Civil Engg",

**References:**

[R1] D.S.R. [Delhi Schedule Rates] C.P.W.D

[R2] PWD Account Code

[R3] Samuelson and Nardhaus-Economics, Mc Graw Hill

[R4] "Text book of Estimating and Costing" by G.S.Birdie

[R5] 'Civil Engineering Building Drawing' by Gurucharan Singh



**OPEN CHANNEL, FLOW AND NUMERICAL HYDRAULICS****Paper Code: ETCE-308****Paper: Open Channel, Flow and Numerical Hydraulics**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** To introduce the concepts of channel hydraulics. The contents of the course are applicable in design of inland waterways needed for irrigation, navigation etc., the course also deals with finite volume approach for convection, diffusion and transport problems.

**UNIT I**

**Flow in open channels:** Type of channels, classification of flows, continuity energy and momentum equation, concept of critical depth and specific energy, critical depth for rectangular, triangular, circular and trapezoidal channels, flow through transition with a hump and with change in width (contraction and expansion).

**Uniform flow:** Chezy's equation, Manning's formula, Factors affecting Manning's roughness coefficient, velocity distribution, shear stress distribution, Uniform flow computations for rectangular, trapezoidal and circular channels, standard line canal channels, Hydraulically efficient channel sections, compound sections, Critical slope and limit slope, Design of irrigation canals.

**[T1,R1][No. of Hours: 12]****UNIT II**

**Gradually Varied Flow:** Classification of flow profiles, M, S, C, H and A profiles, control sections, serial combination of channel sections, Transitional depth, numerical solution of gradually varied flow problems.

**Hydraulic jump:** Hydraulic jump in rectangular channel: sequent depth ratio, Energy loss; Classification of jumps, characteristics of jumps in rectangular channels, use of jump as an energy dissipater.

**[T2,R1] [No. of Hours: 11]****UNIT III**

**Sediment Transport :** Hydraulics of mobile bed channels, sediment load, bed load, suspended load, Design of stable channels carrying clear water using Critical Tractive Force Approach, Regime channels, Kennedy equation and Lacey's equations, Lining of irrigation canals, Design of lined irrigation canals.

**[T2,R3] [No. of Hours: 11]****UNIT IV**

**The finite volume Method for Diffusion Problems:** Introduction, one-dimensional steady state diffusion, two-dimensional diffusion problems, discretised equations for diffusion problems.

**The Finite volume Method for Convection-Diffusion Problems:** Steady one-dimensional convection and diffusion, The central differencing scheme.

**Basic mechanisms for mixing:** Laminar and turbulent diffusion, Dispersion and advection. Mixing in rivers, lakes and coastal waters.

**The general transport (advection-diffusion) equation:** Formulation and special cases, Transport processes and spreading of pollutant. Balance equations for water and pollutants in surface water systems.

**[T1,T2][No. of Hours: 11]****Text Books:**

- [T1] K. Subramanya, "Flow in Open Channels", Tata McGraw Hill  
 [T2] G.L. Aswa, "Fluid flow in pipes and Open Channel", CBS Publication

**References:**

- [R1] Chow, V.T., "Open Channel Hydraulics", McGraw Hill Book Company 1959  
 [R2] Asawa, G.L., "Flow of Fluids in Pipes and Channels", CBS Publishers, New Delhi 2007  
 [R3] H. K. Versteeg and W. Malalasekera, "An Introduction To Computational Fluid Dynamics: The Finite Volume Method", Longman scientific and technical publishers.  
 [R4] John D. Anderson, "Computational Fluid Dynamics: The Basics with an Applications", McGraw- Hill,  
 [R5] Vivek V. Ranade, Computational Flow Modeling For Chemical Reactor Engineering, Academic Press, San Diego.

**ADVANCED STRUCTURAL DESIGN**

**Paper Code: ETCE-310**  
**Paper: Advanced Structural Design**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** Develop professional level competence in the seismic design and detailing of concrete and steel structures, structural elements as well as design of commonly used prestressed concrete structures.

**UNIT I**

**Introduction to Seismic design:** General principles of seismic design, Introduction to IS 1893 : 2002, Building equivalent static analysis, Vertical distribution of seismic forces and horizontal shears, dynamic analysis, design spectrum, Seismic weights, Modal combination, Load combinations and permissible stresses, Guidelines for earthquake resistant design, Ductile detailing for seismic design, Analysis for lateral Loads: Introduction to IS 875 Part-III.

[T1][No. of Hours: 12]

**UNIT II**

**Concrete structure design:** Design of elevated and underground water tanks as per IS: 3370 and IS: 1893 Part-V. Design of retaining walls, Design of Box culvert.

[T2][No. of Hours: 12]

**UNIT III**

**Prestressed concrete:** Need for prestressing, pre tensioning and post tensioning methods, Concept of load balancing and cable profile, End anchorage, losses of prestress, Design of pre-stressed concrete beams as per IS: 1343.

[T1,T2][No. of Hours: 10]

**UNIT IV**

**Steel structural design:** Design of elevated water tanks, Design of transmission and communication towers and design of gantry girder as per IS: 800.

[T1,T2][No. of Hours: 10]

**Text Books:**

- [T1] N. Krishna Raju, R.N.Pranesh, "Reinforced concrete Design", CBS Publishers  
 [T2] P.C.Verghese, "Advance Reinforced concrete Design" PHI Delhi

**References:**

- [R1] N. Krishna Raju, "Prestressed concrete", Tata McGraw Hill.  
 [R2] Arther H. Nilson, "Design of concrete structures", Tata McGraw Hill  
 [R3] Arya and Ajamani, "Design of steel structures", Nem Chand and Bros. Publishers  
 [R4] C. Syal and A.K. Goel, "Reinforced concrete structures", S. Chand.  
 [R5] Prestressed concrete, Pandit and Gupta, CBS  
 [R6] T.Y. Lin, Design of Prestressed Concrete Structures, Asia Publishing House, 1955.  
 [R7] Edward Nawy, Prestressed Concrete: A fundamental approach, prentice hall, New Jersey  
 [R8] BIS 1893 – 2002 and BIS 875 Part III  
 [R9] N.Krishna Raju, "Advance Reinforced concrete Design" CBS Publishers

**TRANSPORTATION ENGINEERING-I**

**Paper Code: ETCE-312**  
**Paper: Transportation Engineering-I**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: To learn the fundamentals for alignment and geometric and pavement design of highway, various aspects of traffic engineering, highway construction materials, quality control and maintenance etc.*

**UNIT I**

**Highway Development and Alignment:** Scope of highway engineering, road development and planning in India, role of NHAI, classification of roads, types of road pattern, Planning and Engineering surveys, Highway alignment, Highway project financing and economics of urban roads, expressways, national and state highways.

**Highway geometric design:** Cross section, elements, width, camber, gradient, sight distance, requirements and design principles of horizontal and vertical alignment, Alignment and Geometrics of hill roads. Highway safety and safety audit.

**[T1,T2][No. of Hours: 11]****UNIT II**

**Traffic Engineering:** Traffic characteristics and operations, Traffic flow, Capacity and level of services for state highway, national highway and expressway, Design of traffic facilities: Intersection, Roundabout, interchanges, parking facilities road signs, Traffic control devices, parking requirements and design, Urban Transportation planning process, Highway lighting, Traffic signal, Traffic planning and Administration, Introduction of transportation demand analysis. Urban Transport systems, planning and design, Urban intersections, Traffic sections.

**[T1,T2][No. of Hours: 11]****UNIT III**

**Highway materials:** Properties of sub-grade and pavement component materials, Tests on sub grade soil, aggregates and bituminous materials, Bituminous paving mixes, Marshall Mix design criteria. Use of flyash, concrete and polymers in highway construction

**Pavement design:** Types of pavement [WBM, RCC, Prestressed CC etc], Factors influencing the design of flexible and rigid pavements, Methods of flexible and rigid pavement design, I.R.C codes and recommendations.

**Road side development:** Arboriculture, planning plantation of trees, species selection and care of trees.

**[T1,T2][No. of Hours: 12]****UNIT IV**

**Highway construction, technique and quality control:** Techniques of construction of rural, urban roads and expressways, Joints in cement concrete pavements, Design and construction of hill roads.

**Highway maintenance and Drainage:** Causes and types of Pavement failures, Pavement testing, monitoring and evaluation, strengthening of existing pavements, Surface and sub surface drainage, drainage of slopes and erosion control, drainage, maintenance problems on hill roads, road construction in water logged areas.

**[T1,T2][No. of Hours: 11]****Text Books:**

- [T1] Khanna and Justo, "Highway Engineering", Nem Chand and Bros. Publishers  
 [T2] Saxena, "Textbook of Highway and Traffic Engineering", CBS Publishers

**References:**

- [R1] I.S. specifications on concrete, aggregates and bituminous materials  
 [R2] David Cronney, "Design and performance of road pavements", McGraw Hill  
 [R3] Wright Dixon, "Highway Engineering", Wiley India.  
 [R4] Dr. L. R. Kadiyali, "Traffic Engineering and Transport Planning", KP.  
 [R5] James H. Banks "Introduction to Transportation Engineering", McGraw Hill  
 [R6] R. Srinivasa Kumar, "Textbook of Highway Engineering", University Press.



**ENVIRONMENT SYSTEM OPTIMIZATION**

**Paper Code: ETEN-302**

**Paper: Environment System Optimization**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The course aims to introduce fundamentals and need for optimization techniques in engineering problems. Various techniques such as Linear Programming, Geometric Programming, Dynamic Programming and Non-Linear Programming are taught to students to solve various environmental engineering problems for optimal solutions.*

**UNIT-I**

**Introduction to Optimization:** Engineering Applications of Optimization, Statement of an Optimization Problem, Design Constraints, Constraint Surface, Objective Function, Optimization Techniques, Single-Variable Optimization, Multivariable Optimization with no Constraints, Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality Constraints, Convex Programming Problem.

[T1, T2][No. of Hours: 11]

**UNIT-II**

**Linear Programming:** Applications, Standard form, Pivotal Reduction, Simplex Algorithm, Two Phases of the simplex Method, Primal- Dual Relations, Transportation Problem, Integer Linear Programming. Assignment Problem. Examples- reservoir for irrigation and power production, river water quality (including treated effluent component). Water supply and drainage network optimization- case study.

[T1, T2][No. of Hours: 11]

**UNIT-III**

**Geometric Programming:** Introduction, Polynomial, Unconstrained Minimization Problem, Constrained Minimization, Applications of Geometric Programming.

**Dynamic Programming:** Introduction, Multistage Decision Processes, Representation of a Multistage Decision Process, Concept of Sub-optimization and the principle of the Optimality, Computational Procedure in Dynamic Programming, Continuous Dynamic Programming, Design of a Minimum-Cost Drainage System. Water allocation problem, capacity expansion problem, reservoir operation, case study.

[T1, T2][No. of Hours: 12]

**UNIT-IV**

**Nonlinear Programming:** Unrestricted Search, Exhaustive Search, Dichotomous Search, Interval Halving Method, Golden Section Method, Interpolation Method, Quadratic Interpolation Method, Cubic Interpolation Method, Direct Root Method, Case studies in Environmental Engineering.

[T1, T2][No. of Hours: 11]

**Text Books:**

- [T1] Douglas A.H., "Environmental System Optimization", John Wiley and Sons, New York.  
 [T2] Vedula S. and Mujumdar P.P., "Water Resources Systems: Modeling Techniques and Analysis", TMH

**Reference Books:**

- [R1] Rao S.S., "Engineering Optimization- Theory and Optimization", New Age International Publishers  
 [R2] Haith D.A., "Environmental System Optimization", Wiley and Sons, New York.  
 [R3] Geom Z.W., "Optimization In Civil and Environmental Engineering", Old City Publishing, USA.  
 [R4] Sieniutycz S and Jezowski J., "Energy Optimization In Process Systems", Elsevier, U.K.  
 [R5] Floudas A and Pardalos M., "Encyclopedia of Optimization- Volume 2", Springer, United States.

**OPERATION RESEARCH AND MANAGEMENT**

**Paper Code: ETCE-302**

**Paper: Operation Research and Management**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

***Objective:** To prepare students for technical careers and providing a strong foundation for engineering management positions. The subject also deals with concepts of Linear Programming, Geometric Programming, Dynamic Programming and problem formulation/solution of various engineering problems.*

**UNIT I**

Role of Project Manager, Project formulation and Cost Estimation, Project Financing, Economic Evaluation Criteria of the Project, Preparing a detailed project plan, Managing Risk and Uncertainty, Monitoring and Control during Project Execution, Monitoring the Project Interfaces, Project Communication and Documentation, Project Evaluation, Introduction to Bar Charts and Mile-Stone Charts, Introduction to Enterprise Resource Planning.

