

SCHEME OF EXAMINATION

and

SYLLABI

for

Bachelor of Technology Environmental Engineering

Offered by

University School of Engineering and Technology

1st SEMESTER TO 8th SEMESTER



GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY

**Guru Gobind Singh Indraprastha University
Dwarka, Delhi – 110078 [INDIA]**

www.ipu.ac.in

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

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
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
PRACTICAL/VIVA VOCE						
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*#	-----	-----	-----	--
TOTAL			16	18	27	

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.

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

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
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	--
PRACTICAL/VIVA VOCE						
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*#	-----	-----	-----	--
TOTAL			17	15	27	

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.

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

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETMA-203		Numerical Analysis and Statistical Techniques	3	1	4	M
ETCE-203		Strength of Material	3	1	4	
ETCE-205		Fluid Mechanics	3	1	4	M
ETCE-207		Building Materials and Construction	3	0	3	
ETEN-209		Surveying	3	1	4	
ETEN-211		Environmental Chemistry and Microbiology	3	0	3	M
PRACTICAL/VIVA VOCE						
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	
ETEN-257		Surveying Lab	0	2	1	
ETEN-259		Water and Waste water Analysis Lab	0	2	1	
		NCC/NSS*#	-	-	-	
TOTAL			18	14	27	

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

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETEN-202		Physico-Chemical Treatment Processes	3	1	4	M
ETEN-204		Structural Engineering	3	1	4	
ETEN-206		Environmental Hydraulics	3	1	4	M
ETEN-208		Introduction to Environmental Legislations	2	0	2	M
ETEN-210		Geotechnical Engineering	3	1	4	
ETEN-212		Air and Noise Pollution	3	1	4	M
PRACTICAL/VIVA VOCE						
ETEN-252		Water Engineering Design and Drawing Lab	0	2	1	
ETEN-254		Structure Lab	0	2	1	
ETEN- 256		Environmental Hydraulics Lab	0	2	1	
ETEN-258		Air and Noise Pollution Monitoring and Design Lab	0	2	1	
ETEN-260		Seminar#	0	2	1	
ETSS-250		NCC/NSS*#	-	-	1	
TOTAL			17	15	28	

M: Mandatory for award of degree

Note: Minimum of 2 week of Environmental Monitoring Training/ Software Training related to Environmental Engineering will be held after 4th Semester, however, weekly presentations and Viva Voce will be conducted in 5th Semester (**ETEN-359**).

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

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

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETHS 301		Communication Skills for Professionals	2	0	1	
ETEN-303		Biochemical Processes in Wastewater Treatment	3	1	4	M
ETEN-305		Design of Structures	3	0	3	
ETEN-307		Hydrology and Drainage Engineering	3	1	4	M
ETEN-309		Environmental Instrumentation	3	1	4	M
ETEN-311		Water Supply and Sewage System	3	1	4	M
PRACTICAL/VIVA VOCE						
ETHS 351		Communication Skills for Professionals Lab	0	2	1	
ETEN-353		Structure Design Lab	0	2	1	
ETEN-355		Material Testing Lab	0	3	2	
ETEN-357		Seminar on Environmental Engg projects/ Visits/ Case Studies [#]	0	2	1	
ETEN-359		Environmental Modelling / Software Training ^{^#}	0	2	1	
TOTAL			17	15	26	

M: Mandatory for award of degree

[^] Minimum of 2 week of Environmental Monitoring Training/ Software Training related to Environmental Engineering was held after 4th Semester, however, weekly presentations and Viva Voce will be conducted in this semester (**ETEN-359**).

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

[#] NUES (Non University Examination System)

**BACHELOR OF TECHNOLOGY
(ENVIRONMENTAL ENGINEERING)
SIXTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETEN-304		Principles of Solid Waste Management	3	0	3	M
ETEN-306		Industrial Waste Management	3	0	3	M
ETEN-308		Economics for Engineers	3	1	4	
ETEN-310		Advance Design of Structures	3	0	3	M
ETEN- 312		Transportation Engineering	3	1	4	
GENERAL ELECTIVE –1(Choose any one)						
ETEN-302		Environment System Optimization	3	1	4	
ETCE-302		Operation Research and Management	3	1	4	
ETIT-302		Decision Science	3	1	4	
PRACTICAL/VIVA VOCE						
ETEN-352		Solid Waste Management Lab	0	2	1	
ETEN-354		Effluent Treatment System Design and Drawing Lab	0	2	1	
ETEN-356		Advance Design of Structures Lab	0	2	1	
ETEN-358		Economic Development and Environmental Concerns	0	2	1	
ETEN-360		Environmental Monitoring and Surveying Camp: Case Studies [^]	0	0	1	
ETEN-362		Seminar (topic should be linked to industrial training/Surveying Camp/ Soft skills learnt) [#]	0	2	1	
TOTAL			18	13	27	

M: Mandatory for award of degree

Note: Minimum of 4 weeks of industrial training related to Environmental Engineering will be held after 6th semester; however, viva-voce will be conducted in 7th Semester (**ETEN 459**).

[^]Minimum of 2 Week Environmental Modelling/ Surveying Camp (**ETEN 360**) was held after 5th semester; however, Viva Voce is to be conducted in this Semester.

**BACHELOR OF TECHNOLOGY
(ENVIRONMENTAL ENGINEERING)
SEVENTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETEN-401		Biomedical , Hazardous and E-waste management	3	1	4
ETEN-403		EIA and EMS	3	0	3
ETEN-405		Applications of Remote Sensing and GIS	3	0	3
CORE ELECTIVE – 1(CHOOSE ANY ONE)					
ETCE-411		Water Resource System Planning	3	1	4
ETEN-413		Sustainable Energy Systems	3	1	4
ETEN-415		Advance Separation Process	3	1	4
GENERAL ELECTIVE – 2(CHOOSE ANY ONE)					
ETCE-419		Data Analytics	3	1	4
ETEC-421		Data Communication and Networks	3	0	3
ETCS-425		Database Management Systems	3	0	3
ETEN-421		Planning and Design of Green Buildings	3	1	4
ETHS-419		Sociology and Elements of Indian History for Engineers	3	0	3
PRACTICAL/VIVA VOCE					
ETEN-451		Applications of Remote sensing Lab	0	2	1
ETEN-453		EIA and EMS Lab	0	2	1
ETEN-455		Lab Based on Core or General Elective	0	2	1
ETEN-457		Minor Project *	0	6	3
ETEN-459		Industrial Training^	0	2	1
TOTAL			15	17	25

^ Minimum of 4 weeks Industrial Training related to Environmental Engineering was conducted at the end of 6th Semester; however weekly Presentations and Viva-voce is to be conducted in this Semester.

* The students are required to submit synopsis at the beginning of the semester for approval from the departmental committee. The student will have to present the progress of the work through seminars, progress reports and final project report.

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

Code No.	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETHS-402		Human Values and Professional Ethics-II	1	0	1
ETEN-404		Planning and Management of Environmental Projects	3	1	4
ETEN-406		Environmental Modelling	3	0	3
CORE ELECTIVE – 2(CHOOSE ANY ONE)					
ETCE-410		Transportation Planning and Management	3	1	4
ETCE-412		Ground Water Assessment Development and Management	3	1	4
ETEN-414		Environmental Preventive Health Issues	3	1	4
CORE ELECTIVE – 3(CHOOSE ANY ONE)					
ETEN-416		Climate change assessment and mitigation measures	3	1	4
ETEN-418		Ground Water Contamination, and Remediation	3	1	4
ETEN-420		Bio and Chemical Technology Applications in Waste Management	3	1	4
PRACTICAL/VIVA VOCE					
ETEN-452		Estimation of Environmental Projects	0	2	1
ETEN-454		Environment Modelling Applications	0	2	1
ETEN-456		Lab Based on Core Electives	0	2	1
ETEN-460		Major Project*	0	12	8
TOTAL			13	21	27

* 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.
Imp:- Elective Paper will be floated if one-third of the total students opt for the same. It is advice that the decision about the elective subject is done before 15th 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. (ENV.) Programme = 214.
2. Each student shall be required to appear for examinations in all courses. However, for the award of 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. (ENV) Programme = 160.
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

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. 12]**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", 3rd 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 π 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

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 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: ETEN-209

Paper: Surveying

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 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, 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, Distribution of closing error.

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 problems. Errors in plane table survey .

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

UNIT – II

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. Longitudinal leveling. Cross section leveling, Fly leveling and reciprocal leveling. Errors in leveling. Curvature and refraction correction. Advanced leveling instruments.

Contouring: Definition of contours, Contour interval, Characteristics of contours. Direct and indirect methods of contouring, Estimation of volumes of the earthwork by means of contour lines and section. Plane table contouring using clinometer, Topographic maps.

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.

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

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.

Curves: Types of curves, Elements of a curve, Simple curves, Different methods of setting out. Introduction to compound, reverse, Transition and vertical curves.

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

UNIT – IV

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 .

Introduction to modern surveying instruments like Total station, GPS and DGPS.

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

Text Books:

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

Reference Books:

- [R1] Clark D., "Plane and Geodetic surveying for Engineers", Volume I and II, CBS Publishers and Distributors
 [R2] Bhavikatti S.S., "Surveying and Levelling", Volume I and II, I.K. International Publishing House (P) Ltd.,
 [R3] Thomas W.N., "Surveying", E. Arnold, University of California.
 [R4] Arora K.R., "Surveying", Volume I and II, Standard Book House," New Delhi

ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY**Paper Code: ETEN-211****L T/P C****Paper: Environmental Chemistry and Microbiology****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: To provide detail understating of various aspects of chemistry, in specialized areas of environment management and practices. Also develop understanding of role of microorganisms and their activities of environmental and geochemical significance. Further, also develop conceptual understanding of metabolic processes catalysed by microorganisms related to major elemental cycles, biogeochemical processes and organic contaminant degradation.

UNIT – I

Fundamentals of chemical kinetics, Acid-base chemistry of natural waters, Acid deposition, Trace metals in water. Fundamentals of free radical chemistry, Smog and aerosols. Stratospheric ozone depletion, Health aspects of ozone depletion, BOD and COD tests

[T1,T2][No. of Hours 12]**UNIT – II**

Grab and Composite Sampling for natural water bodies and industrial Effluents, Monitoring techniques and toxic effects of organic compounds such as Phenols, Pesticides, Surfactants, Tannin, Lignin and Hydrocarbons. Environmental toxicity and analysis: Principles of toxicity and standards, Analysis of Chromium,, Cobalt, Manganese, Nickel, Copper, Mercury, Arsenic and Organo-metallic compounds. Chemical speciation of (Cu, Pb, As, Hg, Cr).

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

Microorganisms in water and wastewater engineering: Characteristics of water and sewage, Microbial examination of water and wastewater, Taste and odours, coliform, bacteria tests, Heterotrophic Plate Count (HPC). Bacterial growth, Kinetics of bacterial growth, Acclimatization of waste and microbial inhibition. Biologically degradable Plastics and surface active substances. Microorganism in air pollution control (Bio filters and bio scrubbers).

[T1,T2][No. of Hours 10]**UNIT – IV**

Bioremediation and Biore Restoration: Use of microbes for improving soil fertility, Restoration of soils contaminated with heavy metals/pesticides and other toxic organic chemicals. Biochemistry and Microbiology of Landfills and Composting, Recycling and processing of organic residues, Xenobiotics.