Engineering Application of Operational Research, Statement of an Optimization Problem, and Classification of Optimization Problems.

[T1][No. of Hours: 11]

**UNIT II**

Standard Form of Linear Programming, Simplex Algorithm, Two Phases of the Simplex Method, Duality in Linear Programming, Sensitivity of Post optimality Analysis, Transportation Problems, Assignment Model.

[T2] [No. of Hours: 12]

**UNIT III**

Deterministic Dynamic Programming, Classical Optimization Techniques, Unconstrained and Constrained Problems, Nonlinear Programming, Unconstrained Algorithm, Direct search Method, Gradient Method.

[T1,T2][No. of Hours: 11]

**UNIT IV**

General Management Concepts, Planning, Policy making, Programmes and Procedures, Staffing Technical Organizations, Models of Organization Development, Authority and Power, Delegation, Committees and Meetings, Technical, Administrative and Engineering Management, Manufacturing and System Management Human Resource Planning and Management, Motivation, Performance Management and Appraisal, Participative Management, Trade Unions, Organization and Management, Introduction to Material Management, Financial Management, Quality Management and Project management.

[T1,T2][No. of Hours: 11]

**Text Books:**

[T1] Hamdy A.Taha- Operations Research, Pearson Education, New Delhi.

[T2] Harvey M.Wagner-Principles of Operations Research- PHI, New Delhi

**References:**

[R1] Gary R.Heerkens -Project Managesment, Tata Mcgraw Hill Publication, New Delhi

[R2] Daniel L.Babacock-Managing Engineering and Technology- Lucy C. Morse, PHI, New Delhi

[R3] J David Hunger, Thomas L.Wheelen,- Essentials of Strategic Management- PHI, New Delhi

[R4] Engineering Optimization [Theory and practice] – Singiresu S.Rao, New Age, New Delhi.

[R5] A. K. Gupta,-Engineering Management , S.Chand and Company Ltd., New Delhi.



**DECISION SCIENCE**

**Paper Code: ETIT-302**  
**Paper: Decision Science**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: Skills acquired from this course will enable students to apply various decisions making and optimization techniques in solving problems pertaining to their respective areas of study.*

**UNIT- I**

Descriptive Statistics, Presentation of Data, Measures of Central Tendency and Variation, Probability-Concepts, Theorems, Bayes' Rule, Linear Programming, Formulation, Graphical and Simplex Method.

[T1][R1] [No. of hrs. 10]

**UNIT- II**

Decision Sciences and Role of quantitative techniques, Steps in decision making. Decision making under uncertainty, including optimism criterion, pessimism criterion, Laplace criterion, optimism criterion, Hurwicz criterion and Regret criterion. Decision making under risk, Multistage decision making, Multi criteria decision making. Posterior probabilities and Bayesian Analysis.

[T1][T2][No. of hrs. 10]

**UNIT- III**

**Game Theory:** Two person zero-sum games, concept of dominance, Pure and Mixed Strategy. Arithmetic, Algebraic, Matrix Algebra method. Solution by Dominance, Subgame and Linear programming method. Queuing Theory, Basic structure, Terminology, Classification, Birth and Death Process. Queuing Models upto 2 service stations.

[T1][R1][No. of hrs. 12]

**UNIT-IV**

Transportation Problems, Initial Basic Feasible Solution, Test for Optimality. Assignment problems. Network Analysis - PERT and CPM.

Network Models, Concept, Drawing network, identifying critical path, Calculating EST, LST, EFT, LFT, Slack and probability of project completion (CPM and PERT), Crashing of Network.

[T1][R3][No. of hrs. 12]

**Text Books:**

- [T1] Ken Black (2009) Business Statistics: For Contemporary Decision Making, 5th edition, Wiley-India.  
 [T2] Barry Render, RM Stair, ME Hanna and TN Badri (2009) Quantitative Analysis for Management, 10<sup>th</sup> edition, Pearson Prentice Hall.

**References Book:**

- [R1] Operations Research, H.A. Taha , Prentice-Hall India, 6<sup>th</sup> Edition, 2004

**TRANSPORTATION ENGINEERING LAB**

**Paper Code: ETCE-352**

**L T/P C**

**Paper: Transportation Engineering Lab**

**0 2 1**

**Note:** Based on theory 8-10 experiments are to be performed. The list is provided below:

**List of Experiments:**

1. Aggregate crushing strength test.
2. Los Angeles Abrasion test.
3. Aggregate impact test.
4. Flakiness index and elongation index test.
5. Penetration test.
6. Ductility test.
7. Viscosity test.
8. Softening point test.
9. Flash and fire point test.
10. Determination of bitumen content by centrifuge extractor.
11. Determination of marshal stability value.
12. Determination of rebound deflection of pavement by Benkelman beam.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

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**APPLICATIONS OF REMOTE SENSING LAB**

**Paper code: ETCE-354**

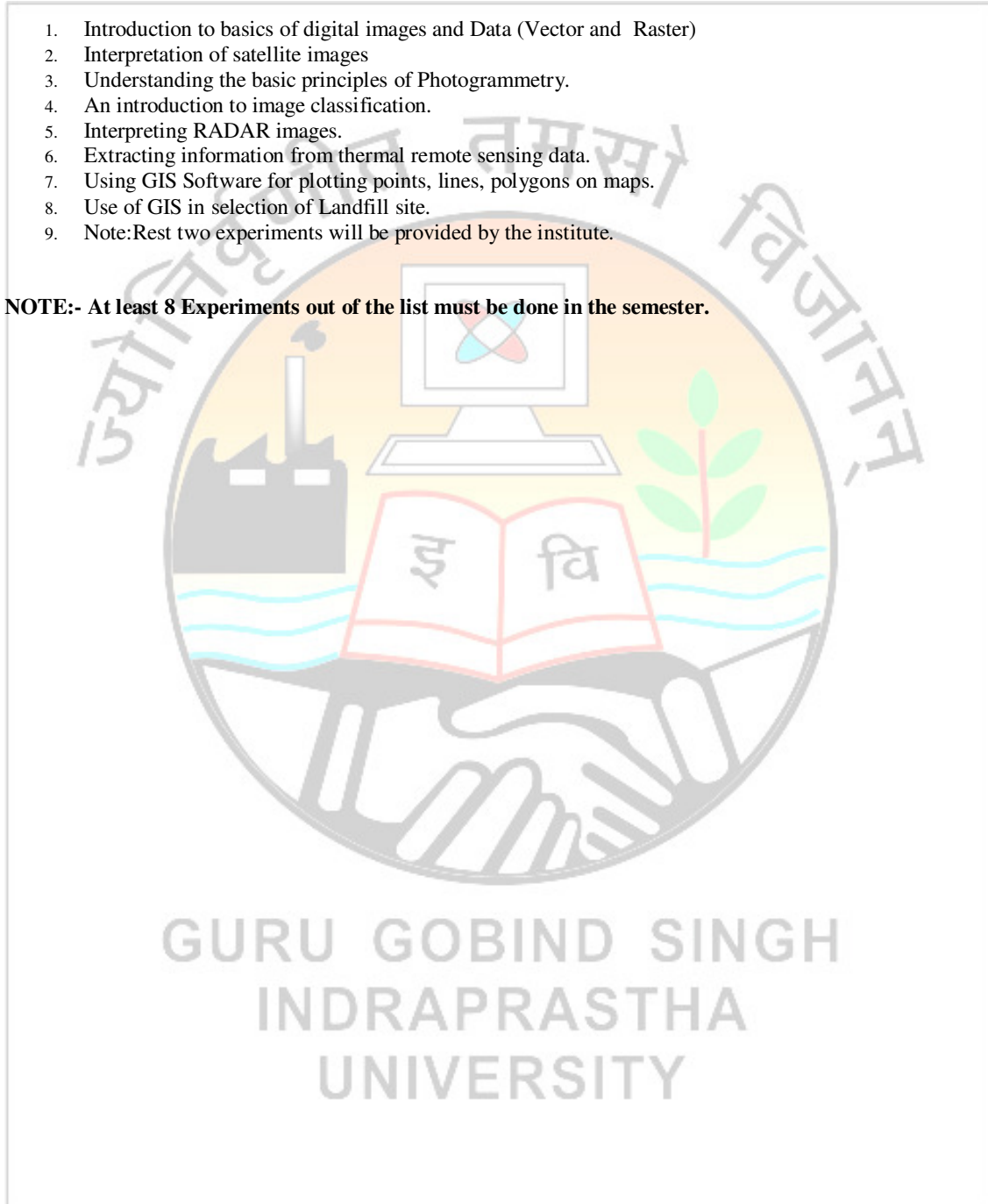
**Paper: Applications of Remote Sensing Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Introduction to basics of digital images and Data (Vector and Raster)
2. Interpretation of satellite images
3. Understanding the basic principles of Photogrammetry.
4. An introduction to image classification.
5. Interpreting RADAR images.
6. Extracting information from thermal remote sensing data.
7. Using GIS Software for plotting points, lines, polygons on maps.
8. Use of GIS in selection of Landfill site.
9. Note: Rest two experiments will be provided by the institute.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**



**STRUCTURES DESIGN LAB**

**Paper Code: ETCE-356**  
**Paper: Structures Design Lab**

L	T/P	C
0	2	1

**List of Experiments:**

1. Detailed design of structural elements of a multistory building [G+3 or more] as per recommendations of BIS: 1893-2002, BIS: 456-2000, BIS 13920:1993.
2. Design of Elevated and underground RCC water tank as per BIS:3370-1965
3. Design of Cantilever and counter-fort retaining walls
4. Design of box Culvert
5. Design of Pre-stressed concrete beams
6. Design of elevated steel water tank
7. Design of transmission line towers
8. Ductile detailing of structure elements and joints for seismic design as per BIS 13920:1993

Rest two experiments will be provided by the institute

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**



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 UNIVERSITY**

**ECONOMICS FOR ENGINEERS**

**Paper Code: ETCE-401**  
**Paper: Economics for Engineers**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

***Objective:** The objective of this course is to give the working engineer an overview of the economics principles often employed in effective engineering decisions as related to the designing, planning and implementation of successful civil engineering projects.*

**UNIT – I**

Engineering economics and its definition, Nature and scope, Overview of Indian Financial Scenario. Utility, Theory of demand, law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply, Determination of equilibrium price under perfect competition. Time value of money-Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence Evaluation of Engineering projects, Concept of Internal rate of return (IRR).

**[T1,T2] [No. of Hrs: 10]****UNIT – II**

Cost Concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into Fixed and variable costs, Break-even Analysis-Linear Approach. Engineering Accounting, Manufacturing Cost, Manufacturing Cost Estimation, Preparing Financial Business Cases, Profit and loss A/c Balance sheet. Asset Depreciation and its Impact on Economic Analyses, Depreciation Policy, Straight line method and declining balance method, Economic Justification of Asset Replacements.

**[T1,T2] [No. of Hrs. 12]****UNIT – III**

Types of business ownership: Private ownership- individual, Partnership, Joint stock companies, Co-operative societies, State ownership-government departmental organization, Public corporations, Government companies, Public Private Partnership (PPP) and its management. Store keeping, Elements of Materials management and control polices. Banking: Meaning and functions of commercial banks, Function of Reserve Bank of India.

**[T2,R4] [No. of Hrs. 12]****UNIT IV**

Asset Depreciation and its Impact on Economic Analyses, Depreciation Policy, Straight line method and declining balance method, Economic Justification of Asset Replacements. Development of business case analyses for new product development projects and the impact of taxes on engineering economic decisions. Inflation and its impact on economy.

**[T1, R5][No. of Hours: 11]****Text Books:**

- [T1] Sullivan, Wicks, Koelling, "Engineering Economy", Pearson Education  
 [T2] S.C. Sharma and T.R. Banga, "Industrial organization and engineering economics"

**References Books:**

- [R1] Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.  
 [R2] C. T. Horngreen, "Cost Accounting", Pearson Education India.  
 [R3] R. R. Paul, "Money banking and International Trade", Kalyani Publuisher, New-Delhi.  
 [R4] Engineering Economics by Tahir Hussain, University Science Press, 2010  
 [R5] Engineering Economics by Dr. Rajan Mishra – University Science Press, 2009  
 [R6] H.L. Ahuja, "Principle of Economics", S. Chand  
 [R7] Khan, Siddiquee, Kumar, "Engineering Economy" Pearson Education



**IRRIGATION ENGINEERING**

**Paper Code: ETCE-403**  
**Paper: Irrigation Engineering**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

**Objective:** The course deals with various principles and requirements of irrigation scheme involving canals/channels carrying clear or Sediment-Laden water, design of canal sections, sheet pile, cut-off walls, canal fall, distributory head regulator, cross regulator, cross drainage structures, canal head works, dams, spillways, guide bank and bank protection.