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

- [T1] Sawyer C.N., McCarty P.L. and Parkin G.F., "Chemistry for Environmental Engineering and Science", Tata McGraw Hill Publishing Company Ltd., New Delhi.
- [T2] Goel P.K., "Water Pollution, Causes , Effects and control", New Age International (P) Ltd., New Delhi.

Reference Books

- [R1] De A.K., "Environmental Chemistry ", New Age International (P) Ltd., New Delhi.
- [R2] Khopkar S.M., "Environmental Pollution Analysis", New Age International (P) Ltd., New Delhi.
- [R3] Bhatia S.C., "Environmental Chemistry", CBS Publishers and Distributors, New Delhi.
- [R4] Pelczar M.J., Chan E.C.S., Krieg N.R., "Microbiology", Tata McGraw Hill Education (P) Ltd., New Delhi.
- [R5] Dara S.S., "A Textbook of Environmental Chemistry and Pollution Control", S. Chand and Company Ltd., New Delhi.
- [R6] Pani B., "Textbook of Environmental Chemistry", I.K. International Publishing House (P) Ltd., New Delhi.

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.

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

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_c , 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.

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.

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

SURVEYING LAB**Paper Code: ETEN-257****Paper: Surveying Lab**

L	T/P	C
0	2	1

Based on theory courses ETEN 209 (10- 12 experiments)

1. Linear measurement using tape, chain and tacheometric methods.
2. Leveling 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.

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

WATER AND WASTEWATER ANALYSIS LAB

Paper Code: ETEN-259

L T/P C

Paper: Water and Wastewater Analysis Lab

0 2 1

List of Experiments:

Based on theory courses ETEN 203 (8-10 experiments)

1. Determination of COD of the wastewater sample.
2. Determination of BOD of the wastewater sample.
3. Determination of Total kjeldahl Nitrogen (TKN), Ammoniacal nitrogen and Organic Nitrogen in wastewater sample.
4. Determination of Phosphate and Orthophosphate using UV/Visible Spectrophotometer.
5. Optimization of coagulant dose with Jar Test for the treatment of water/ wastewater/ effluent.
6. Optimization of pH for precipitation of hydroxides of Chromium and Zinc.
7. Determination of Chromium and Zinc in industrial wastewaters Determination of effect of pH and time on adsorption of textile dye on Activated carbon.
8. Development of Adsorption Isotherms for batch operations.
9. Presumptive test for detection of microorganisms.
10. Confirmative test for confirmation of E. Coli.
11. Plate count test for E. Coli/ Pathogenic Bacteria.
12. Determination of Nitrate in the given wastewater sample using UV/Visible Spectrophotometer/ Ion Selective electrode
13. Determination of fluoride concentration in the given waste water sample using UV/Visible Spectrophotometer/ Ion Selective electrode.
14. Estimation of chloride, residual chlorine and chlorine demand of a given water sample.

Reference Books

1. American Public Health Association, "Standard Methods for Examination of Water and Wastewater", American Water Works Association, Water Environment Federation.
2. Sawyer C.N., McCarty P.L. and Parkin G.F., "Chemistry for Environmental Engineering and Science", Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. De A.K., "Environmental Chemistry ", New Age International Ltd., New Delhi, 1995.
4. CPCB, " Guide on Water and Wastewater analysis".

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

PHYSIO-CHEMICAL TREATMENT PROCESSES

Paper Code: ETEN-202

Paper: Physico-Chemical Treatment Processes

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:

- (1) To become familiar with conventional and advanced physical and chemical processes used to purify water, wastewater and air emissions.
- (2) To understand the basic principles of design and operation of a variety of treatment processes;
- (3) To be able to calculate basic process parameters such as needed disinfection contact times, sizing of sedimentation basins, filter flow rates, number of membrane modules needed for treatment of a given feed flow rate, etc.

UNIT – I

Unit operations and their applications in treatment of water, Sewage, Industrial effluent and emissions. Mixing and Flocculation: Gravitational, Mechanical and Pneumatic devices, Types of impellers. Sedimentation: Discrete settling, Flocculent settling, Hindered or Zone settling, Compression settling. Long tube settling tests, sedimentation equipment, Batch flow and continuous flow operations. Principles, Design concepts and suitability of gravity settlers and sludge thickeners. Flotation and aerosol separation: Methods of flotation, chemical agents promoting flotation, gas particle contact. Aerosol characteristics and their separation, Particle characteristics.

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

UNIT – II

Flow through beds of solids : Slow sand filters, Rapid sand filters, Pressure filters, Ion exchange units, Adsorption towers, Flow through expanded beds, Flow through porous plates and membranes.

Gas transfer: Mechanism of transfer, Film coefficients and equilibrium relationships, Gas dispersion. Principles, Design concepts and suitability of packed columns, Tray columns, Spray units etc.

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

UNIT – III

Principles, Design concepts and suitability of Adsorption (fixed bed and moving bed), absorption and desorption.

Membrane System: Reverse Osmosis, Electrodialysis, Ultrafiltration, Nanofiltration.

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

UNIT – IV

Principles, Design concepts and suitability of centrifugal separators, Impingement separators, Electrostatic precipitators and scrubbers, Chemical precipitation, Vacuum filtration and hydraulic press.

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

Text Books:

- [T1] Davis M.L., Cornwell D.A., "Introduction to Environmental Engineering", Tata McGraw Hill Education (P) Ltd., New Delhi.
- [T2] Peavy H.S., Rowe D.R., Tchobanoglous G., "Environmental Engineering", Tata McGraw Hill Education (P) Ltd., New Delhi.

Reference Books:

- [R1] Sincero A.P. and Sincero G.A., "Environmental Engineering- a Design Approach", PHI
- [R2] Qasim S.R., "Water Works Engineering", PHI Learning (P) Ltd., New Delhi.
- [R3] Droste R.L., "Theory and Practice of Water and Wastewater Treatment", Wiley India (P) Ltd.,
- [R4] Hammer M.J. and Hammer M.J., Jr., "Water and Wastewater Technology",
- [R5] Metcalf and Eddy, "Wastewater Engineering- Treatment and reuse," TMH
- [R6] Arceivala S.J. and Asolekar S.R., "Wastewater Treatment for Pollution Control and Reuse", TMH
- [R7] Weber W.J., "Environmental Systems and Processes: Principles, Modeling and Design", John Wiley and Sons.

STRUCTURAL ENGINEERING

Paper Code: ETEN-204

Paper: Structural 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.

Objectives: (i) To identify determinate, indeterminate, stable and unstable structures, (ii) To determine forces and deflections in trusses, beams and frames, (iii) To construct influence lines and be able to use them, and (iv) To use computer tools to assist in classical structural analysis.

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,T2] [No. of Hours: 12]

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, Application of Muller Breslau Principle for determinate structures.

Indeterminate structures: Indeterminacy, choice of unknowns, Castigliano's second theorem and its applications.

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

UNIT III

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.

Moment distribution method: Analysis of beams and frames.

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

UNIT IV

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,T2] [No. of Hours: 10]

Text Books:

[T1] Structural Analysis, G.S. Pandit, CBS Publication.

[T2] Fundamental of Structural Analysis, Sujit kumar Roy, S. Chand Publication.

References Books:

[R1] Statically Indeterminate Structures, C.K.Wang, Mc Graw Hill

[R2] Basic Structural Analysis, C.S. Reddy, Tata McGraw Hill

[R3] Structural Analysis, R.C. Hibbler, Pearson Publications

[R4] Structures, Schodek, Pearson Education

[R5] Comprehensive Structural Analysis, Vaidyanathan and P Perumal, Luxmi Publications

ENVIRONMENTAL HYDRAULICS

Paper Code: ETEN-206
Paper: Environmental 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: The course refers primarily to Laminar and Turbulent flow concepts, pipe flow and open channel flow concepts. Further, the course covers concepts of movement and transformation of pollutants released in the atmospheric environment.

UNIT I

Navier's-Stokes equation of motion for laminar Flow; Laminar flow between two parallel plates, laminar flow through pipes, Dimensional Analysis and Modal Studies, Velocity distribution in turbulent flow; shear stress due to turbulence, turbulent flow in circular pipes, resistance of smooth and artificially roughened pipes, General resistance diagram.

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

UNIT II

Pipe Flow Problems: Losses in pipe flow, pipes in series, pipes in parallel, branching pipes, siphons, multi-reservoir problems, pipe net work analysis using Hardy Cross Method, unsteady flow in pipes, water hammer analysis.

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

UNIT III

Open Channel Flow: Derivation of the general one-dimensional equations of continuity, momentum and energy used in open channel flow analysis, Steady non-uniform flows, channel transitions and controls, hydraulic jumps surges, Unsteady flow in open channels, Method of characteristics, surge formation, Kinematics of waves, flood routing and overhead flow Turbines.

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

UNIT IV

Atmospheric Boundary Layer and Diffusion : Solar Radiation, Air stability, Logarithmic profile, Turbulence, Statistical Measures, Boundary Layer Scaling, Turbulent Gradient Transport, Statistical Theories of Turbulent Diffusion, Eddy diffusion model, Gaussian dispersion model, Evaluation of standard deviation, Estimation of maximum ground level concentration, Models based on K – Theory, Removal Mechanisms, Box Models. Elements of Meteorology, Wind velocity profiles, Maximum mixing depth, Wind rose, General characteristics of stack plumes, Heat island effect.

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

Text Books:

- [T1] Subramanya K., "Flow in Open Channels", Tata McGraw Hill Education (P) Ltd., New Delhi.
[T2] Garde R.J., Mirajgaoker A.G., "Engineering Fluid Mechanics", Scitech Publications (P) Ltd., Chennai.

Reference Books :

- [R1] Lyons T. and Scott B., "Principles of Air Pollution Meteorology", CBS Publishers and Distributors (P) Ltd., New Delhi. (for Unit-IV)
[R2] Jacobson M.Z., "Fundamentals of Atmospheric Modelling", Cambridge University Press, New York.
[R3] Shaughnessy E.J., Katz I.M. and Schaffer J.P., "Introduction to Fluid Mechanics", Oxford University Press, New Delhi.
[R4] Bansal R.K., "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi.
[R5] Jain A.K., "Fluid Mechanics", Khanna Publishers, New Delhi.
[R6] Munson B.R., Young D.F. and Okiishi T.H., "Fundamentals of Fluid Mechanics", Wiley India (P) Ltd., New Delhi.

INTRODUCTION TO ENVIRONMENTAL LEGISLATION

Paper Code: ETEN-208

L T/P C

Paper: Introduction to Environmental Legislation

2 0 2

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 intends to give the students basic knowledge on some of the important environmental laws and issues of India and the world enabling them to analyse and understand environmental regulation and legal solution.

UNIT – I

Evolution of Engineering and Law, Evolution of environmental policy and major policy parameters, Importance of Environmental planning and Management, Agencies for Environmental planning, Power and responsibilities, National and International conventions. Legal Framework for Environmental Planning: Environmental Legislation, Public policy strategies in pollution control.

International Policy Framework and Conventions.

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

UNIT – II

Control of Pollution Acts: Water (prevention and control of pollution) Act 1974, Cess Act 1977, Air (prevention and control of pollution) Act 1981, Power and responsibilities of central and state pollution control boards, Noise Pollution(Regulation and control)Act 2000.

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

UNIT-III

The Environment Protection Act, 1986 with rules and amendments, Motor Vehicle Act, 1988 and The Central Motor Vehicles Rules, 1989 with amendments. Municipal Waste (Management and Handling Rules, 2000), Biomedical Waste (Management and Handling) rules.

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

UNIT – IV

Hazardous Waste (Management and Handling Rules, 1989 and amendments), Federal Hazardous Waste Regulations under RCRA, Superfund, CERCLA and SARA.Indian Forest Act 1927, Forest Conservation Act 1980, Coastal Zone Management Act 1972, Wild Life (Protection) Act 1972, Clean water Act, Wetland Preservation Act, EIA Notification 1994, EIA Notification 2006.

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

Text Books:

- [T1] Leelakrishnan P., “Environmental Law in India”, Lexis Nexis, New Delhi.
 [T2] Patil S.M., “Law on Environment”, PHI Learning (P) Ltd., New Delhi.

Reference Books:

- [R1] Freestone D. and Streck C., “Legal Aspects of Carbon Trading”, Oxford University Press, New York.
 [R2] Bockrath J.T., “Contracts and the Legal Environment”, Tata McGraw Hill Publishing Company Ltd., New Delhi.
 [R3] Sengar, “Environmental Law”, PHI Learning (P) Ltd., New Delhi.

GEOTECHNICAL ENGINEERING

Paper Code: ETEN-210
Paper: 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 12.5 marks.

Objective: To provide a basic understanding of the physical and mechanical characteristics of soils and how these relate to the engineering behavior of soils. Further, course aims to provide basic concepts of Bearing Capacity of soils and foundation engineering.

UNIT – I

Soil formation, properties and classification : Origin of soils, Composition of soil, particle size and shapes, Three phase diagram and relationships among void ratio, specific gravity, Dry density, porosity, Water content, Unit weights and degree of saturation, Classification of soils.

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.

Permeability and seepage: Concept of pore water pressure, Total, Effective and neutral stresses. Darcy's law, Laboratory and field permeability tests, Seepage forces, Seepage through earth dams, Exit gradient and uplift pressure, Mechanics of piping, Methods of dewatering, design of filters.

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

UNIT – II

Stress distribution: Stress at a point, Concept of Mohr's circle, Calculation of stresses due to force of gravity, Point, Line and uniformly distributed loads, Influence charts, contact pressure distribution, Boussineque's equation for vertical pressure.

Consolidation and settlement : Consolidation test and compressibility characteristics, Terzaghi's theory of one dimensional consolidation, Types of clay deposits, Normal/over/under consolidated clays, Determination of pre-consolidation pressure and its significance, Time factor and coefficient of consolidation, Fitting methods, Settlement analysis.

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

UNIT – III

Soil improvement techniques: Compaction, Drainage and vibration methods, Grouting and injection, Chemical stabilization, Geomembranes and geotextiles

Compaction of soils: Objectives, Compactive effort, Laboratory compaction, Standard Proctor test, Concept of optimum moisture content and zero air voids line, Effect of compaction on soil properties, Compaction specifications and field control.

Shear strength of soil: Stress strain curve, Mohr-coulomb failure criteria, 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 cohesive and granular soils.

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

UNIT – IV

Bearing capacity of soils: Methods of determining bearing capacity, Analytical methods, Effect of water table, Safe bearing capacity, Foundation settlements, Plate load tests and Penetration tests.

Shallow foundations: Types of shallow foundations, Selection of type of foundation, Design of shallow foundations, Combined footings and Raft foundations.

Deep foundations: Classification of Piles, Pile driving equipment, Calculation of bearing capacity of a single pile, Pile groups, well and caisson.

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

Text Books:

[T1] Raj P.P., "Soil mechanics and Foundation Engineering", Pearson Education, New Delhi.

[T2] Singh A., "Soil Engineering in Theory and Practice", Volume I, CBS Publishers and Distributors (P) Ltd., New Delhi.

Reference Books:

- [R1] Terzaghi K., Peck R.B. and Mesri G., “Soil Mechanics in Engineering Practice”, Wiley India (P) Ltd
- [R2] Khan I.H., “Textbook of Geotechnical Engineering”, PHI (P) Ltd., New Delhi.
- [R3] Murthy V.N.S., “Textbook of Soil Mechanics and Foundation Engineering”, CBS Publishers
- [R4] Kumar S.H., “Geotechnical Earth Science Engineering”, Pearson Publication, New Delhi.
- [R5] Singh A., “Soil Engineering in Theory and Practice”, Volume 2, CBS Publishers



AIR AND NOISE POLLUTION**Paper Code: ETEN-212****Paper: Air and Noise Pollution**

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 emphasis in this course will be the monitoring and control of particulate and Gaseous pollutants, Minimization of the noise and noise pollution including technical measures, Codes, regulations, directives and standards about noise pollution.

UNIT – I

Concept of unpolluted air, Gaseous and vapour pollutants in atmosphere, Scales of air pollution, Primary and secondary pollutants, Ambient Air Quality, Monitoring for pollutants (SO₂, NO₂, O₃, PAN, Particulates, Hydrocarbons, PAH's) and their health effects. Stack monitoring for SO_x, NO_x, CO, CO₂, Hydrocarbons, Fluorides, Ammonia, VOCs, Effects of air pollution on vegetation, materials and structures. Stack monitoring for thermal power plant, Oil refinery industry, Fertilizer industry, Non ferrous metal industry. Recent techniques of online stack monitoring, Emission inventory. Trends of AAQ in Urban, Rural and Industrial areas.

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

Air quality criteria, National and International air emission standards and AAQ guidelines, Indoor air quality, Averaging time, Air pollution system, Alternative control strategies. GLC estimates for multiple sources using standard software (e.g., EPA's ISC model). Determination of effective stack height.

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

Distribution and sources of Particulate matter, Hood duct design, Particulate collection mechanisms, Control systems and their design. Flue-gas desulfurization processes, Flue gas control methods for NO_x. Emission standards for automobiles, Origin of exhaust emissions from gasoline, Diesel, CNG and LPG engines. Crankcase and evaporative emissions, Emission reduction by fuel changes, Emission reduction by engine design changes, Catalytic converters, Diesel engine emissions

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

Noise: Characteristics, Sources, Types of noise, Impact of noise

Physics of sound- Speed of sound, Sound pressure, Frequency, Wavelength, RMS Sound Pressure, Sound Pressure Level, Loudness, Sound Power Level and Sound Energy Density, Sound propagation, Wind and temperature gradient.

Enclosures and Barriers: Lead as a noise barrier, Plenum barriers, Barrier around pipe, wires and rectangular duct work, High transmission loss ceilings, Acoustical foams, Nylon in noise reduction, damping compounds.

Noise measuring equipments: Sound Level Meter, Octave Band Analyzer, Statistical Analyzer and Noise Average Meter

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

- [T1] Rao M.N. and Rao H.V.N., "Air Pollution", Tata McGraw Hill Publishing Company Ltd., New Delhi.
 [T2] Wang L.K., Pereira N.C., Hung Y.T., "Advanced Air and noise pollution control", Volume I andII, Humana Press, New Jersey.

Reference Books :

- [R1] Ghassemi A., "Pollution Control and Waste Minimization", Marcel Dekker, Inc., New York.
 [R2] Rao C.S., "Environmental Pollution Control Engineering", New Age International (P) Ltd., New Delhi.
 [R3] Singal S.P., "Noise pollution and control strategy", Alpha Science International, New Delhi.
 [R4] Ray T.K., " Air Pollution Control In Industries", Volume I, Tbi, New Delhi.
 [R5] Stern A.C., Boubel R.W., Fox D.L., Turner B., "Fundamentals of Air Pollution, Hardcover", Elsevier Science and Technology Books.
 [R6] Narayanan P., "Environmental Pollution Principles, Analysis and Control", CBS Publishers

WATER ENGINEERING DESIGN AND DRAWING LAB

Paper Code: ETEN-252

L T/P C

Paper: Water Engineering Design and Drawing Lab

0 2

1

List of Experiments:

Design as per CPHEEO manual for

1. Spray aerator.
2. Mechanical rapid mix unit.
3. Clariflocculator.
4. Rectangular sedimentation tank.
5. Radial circular settling tank.
6. Tube settler module.
7. Slow sand Filter.
8. Rapid Gravity Filter.
9. Iron removal unit.
10. Computation of chemical dosages in Water softening treatment process.

Reference Books:

- [R1] Gupta C.D. and Gupta V.K., "Water Supply Handbook", Jain Brothers, New Delhi.
 [R2] Qasim S.R., "Water works Engineering", PHI Learning (P) Ltd., New Delhi.
 [R3] CPHEEO Manual on Water and Wastewater.

Note: At least 8 Experiments from the syllabus must be done in the semester.

STRUCTURE LAB

Paper code: ETEN-254
Paper: Structure Lab

L	T/P	C
0	2	1

Structure Lab Experiments based on the syllabus ETEN-203 and ETEN-204 (10-12 Experiments).

Note: At least 8 Experiments from the syllabus must be done in the semester.



ENVIRONMENTAL HYDRAULICS LAB**Paper code: ETEN-256****Paper: Environmental Hydraulics Lab**

L	T/P	C
0	2	1

List of Experiments:

1. Determination of flow through Venturimeter.
2. Analysis of pipe network using Hardy Cross method.
3. Analysis of pipe network using EPANET.
4. Determination of characteristics of Centrifugal pump.
5. Determination of characteristics of Turbine.
6. Case Study of Air Pollution/Wastewater in Ambient environment.

In addition to the above, 4 Experiments or design labs based on the concept of the course ETEN 206

Note: At least 8 Experiments from the syllabus must be done in the semester.

AIR AND NOISE POLLUTION MONITORING AND DESIGN LAB

Paper Code: ETEN-258	L	T/P	C
Paper: Air and Noise Pollution Monitoring and Design Lab	0	2	1

List of Experiments:

Based on theory course ETEN-212 (10-12 experiments)

1. Measurement of relative humidity in ambient air using Psychrometric charts.
2. Measurement of the suspended particulate matter (SPM) in the ambient air using high volume air sampler APM 430.
3. To measure the concentration of SO_x in ambient air gravimetrically and Titrimetrically.
4. To determine the NO_x concentration in the ambient air by using Modified Jacobs and Hochheiser Method (IS 5182 Part 6 Methods for Measurement of Air Pollution: Oxides of nitrogen).
5. To plot Windrose diagram for a given wind speed and wind direction data manually and using Software.
6. Design of Gravity Settler.
7. Design of Fabric Filter/Bag House.
8. Design of system of cyclone in series.
9. Design of Venturi Scrubber.
10. Detection of Noise level and Vibration by using Sound Level Meter.

Reference Books:

[R1] Ray T.K., “ Air Pollution Control in Industries”, Volume I, Tbi, New Delhi.

Note: At least 8 Experiments from the syllabus must be done in the semester.

SEMINAR**Paper Code: ETEN-260****Paper name: SEMINAR**

L	T/P	C
0	2	1

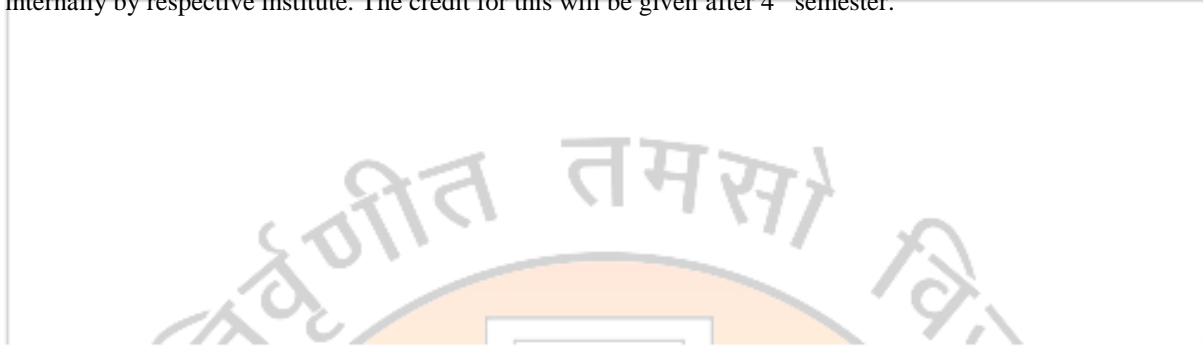
The objective is to assess and enhance the presenting capability of the students. Also to impart training to a student to face audience and present his ideas and thus creating in him self esteem and courage that are essential for an engineer. Individual students are required to choose a topic of their interest from the syllabus of second year (i.e. 3rd and 4th 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.