**UNIT I**

Major and medium irrigation schemes of India, Command area development, Types of Soils and their suitability for irrigation, Root Zone soil water, Irrigation requirements, Irrigation water quality, Irrigation canal system, Duty of water, Canal losses, Estimation of design discharge of a canal, canal outlets, Canal regulation, Water logging, causes, effects and remedial measures.

Alluvial channels carrying clear water and Sediment-Laden water, Evaporation and seepage losses in channels, Cross section of irrigation channels, Berms, Freeboard and service road, Silting of channels.

**[T1,T2] [No. of Hours: 11]****UNIT II**

Sheet pile cut-off walls, Khosla's theory and its applications, Correction for Floor Thickness, Correction for Mutual Interference of sheet piles, Correction for the slope of the floor, Method for determination of exit gradient, Uplift force on the floor of canal structure.

Canal regulation structures, Canal Fall, Types of canal fall, Cistern element, Vertical/ Horizontal/Inclined-impact Cisterns, No-Impact Cisterns, Roughening measures for energy dissipation such as Friction Block, Ribbed pitching and Provisions such as baffle wall/ deflector/dentated cill etc at the Downstream end of cistern system

Distributory Head Regulator and Cross Regulator and their Design criteria, Control of Sediment Entry into an offtaking channel.

**[T1,R2][No. of Hours: 11]****UNIT III**

Cross Drainage Structure, their need and types, Head loss through cross drainage structures, Design of Transitions for canal waterway using Hind's Method, Uperi Method and Vittal and Chiranjeevi's method, Canal Headworks, Selection of the site, Weir or Barrage, Undersluices, Divide Wall, Fish Ladder, Canal Head Regulator, Sediment Excluders and Sediment Ejector, Settling Basin, River Training for Canal Headworks.

**[T2,R2][No. of Hours: 11]****UNIT IV**

Types of dams, Factors and General Design Criteria for Embankment Dams, Freeboard, Suitability of Foundation, Slope protection, Factors and General Design Criteria for Gravity Dams, Forces on gravity Dam, Causes of failure of a gravity Dam, Stability Analysis of Gravity Dams, Galleries and outlets.

Main components of Spillway, Types of spillways, energy dissipaters, Cavitation erosion on spillway surface Classification/ behaviour of rivers, Cutoffs, Aggradation and Degradation, River Training and its objectives, River training Methods such as Levees, Spurs, Guide Banks, Design of Guide Bank and Bank Protection.

**[T1,T2][No. of Hours: 12]****Text Books:**

- [T1] G.L Asawa-Irrigation and Water Resources Engineering, New Age Internal Publishers, New Delhi.  
 [T2] S.K.Garg- Irrigation Engineering and Hydraulic Structures, Khanna Publishers, Delhi

**References Books:**

- [R1] Ralph A.Wurbs, Wisley P.James- Water Resources Engineering, PHI, New Delhi.  
 [R2] R.K.Sharma and T.K.Sharma- Irrigation Engineering. S.Chand and Company Ltd., New Delhi.  
 [R3] Satya Narayana Murty Challa-Water Resources Engineering [Principles and Practice] NewAge Intl.  
 [R5] Applied Hydrology - Ven T Chow, David R Maidment, Larry W Mays, McGraw-Hill, New Delhi  
 [R6] Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand and Brothers, roorkee

**TRANSPORTATION ENGINEERING-II****Paper Code: ETCE-405****Paper: Transportation Engineering-II**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: To learn the fundamentals, planning and design concepts of railways, airways, tunneling, docks and harbours and other minor modes of transportation.*

**UNIT I**

**Components and Geometric design of Railways** : Requirement and capacity of railway tracks, Various gauges, typical cross sections, Coning of wheels and tilting of rails, Functions and requirements of component parts of a railway track, Wear and tear and creep of rails, Requirement and types of sleepers, rail fixtures, ballast, sub-grade and embankments, Geometric design of railway track, Horizontal curves, radius, super elevation, transition curves, safe speed on curves, different types of gradients, Grade compensation.

**[T1,T2][No. of Hours: 11]****UNIT II**

**Railway operation and control** : Points and crossings and their design, Track junctions and simple track layouts, details of different types of stations and yards, signaling and interlocking, Various systems for control of train movements.

**Railway construction and maintenance**: Construction of railway track, earthwork, plate laying and packing, maintenance of track alignment, renewal of component parts and track drainage, modern methods of track maintenance, Classification and causes of accidents and their prevention.

**Delhi Metro**: Salient features of design, construction, operation and maintenance.

**[T1,T2][No. of Hours: 11]****UNIT III**

**Tunneling**: Considerations in tunneling, Tunnel alignment and grade, size and shape of a tunnel, methods of tunneling in hard rocks, Methods of tunneling in soft soils, compressed air and shield tunneling, shafts in tunnels, Safety measures, ventilation, lighting and drainage in tunnels

**Docks and Harbours** : Historical development of ports, harbours and docks, Tides, winds and waves, Causes and impact of Tsunami waves, Types of harbours, Types of docks, Break waters classification and types, Jetties, Landing stages and wharves.

**[T2][No. of Hours: 11]****UNIT IV**

**Airport planning and design**: Traffic characteristics and operations, fleet requirements, component parts of airport and site selection, Runway design, Orientation, basic runway length, geometric design, design of taxiways and aprons, terminal area planning, facilities in terminal area and their planning concepts, Environmental requirements for Airport projects, Design of Airport drainage system, Lightening of airport, Specific requirements for design of airport pavements.

**[T2][No. of Hours: 12]****Text Books:**

- [T1] Saxena and Arora, "A Text Book of Railway Engineering", Dhanpat Rai publications  
 [T2] Khanna and Arora, "Airport Planning and design", Nemchand and Bros

**References Books:**

- [R1] Horonjeff, "Planning and design of Airports", TMH  
 [R2] Mundrey, "Railway Track Engineering", TMH  
 [R3] Docks and Harbors, Levison Francis, Clarendon press,(2006)  
 [R4] John O. Bickel, Thomas R. Kuesel, Elwyn H King, "Tunnel Engineering Handbook", CBS Publication.  
 [R5] Railways, Bridges and Tunnels, Vazirani. V.N, Chandola.S.P, Khanna publications, New Delhi (1997)

**WATER RESOURCE SYSTEM PLANNING**

**Paper Code: ETCE-411**

**Paper: Water Resource System planning**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

***Objective:** The course will cover the topics of water planning and management by providing in- depth coverage of the tools of analysis, namely econometric principles, Fuzzy rule based model, optimization and simulation, and by providing the theoretical framework for analysis.*

**UNIT I**

Introduction of Water Systems engineering-scope and approach  
Issues and the systems planning approach, Water system dynamics, Water Resource [W.R.] development alternatives, Water systems planning objectives, Constraints and Criteria, Economic and Econometric principles, Cost and Benefit Curves.

**[T1,R2][No. of Hours: 10]**

**UNIT II**

Application of Linear programming [LP] and Dynamic programming [DP] models in Water Resource Engineering, Problem formulation for W.R. systems, Multi-objective Water Resource Planning, Non-inferior Solutions, Plan Formulation, Weighting Method, Constraint Method, Plan Selection.  
Reservoir Operation, Standard Operating Policy, Optimal Operating Policy using LP Rules, Curves for Reservoir Operations  
Reservoir Systems [Deterministic Inflow], Reservoir Sizing, Sequent Peak Analysis Neglecting Evaporation, Sequent Peak Analysis Considering Evaporation Loss, Reservoir Capacity using LP , Storage Yield Function, Mixed Integer LP Formulation for Maximizing Yield.

**[T2,R2][No. of Hours: 10]**

**UNIT III**

Multireservoir Operation, Stationary Policy using DP, Simulation of Reservoir Operation for Hydropower Generation, Reservoir Systems [Random Inflow], Lognormal and Exponential Distributions, Chance Constrained LP, Linear Decision Rule, Deterministic Equivalent of a chance constraint  
Concept of Reliability, Reliability-based Reservoir Sizing, Maximum Reliability, Stochastic Dynamic programming for reservoir operation, State variable discretisation, Inflow as a stochastic process, Steady state operating policy, Steady State Probabilities, Real-time Operation, Case Study.

**[T1,T2][No. of Hours: 11]**

**UNIT IV**

Water quality managements planning and associated models, Regional planning models, Policy issues for improvement in utilization of water resources, Optical Irrigation Water allocation for single and multiple crops, Crop Yield optimization.  
Applications of Linear Programming in [1] Optimal Irrigation water allocation to multiple crops, [2] Multireservoir system for irrigation planning, [3] Reservoir Operation [Short term] for irrigation, [4] Reservoir operation for Hydropower optimization.  
Application of dynamic programming in - [1] Steady State Reservoir operating policy for irrigation, [2] Real-time Reservoir Operation for Irrigation, An Example application for inflow forecasting, Fuzzy Sets and Fuzzy logic, Introduction, Fuzzy rule based reservoir operation model.

**[T1,R3] [No. of Hours: 10]**

**Text Books:**

- [T1] Water Resources Systems Planning and Management, Sharad K. Jain, 2003 ,Elsevier ,Singh .P.V  
[T2] Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications, Daniel P. Loucks, Eelco Van Beek, 2005.

**References:**

- [R1] S.Vedula, P.P.Majumdar-Water Resources Systems, Tata Mcgraw Hill Publishing Company Ltd., ND  
[R2] M.C. Chaturvedi, W.R.Systems-Planning and Management, Tata McGraw Hill Publications, New Delhi

- [R3] Louks D Petal W.R. System Planning and Analysis, Prentice Hall – 1981.  
[R4] Maass. A. eta:-Design Water Resources Systems-McMillan, 1968.  
[R5] A.S. Goodman, Principals of Water Resources Planning, Prentice Hall, 1984





**EARTHQUAKE TECHNOLOGY****Paper Code: ETCE-413****L T/P C****Paper: Earthquake Technology****3 1 4****INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

***Objective:** To introduce the basic concepts in dynamic as well as probabilistic modeling of earthquake loading and dynamic analyses/simulation with uncertainty in earthquake engineering and to introduce the basics of structural dynamic analyses with emphasis on earthquake engineering applications.*

**UNIT I**

Introduction, Causes and Classification of Earthquakes, Surface Wave Magnitude, Body Wave Magnitude, Moment Magnitude, Modified Mercalli Intensity Scale, Comprehensive Intensity Scale [MSKG 64] as per IS: 1893 Part-I, Characteristics of ground motion, local site effects, Impact of earthquake on buildings and infrastructure, Iso-seismal map, Development of seismic zoning map of India, Types of Ground failures due to earthquake.

D' Alembert's principle, Equation of motion, Degrees of freedom, Damping, Free and Forced Vibrations of an un-damped and damped single degree freedom system and its equivalence.

**[T1][No. of Hours: 11]****UNIT II**

Free vibrations of an Un-damped two degree freedom system, Determination of frequencies and mode shape and concept of vibration absorber, Equation of Motion for multi-degree freedom system using D' Alembert's principle, Stiffness Coefficient and Flexibility coefficient, Determination of Frequencies and Mode Shapes for Three storey building idealize as lumped mass cantilever model with one degree of freedom at each mass, using matrix iteration technique, Holzers' Method and Stodolas' Method.

**[T2][No. of Hours: 11]****UNIT III**

Orthogonality Property of Normal Modes, Modal Analysis, Modal Super position Methods, Fourier Spectra, Response Spectra, Dynamic Analysis by Response Spectrum Method as per IS 1893, Effect of form and irregularities in building as per IS 1893 on its seismic performance, Short column Effect.

Comparative Merits of Stiff and Flexible construction, Failure Modes, Whipping Effect, General Principles and Philosophy of Earthquake Resistant Design, Concept of Capacity Based Design and Performance Based Design. Torsion in buildings during earthquakes, Determination of Torsional shares in columns of a framed building. Different type of lateral load resistance systems, Pounding of buildings and Required seismic separation between two adjacent buildings storey, Drift limitations for Buildings as per IS Code, Introduction of P-  $\Delta$  Effect,

**[T1,T2][No. of Hours: 11]****UNIT IV**

Earthquake resistance requirements for horizontal and vertical projections of the building, Special considerations for non-structural components attached to the building.

Importance of shear wall buildings in earthquake resistance and Design of Reinforced Concrete Shear Walls as per IS 13920, Concept of Vibration Isolation of Buildings, Control devices like active control, passive control, hybrid control, semi-active control, isolation devices, energy dissipation devices, Need for Seismic Evaluation of Buildings and their Retrofitting, Condition Assessment of existing Buildings, GSDMA Guidelines on Seismic Evaluation and strengthening of Buildings.