NCC/NSS

Paper code: ETSS-250
Paper: NCC/NSS

L	T/P	C
0	0	1

NCC/NSS is to be completed in any one semester from semester 1 to semester 4. However, it will be evaluated internally by respective institute. The credit for this will be given after 4th semester.



COMMUNICATION SKILLS FOR PROFESSIONALS

Paper Code: ETHS-301

L T/P C

Paper: Communication Skills for Professionals

2 0 1

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.

BIOCHEMICAL PROCESSES IN WASTEWATER TREATMENT

Paper Code: ETEN-303	L	T/P	C
Paper: Biochemical Processes in Wastewater Treatment	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: This course introduces the students to the principles of biochemical processes in wastewater treatment and pollution control, with particular emphasis on municipal wastewater treatment. At the end of the course, students should have a thorough understanding of wastewater treatment processes as well as biosolids handling, treatment and disposal. They would be able to design various facilities for biological treatment of wastewater.

UNIT – I

Estimating wastewater flow rates, Physical, Chemical and biological characteristics of wastewater, Reactor types, Flow regimes, Application of Material Balance equations for batch, complete mix and plug flow reactor. Introduction to industrial effluent disposal, Wastewater treatment, sludge disposal and reuse, Classification of wastewater treatment methods. Selection of Treatment-process, flow diagrams, Evaluation and selection of design flow rates, Evaluation and selection of design mass loadings. Process selection, elements of conceptual process design.

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

UNIT – II

Design of facilities for the biological treatment of wastewater: Activated sludge process, Selection and design of physical facilities for activated sludge process, Activated sludge process design, Aerated lagoons, Trickling filters, Rotating biological contractors, Combined aerobic treatment processes, Stabilization ponds.

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

UNIT – III

Anaerobic processes of treatment, single stage and two stage digestion, upflow anaerobic sludge blanket (UASB) system for treatment of sewage and industrial effluents.

Biological nutrient removal, Removal of nitrogen by biological nitrification/denitrification.

Removal of phosphorous by biological methods, Combined removal of nitrogen and phosphorus by biological methods.

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

UNIT – IV

Aerobic suspended-growth treatment processes, Aerobic attached - growth treatment processes, Anaerobic suspended - growth treatment processes, anaerobic attached-growth treatment processes, Pond treatment processes.

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

Text:

- [T1] Metcalf and Eddy, “Wastewater Engineering- Treatment and reuse,” Tata McGraw Hill Publishing Company Ltd., New Delhi.
- [T2] Davis M.L., Cornwell D.A., “Introduction to Environmental Engineering”, Tata McGraw Hill Education (P) Ltd., New Delhi.

Reference Books:

- [R1] Droste R.L., “Theory and Practice of Water and Wastewater Treatment”, Wiley India (P) Ltd.
- [R2] Hammer M.J. and Hammer M.J., Jr., “Water and Wastewater Technology”, PHI (P) Ltd., New Delhi.
- [R3] Benefield L.D. and Randall C.W., “ Biological Process Design for Waste water Treatment”, PHI Learning (P) Ltd., New Delhi.
- [R4] CPHEEO Manual.
- [R5] Peavy H.S., Rowe D.R., Tchobanoglous G., “Environmental Engineering”, Tata McGraw Hill Education (P) Ltd., New Delhi.
- [R6] Venkateswarlu K.S., “Water Chemistry, Industrial and Power Station Water Treatment, New Age International Publishers, New Delhi.

DESIGN OF STRUCTURES

Paper Code: ETEN-305

Paper: Design of Structures

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: 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.

[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.

HYDROLOGY AND DRAINAGE ENGINEERING

Paper Code: ETEN-307

Paper: Hydrology and Drainage 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:

1. Introduce students to various methods of estimation and analysis of rainfall and stream flow.
2. Use of techniques to assess 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

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, Floods and Droughts, causes and management.

Hydrographs: Hydrograph and its components, 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, Uses and limitations of unit hydrographs.

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

UNIT – II

Floods: Computations of peak floods by empirical formulae, by rational method and by unit hydrograph method, frequency analysis of floods and droughts, flood routing principles, reservoir routing.

Interception and Depression Storage, Evaporation and Transpiration, Evapotranspiration, Estimating Evapotranspiration.

Infiltration: Horton's Infiltration Model, SCS Runoff Curve Number Procedure.

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

UNIT – III

Alignment of canals, Distribution system for canal irrigation, Design of canals and conduits, Design of lined irrigated channels.

Reclamation of water logged and saline soils for agricultural purposes: Causes of water logging, water logging control, Reclamation of saline and alkaline lands, Land drainage.

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

UNIT – IV

Rainfall: Measurements by rain gauges, Design of rain gauges network, Average annual rainfall and index of wetness, Mean rainfall over a drainage basin.

Dams, Weirs and Barrages: Types of and their preliminary design principles, Spillways and energy dissipaters, Outlet works through dams and river intakes, Weirs and barrages, Cross- drainage and drop structures, Regulating and silt control structures. Reservoir sedimentation.

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

Text Books:

- [T1] Subramanya K. , "Engineering Hydrology" Tata McGraw Hill Publishing Company Ltd., New Delhi.
 [T2] Garg S.K., "Irrigation Engineering and Hydraulic Structures," Khanna publishers, New Delhi.

Reference Books:

- [R1] Asawa G.L., "Irrigation and Water Resource Engineering", New Age International (P) Ltd.
 [R2] Raghunath H.M., "Hydrology" New Age International (P) Ltd., New Delhi.
 [R3] Todd D.K., "Groundwater Hydrology", Willey India (P) Ltd., New Delhi.
 [R4] Jain, "Hydrology and Water Resources of India", CBS Publishers and Distributers (P) Ltd., New Delhi.

ENVIRONMENTAL INSTRUMENTATION**Paper Code: ETEN-309****Paper: Environmental Instrumentation**

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: In this course students will learn various types of instrumentation based techniques used in environmental sciences. The course will introduce students to the techniques of instrument calibration, deployment, and data acquisition. Students will also become familiar with Principles of continuous ambient air quality monitoring instruments.

UNIT – I

Environmental analysis: Accuracy, Precision, Types of errors, Minimization of error, Significant figures, Criteria for rejection of data. Signals and Data: Signal to Noise Ratio, Sensitivity and Detection limit, Evaluation of results.

Absorption and Emission Spectroscopy: Electromagnetic Spectrum, Atomic, Molecular and Vibrational energy Levels, Raman Effect, Lasers, Nuclear and Electron Spin behavior, X- ray energy levels.

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

Ultraviolet and Visible Spectrometry:: Radiation sources, wavelength selection, sampling devices and detectors, Instruments for absorption photometry, Fundamental laws of photometry, photometric accuracy and precision.

Difference and derivative Spectroscopy, Photometric Titrations, Turbidimetry and Nephelometry.

Principle of Flame emission spectroscopy (FES) and Atomic Absorption Spectroscopy (AAS), Interferences associated with flames and furnaces, Comparison of FES and AAS.

Principles of Inductively Coupled Plasma (ICP) Atomic Fluorescence Spectroscopy, Comparison of ICP and AAS methods.

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

Principles of NMR Spectroscopy, Elucidation of NMR Spectra.

Mass Spectrometry (MS) : Ionization methods, Ion collection systems, Vacuum system, Isotope-ratio Spectrometry, Correlation of Mass spectra with molecular structure. Interfacing with ICP with MS.

Chromatographic Methods: Classification, Principle of Gas Chromatography, Gas chromatographic columns, liquid phases and column selection, detectors for GC, Gas-solid Chromatography, Interfacing GC with MS.

HPLC: Mobile phase Delivery System, Sample Introduction, Separation Columns, Detectors.

Ion Chromatography, Paper and Thin Layer Chromatography.

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

Automated analysis: Infrared Process Analyzers, Oxygen Analysers, Chemical Sensors, Continuous online process control, Automatic Chemical Analyzers and Automatic Elemental Analysers

Continuous Monitoring Instruments and their principles; NDIR for CO, Chemiluminescent analyzer for NO_x, Fluorescent analyzer for SO₂, Instruments for Hydrocarbons and ozone monitoring, Automated wet chemical analyzer for water quality.

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

[T1] Willard H.H., Meritt L.L., Dean J.A., Settle F.A., "Instrumental Methods of Analysis", CBS Publishers and Distributors (P) Ltd., New Delhi.

[T2] Sawyer C.N., McCarty P.L. and Parkin G.F., "Chemistry for Environmental Engineering and Science", Tata McGraw Hill Publishing Company Ltd., New Delhi.

Reference Books:

[R1] De A.K., "Environmental Chemistry", New Age International (P) Ltd., New Delhi.

[R2] Sharma B.K., "Analytical Chemistry", Krishns Prakashan, Meerut.

[R3] Reesok R.L. and Shields L.D., "Modern Methods of Chemical Analysis", Wiley India (P) Ltd.

[R4] Ewing G.W., "Instrumental Methods of Chemical Analysis", Tata McGraw Hill

WATER SUPPLY AND SEWAGE SYSTEM

Paper Code: ETEN-311

Paper: Water Supply and Sewage System

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 will deal with planning for water supply and distribution projects, sewage collection and treatment projects. Students will be introduced to the designing of pumping stations, intake structures etc. The students will also be exposed to waste water disposal into rivers, lake and estuaries.

UNIT – I

Water Requirements: Need to protect water supplies, Various types of water demands, Factors affecting consumption of water, variations in demand, Per capita demand, Total requirements of water for a town or a city, Coincident draft, Effect of variations in demand on the design capacities of different components of a water supply scheme, Design periods, Population forecasting methods, Water Quality standards for municipal or domestic supplies, Water quality standards for industrial supplies.

Classification of sources of water, Surface sources: Reservoir planning, Storage capacity and yield, Zones of underground water, Movement of ground water and its velocity, Groundwater yield, Specific yield and specific retention, Aquifers and their types, Locating a well, Construction of well, Tube wells and Rainey wells.

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

UNIT – II

Water lifting arrangement, Source selection in hilly and rural areas, Appropriate treatment technology for rural water supplies.

Intakes: Factors governing the location of intakes, Types of intakes including simple submerged intakes, Wet and dry intake towers.

Conduits: Gravity conduits such as canals, Flumes, Aqueducts and pressure conduits, pipe materials and their joints, Corrosion of metal pipes, Laying of pipes and pipe appurtenances such as gate valves, Air valves, Blow off valves, Pressure relief valves, Check valves, Manholes, Insulation joints, Anchorages etc. Testing of pipe lines, Head loss through pipes and pipe fittings, Disinfection of pipelines before use.

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

UNIT – III

Distribution system planning. Types of distribution reservoirs including surface reservoirs and elevated reservoirs, Types of fire hydrants and their requirements, Types of water meters and their requirements Wastage of water in distribution system. Materials for service pipes, Service connection. Principles, Design, Concepts and Suitability of Disinfection

Types of sewage and types of sewerage systems, Components of sewerage system, Future forecasts and estimating design sewage discharge. Estimating the peak runoff.

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

UNIT – IV

Provision of free board in sewers and Storm water drains Hydraulic formulas for determining flow velocities in sewers and drains, Maximum and minimum velocities to be generated in sewers.

Shapes of sewer pipes, Forces acting on sewer pipes, Sewer materials, Laying and testing of sewer pipes.

Sewer Appurtenances: Man holes, Drop man holes, Lamp holes, Clean outs, Street inlets, Called gullies, Catch basins, Flushing tanks, Grease and oil traps, Inverted siphons, Storm water regulators.

Maintenance, Cleaning and Ventilation of sewers.

Types of pumps and pumping stations for water supply and Sewerage system, Factors affecting the selection of particular type of a pump, Head power and efficiency of pumps, Economic diameter of pumping mains.

Plumbing systems, Sewerage plans for building and design of sewer, Sanitary fittings and other accessories.

Wastewater disposal into rivers, lake and estuaries.

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

Text Books:

- [T1] Nathanson J.A., “Basic Environmental Technology, Water Supply, Waste Management and Pollution Control”, PHI (P) Ltd., New Delhi..
- [T2] CPHEEO,” Manual on Water Supply and Treatment and Sewerage and Sewage Treatment”, Ministry of Urban Development, New Delhi.

Reference Books:

- [R1] Christian K., “Wastewater Treatment, Concept and Treatment”, PHI (P) Ltd., New Delhi..
- [R2] Garg S.K., “Environmental Engineering (Vol. 1), Water Supply Engineering”, Khanna Publishers.,New Delhi.
- [R3] Garg S.K., “Sewage Disposal and Air Pollution Engineering (Vol. II)”, Khanna Publishers., New Delhi.
- [R4] Punamia B.C., Jain A., Jain A., “Water Supply Engineering”, Laxmi Publications., New Delhi.
- [R5] Bhattacharya S.K., “ Urban Domestic Water Supply in Developing Countries”, CBS Publishers and Distributers (P) Ltd., New Delhi.

COMMUNICATION SKILLS FOR PROFESSIONALS LAB

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

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:

- 1. 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.
- 2. 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.
- 3. Conversation Activities**-- Effective Conversation Skills; Formal/Informal Conversation; Addressing higher officials, colleagues, subordinates, a public gathering; Participating in a video conference.
- 4. 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.
- 5. Making a Power Point Presentation** -- Structure and format; Covering elements of an effective presentation; Body language dynamics.
- 6. 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.
- 7. 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.
- 8. 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:

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

Reference Books:

1. Patnaik, Priyadarshi. *Group Discussion and Interview Skills: With VCD*. Cambridge University Press India (Foundation Books), 2012 edition.
2. Kaul, Asha. *Business Communication*. PHI Learning: 2009.
3. 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.

STRUCTURE DESIGN LAB**Paper Code: ETEN-351****Paper: Structure Design Lab**

L	T/P	C
0	2	1

Based on Unit-II, Unit-III and Unit-IV of theory course ETEN 305**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**

MATERIAL TESTING LAB**Paper Code: ETEN-355****Paper: Material Testing Lab**

L	T/P	C
0	3	2

List of Experiments:**Based on Course ETEN-210 and ETEN-305 (10-12 Experiments):**

1. Estimation of quantity of water for cement paste for normal consistency.
2. Determination of fineness of cement.
3. Detection of Initial and Final setting time of cement.
4. Determination of tensile and compressive strength of cement.
5. Determination of compressive strength of concrete by cube test.
6. Determination of water content of soil sample.
7. Determination of particle size distribution of a soil sample.
8. Estimation of liquid limit of soil using liquid limit apparatus.
9. Determination of specific gravity of soil sample using pycnometer.
10. Determination of optimum moisture content and maximum dry density of soil by Proctor test.

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

SEMINAR ON ENVIRONMENTAL ENGG. PROJECTS/VISITS/CASE STUDIES

Paper Code: ETEN-357	L	T/P	C
Paper: Seminar on Environmental Engg. Projects/Visits/Case Studies	0	2	1

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 Environmental 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.

ENVIRONMENTAL MODELING/ SOFTWARE TRAINING

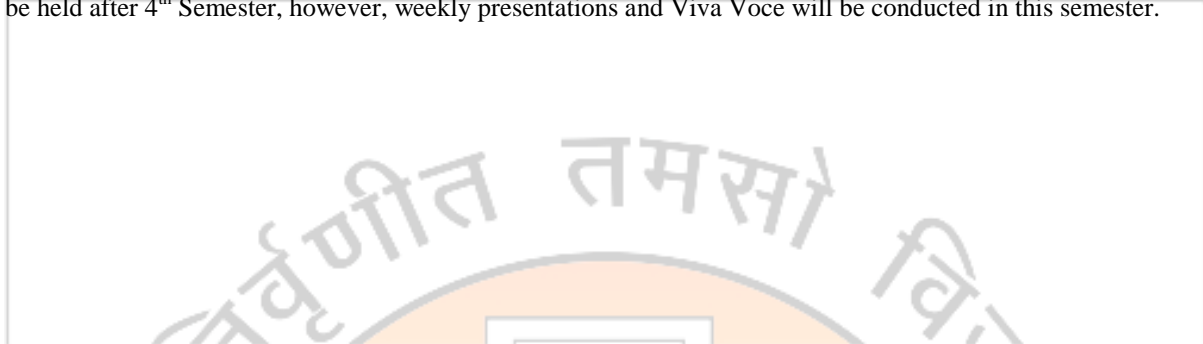
Paper Code: ETEN-359

L T/P C

Paper: Environmental Modeling/ Software Training

0 2 1

Minimum of 2 weeks Environmental Modeling/ Software Training related to Environmental Engineering is to be held after 4th Semester, however, weekly presentations and Viva Voce will be conducted in this semester.



PRINCIPLES OF SOLID WASTE MANAGEMENT

Paper Code: ETEN-304

Paper: Principles of Solid Waste Management

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: On completion of the course, students will:

1. Understand the implications of the production, resource management and environmental impact of solid waste management;
2. Understand components of solid waste management infrastructure systems to minimize the above effects.
3. Be aware of the significance of recycling, reuse and reclamation of solid wastes, sludges and landfills sites.

UNIT – I

Sources, Composition and Properties of Municipal solid waste.

Life cycle analysis of waste. Need for solid waste management, integrated solid waste management (SWM) System, Hierarchical approach for SWM. Segregation, reuse and recycling of solid waste, storage.

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

UNIT – II

Methods of treatment of solid waste - Incineration, Pyrolysis and Gasification Systems. Types and design of Incinerators, Composting: Theory of composting, Manual and mechanized composting, Design of composting plan.

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.

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

UNIT – III

Characteristics and quantities of sludges from various unit operations, Sludge treatment flow diagrams, Stabilization, Anaerobic sludge digestion, Aerobic sludge digestion, Composting, Conditioning, Dewatering, Thermal reduction, Land application of sludge.

Landfills: Classification, Types and methods, Site selection, Site preparation, Composition, Characteristics, Generation, and Control of Landfill gases; Composition, Formation, Movement and control of leachate in landfills; landfill design. Revegetation of closed landfill sites, Long term post closure plan, Groundwater monitoring during and after closure.

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

UNIT – IV

Remedial actions for abundant waste disposal sites, Waste to energy- Heat value of refused, combustion and energy recovery, energy production from waste, material and thermal balances, other technologies. Case Studies, Health and safety issues, Monitoring Requirements in respect of Dioxins, furans, NO_x, Environmental Issues, Solid waste and livelihood.

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

Text Books:

- [T1] CPHEEO, “Manual on Municipal Solid Waste Management”, Ministry of Urban Development, ND
- [T2] Tchobanoglous G., Theisen H., Viquel S.A., “Integrated Solid Waste Management: Engineering, Principles and Management issues”, Tata McGraw Hill Publishing Company Ltd., New Delhi.

Reference Books:

- [R1] Peavy H.S., Rowe D.R., Tchobanoglous G., “Environmental Engineering”, Tata McGraw Hill
- [R2] Cunningham W.P., Cunningham M.A., “Principles of Environmental Science”, Tata McGraw Hill
- [R3] Krishnamoorthy B., “Environmental Management, Text Book and Cases”, PHI Learning (P) Ltd.,
- [R4] Chandrappa R., Das D.B., “Solid Waste Management: Principals and Practice”,
- [R5] Davis M.L., Cornwell D.A., “Introduction to Environmental Engineering”, Tata McGraw Hill

INDUSTRIAL WASTE MANAGEMENT

Paper Code: ETEN-306

Paper: Industrial Waste Management

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:** The overall aim of the subject is to give deeper knowledge in the problems and possibilities of waste management from various water/air polluting industries. The course will employ a holistic view on the solutions, recycle and reuse opportunities as well as examine feasibility and technical aspects.*

UNIT I

Standards for disposal of treated industrial wastewaters into water bodies, municipal sewer and land, Standards for disposal of industrial solid wastes and gaseous emission from various industries and treatment systems such as incinerator etc.

Industrial waste generation (solid and liquid waste and gaseous emission) and their characteristics, variation in its quality and quantity, Estimation of capacity of equalization tank.

Industry specific physico-chemical and biological treatment requirements, alternatives and their evaluation in respect of treatment.

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

UNIT II

Waste streams (solid, liquid and gaseous), their characteristics and manufacturing processes of integrated steel plant, sponge iron unit, alumina/aluminum manufacturing unit, copper smelter, fertilizer plant, thermal power plant, distillery/brewery, paper/pulp industry, tannery, textile unit and oil refinery. Case Studies.

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

UNIT III

Methods of waste reduction such as process modification, volume and strength reduction, segregation, reuse, recycle, material conservation, good housekeeping. Neutralization, equalization, precipitation and solidification. Economic feasibility of joint treatment of raw industrial effluent with municipal sewage. Need assessment and design of common effluent treatment plant for industrial estates.

Planning and management of industrial wastes (solid, liquid and gaseous) from small scale industries.

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

UNIT IV

Selection of unit operations and their design for treatment and management of wastes (solid, liquid and gaseous) from integrated steel plant, sponge iron unit, alumina/aluminum manufacturing unit, copper smelter, fertilizer plant, thermal power plant, distillery/brewery, paper/pulp industry, tannery, textile unit and oil refinery. Case Studies.

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

Text Books:

- [T1] Wesley W., Eckenfelder Jr., "Industrial Water Pollution Control", Tata McGraw Hill
 [T2] Mahajan S.P., "Pollution Control in Process Industries", Tata McGraw Hill Education (P) Ltd.

Reference Books:

- [R1] Nemerow N.L and Agardy F.J., "Strategies of Industrial and Hazardous Waste Management", International Thomson Publishing Company, New York.
 [R2] Crites R.W., Reed S.C. and Bastion R., "Land Treatment Systems for Municipal and Industrial Wastes", Tata McGraw Hill Publishing Company Ltd., New Delhi.
 [R3] Ostler, N.K., "Industrial Waste Steam Generation", PHI Learning (P) Ltd., New Delhi.

ECONOMICS FOR ENGINEERS**Paper Code: ETEN-308****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 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 environmental 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 Hours: 11]**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 Hours: 11]**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.