**[T1,T2][No. of Hours: 11]****Text Books:**

- [T1] Steven and Kramer.-Geotechnical Earthquake Engineering, Pearson Education.  
 [T2] Anil K. Chopra -Dynamics of Structures" [Third Edition], Published by Pearson Education

**References Books:**

- [R1] IS 1893 [Part-I]- 2002 : "Criteria for Earthquake Resistance Design of Structure".  
 [R2] IS 4326: 1993 – "Earthquake Resistant Design and Construction of Building – Code of Practice.



- [R3] IS 13920: 1993 – Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force – Code of Practice.
- [R4] IS 13935: 1995 “Repair and Seismic Strengthening of Buildings – Guidelines “.
- [R5] GSDMA-IITK “Guidelines for Seismic Strengthening of Buildings.



**GEO-SYNTHETICS AND REINFORCED SOIL**

**Paper Code: ETCE-415**

**Paper: Geo-synthetics and Reinforced Soil**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

***Objective:** To introduce the students to the different types of geosynthetics, their manufacturing technique, testing methods and their applications in different types of Civil Engineering projects.*

**UNIT - I**

**Introduction:** Historical background of reinforced soil, Principles of reinforced soil through Mohr circle analysis.

**Different types of geosynthetics:** Types of geosynthetics like geotextiles, geogrids, geonets, geocells, geo-composites, their manufacturing methods.

**Testing methods for geosynthetics:** Techniques for testing of different index properties, strength properties, Apparent Opening Size, In-plane and cross-plane permeability tests.

[T1,T2][No. of Hrs: 12]

**UNIT - II**

**Reinforced Soil retaining walls:** Different types of walls like wrap-around walls, full-height panel walls, discrete-facing panel walls, modular block walls Design methods as per BS-8006 and FHWA methods Construction methods for reinforced soil retaining walls.

**Reinforced soil slopes:** Different slope stability analysis methods like planar wedge method, bi-linear wedge method, circular slip methods, Erosion control on slopes using geosynthetics.

[T1][No. of Hrs: 12]

**UNIT - III**

**Applications in foundations:** Binquet and Lee's approach for analysis of foundations with reinforcement layers.

**Drainage and filtration applications of geosynthetics:** Different filtration requirements, filtration in different types of soils and criteria for selection of geotextiles.

[T2][No. of Hrs: 10]

**UNIT - IV**

**Pavement application:** Geosynthetics for separation and reinforcement in flexible pavements, design by Giroud-Noiray approach, reflection cracking and control using geosynthetics.

**Construction of landfills using geosynthetics:** Different components of modern landfills, collection techniques for leachate, application of different geosynthetics like geonets, geotextiles for drainage in landfills, use of geomembranes and Geosynthetic Clay Liner [GCL] as barriers.

[T1,T2][No. of Hrs: 11]

**Text Books:**

- [T1] Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 4th edition.  
 [T2] Jewell, R.A., "Soil Reinforcement with Geotextiles", Special Publication No. 123, CIRIA, Thomas Telford. London, UK, 1996.

**References**

- [R1] Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.  
 [R2] Reinforced Soil Engineering: Advances in Research and Practice, Hoe I. Ling, Dov Leshchinsky Fumio 2003-Tatsuoka.  
 [R3] Design and Practice of Geosynthetic-Reinforced Soil Structures, Hoe I. Ling, Guido Gottardi Daniele, 2013-Cazzuffi  
 [R4] Geosynthetics and Their Applications, Sanjay Kumar Shukla – 2002  
 [R5] Geosynthetics Asia 1997: Select papers, C.V.J. Varma, Venkatappa Rao, G 1998-Rao, G.R.A

**STRUCTURE REPAIR AND REHABILITATION**

**Paper Code: ETCE-417**

**Paper: Structure Repair and Rehabilitation**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: To help students in understanding the various causes of structural failure and latest techniques in repair and rehabilitation of structures.*

**UNIT I**

**Evaluating concrete in concrete structures:** site survey, cracking, disintegration and spalling, scaling, dusting, distortion, erosion, seepage, crack survey, joint inspections, physical and chemical analysis, NDT testing

**Causes of distress and deterioration:** Accidental loading, chemical reactions, corrosion, freezing and thawing, settlement and movement, shrinkage, temperature changes.

[T1][No. of Hours: 12]

**UNIT II**

**Materials and methods for repair and rehabilitation:** planning and design of concrete repair, Autogeneous healing, crack arrest techniques, drilling and plugging, Fiber reinforced concrete, flexible sealing, gravity soak, chemical grouting, hydraulic-cement grouting, jacketing, polymer overlays, polymer coating, polymer injection, polymer concrete, shotcrete, judicious neglect, shrinkage-compensating concrete.

[T2][No. of Hours: 12]

**UNIT III**

**Maintenance of concrete:** Stains and stain removal, cleaning details, oil stains, grease, dirt, mildew, asphalt, efflorescence, coating and sealing compounds.

**Specialized repairs:** rehabbing lock walls, blasting lock walls, anchors, pre-placed aggregate concrete, cut-off walls, under water repairs, geomembrane work.

[T1,T2][No. of Hours: 11]

**UNIT IV**

**Trouble shooting defects in concrete:** excess water, bad design data, chemical attacks, alakali-aggregate reaction, freezing, moving water and cavitation.

[T1,T2][No. of Hours:10]

**Text Books:**

[T1] S.N.Sinha , RCC Design, Tata McGraw-Hill Publishing ltd,2002

[T2] Allen R.T.L, Repair Of Concrete Structures, John Willey and Sons,1987

**References Books:**

[R1] Handbook on repair and rehabilitation of RCC buildings, published by CPWD, Government of India. <http://cpwd.gov.in/Units/handbook.pdf>

[R2] R. Dodge Woodson [2009]. Concrete Structures: Protection, Repair and Rehabilitation. Elsevier publications.

[R3] B .Sivagnanam –“Rehabilitation“- Indian concrete journal, December 2002, vol.76.

[R4] [http://www.structural.net/Repair/repair\\_concrete.html](http://www.structural.net/Repair/repair_concrete.html)

[R5] [http://www.icivilengineer.com/Structural\\_Engineering/Structure\\_Maintenance/](http://www.icivilengineer.com/Structural_Engineering/Structure_Maintenance/)

**DATA ANALYTICS****Paper Code: ETCE-419****Paper: Data Analytics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

***Objective:** This course is aimed at providing in-depth understanding of data analysis based on statistical techniques. The approach to data analysis involves exploratory methods, continuous distributions such as normal, lognormal distribution, probability plotting for normal distributions, hypothesis testing etc. The subject deals with model estimation and testing using para metric and non parametric methods, identification and accommodation of outliers, frequency analysis of extreme events like fild, storms, droughts etc and use of simulation techniques such as monte-carlo simulation.*

**UNIT – I**

**Preliminary Data Analysis:** Graphical representation-line diagram or Bar Chart, Dot diagram, Histogram, Exploratory methods- stem and leaf plot, Box plot. Random events- sample space and events, the null event, Intersection and Union, Venn Diagram and Event space. Continuous Distributions- Normal Distribution, Lognormal Distribution, Bivariate Normal Distribution.

**[T1][No. of Hrs. 10]****UNIT – II**

**Model Estimation and Testing:** Properties of Estimators- Unbiasedness, Consistency, Minimum Variance, Efficiency, Sufficiency. Estimation of Confidence Intervals. Hypothesis testing- Procedure for testing, Probabilities of Type I and Type II Errors and the power function, Tests of Hypothesis involving the Variance, the F Distribution and its use. Nonparametric methods- Wilcoxon Signed- Rank Test for Association of Paired Observations.

**[T2][No. of Hrs. 12]****UNIT – III**

**Goodness of Fit Tests:** Chi-squared Goodness of Fit test, Kolmogorov- Smirnov Goodness of Fit test, Kolmogorov- Smirnov Two- sample test, Anderson- Darling Goodness of Fit test, Other methods for testing the Goodness of Fit to a Normal Distribution.

**Analysis of Variance:** One-Way Analysis of Variance, Two-way analysis of Variance.

Probability Plotting for Normal Distribution, Probability Plotting for Type I Extreme Value Distribution.

**Identification and Accomodation of Outliers:** Hypothesis Tests, Test Statistics for Detection of Outliers, Dealing with Nonnormal Data.

Estimation of Probabilities of Extreme events when outliers are present. Multivariate Analysis- Principle Components Analysis, Factor Analysis, Cluster analysis.

**Spatial Correlation:** The Estimation problem, Spatial Correlation and the Semivariogram, some Semivariogram Models and Physical Aspects, Spatial Interpolations and Kriging.

**[T1,T2] [No. of Hrs. 12]****UNIT – IV**

**Frequency Analysis of Extreme Events:** Order Statistics- Functions of Order Statistics, Expected value and Variance of Order Statistics, Expected Value and Variance of Order Statistics. Extreme Value Distributions- Basic Concepts, Gumbel Distribution, Weibull Distribution as an Extreme Value Model, General Extreme Value Distribution. Analysis of Natural Hazards: Floods, storms and Droughts, Earthquakes and volcanic eruptions, winds, sea levels and Highest sea waves.

**Simulation techniques for Design:** MonteCarlo Simulation- Statistical Experiments, Probability Integral Tranform, Sample size and accuracy of Monte Carlo Experiments.

**[T1,T2] [No. of Hrs. 11]****Text Books:**

[T1] Kottegoda N.T. and Rosso R., “Probability, Statistics and Reliability for Civil and Environmental Engineers”, McGraw Hill, USA.

[T2] Azzalini A., Scarpa B., “Data Analysis and Data Mining- An Introduction”, Oxford University Press, New York.

**Reference Books:**

- [R1] Stokes M.E., Davis C.S., Koch G.G., "Categorical Data Analysis Using the SAS System", SAS Publishing, North Carolina.
- [R2] Ruppert D., "Statistics and Data Analysis for Financial Engineering", Springer, New York.





**PLANNING AND DESIGN OF GREEN BUILDINGS**

**Paper Code: ETEN-419**

**Paper: Planning and design of Green buildings**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

**Objective:**

1. To introduce the key concept, requirements and important issues of Designs Construction and Commissioning of green buildings.
2. To develop practical skills for planning and designing sustainable building projects.

**UNIT – I**

Green building concept- History, Increased public focus on Sustainability and Energy Efficiency, Supportive Framework and general condition, Green Home Certifications, CO<sub>2</sub> Emission Trade, High Performance Building Characteristic, the LEED rating system, Rating system for Sustainable Building.  
An integrated view of green building- Lifecycle engineering, Barriers to green building growth.

[T1,T2][No. of Hours: 11]

**UNIT – II**

Green Building Requirements : Principles of Energy, Heat Flow, Fuel Types, Air Flow, Moisture Flow, Condensation and Dew Point, Relative Humidity, Concept of Earth air Tunnel System for moderating air temperature.

Design, construction, commissioning and monitoring for green building- Urban development and infrastructure, building shape and orientation, building envelope, building materials and furnishing, natural resources.

[T1,T2][No. of Hours: 12]

**UNIT – III**

Planning of Green From Start- Traditional Design, Integrated Design, Site Selection , Site Development, House Design, Construction and Planning, Construction Waste, Remodeling  
Structural System- Types of Foundation, Foundation Selection, Materials required, Soil Gas, Tree Protection, Pest Control, Floors and Exterior walls, Roofs, Landscaping.

[T1,T2][No. of Hours: 11]

**UNIT – IV**

Sustainable building procedure requirement, Blower door test, Thermography, Indoor Comfort, Air Quality, Noise Protection, Day light Performance and Non-Glaring, Emulation, Monitoring and Energy Management, Conscious handling of resources- Energy benchmark as target values for design, regenerative energy resources, primary energy demand for indoor climate conditioning, Energy demand for Lifecycle of a building, Water requirement, Case study.

[T1,T2][No. of Hours: 10]

**Text Books:**

- [T1] Yudelson J, “The Green Building Revolution”, Island Press, New York.  
[T2] Kibert C.J., “Sustainable Construction - Green Building Design and Delivery” John Wiley and Sons, New York

**Reference Books:**

- [R1] Edward B., “Guide to Sustainability: A Design Primer”, RIBA Publishing, U.K.  
[R2] Sassi P., “Strategies for Sustainable Architecture”, Taylor and Francis, New York.  
[R3] Wines J., “Green Architecture”, Taschen, New York.

**DATA COMMUNICATIONS AND NETWORKS****Paper Code: ETEC-421****L T/P C****Paper: Data Communications and Networks****3 0 3****INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

**Objectives:** The objective of the paper is to provide an introduction to the fundamental concepts on data communication and the design, deployment, and management of computer networks.

**UNIT- I**

**Data Communications :** Components, protocols and standards, Network and Protocol Architecture, Reference Model ISO-OSI, TCP/IP-Overview ,topology, transmission mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface standards, modems, cable modem, transmission media-guided and unguided, transmission impairment, Performance, wavelength and Shannon capacity.

**Error Detection and Correction:**

Types of error, Error detection codes:-parity, linear block codes, cyclic redundancy check (CRC codes); Burst error detecting and correcting codes; Convolution codes.

**Switching:**

Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

**[T1, T2, R3][No. of Hours: 11]****UNIT- II**

**Data Link Layer:** Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to-Point Access: PPP Point-to-Point Protocol, PPP Stack,

**Medium Access Sub layer:** Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 and 802.11 for LANS and WLAN, high-speed LANs, Token ring, Token Bus, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

**[T1, T2][No. of Hours: 11]****UNIT- III**

**Network Layer:** Design issues, Routing algorithms, Congestion control algorithms, Host to Host Delivery: Internetworking, addressing and routing, IP addressing (class full and Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6 and ICMPV6.

**[T1, T2][No. of Hours: 11]****UNIT- IV**

**Transport Layer:** Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

**Application Layer:** Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

**[T2, T1, R3][No. of Hours: 11]****Text Books:**

- [T1] Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Pearson, 5<sup>th</sup> Ed  
 [T2] Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4<sup>th</sup> Ed

**Reference Books:**

- [R1] Computer Networks: A system Approach: Larry L, Peterson and Bruce S. Davie, Elsevier, 4<sup>th</sup> Ed.  
 [R2] Introduction to data Communications and Networking, Tomasi, Pearson 7<sup>th</sup> impression 2011  
 [R3] Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9<sup>th</sup> Ed.  
 [R4] Network for Computer Scientists and Engineers: Zheng, Oxford University Press  
 [R5] Data Communications and Networking: White, Cengage Learning

**SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS**

**Paper Code: ETHS-419**

**Paper: Sociology and Elements of Indian History for Engineers**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of this course is to familiarize the prospective engineers with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues and problems in Indian society. The course would enable them to analyze critically the social processes of globalization, modernization and social change. All of this is a part of the quest to help the students imbibe such skills that will enhance them to be better citizens and human beings at their work place or in the family or in other social institutions.*

**UNIT I**

*Module 1A: Introduction to Elements of Indian History: What is history? ; History Sources-Archaeology, Numismatics, Epigraphy and Archival research; Methods used in History; History and historiography;*

[3 Lectures]

*Module 1B: Introduction to sociological concepts-structure, system, organization, social institution, Culture social stratification (caste, class, gender, power). State and civil society;*

[7 Lectures]

**[T1][No. of Hrs. 10]**

**UNIT II**

*Module 2A: Indian history and periodization; evolution of urbanization process: first, second and third phase of urbanization; Evolution of polity; early states of empires; Understanding social structures-feudalism debate;*

[3 Lectures]

*Module 2B: Understanding social structure and social processes: Perspectives of Marx, Weber and Durkheim;*

[7 Lectures]

**[T1][No. of Hrs. 10]**

**UNIT III**

*Module 3A: From Feudalism to colonialism-the coming of British; Modernity and struggle for independence;*

[3 Lectures]

*Module 3B: Understanding social structure and social processes: Perspectives of Marx, Weber and Durkheim;*

[9 Lectures]

**[T1][No. of Hrs. 12]**

**UNIT IV**

*Module 4A: Issues and concerns in post-colonial India (upto 1991); Issues and concerns in post-colonial India 2<sup>nd</sup> phase (LPG decade post 1991)*

[3 Lectures]

*Module 4B: Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing nature of work and organization.*

[10 Lectures]

**[T1][No. of Hrs. 13]**

**Text Books:**

[T1] Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan.

[T2] Giddens, A (2009), Sociology, Polity, 6<sup>th</sup> Edition

**Reference Books:**

[R1] Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan

[R2] Haralambos M, RM Heald, M Holborn (2000), Sociology, Collins.

**DATABASE MANAGEMENT SYSTEMS**

**Paper Code: ETCS-425**

**Paper: Database Management Systems**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The concepts related to database, database techniques, SQL and database operations are introduced in this subject. This creates strong foundation for application data design.*

**UNIT-I : Introductory Concepts of DBMS:** Introduction and application of DBMS, Data Independence, Database System Architecture – levels, Mapping, Database users and DBA, Entity – Relationship model, constraints, keys, Design issues, E-R Diagram, Extended E-R features- Generalization, Specialization, Aggregation, Translating E-R model into Relational model.

[T1, T2][No. of Hrs. 10]

**UNIT-II : Relational Model:** The relational Model, The catalog, Types, Keys, Relational Algebra, Fundamental operations, Additional Operations-, SQL fundamentals, DDL,DML,DCL PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Integrity – Triggers.

[T2, R3][No. of Hrs. 10]

**UNIT-III:** Functional Dependencies, Non-loss Decomposition, First, Second, Third Normal Forms, Dependency Preservation, Boyce/Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

[T2, R1][No. of Hrs. 10]

**UNIT-IV: Transaction Management:** ACID properties, serializability of Transaction, Testing for Serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, Database recovery management.

**Implementation Techniques:** Overview of Physical Storage Media, File Organization, Indexing and Hashing, B+ tree Index Files, Query Processing Overview, Catalog Information for Cost Estimation, Selection Operation, Sorting, Join Operation, Materialized views, Database Tuning.

[T1, T2, R2][No. of Hrs. 12]

**Text Books:**

- [T1] Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 5<sup>th</sup> Edition, Tata McGraw Hill, 2006
- [T2] Elmsari and Navathe, “Fundamentals of Database Systems”, 4th Ed., A. Wesley, 2004

**References Books:**

- [R1] C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, 8<sup>th</sup> Edition, Pearson Education, 2006.
- [R2] J. D. Ullman, “Principles of Database Systems”, 2nd Ed., Galgotia Publications, 1999.



**IRRIGATION ENGINEERING DESIGN LAB****Paper Code: ETCE-451****Paper: Irrigation Engineering Design Lab**

L	T/P	C
0	2	1

**List of Experiments:**

List of design, detailing and drawing of the following problems:

1. Design of Irrigation Canal [lined and unlined]
2. Design of canal outlets
3. Design of Alluvial channels carrying clear and sediment laden water
4. Design the section of hydraulic jump
5. Design of cross drainage structures with typical plan and section
6. Design of profile of ogee spillway
7. Design of Trapezoidal Notch Fall, SARDA fall and Glacis Fall.
8. Design of Cisterns
9. Analysis and Design of gravity dam
10. Analysis and Design of earth embankment dam
11. Problems related to energy dissipaters

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**


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**ECONOMICS OF INFRASTRUCTURE PROJECTS: CASE STUDIES**

Paper Code: ETCE-453

L T/P C

Paper: Economics of Infrastructure Projects: Case Studies

0 2 1

Based on theory course ETCE-401, 10-12 exercises, designs/experiments.

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**

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**DATABASE MANAGEMENT SYSTEMS LAB****Paper Code: ETCE-459(ELECTIVE)****L T/P C****Paper: Database Management Systems Lab****0 2 1****LAB BASED ON DBMS**

Lab includes implementation of DDL, DCL, DML i.e SQL in Oracle.

**List of Experiments:**

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER, UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the queries for implementing the following functions: MAX (), MIN (),AVG (),COUNT ()
6. Write the queries to implement the concept of Integrity constrains
7. Write the queries to create the views
8. Perform the queries for triggers
9. Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints

**TEXT BOOK:**

1. SQL/ PL/SQL, The programming language of Oracle, Ivan Bayross, 4th Edition BPB Publications



**GURU GOBIND SINGH  
INDRAPRASTHA  
UNIVERSITY**

**MINOR PROJECT**

**Paper code: ETCE-455**  
**Paper: Minor Project**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>6</b>	<b>3</b>

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format.

The Project work will be a design project or experimental project or computer oriented project or Research Review Project on any of the topics of civil engineering interest. It will be a group project.

The assessment of the project will be done at the end of the 7th semester by a departmental committee consisting of 2-3 faculty members/experts specialized in various fields of Civil Engineering. The students will present their project work before the committee. The complete project report is to be submitted prior to the practical exams of 7th semester. However, an interim report based on the work carried out will have to be submitted by the students within two weeks of first mid semester exam of 7th semester to the Project Guides based on the Assessment after submission of interim report, but prior to commencement of Theory exams.



**GURU GOBIND SINGH  
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 UNIVERSITY**

**INDUSTRIAL TRAINING RELATED TO CIVIL ENGINEERING**

Paper code: ETCE-457

Paper: Industrial Training related to Civil Engineering

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>1</b>

Minimum 4 weeks Industrial Training related to Environmental Engineering is to be conducted after 6<sup>th</sup> semester. However, weekly presentations and Viva-voce is to be conducted in this semester.



**GURU GOBIND SINGH  
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UNIVERSITY**

**HUMAN VALUES AND PROFESSIONAL ETHICS – II****Paper Code: ETHS-402****Paper : Human Values and Professional Ethics-II**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>1</b>	<b>0</b>	<b>1</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.
3. Two internal sessional test of 10 marks each and one project report\* carrying 5 marks.

**Objectives:**

1. *The main object of this paper is to inculcate the skills of ethical decision making and then to apply these skills to the real and current challenges of the engineering profession.*
2. *To enable student to understand the need and importance of value-education and education for Human Rights.*
3. *To acquaint students to the National and International values for Global development*

**UNIT I - Appraisal of Human Values and Professional Ethics:**

**Review of Universal Human Values:** Truth, Love, Peace, Right conduct, Non violence, Justice and Responsibility. Living in harmony with 'SELF', Family, Society and Nature. Indian pluralism - the way of life of Islam, Buddhism, Christianity, Jainism, Sikhism and Hinduism, Greek - Roman and Chinese cultural values. Sensitization of Impact of Modern Education and Media on Values:

- a) Impact of Science and Technology
- b) Effects of Printed Media and Television on Values
- c) Effects of computer aided media on Values (Internet, e-mail, Chat etc.)
- d) Role of teacher in the preservation of tradition and culture.
- e) Role of family, tradition and community prayers in value development.

**Review of Professional Ethics:** Accountability, Collegiality, Royalty, Responsibility and Ethics Living. Engineer as a role model for civil society, Living in harmony with 'NATURE', Four orders of living, their inter-correctness, Holistic technology (eco-friendly and sustainable technology).

[T1] [T2] [R1] [R5] [R4][No. of Hrs. 03]

**UNIT II – Engineers responsibility for safety:**

Safety and Risks, Risk and Cost, Risk benefit analysis, testing methods for safety. Engineer's Responsibility for Safety Social and Value dimensions of Technology - Technology Pessimism – The Perils of Technological Optimism – The

Promise of Technology – Computer Technology Privacy

**Some Case Studies:** Case Studies, BHOPAL Gas Tragedy, Nuclear Power Plant Disasters, Space Shuttle Challenger, Three Mile Island Accident, etc.

[T1] [T2] [R4] [R2][No. of Hrs. 03]

**UNIT III – Global Issues:**

**Globalization and MNCs:** International Trade, Issues,

**Case Studies:** Kellogg's, Satyam, Infosys Foundation, TATA Group of Companies

**Business Ethics:** Corporate Governance, Finance and Accounting, IPR.

**Corporate Social Responsibility (CSR):** Definition, Concept, ISO, CSR.

**Environmental Ethics:** Sustainable Development, Eco-System, Ozone depletion, Pollution.

**Computer Ethics:** Cyber Crimes, Data Stealing, Hacking, Embezzlement.

[T1] [T2] [R4][No. of Hrs. 05]

**UNIT IV - Engineers Responsibilities and Rights and Ethical Codes:**

Collegiality and loyalty, Conflict of interests, confidentiality, occupational crimes, professional rights, responsibilities. To boost industrial production with excellent quality and efficiency, To enhance national economy, To boost team spirit, Work Culture and feeling of job satisfaction, National integration, Examples of some illustrious professionals.

Need for Ethical Codes, Study of some sample codes such as institution of Electrical and Electronics Engineers, Computer Society of India etc., Ethical Audit.

**Development and implementation of Codes:** Oath to be taken by Engineering graduates and its importance\*\*,

[T1] [T2] [R4][R2][No. of Hrs. 05]



**Text Books:**

- [T1] Professional Ethics, R. Subramanian, Oxford University Press.  
 [T2] Professional Ethics and Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education.