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

Environmental Economics: Relevance of Environmental Economics, Economic development in India and its implication on natural resources and environment, Economic efficiency and markets, the economics of environmental quality, Framework of analysis, Cost Benefit Analysis, Cost criteria for environmental evaluation, Decentralized policies, Command and Control strategies, Emission taxes and subsidies, Transferable discharge permits, Environmental Kuznets Curve(EKC).

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

- [T1] S.C. Sharma and T.R. Banga, "Industrial Organization and Engineering Economics". Khanna Pub.
[T2] Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.

Reference Books:

- [R1] Roger Perman and others, "Natural resources and Environmental Economics", 2nd Ed., Longman, US, 1996.
[R2] C. T. Horngreen, "Cost Accounting", Pearson Education India.
[R3] R. R. Paul, "Money banking and International Trade", Kalyani Publisher, New-Delhi.

ADVANCE DESIGN OF STRUCTURES**Paper Code: ETEN-310****Paper: Advance Design of Structures**

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: To provide knowledge and competence in the application of advanced structural analysis and design based on knowledge and understanding of forces including seismic and wind forces and their application to civil engineering and Environmental Engineering structures such as water tanks, chimneys etc.

UNIT – I

Introduction to Seismic design: General principles of seismic design, Review of IS 1893: 2002, Load combinations and permissible stresses, Guidelines for earthquake resistant design, Ductile detailing for seismic design, Analysis of wind forces, Codal provisions.

Concrete structure design: Design of rectangular/circular water tanks on ground level/underground.

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

Prestressed concrete: Needs for prestressing, Methods of prestressing; Concept of load balancing, losses of prestress, Design of simple beams.

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

Steel structure design: Analysis and design of Riveted and Welded connections, Code requirements, Design and analysis of tension and compression members, Column bases and foundations, Roof trusses.

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

Water tanks and Chimneys: Design of elevated rectangular/circular water tanks and design of staging, Design of chimney.

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

[T1] Sinha S.N., “Reinforced Concrete Design”, Tata McGraw Hill Education (P) Ltd., New Delhi.

[T2] Raju N.K., “Prestressed Concrete”, Tata McGraw Hill Education (P) Ltd., New Delhi.

Reference Books:

[R1] Gambhir M.L., “Design of Reinforced Concrete Structures”, PHI Learning (P) Ltd., New Delhi.

[R2] Jain A.K., “Limit State Design of Reinforced Concrete Structures”, Nem Chand Publishers, Roorkee.

[R3] Raju N.K., “Reinforced Concrete”, New Age International (P) Ltd., New Delhi.

[R4] Varghese P.C., “Limit State Design of Reinforced Concrete”, PHI Learning (P) Ltd., New Delhi.

[R5] Pillai S.U., “Reinforced Concrete Design”, Tata McGraw Hill Education (P) Ltd., New Delhi.

[R6] Duggal S.K., “Design of Steel Structures”, Tata McGraw Hill Education (P) Ltd., New Delhi.

[R7] Negi L.S., “Design of Steel Structures”, Tata McGraw Hill Education (P) Ltd., New Delhi.

TRANSPORTATION ENGINEERING

Paper Code: ETEN-312

Paper: Transportation 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 give an overview of Transportation Engineering, basic characteristics of Transportation planning, construction techniques, Highway alignment and design and basic parameter of Traffic Engineering.

UNIT I

Highway Development and Alignment : 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.

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

UNIT II

Traffic Engineering: Traffic characteristics and operations, traffic control devices, Traffic Studies including air pollution and their presentation, Traffic Signals, design of traffic signals, Parking requirements and design, Traffic planning and Administration. Introduction to Intelligent Transport System (ITS)

Delhi Metro project: Salient features of design, Construction, Operation and maintenance.

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

UNIT III

Highway Materials Construction, Technique and Quality Control: Properties of subgrade 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. Techniques of construction of rural and urban roads and expressways, Joints in cement concrete pavements, Road construction in water logged areas, Construction of hill roads.

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

UNIT IV

Highway Drainage: Surface and sub surface drainage, Drainage of slopes and erosion control.

Transportation Planning and Management: Urban Travel characteristics, Travel demand, Estimation, Forecasting methods and models, Trip Generation methods, Trip distribution – growth factor methods.

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

Text Books:

[T1] Khanna and Justo, “Highway Engineering”, Nem Chand and Bros. Publishers, Roorkee.

[T2] Chandola S.P., “Transportation Engineering”, S. Chand Publication, New Delhi.

Reference Books:

[R1] Vuchic V.R., “Urban Public Transportation Systems and Technology”, PHI Learning (P) Ltd.

[R2] Corney D., “Design and Performance of Road Pavements”, Tata McGraw Hill Education (P) Ltd.

[R3] Chakroborty P., Das A., “Principles of Transportation Engineering”, PHI Learning (P) Ltd.

[R4] Khisty C.J., “Transportation Engineering”, PHI Learning (P) Ltd., New Delhi.

ENVIRONMENT SYSTEM OPTIMIZATION**Paper Code: ETEN-302****Paper: Environment System Optimization**

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 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] Geem 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

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 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: 11]

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: 12]

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 Management, Tata Mcgraw Hill Publication, New Delhi

[R2] Daniel L.Babacock-Managing Engineering andTechnology- 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, 10th edition, Pearson Prentice Hall.

References Book:

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

SOLID WASTE MANAGEMENT LAB**Paper Code: ETEN-352****Paper: Solid Waste Management Lab**

L	T/P	C
0	2	1

List of Experiments:**A. Based on theory course ETEN 304 (10-12 experiments).**

1. Solid waste sample preparation and technique.
2. Analysis of % composition of solid waste.
3. Proximate Analysis of solid waste.
4. Ultimate analysis of solid waste.
5. Laying out of Collection routes
6. Brief survey of Solid waste collection vehicles.

B. 4-5 experiments on Leachate analysis (BOD/ COD/ TSS/ TDS etc.)**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

EFFLUENT TREATMENT SYSTEM DESIGN AND DRAWING LAB

Paper Code: ETEN-354	L	T/P	C
Paper: Effluent Treatment System Design and Drawing Lab	0	2	1

List of Experiments:

Based on theory course ETEN 306 (10-12 experiments) and ETEN 303.

1. Design of Equalization Tank
2. Design of Sedimentation tank
3. Design of Oil and grease removal unit
4. Design of aerator and settling tank of an Activated sludge process
5. Design of Trickling filter
6. Design of secondary clarifier.
7. Design of Rotating Biological Contactor.
8. Oxidation pond and Oxidation Ditch design.
9. Design of Anaerobic Filter.
10. Two step Anaerobic Digestion System design
11. Design of Sludge Digester
12. Design of Sludge Thickener
13. Design of Air stripping tower

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

ADVANCE DESIGN OF STRUCTURES LAB**Paper Code: ETEN-356****Paper: Advance Design of Structures Lab**

L	T/P	C
0	2	1

Advance Design of Structures Lab Experiments based on syllabus ETEN-310 (8-10 experiments).**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**

ECONOMIC DEVELOPMENT AND ENVIRONMENTAL CONCERNS

Paper Code: ETEN-358	L	T/P	C
Paper: Economic Development and Environmental Concerns	0	2	1

Economic Development and Environmental Concerns Experiments based on syllabus ETEN-308.

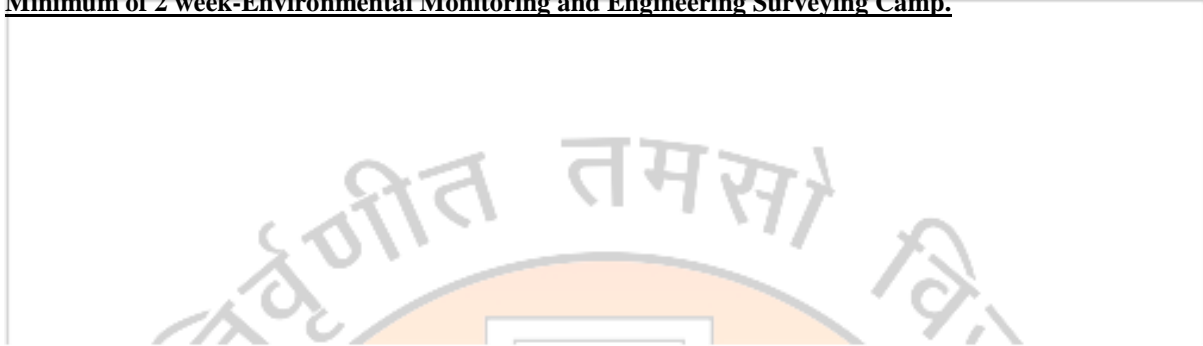
NOTE:- At least 8 Experiments from the syllabus must be done in the semester.



ENVIRONMENTAL MONITORING AND ENGINEERING SURVEYING CAMP

Paper Code: ETEN-360	L	T/P	C
Paper: Environmental Monitoring and Engineering Surveying Camp	0	0	1

Minimum of 2 week-Environmental Monitoring and Engineering Surveying Camp.



SEMINAR**Paper Code: ETEN-362****Paper: Seminar**

L	T/P	C
0	2	1

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. 3rd and 4th 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.

BIOMEDICAL, HAZARDOUS AND E-WASTE MANAGEMENT

Paper Code: ETEN-401

L T/P C

Paper: Biomedical, Hazardous and E-Waste Management

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: This course covers various aspects of hazardous waste, biomedical waste and E-waste such as collection, segregation, recovery, labeling requirements, storage areas, treatment and disposal facilities.

UNIT – I

Sources, Composition and characteristic of hazardous waste, Hazardous Waste (Management and Handling) Rules, 1989 and amendments, Federal Hazardous Waste Regulations under RCRA, Superfund, CERCLA and SARA. Toxicology, public health impact, Protocols, issues and challenges in transportation of hazardous waste.

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

UNIT – II

Characterization of medical waste- Bio-medical wastes (Management and Handling) Rules, 1998, Amendments and guidelines, segregation, packaging, storage, transport of infectious waste. Techniques of Bio-medical waste management. Health and safety rules. Protocols, issues and challenges in transportation of Biomedical waste.

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

UNIT – III

Treatment method- Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bioremediation, Thermal Conversion Technologies, accumulation and storage of hazardous waste, land disposal of hazardous waste, other treatment and disposal method. Common Hazardous Waste Treatment facilities (TSDF).

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

UNIT – IV

E-waste: Introduction, toxicity due to hazardous substances in e-waste and their impacts, domestic e-waste disposal, e-waste management, technologies for recovery of resource from electronic waste, guidelines for environmentally sound management of e-waste, occupational and environmental health perspectives of recycling e-waste in India.

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

Text Books:

- [T1] Tchobanoglous G., Theisen H., Viquel S.A., “Integrated Solid Waste Management: Engineering, Principles and Management issues”, Tata McGraw Hill Publishing Company Ltd., New Delhi.
- [T2] CPHEEO Manual on Municipal Solid Waste Management.

Reference Books:

- [R1] Peavy H.S., Rowe D.R., Tchobanoglous G., “Environmental Engineering”, Tata McGraw Hill Publishing Company Ltd., New Delhi.
- [R2] Cunningham W.P., Cunningham M.A., “Principles of Environmental Science”, Tata McGraw Hill Publishing Company Ltd., New Delhi.
- [R3] Johri R., “E-waste: implications, regulations, and management in India and current global best practices”, TERI Press, New Delhi.
- [R4] Krishnamoorthy B., “Environmental Management, Text Book and Cases”, PHI Learning (P) Ltd., New Delhi.