**References Books:**

- [R1] Human Values and Professional Ethics: R. R. Gaur, R. Sangal and G. P. Bagaria, Ecel Books (2010, New Delhi). Also, the Teachers' Manual by the same author  
 [R2] Fundamentals of Ethics, Edmond G. Seebauer and Robert L. Barry, Oxford University Press  
 [R3] Values Education: The paradigm shift, by Sri Satya Sai International Center for Human Values, New Delhi.  
 [R4] Professional Ethics and Human Values – M.Govindrajan, S.Natarajan and V.S. Senthil Kumar, PHI Learning Pvt. Ltd. Delhi  
 [R5] A Textbook on Professional Ethics and Human Values – R.S. Naagarazan – New Age International (P) Limited, Publishers New Delhi.  
 [R6] Human Values and Professional Ethics- S B Gogate- Vikas publishing house PVT LTD New Delhi.  
 [R7] Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw Hill  
 [R8] Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning  
 [R9] PSR Murthy, "Indian Culture Values and Professional Ethics", BS Publications  
 [R10] Caroline Whitback< Ethics in Engineering Practice and Research, Cambridgs University Press  
 [R11] Charles D Fleddermann, "Engineering Ethics", Prentice Hall.  
 [R12] George Reynolds, "Ethics in Information Technology", Cengage Learning  
 [R13] C, Sheshadri; The Source book of Value Education, NCERT  
 [R14] M. Shery; Bhartiya Sanskriti, Agra (Dayalbagh)

\*Any topic related to the experience of the B.Tech student in the assimilation and implementation of human values and professional ethics during the past three years of his/her studies in the institute OR A rigorous ethical analysis of a recent case of violation of professional ethics particularly related to engineering profession.

\*\*All students are required to take OATH in writing prior to submission of major project and the record of the same is to be maintained at the college level and/or, this oath may be administered by the head of the institutions during the graduation ceremonies. The draft for the same is available alongwith the scheme and syllabus.

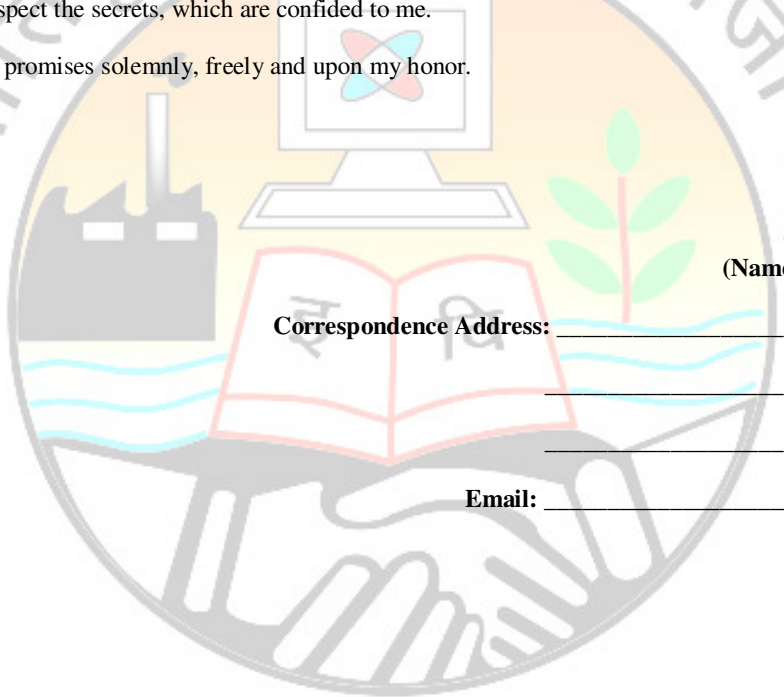
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**OATH TO BE TAKEN BY ENGINEERING GRADUATES**

In a manner similar to the Hippocratic Oath taken by the medical graduates, Oath to be taken by the engineering graduates is as given below.

1. I solemnly pledge myself to consecrate my life to the service of humanity.
2. I will give my teacher the respect and gratitude, which is their due.
3. I will be loyal to the profession of engineering and be just and generous to its members.
4. Whatever project I undertake, it will be for the good of mankind.
5. I will exercise my profession solely for the benefit of humanity and perform no act for criminal purpose and not contrary to the laws of humanity.
6. I will keep away from wrong, corruption and avoid tempting others to vicious practices.
7. I will endeavor to avoid waste and consumption of non-renewable resources.
8. I will speak out against evil and unjust practices whenever and wherever I encounter them.
9. I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my work, even under threat.
10. I will practice my profession with conscience, dignity and uprightness.
11. I will respect the secrets, which are confided to me.

I make these promises solemnly, freely and upon my honor.



(Name of the Student) \_\_\_\_\_

**Correspondence Address:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Email:** \_\_\_\_\_

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**PLANNING AND MANAGEMENT OF CONSTRUCTION PROJECTS**

**Paper Code: ETCE-404**

**Paper: Planning and Management of Construction Projects**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objective:** This course is aimed at providing both basic and advanced exposure to Construction Project Management so as to enable the manager/ consultant of tomorrow to successfully plan and complete sophisticated projects within the constraints of capital, time and other resources. The course also deals with basic concept of network analysis, O and M works, contract Management etc.*

**UNIT-I**

**Master Plan and Building By laws:** Objectives and necessity of Master Plan, Land use features, Building Bylaws, Function of Local Authority. Provision of Building Regulation, Salient features of Land Acquisition, etc

**Project Planning:** Scheduling, Controlling, Methods of Planning and Programming, Schedules for Labour, Materials and Equipment, Graphical Presentation of Earthwork.

**Work Accounts:** Muster roll, measurement book, cash book imprest, temporary advance, classification of stores, stock, receipt and issue of stores, authority of use, and materials at site account, Master Test Register-Site Order Book, Dismantle Register, Inspection Register, Hindrance Register, Building Register surplus and shortage, A Sample Case Study.

[T1,T2][No. of Hours: 12]

**UNIT-II**

**Network and Network Analysis:** CPM, Activity time estimate, earliest event time, Latest allowable occurrence time, Start and finish time of activity, Float, Critical activities and critical path, updating crashing.

Development of PERT network, Network rules, Graphical guidelines for networks, Work breakdown structure, Time estimates and computations using PERT.

[T1,T2][No. of Hours: 12]

**UNIT-III**

**Contract Management:** Scope of work, Detailed Estimate [approved plan], Administrative approval/Estimate Sanction, Notice inviting tenders and its types, Tender, earnest money deposit, security deposit, types of contracts, Essentials of legally valid contract, Contract between Engineer and Employers, Appointment and authority of Engineer for execution of civil construction works, Category of contractors.

**Public Works Administration:** C.P.W.D. Organization set up, system of accounts, classes of works in PWD, Estimates, Delhi Scheduled Rules [CPWD], Cost adjustment indices sub head, sub works, administrative approval, technical sanction, possession of funds, expenditure sanction, Various methods of executing works.

[T1,T2][No. of Hours: 11]

**UNIT-IV**

Project Monitoring using PRIMAVERA or MS Project

**Construction Equipment:** Equipment for excavation and transportation of earth, hauling equipment, hoisting equipment, pile driving equipment, Equipment for pumping water, Dozers and cranes, Scraper, Batching plants, RMC equipment etc.

[T1,T2][No. of Hours: 10]

**Text Books:**

[T1] Managing Construction Projects by Graham M. Winch, John Wiley and Sons, 2010

[T2] Construction project management: planning and scheduling by Henry F. W. Naylor -Delmar Pub, 1995

**References Books:**

[R1] Peurifoy-Construction Planning, equipment and methods, Tata Mc Graw Hill

[R2] Joseph Frein- Handbook of Construction Management and Organization, Springer

[R3] CPWD Manual of Works.

[R4] G. K. Hirashan -Fundamentals of Town Planning , Dhanpat Rai Publication

[R5] Essentials of Construction Project Management by Martin Loosemore UNSW press – 2003

- [R6] Punmia and Khandelwal, "PERT and CPM", Laxmi Publications, New Delhi.  
[R7] Hinze J., "Construction Contracts", Tata McGraw Hill Education (P) Ltd., New Delhi. (for Unit-IV)  
[R8] CPWD, "Delhi Schedule of Rates", New Delhi.



**ANALYSIS AND DESIGN OF BRIDGES**

**Paper code: ETCE-406**

**Paper: Analysis and Design of Bridges**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objective:** To help students in understanding the various concepts of structural analysis and design of concrete and steel bridges.

**UNIT-I**

Selection of bridge site, preliminary data to be collected, preliminary drawings, design discharge, linear water way, economical span, location of piers and abutments, vertical clearance, width of carriageway.

Standard Specifications of Bridges, IRC Bridge codes, clearances, Dead load, live loads, application of LL on deck slabs, impact effect of wind load, longitudinal forces, centrifugal forces, Force due to water currents, buoyancy effect, temperature effects, secondary stresses, erection seismic force, specifications for railway bridges, forces due to earthquake on railway bridges.

[T1,T2][No. of Hours: 12]

**UNIT-II**

Reinforced concrete bridges, box culverts, T-beam bridges, hollow girder bridges, continuous bridges, balanced cantilever bridges, arch bridges, [Illustrative examples of culverts, T-beam bridges, balanced cantilever bridge and arch bridges.

[T1,T2][No. of Hours: 10]

**UNIT-III**

Steel bridges, plate girder bridges, box girder bridges, cable stayed bridges, suspension bridges [Illustrative examples of plate girder, truss bridge and suspension bridges].

Importance of bearings, and joints, bearings for slab bridges, bearing for girder bridges, expansion bearings, modern trend in bearing designs, joints, expansion joints.

[T1,T2][No. of Hours: 11]

**UNIT-IV**

Design of prestressed concrete slab deck, post tensioned prestressed concrete, T-Beam and Slab, Bridge deck-structural components, Load distribution methods and design, Assembly of prestressing steel and grouting of ducts, Expansion joints for bridge decks.

Design of two span continuous prestressed concrete bridge deck, Cellular Box girder bridges.

[T1,T2][No. of Hours: 12]

**Text Books:**

- [T1] Narendra Taly, Design of Modern Highway Bridges, McGraw Hill Companies.  
 [T2] O'Connor C., Design of Bridge Super Structure

**References Books:**

- [R1] D. Johnson Victor, Essentials of Bridge Engineering, Indian Book House Pvt. Ltd.  
 [R2] Edward Arnold, The theory of Suspension Bridges, Selperg A, London  
 [R3] Troystsky M.S., Cable Stayed Bridges, Crosby Lockwood Staples, London.  
 [R4] Libby and Perkins, Modern Pre stressed Concrete Highway Superstructure, CBS.  
 [R5] T. R. Jagadeesh, M.S.Jayaram, Design of Bridge Structures, Prentice Hall of India, New Delhi



**TRANSPORTATION, PLANNING AND MANAGEMENT**

**Paper Code: ETCE-410**

**Paper: Transportation, Planning and Management**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objectives:** This course aims at understanding system approach to traffic planning process based on travel demand and traffic management. Further, exposure to traffic management for accident prevention, smooth highway traffic flow has been dealt. Application of queuing approach to traffic flow, trip generation, trip distribution models have also been used for traffic analysis. The ultimate aim of the course is to develop urgent intelligent transport system based on the experience of ITS in developed world.*

**UNIT-I**

Urban travel characteristics, System approach to Traffic Planning Process, Methods of Measuring Spot Speeds, Radar Speed Meters, Video Camera Method, Moving Observer Method, Presentation of Travel Time and Journey Speed Data, Vehicle Volume Classification and Occupancy Counts by manual methods, combination of manual and mechanical method, Origin-Destination Survey, Parking Surveys, Use of photographic Techniques in Traffic Survey, Analysis and Interpretation of Traffic Study, fitting a Normal Distribution Curve to Observed Speed Data, Accuracy of sampling, Time Mean Speed and Space Mean Speed.

Traffic Forecasting using travel demand function, Traffic and Parking Problems, Parking Space requirement standards, Design standards for on-street and off-street parking facilities. Public transport systems, planning for pedestrians and bicycles.

[T1,T2][No. of Hours: 12]

**UNIT-II**

Number and Location of Traffic Signals, Fixed Time Signals and Vehicle Actuated signals, Optimum Cycle Length, Co-ordinated Control of Signals, Delay at Signalized Intersections

Regulation of Vehicle Speed, Regulation concerning the Driver, Traffic Parking Regulations, Enforcement of Regulation,

Introduction to Travel Demand and Traffic Management, Traffic Management measures and their influence on accident prevention, Road Safety Audit. Theory of Traffic Flow, Basic Diagram of Traffic flow, Speed Flow Curves, Vehicular Stream equations and diagrams, Cases of uniform flow, Highway traffic flow, Shock Waves in traffic. Uninterrupted speed flow relationships, Fleet size, Transit Network fleet size, Minimum station headway or interrupted flow, Freeway capacity and level of service, Freeway congestion quantification.

[T1,T2][No. of Hours: 11]

**UNIT-III**

Application of Queuing approach to traffic flow, Probabilistic aspects of Traffic flow, Poisson's Distribution of Vehicle Arrivals, Gap and Headway Distribution, Analysis of Traffic delay at uncontrolled intersections using Adam's formula, Trip generation models: Zonal models, Category analysis. Trip distribution models: Growth factor models, Gravity models. Mode split analysis: Mode choice behavior, Mode split curves, Probabilistic models.

[T1,T2][No. of Hours: 10]

**UNIT-IV**

Urban Intelligent Transport System, Urban Transportation issues. Transportation Demand Analysis, Sequential Demand Analysis, Development of comprehensive mobility plan, Standards of Intelligent Transportation System [ITS], Experience of ITS in Europe/Japan/North America, Sensors in ITS, ITS applications such as Detector, Traffic Signal systems, Freeway Management, Electronic Road Pricing and Automatic vehicle classification, ITS for traffic law enforcement, Application of GIS in ITS. Simultaneous or direct demand formulation, Model of demand elasticities, Direct and Cross elasticities Comprehensive examples of traffic impact study.

[T1,T2][No. of Hours: 12]

**Text Books:**

[T1] Dr. L.R.Kadiyali -Traffic Engineering and Transport Planning, Khanna Publication

[T2] C.S.Papacostas and P.O.Prevedouros - Transportation Engineering and Planning, PHI, New Delhi

**References Books:**

- [R1] Urban Transport: Planning and Management by Ashok Kumar Jain – 2009, APH pub Corporation, ND.  
 [R2] Partha Chakroborty Animesh Das-Principles of Transportation Engineering, PHI, New Delhi.  
 [R3] Dicky J.W., Metropolitan Transportation Planning, Tata McGraw Hill  
 [R4] Hutchinson B.G., Principles of Urban Transportation System Planning, McGraw Hill  
 [R5] Public Transport: Its Planning, Management and Operation by Peter R. White – 2003, Spon press.



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**GROUND WATER ASSESSMENT, DEVELOPMENT AND MANAGEMENT**

**Paper Code: ETCE-412**

**Paper: Ground Water Assessment, Development and Management**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objective:** The course will help students:

1. To apply appropriate methods to groundwater resource evaluation;
2. Use different methods to estimate groundwater recharge;
3. Combine these skills for groundwater resource assessment, Development and Management

**UNIT-I**

Types of Water-Bearing Formations, Influence of Physiography and Climate on Ground Water availability, Ground Water Investigations, Surface Investigations, Hydrological Investigations, Test Drilling, Geophysical Methods, Resistivity Method, Electric Logging, Gamma-Ray Logging, electrical Resistivity Surveying, Seismic Refraction Surveying, Ground Water Resource Assessment, methods of Artificial Recharge of Ground Water, Ground Water Pollution, Ground Water Quality, Conjunctive Use of Ground Water with Canal Water. Aquifer Characteristics Influencing Yield of Wells, Static Water Level, Transmissibility, Coefficient of Storage, Specific Yield, Hydraulic Resistance, Leakage Factor, Steady State Radial Flow, Theoretical Aspects of Steady State Flow to Cavity Wells.

[T1,T2][No. of Hours: 11]

**UNIT-II**

Unsteady State Flow to Wells in Unconfined and Confined Aquifers, Procedure for Determining Hydraulic Properties of Confined Aquifers, Cooper-Jacob Method of Solution, Recovery Test, Unsteady State Flow to Cavity Wells, Procedure for Determining Hydraulic Properties of confined Aquifers using Cavity Wells. Pumping Tests, Step Drawdown Test, Significance of Well Loss Coefficient, Pumping Test Procedures, Observation Wells, Well Interference, Interference of Wells in Confined Aquifers. Design of Open Wells, Depth of Well, Thickness of Well Lining, Nomograph for Design of Well Steining, Design of RCC Lining, Weep Holes in Well Lining, Well Curbs, Design of Well Curb, Increasing the Yield of Open Wells, Horizontal Boring in Open Wells, Installation of Radial Filters in Wells in Alluvial Formations, Radial Boring in Open Wells. Pollution Travel in Soil and Aquifers, Location and Design of Wells with Sanitary Protection, Well Location, Well Construction, Disinfection of Wells.

[T1,T2][No. of Hours: 12]

**UNIT-III**

Multiple-Well System, Radial Wells and Infiltration Galleries, Design of Tube Wells, Design of Housing Pipe and Well Casing, Bore Size and Well Depth, Selection of Strata to be Screened, Design of Well Screen, Design of Gravel Pack, Sanitary Protection of Tube Wells, Common Causes of Contamination and Their Remedies, Design of Skimming Wells. Ground Water Exploration, Geologic and hydrologic methods, Surface geophysical methods, Hydro-geologic well logging, Geophysical well logging, Tracer techniques.

[T1,T2][No. of Hours: 10]

**UNIT-IV**

Ground Water Modelling using finite difference, use of appropriate software like Modflow etc, Case Study. Pumping of Water, Design of Centrifugal pumps, Design of Impeller, Shaft Impeller inlet and vane angles, Diameter of the Eye of Impeller, Impeller outlet and vane angle, Design of Impeller vanes, Design of Volute, Design of vanes, effect of Suction lift on discharge and efficiency, Centrifugal pump installation in open wells/tube wells, operation and maintenance. Vertical Turbine pumps and their installation, operation and maintenance, submersible pump and their installation, operation and maintenance, propeller pumps and their operating characteristics and installation, Jet pumps, Performance characteristics and installation.

[T1,T2][No. of Hours: 12]

**Text Books:**

- [T1] Karanth K.R., “Ground Water Assessment Development and Management”, Tata McGraw Hill Education (P) Ltd., New Delhi.
- [T2] Sondhi M.K., “Water Wells and Pumps”, Tata McGraw Hill Education (P) Ltd., New Delhi.

**Reference Books:**

- [R1] Garg S.K., “Environmental Engineering (Vol. 1), Water Supply Engineering”, Khanna Publishers.,New Delhi.
- [R2] Ramanathan A.L., Bhattacharya P., Keshari A.K., Bundschuh J., Chandrasekharam D., Singh S.K., “Assessment of Groundwater Resources and Management”, I.K. International (P) Ltd., New Delhi.
- [R3] Hiscock K.M., Rivett M.O., Davison R.M., “Sustainable Groundwater Development”, Geological Society Special Publication No. 193, London.



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**ADVANCE GEOTECHNICAL ENGINEERING****Paper Code: ETCE-416****Paper: Advance Geotechnical Engineering**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objective:** To introduce the fundamentals of soil dynamics and design of machine foundations as well as introduce the advanced topics of geotechnical engineering, such as, foundation of expansive soils and concepts and applications of geoenvironmental engineering.

**UNIT-I**

**Soil Dynamics:** One Dimensional wave propagation, One Dimensional Wave in layered body, impedance ratio, angle of refraction, critical angle of incidence, introduction of attenuation of stress waves, Definitions of Material Damping and Radiation Damping in soil. Measurements of Wave Propagation Velocity, Shear Modulus, Thickness of soil layers etc; Field Tests like Low Strain Test, Seismic Reflection Test, Seismic Refraction Test for Horizontal Layering and inclined or irregular layering, Suspension Logging Test, Steady States Vibration [Raleigh wave] Test, Seismic Cross Hole Test, Seismic Down Hole Test, Seismic Cone Test, Details and interpretation of Standard Penetration Test and Cone Penetration Tests. Laboratory Tests: Cyclic Triaxial Shear Test, Introduction of Centrifuge and Shaking Table Test.

**[T1,T2] [No. of Hours: 12]****UNIT-II**

**Machine Foundation:** Types of Machine Foundations, General Requirements, Design Data, Dynamic Loads induced in simple Crank Mechanism, Permissible Amplitudes and Bearing Pressure, General Theory of Transmissibility of force for Vibrating machines in brief  
**Analysis and Design of Block Type Machine Foundations:** Brief review of Empirical Methods based on considering Soil as a Semi infinite Elastic Solid and Soil as a spring, Barkans Method of Analysis for Block Foundations including Vertical sliding, rocking and yawing of vibrations. Introduction of codes related with Machine Foundations.

**[T1,T2][No. of Hours: 12]****UNIT-III**

**Foundation on Expansive Soils:** Identification of expansive soils by field inspection and Laboratory Tests, general mechanism and characterization of swelling, Types of Damages in Building on expansive clay. Design of foundation on expansive soils like under-reamed piles, Computation of collapse settlement, Retaining walls in expansive soils, Treatment of cracked buildings.

**[T1,T2][No. of Hours: 10]****UNIT-IV**

**Environmental Geo-technology:** Contamination due to landfills, subsurface contamination due to leachate and its effects. One dimensional analysis of contaminant transport, contaminated sites, Containment of solid waste in landfills, Vertical barrier for containment, Geo-technical reuse of construction and industrial waste materials  
 Case study of Ash disposal from Thermal power plant, Ash pond and its design with/without geo-textiles, Environmental impact and control.

**[T1,T2][No. of Hours: 10]****Text Books:**

- [T1] Fundamentals of Soil Dynamics by B.M. Das, Elsevier Publication  
 [T2] Foundation engineering, Varghese, PHI Learning Pvt. Ltd.

**References Books:**

- [R1] Foundation for Machine: Analysis and Design by S. Prakash and V. K. Puri, John Wiley  
 [R2] Geotechnical Earthquake Engineering by Kramer, Pearson publications.  
 [R3] Gulati-Datta - Geo-Technical Engineering, Tata McGraw Hill Publishers  
 [R4] Waste containment systems, waste stabilization and landfills: design and evaluation, Hari D Sharma, and Sangeeta P.Lewis, John Willey and Sons.



- [R5] V.N.S. Murthy -Advanced Foundation Engineering, CBS Publishers and Distributors.  
[R6] Foundation analysis and Design, Bowles, McGraw Hill Education(I) Pvt. Ltd.



**FEM IN STRUCTURAL ENGINEERING**

**Paper Code: ETCE-418**

**Paper: FEM in Structural Engineering**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objective:** To introduce the concept of the FEM for obtaining solution of ordinary and partial differential equation. The course deals with numerical discretisation as a finite element approach and deals with various methods/problems such as Continuum problems, weighted residual methods, higher order finite element approximation, variational methods, partial discretisation and time-dependent problems and generalized finite elements and error estimates.*

**UNIT-I**

**Boundary Value Problems and the Need for Numerical Discretisation:** Introduction, examples of Continuum problems, history of finite element method.

**Weighted residual methods:** Approximation by trial functions, weighted residual forms, piecewise trial functions, weak formulation, Galerkin method, examples of One-, two- and three -dimensional problems.

[T1,T2][No. of Hours: 11]

**UNIT-II**

**Higher order finite element approximation:** Degree of polynomial in trial functions and rate of convergence, the patch test, shape functions for C0 and C1 continuity, one-, two- and three-dimensional shape functions.

**Isoperimetric formulation:** The concept of mapping, isoperimetric formulation, numerical integration, mapping and its use in mesh generation.

[T1,T2][No. of Hours: 10]

**UNIT-III**

**Variational Methods:** Variational principles, establishment of natural Variational principles, approximate solution of differential equations by Rayleigh-Ritz method, the use of Lagrange multipliers, general Variational principles, penalty functions, least-square method.

**Partial discretisation and time-dependent problems:** Partial discretisation applied to boundary value problems, time-dependent problems via partial discretisation, analytical solution procedures, finite element solution procedures in time domain.

[T1,T2][No. of Hours: 12]

**UNIT-IV**

**Generalized finite elements and error estimates:** The generalized finite element method, the discretisation error in a numerical solution, measure of discretisation error, estimate of discretisation error

**Coordinate Transformation:** Transformation of vectors and tensors, transformation of stiffness matrices, degree of freedom within elements, condensation, condensation and recovery algorithm, sub structuring, structural symmetry.

[T1,T2][No. of Hours: 12]

**Text Books:**

- [T1] Zienkiewicz, O.C., and Morgan, K., Finite Element Approximation, John Wiley and Sons.  
 [T2] Reddy, J.N., An Introduction to the Finite Element Method, McGraw Hill.