EIA AND EMS**Paper Code: ETEN-403****Paper: EIA and EMS**

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:

- (1) *To provide an exposure to principles and procedures for EIA and EMS.*
- (2) *To focus on the methodology of EIA.*
- (3) *To emphasize on environmental audit, principles of ISO 14001 and monitoring and contingency plan to minimize release of emissions.*

UNIT -I

EIA: Steps in EIA: description of proposed activity, analysis of site selection procedure and alternate sites, baseline conditions / major concerns, description of potential positive and negative environmental, social, economic and cultural impacts including cumulative, regional, temporal and spatial considerations, significance of impacts, mitigation plans, identify issues related to human health, consideration of alternatives, including not proceeding.

EIA Methodologies: Criteria for the selection of EIA methodology, EIA methods, Adhoc method, Matrix method, Network method, Overlay method, Cost-Benefit analysis.

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

Principles of ISO 14001: Commitment and Policy, Planning, Implementation, Measurement and Evaluation, Review and Improve. Salient points of ISO codes related to EMS. Life cycle assessment, Triple bottom line approach.

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

Environmental Audit: ISO-19011, Qualities of Environmental Auditor, Contents of EA reports, Environmental Audit Terminology, Environmental management System audit.

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

Monitoring plans (impacts and mitigation efforts), contingency plans for unpredicted impacts , waste minimization and recycling plans, public consultation program, plans to minimize release of adverse substances, EIA Notifications and their flaws, Reporting.

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

- [T1] Barthwal R.R., “Environmental Impact Assessment”, New Age International (P) Ltd., New Delhi.
 [T2] Jain R.K., “Environmental Impact Assessment”, Tata McGraw Hill Education (P) Ltd., New Delhi.

Reference Books

- [R1] Canter L.W., “Environmental Impact Assessment”, McGraw Hill, New York.
 [R2] Kurge W.,” ISO 14001 Certification – Environmental Management System”, PHI Learning (P) Ltd., New Delhi. [R3] Lampercht J.,” ISO 9000 – Preparing for Registration”, Dekker Pub. Co.
 [R4] Badrinath S. D. and Raman N. S.,”Certification Scheme for Environmental Audit”, Chemical Business Volume-7, New Delhi..
 [R5] Badrinath S. D. and Rama N. S.,“Environmental Audit: A Step Towards an Ecological Economy”, Chemical Business Volume 12, New Delhi.

APPLICATION OF REMOTE SENSING AND GIS

Paper Code: ETEN-405

Paper: Application of Remote Sensing and GIS

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:

1. *Understand the principles of remote sensing and digital image processing;*
2. *Understand the principles of Geographic Information Systems (GIS);*
3. *Gain experience in the applications of remote sensing and GIS for environmental engineering such as assessment of cyclone, rainfall, atmospheric humidity etc.*
4. *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, T2][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, T2][No. of Hours: 11]

UNIT IV

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

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

Text Books:

- [T1] Chang K.T., "Introduction to Geographic Information System", Tata McGraw Hill Education (P) Ltd.,
 [T2] Joseph G., "Fundamentals of Remote Sensing", University Press (India) Ltd., Hyderabad.

Reference Books:

- [R1] Clarke K.C., Parks B.O., Crane M.P., "GIS and Environmental Modeling", PHI Learning (P) Ltd.,
 [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 Learning (P). Ltd., New Delhi.
 [R4] Chakraborty D. and Sahoo R.N., "Fundamentals of Geographic Information System", Viva Books

WATER RESOURCE SYSTEM PLANNING

Paper Code: ETCE-411

Paper: Water Resource System planning

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 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, V.P. Singh, Elsevier, 2003

[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



SUSTAINABLE ENERGY SYSTEMS

Paper Code: ETEN-413

Paper: Sustainable Energy Systems

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:

1. To describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
2. To explain the technological basis for harnessing various types of renewable energy sources.

UNIT – I

Introduction to sustainable energy – Global sustainability, Role of Energy Conservation, Economics of Energy Generation and conservation System. Geothermal energy: Availability, Geothermal sources, system development and limitations Ocean thermal energy conversion (OTEC): Methods, OTEC system, energy from tides, Scope and economics, Introduction to integrated energy systems.

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

UNIT – II

Solar energy – Production and transfer of solar energy, Sun-Earth angles, Availability and limitations of solar energy, Measuring techniques and estimation of solar radiation ,Photovoltaics and Solar pond, Solar thermal collectors, Flat plate collectors .Heat transfer processes, Short term and long term collector performance, Solar concentrators – Design, analysis and performance evaluation. Applications of Solar energy.

[T1, T2, R2][No. of Hours: 11]

UNIT – III

Wind energy: Introduction, Wind Characteristics, Principles of wind energy conversion, Site selection considerations. Types of Wind machines, Wind power plant design, Wind Farms, Operation, maintenance and economics. Energy storage, applications of Wind Energy, Environmental Aspects.

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

UNIT – IV

Energy from Biomass, Biomass conversion technologies, Biogas Generation, Classification of Biogas plants, Biomass as a source of energy, thermal gasification of Biomass. Energy Storage : Mechanical Technologies, Pumped Hydroelectric storage, Compressed Air Energy Storage, Fundamentals of Battery and Fuel cells, Rechargeable Batteries, Fuel Cells and Hydrogen.

[T1, T2,R3][No. of Hours: 12]

Text Books:

- [T1] Rai G.D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi.
 [T2] Thorndike E.H., “Energy and Environment- a primer for Scientist and Engineers”, Wesley Publishing Company.

Reference Books:

- [R1] Mittal K.M., “Non-conventional Energy Systems-Principles, Progress and Prospects”, Wheeler Publications, New Delhi.
 [R2] Duffie J.A. and Beckman W.A., “Solar Energy thermal processes”, John Wiley, New York.
 [R3] Kreith F. and Kreider J.F., “Principles of Solar Engineering”, Tata McGraw Hill Education (P) Ltd.
 [R4] Ahmed, “Wind energy- Theory and Practice”, PHI Learning (P) Ltd., New Delhi.
 [R5] Kothari, “Renewable Energy Sources and Emerging Technologies”, PHI Learning (P) Ltd., New Delhi.

ADVANCE SEPARATION PROCESS**Paper Code: ETEN-415****Paper: Advance Separation Process**

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 understand the governing mechanisms and driving forces of various advanced separation processes such as reverse osmosis, Nano filtration, ultra filtration, ionic separation etc. and to perform process and design calculations for these processes.

UNIT I

Introduction: Review of conventional processes, Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and equipment used in cross flow filtration, cross flow electro filtration, dual functional filter, Surface based solid - liquid separations involving a second liquid, Sirofloc filter.

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

Membrane Separation: Types and choice of membranes, Plate and frame, tubular, spiral wound and hollow fiber membrane reactors and their relative merits, Commercial, pilot plant and laboratory membranes permeators involving dialysis, reverse osmosis, Nanofiltration, Ultrafiltration, Microfiltration and Donnan dialysis, Economics of membrane operations, Ceramic membranes.

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

Separation By Adsorption Techniques: Choice of adsorbents, Normal adsorption techniques, Types of equipment and commercial processes, Recent advances and process economics, Gas Separation techniques for recovery and reuse, Case Studies.

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

Ionic Separations: Controlling factors, Applications, Types of equipment employed for electrophoresis, Di-electrophoresis, Electro dialysis, Commercial Processes. Separations involving lyophilisation, Pre evaporation and permeation techniques for solids, liquids and gases. Industrial viability and examples, Zone melting, Adductive crystallization, other separation process, Supercritical fluid extraction.

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

- [T1] King, C.J. " Separation Processes ", Tata McGraw - Hill Publishing Co., Ltd, New Delhi.
 [T2] Ronald W. Roussel – "Handbook of Separation Process Technology ", John Wiley, New York.

Reference Books :

- [R1] Lacey, R.E. and Loeb S. - "Industrial Processing with Membranes ", Wiley-Inter Science, New York.
 [R2] Schoew, H.M. "New Chemical Engineering Separation Techniques ", Interscience Publishers.
 [R3] Kestory, R.E. "Synthetic Polymeric Membrances", Wiley, New York.

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

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: 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 parametric and non-parametric methods, identification and accommodation of outliers, frequency analysis of extreme events like flood, 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 on Signed- Rank Test for Association of Paired Observations.

[T2][No. of Hrs. 10]**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 Accommodation of Outliers: Hypothesis Tests, Test Statistics for Detection of Outliers, Dealing with Non-normal 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 Transform, Sample size and accuracy of Monte Carlo Experiments.

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

[T1] Kottogoda 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.



DATA COMMUNICATION AND NETWORKS

Paper Code: ETEC-421

L	T/P	C
3	1	4

Paper: Data Communication and Networks

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: 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. Review of Error Detection and Correction codes.

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

[T1, T2, R1, R4] [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, R1][No. of Hours: 12]

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 ad ICMPV6.

[T1, T2, R1][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, R1, R4][No. of Hours: 10]

Text Books:

[T1] A. S. Tannenbum, D. Wetherall, “Computer Networks”, Prentice Hall, Pearson, 5th Ed

[T2] Behrouz A. Forouzan, “Data Communications and Networking”, Tata McGraw-Hill, 4th Ed

Reference Books:

[R1] Fred Halsall, “Computer Networks”, Addison – Wesley Pub. Co. 1996.

[R2] Larry L, Peterson and Bruce S. Davie, “Computer Networks: A system Approach”, Elsevier, 4th Ed

[R3] Tomasi, “Introduction To Data Communications and Networking”, Pearson 7th impression 2011

[R4] William Stallings, “Data and Computer Communications”, Prentice Hall, Imprint of Pearson, 9th Ed.

[R5] Zheng , “Network for Computer Scientists and Engineers”, Oxford University Press

[R6] Data Communications and Networking: White, Cengage Learning

DATABASE MANAGEMENT SYSTEMS

Paper Code: ETCS-425

Paper: Database Management Systems

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: 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”, 5th 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”, 8th Edition, Pearson Education, 2006.
- [R2] J. D. Ullman, “Principles of Database Systems”, 2nd Ed., Galgotia Publications, 1999.

PLANNING AND DESIGN OF GREEN BUILDINGS

Paper Code: ETEN-421

Paper: Planning and Design of Green Buildings

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:

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, CO₂ 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.

SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

Paper Code: ETHS-419

Paper: Sociology and Elements of Indian History for Engineers

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 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 2nd 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, 6th Edition

Reference Books:

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

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

APPLICATION OF REMOTE SENSING AND GIS LAB**Paper Code: ETEN-451****L T/P C****Paper: Application of Remote Sensing and GIS Lab****0 2 1****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.

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

EIA AND EMS LAB**Paper Code: ETEN-453****L T/P C****Paper: EIA and EMS Lab****0 2 1****List of Experiments:**

Concept of Environmental Impact Assessment, Rapid Environmental Impact Assessment, Environmental Impact Statement

Exercises on Screening, Scoping, Prediction, Identification and Evaluation of Impacts.

Exercises based on EIA Methodologies and computation of various indexes.

Case studies related to EIA one each in following categories:

1. Large water polluting industries like paper, Dairy, Urea, Fertilizers and Textile.
2. Large Air Polluting Industries like Cement, Pulp and Paper, Organic Chemicals, Pesticides, Phosphoric Fertilizer and coal based Thermal Power Plant.
3. Large civic facility:- Wastewater Treatment Plant, Solid Waste Management facility, Landfill site, CETP.
4. Water Resource Project (Dam, Hydropower Plant)
5. Environmental Audit of an industry.