**References:**

- [R1] Huebner, K.H., Thornton, E.A., and Byrom, T.G., The Finite Element Method for Engineers, John Wiley  
 [R2] Hutton, D.V., Fundamentals of Finite Element Analysis, McGraw Hill.  
 [R3] Kikuchi, N., Finite Element Methods in Mechanics, Cambridge University Press.  
 [R4] Cook, R.D., Malkus, D.S., Plesha, M.E., and Witt, R.J., Concepts and Applications of Finite Element Analysis, John Wiley and Sons.  
 [R5] Zienkiewicz, O.C., and Taylor, R.L., The Finite Element Method, Vol. I and II, McGraw Hill.

**GROUND WATER CONTAMINATION AND MITIGATION MEASURES**

**Paper Code: ETEN-418**

**Paper: Ground Water Contamination and Mitigation Measures**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objective:** The students will be able to:

1. Describe the human activities that may modify groundwater chemistry;
2. Discuss pollutant classification and the nature of diffuse and point-source pollution, giving examples;
3. Describe the origin and properties of the major organic and inorganic pollutants;
4. Apply the principles of modelling solute transport;
5. Outline the various approaches to remediation of polluted groundwater.

**UNIT-I**

**Ground Water Movement and Contamination:** Introduction, Characteristics of Ground Water, Sources and Types of Ground Water Contamination, Principles of Ground Water Movement, General Flow Equations, Unsaturated Flow and Water Table, Ground Water Flow and Well Mechanics, Sustainable Yield, Mass Balance Equations, Specific Storativity, Initial and Boundary Conditions, Boundary Surface, Particular Boundary Conditions, Complete 3-D Mathematical Flow Model, Modeling 2-D Flow in Aquifers, Complete Aquifer Flow Models, Groundwater Maps and Streamlines, Modeling Flow in the Unsaturated Zone.

[T1,T2] [No. of Hours: 12]

**UNIT-II**

**Contaminant transport mechanism:** Underground storage tanks, Landfills, Septic Systems, Agricultural Wastes, Return Flow from Irrigation and Sewage, Strategy for Hydrologic Site Investigations, Geologic Data Acquisition, Hydrologic Data Acquisition, Acquisition of Soil and Groundwater Quality Data, Data Evaluation Procedures, Contaminant Transport Mechanism such as Advection, Diffusion and Dispersion, Sorption and Desorption, Biodegradation, Mass Transport Equations, One Dimensional Models, Governing Flow and Transport equations, Analytical Methods, Multi-Dimensional Methods.

[T1,T2][No. of Hours: 11]

**UNIT-III**

**Numerical Modeling of Contaminant Transport:** Introduction to Modeling Inorganic and Organic Solute Transport, Numerical Methods, Finite Difference Methods, Numeric Flow Methods, Contaminant Transport Models, Applying Numerical Models to Field Sites, Fate and Transport of organic Substances in Groundwater, Case Studies of Organic and inorganic Groundwater Pollution.

**Non-aqueous Phase Liquids (NAPLs):** Types of NAPL, Transport, Computational methods, Characterizing NAPLs at Remediation Sites.

[T1,T2] [No. of Hours: 11]

**UNIT-IV**

**Natural Attenuation and Risk Based Corrective Action:** General Principles behind Natural Attenuation, Natural Attenuation Protocols and Guidance, Risk Based Corrective Action.

**Ground Water Remediation Alternatives:** Introduction to Remediation methods, Remedial Alternatives, Contaminant Methods for Source Control, Hydraulic Controls and Pump and Treat Systems. Bioremediation, Remediating NAPL Sites. Emerging Remediation Technologies, Case Studies of Remediation.

[T1,T2][No. of Hours: 11]

**Text Books:**

- [T1] Bedient P.B., Rifai H.S., Newell C.J., "Groundwater Contamination- Transport and Remediation", Prentice Hall, New York.
- [T2] Bear J. and Cheng A.H.D., "Modeling Groundwater Flow and Contaminant Transport (Theory and Applications of Transport in Porous Media)", Springer, New York.

**Reference Books:**

- [R1] Cheremisinoff N.P., "Groundwater Remediation and Treatment Technologies", Noyes Publications, New Jersey.
- [R2] Charbeneau R.J., Bedient P.B., Loehr R.C., "Groundwater Remediation", Technomic Publishing Company, Pennsylvania.

- [R3] American Society of Civil Engineers, “Groundwater Contamination by Organic Pollutants- Analysis and Remediation”, Library of Congress Catalogue Card No.: 00-063966, USA.
- [R4] [http://www.interpore.org/reference\\_material/mgfc-course/](http://www.interpore.org/reference_material/mgfc-course/) [Computer mediated Distance learning course on ‘Modeling Groundwater flow and Contaminant transport’ by Jacob Bear].  
Chien C.C., Medina M.A., Pinder G.F., Rieble D.D., Sleep B.B., Zheng C., “Contaminated Groundwater and Sediment-Modeling for Management and Remediation”, Lewis Publishers, Florida





**ENVIRONMENT ENGINEERING**

**Paper Code: ETCE-422**  
**Paper: Environment Engineering**

<b>L</b>	<b>T</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objectives:** The subject deals with primary and secondary air pollutants, monitoring and standards of various pollutants in ambient air, indoor air pollution and noise measurement, occupational noise, handling and management of municipal hazardous and bio-medical waste.

**UNIT – I**

Concept of unpolluted air, Gaseous and vapour pollutants in atmosphere, Scales of air pollution, Primary and secondary pollutants, Ambient Air Quality [AAQ], Monitoring for pollutants [SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, Particulates and their health effects. Stack monitoring for SO<sub>x</sub>, NO<sub>x</sub> and CO. Effects of air pollution on materials, structures and Human health. Air quality criteria, National air emission standards and AAQ guidelines, Indoor Air pollution. Control and management of indoor and outdoor Air pollution. Green house gases Green house effect, Global warming.

**[T1,T2][No. of Hours: 12]****UNIT – II**

**Characteristics and Sources of noise, Legal aspects:** Standards of noise, Legislation in India Types of noise: Neighborhood noise, Traffic noise, Occupational noise, Community noise, Health effects of noise, Physiological hazard and Psychological hazard. Occupational noise-exposure, Noise measuring equipments such as Sound Level Meter. Control of Noise pollution in industrial, residential and silent zone.

Sources, Composition and Properties of Municipal solid waste, Handling and Separation of solid waste, Introduction to Municipal Waste [Management and Handling Rules, 2000], Disposal of Municipal Solid Wastes.

**[T1,T2][No. of Hours: 11]****UNIT – III**

**Solid Waste Collection and Transportation:** Types of collection systems [Hauled- container system and Stationary container system], Collection routes and their Layout, Solid waste Transfer Stations. Landfills: Classification, Types and methods, site selection, site preparation. Composition, Characteristics.

**[T1,T2][No. of Hours: 11]****UNIT – IV**

Generation and Control of Landfill gases, Composition, formation, movement and control of leachate in landfills, landfill design.

**Composting:** Theory of composting, manual and mechanized composting, Characterization, Storage and Segregation of hazardous and biomedical waste  
 Techniques of hazardous and biomedical waste management.

**[T1,T2][No. of Hours: 11]****Text Books:**

- [T1] M.N. Rao and H.V.N. Rao- Air Pollution, Tata McGraw- Hill  
 [T2] Mackenzie L. Davis, David A. Cornwell, "Introduction to environmental engineering, McGraw-Hill- International Edition.

**References Books:**

- [R1] George Tchobanoglous, Hilary Theisen, Samuel A Viquel-Integrated Solid Waste Management: Engineering, Principles and Management issues", McGraw-Hill- International Editions  
 [R2] Michael D. LaGrea, Phillip L. Buckingham, Jeffrey C. Evans-Hazardous Waste Management and Environmental Resource Management, McGraw-Hill- International Edition  
 [R3] Howard S. Peavy, Donald R. Rowe, George Tchobanoglous-Environmental Engineering, McGraw-Hill- International Editions.  
 [R4] Lawrence K. Wang, Norman C. Pereira-Advanced Air and noise pollution control, Humana Press  
 [R5] Kenneth Wark, Cecil F. Warner-Air pollution its origin and control, PHI



**OFFSHORE STRUCTURAL ENGINEERING****Paper Code: ETCE-424****Paper: Offshore Structural Engineering**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: To obtain expertise and specialize in Offshore Structures and subsea Engineering.*

**UNIT I**

**Concrete/composites:** Underwater concrete, mix design, quick setting compounds, high strength grout, fiber reinforced plastics, special composite materials for under water repairs.

**Structural Steel:** Corrosion Mechanism; Types of corrosion; Seawater corrosion; corrosion allowance, cathodic protection design, impressed current method, sacrificial anodes design, protective coatings, splash zone protection, cathodic protection monitoring system.

**Underwater repair:** Underwater welding, repair schemes for tubular members, grouted sleeve connections, and stressed – grouted connections for tubular joints.

**[T1,T2][No of Hours: 12]****UNIT II**

**Static Structural Analysis:** Estimation of wave and current loading on framed structures; maximum base shear and overturning methods; Cyclic loads for fatigue analysis.

**Dynamic Structural analysis:** Dynamic analysis of framed structures; Mode shapes and Eigen frequency analysis; Wave response; dynamic wave response; frequency and time domain analysis of risers and pipelines.

**[T1,T2][No of Hours: 12]****UNIT III**

**Loads on offshore structures:** Wind Loads; Wave and Current Loads; Calculation based on Maximum base Shear and Overturning Moments; Design Wave heights and Spectral Definition; Hydrodynamic Coefficients and Marine Growth; Fatigue Load Definition and Joint Probability distribution; Seismic Loads.

**[T1,T2][No of Hours: 11]****UNIT IV**

**Foundation for Offshore Structures:** Mud-mats: bearing capacity, sliding stability, over-turning stability, short term and long term settlements, factor of safety; Bucket foundation; Suction anchors; Gravity foundation.

**[T1,T2][No of Hours: 10]****Text Books:**

- [T1] Mohamed Abdallah El-Reedy. Offshore Structures: Design, Construction and Maintenance, Elsevier  
 [T2] Hydrodynamics of Offshore Structures by S.K. Chakrabarti, Springer-Verlag

**References:**

- [R1] Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.  
 [R2] Structural Stability - Theory and Implementation by W.F.Chen and E.M.Lui by Elsevier  
 [R3] Construction of Marine and Offshore Structures by Ben C. Gerwick, CRC Press, 1999.  
 [R4] Dynamics of Offshore Structures by James F. Wilson – 2003, John Wiley and Sons  
 [R5] Construction of Marine and Offshore Structures by Ben C. Gerwick, Jr – 2007, CRC Press.

**ESTIMATION OF PROJECTS USING APPLICABLE SOFTWARE**

**Paper Code: ETCE-452**

**L T/P C**

**Paper: Estimation of Projects using Applicable Software**

**0 2 1**

**List of Experiments:**

1. Detailed Estimate [Duration and Cost] for a two storey building.
2. Detailed estimate for following projects:
  - [i] a culvert.
  - [ii] stretch of road about 1 Km long including earthwork.
  - [iii] Elevated water tanks.
  - [iv] Manholes, Septic tanks.
  - [v] Water supply Scheme and
  - [vi] Drainage Scheme.
3. Estimate of Electrification Work for a Material Testing Laboratory.
4. Time Estimate by Network Analysis.
5. Estimation of Air Conditioning requirements for a Library.
6. Valuation reports for:
  - [i] A hotel
  - [ii] A Theatre
  - [iii] An Educational Building

**Books/References:**

1. B.N.Dutta-Estimating and Costing in Civil Engineering, UPSPD
2. Delhi Schedule Rates, C.P.W.D.


  
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UNIVERSITY**

**LAB BASED ON ELECTIVE I OR II**

Paper Code: ETCE-454

L	T/P	C
0	2	1

Paper: Lab based on Elective I or II

Based on theory course 8-10 exercises, designs/experiments.

NOTE:- At least 8 Experiments from the syllabus must be done in the semester.



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**MAJOR PROJECTS**

**Paper Code: ETCE-460**  
**Paper: Major Projects**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>12</b>	<b>8</b>

Students may choose a project based on any subject of Civil Engineering. The students will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format.

The project work will be a design project for possible implementation of project including field surveying a computer oriented project on any of the topics of civil engineering interest. It will be a group project. The topic of the project will be different from the minor project.

The assessment of the project will be done at the end of the semester by a departmental committee consisting of 3-4 faculty members/experts specialized in various fields of Civil Engineering. The students will present their project work before the committee. The complete project report is to be submitted prior to the practical exams of 8th semester. However, an interim report based on the work carried out will have to be submitted by the students within two weeks of first mid semester exam of 8th Semester to the Project Guides based on the Assessment after submission of interim report, but prior to commencement of Theory/Practical exams.

\*\*\*\*\*END\*\*\*\*\*



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