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

DATABASE MANAGEMENT SYSTEMS LAB

Paper Code: ETEN-455 (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 constrains

TEXT BOOK:

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

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

DATA COMMUNICATION AND NETWORKS LAB

Paper Code: ETEN-455(ELECTIVE)	L	T/P	C
Paper: Data Communication and Networks Lab	0	2	1

List of Experiments:

1. Introduction to Computer Network laboratory
Introduction to Discrete Event Simulation
Discrete Event Simulation Tools - ns2/ns3, Omnet++
2. Using Free Open Source Software tools for network simulation – I Preliminary usage of the tool ns3
Simulate telnet and ftp between N sources - N sinks (N = 1, 2, 3). Evaluate the effect of increasing data rate on congestion.
3. Using Free Open Source Software tools for network simulation - II
Advanced usage of the tool ns3
Simulating the effect of queueing disciplines on network performance - Random Early Detection/Weighted RED / Adaptive RED (This can be used as a lead up to DiffServ / IntServ later).
4. Using Free Open Source Software tools for network simulation - III
Advanced usage of the tool ns3 Simulate http, ftp and DBMS access in networks
5. Using Free Open Source Software tools for network simulation - IV
Advanced usage of the tool ns3
Effect of VLAN on network performance - multiple VLANs and single router.
6. Using Free Open Source Software tools for network simulation - IV
Advanced usage of the tool ns3
Effect of VLAN on network performance - multiple VLANs with separate multiple routers.
7. Using Free Open Source Software tools for network simulation - V
Advanced usage of the tool ns3
Simulating the effect of DiffServ / IntServ in routers on throughput enhancement.
8. Using Free Open Source Software tools for network simulation - VI
Advanced usage of the tool ns3
Simulating the performance of wireless networks
9. Case Study I : Evaluating the effect of Network Components on Network Performance
To Design and Implement LAN With Various Topologies and To Evaluate Network Performance Parameters for DBMS etc)
10. Case Study II : Evaluating the effect of Network Components on Network Performance
To Design and Implement LAN Using Switch/Hub/Router As Interconnecting Devices For Two Different LANs and To Evaluate Network Performance Parameters.
11. Mini project - one experiment to be styled as a project of duration 1 month (the last month)

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

MINOR PROJECT**Paper Code: ETEN-457****Paper: Minor Project**

L	T/P	C
0	6	3

Students may choose a project based on any subject of Environmental Engineering. The students will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format.

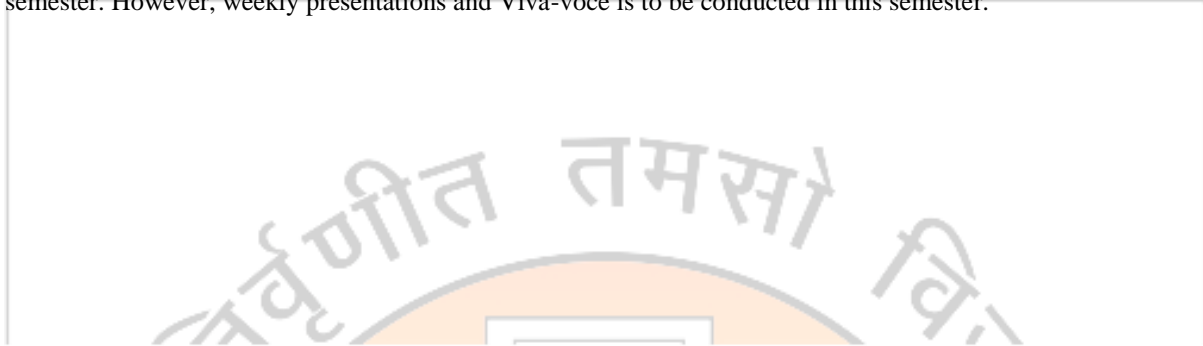
The project work will be a design project for possible implementation of project including field surveying a computer oriented project on any of the topics of environmental engineering interest. It will be a group project. The topic of the project will be different from the minor project.

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 Environmental 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.

INDUSTRIAL TRAINING**Paper code: ETEN-459****Paper: Industrial Training**

L	T/P	C
0	2	1

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



HUMAN VALUES AND PROFESSIONAL ETHICS – II**Paper Code: ETHS-402****L T C****Paper : Human Values and Professional Ethics-II****1 0 1****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. In addition to Question No. 1, the paper shall consist of questions from each of the four units as per the syllabus. Every unit should have two questions. However, students 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, Eecel 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.

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: _____

PLANNING AND MANAGEMENT OF ENVIRONMENTAL PROJECTS

Paper Code: ETEN-404

L T/P C

Paper: Planning and Management of Environment Projects

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: This course is aimed at providing both basic and advanced exposure to Environmental 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

Planning and Layout of Civic facilities like water supply and treatment system, waste water collection treatment, common effluent treatment plant (CETP) and disposal system, solid waste management including engineered landfill sites, functions including regulation by local authorities like water and sanitation Boards, Municipal authority etc., dealing with above mentioned civic facilities.

Project planning, identification, pre-feasibility studies and feasibility report, , administration, legal and financial aspects of management of civic facilities.

Schedules of Labour, materials and equipments, Graphical presentation of earthwork.

Construction Equipments: Equipment for execution 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 Hrs. 12]

UNIT II

Operation and maintenance of water work, waste water treatment facilities and landfill sites, cleaning equipments, precautions, safety equipments, safety practices, emergency maintenance, inspections. record keeping of key activities of OandM.

Monitored data at various stages of treatment facilities, check list, recording of data, reporting and review of performance of various equipments/unit operations of the treatment facilities, sampling requirement, selection of sampling point, test performed in the Laboratory for samples to be taken from various units operations and their effluents, organisation and computerisation of data for decision making and planning interventions.

Instrumentation and controls in water works, waste treatment and solid waste management facilities.

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

UNIT III

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.

Project monitoring using PRIMAVERA or MS Project.

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

UNIT IV

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 between engineer and employers, appointment and authority of engineer for execution of works, public works administration: system of accounts, estimates, Delhi Schedule rates (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 Hrs. 10]

Text Books:

[T1] Punmia and Khandelwal, "PERT and CPM", Laxmi Publications, New Delhi.

[T2] Peurifoy R.L., Schexnayder C.J, Shapira A., "Construction Planning, equipment and methods", Tata Mc Graw Hill (P) Ltd., New Delhi.

Reference Books:

- [R1] Dutta B.N., “Estimation and Costing in Civil Engineering”, UBS Publication Distribution (P) Ltd.,
- [R2] Hinze J., “Construction Contracts”, Tata McGraw Hill Education (P) Ltd., New Delhi. (For Unit-IV)
- [R3] CPHEEO, “Manual on Water and Wastewater Treatment”, Ministry of Urban Development, New Delhi.
- [R4] CPWD, “Delhi Schedule of Rates”, New Delhi.



ENVIRONMENTAL MODELING

Paper Code: ETEN-406
Paper: Environmental Modeling

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 overall aims of the course are for students to acquire:

1. *The appropriate level of advanced theoretical knowledge required to interpret and analyse contemporary and past environmental data for modeling.*
2. *The modelling skills required to investigate the interrelationships between environmental variables, and to predict their responses to changing internal and external conditions.*

UNIT – I

Environmental systems-an introduction, An overview of mathematical models applied to various environmental issues, Concept, Need, Scope and objectives of environmental modelling, Role of mathematical models in environmental quality management, Model classification – Brief review of different types of models, Mathematical (Deterministic), Numerical, Stochastic and Physical Models.

Different stages involved in model building, Calibration and verification of model, Limitations in modelling.

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

UNIT – II

Transport phenomenon, Diffusion, Dispersion, Advection, Adsorption, Conservative and non conservative pollutants.

Surface water quality modelling – River and streams, Estuaries and lakes.

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

UNIT – III

Governing Equations for flow and transport of pollutants, Simplified models for sub-surface plume movements.

Case studies using appropriate software for flow and transport of pollutants.

[T2][No. of Hrs. 12]

UNIT – IV

Dissolved oxygen models – DO sag model, BOD model, Streeter Phelps equation for point and distributed sources.

Eutrophication models for lakes and flowing water; Use of QUAL2K and Water Quality Analysis Simulation Program (WASP). Application of appropriate model for wastewater disposal in river, lake and estuary, application of Air pollution plume model.

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

Text Books:

[T1] Chapra S.C., “Surface water quality modelling”, McGraw Hill., New York.

[T2] Ramaswami A. “Integrated Environmental Modelling”, John Wiley, New York.

Reference Books:

[R1] Rumynin B.G., “Subsurface Solute Transport Model”, Springer, Netherlands.

[R2] Schnoor J., “Environmental Modelling”, John Wiley, New York.

[R3] Jacobson M.Z., “Fundamentals of Atmospheric Modelling”, Cambridge University Press, New York.

[R4] Schnelle K.B. and Dey P.R., “Atmospheric Dispersion Modelling Compliance (1999) Guide”, McGraw-Hill, New York.

TRANSPORTATION, PLANNING AND MANAGEMENT

Paper Code: ETCE-410

Paper: Transportation, Planning and Management

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.

***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.



GROUND WATER ASSESSMENT, DEVELOPMENT AND MANAGEMENT

Paper Code: ETCE-412

L T/P C

Paper: Ground Water Assessment, Development and Management

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 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.

ENVIRONMENTAL PREVENTIVE HEALTH ISSUES**Paper Code: ETCE-414****Paper: Environmental Preventive Health Issues**

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:

1. Recognize potential environmental and occupational risks from environmental hazards and solicit ways to mitigate the risk.
2. Describe factors that affect population susceptibility to adverse health outcomes following exposure to environmental hazards.
3. Recognize potential responses to selected environmental exposures, radiation protection and issues related to occupational health and safety.

UNIT – I

Ecology and Environmental Health, Exposure assessment, Sanitation, Industrial hygiene and environmental management, genetics and environmental health, Environmental Psychology, Environmental Health ethics, Environmental disasters, Legal remedies, Environmental health on the Global, regional and local Scale. Toxicology.

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

Impurities associated with surface and subsurface sources of water supply, Sanitary well, Water borne diseases: Viral, Bacterial, Protozoal and Helminthic, Preventive Measures. Disinfection. Maintenance of Drainage System from Health point of view.

Occupied Room Air: Effective Ventilation and Temperature, Prevention and Control. Disinfection of Air.

Impact of waste management practices on health, Management of Landfill Sites.

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

Health effects associated with lighting: Requirements of good Lighting, Lighting Standards, Biological Effects of Light.

Health effects associated with noise: Effects of Noise Exposure on Health, Noise Control.

Health effects associated with radiation: Exposure to Natural and Manmade Radiation, Types of Radiation, Biological effects of Radiation, Radiation Protection.

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

Occupational Health and Safety: Types of Occupational Hazards, Occupational Diseases such as Silicosis, Anthracosis, Byssinosis etc., Lead Poisoning, Occupational Cancers, Dermatitis, Occupational Hazards of Agricultural Workers, Health problems due to Industrialization, Measures for Health protection of workers, Prevention of Occupational Diseases.

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

- [T1] Park J.E. and Park K., "Textbook of Preventive and Social Medicine", M/s. Banarsidas Bhanot Publishers, Jabalpur.
- [T2] Frumkin H., "Environmental Health: from Global to Local", John Wiley and Sons, USA.

Reference Books:

- [R1] Selendy J.M.H., "Water and Sanitation Related Diseases and the Environment", John Wiley and Sons, USA.
- [R2] Tickner J.A., "Precaution, Environmental Science, and Preventive Public Policy", Island Press, Washington DC.
- [R3] Listorti J.A., Doumani F.M., "Environmental Health-bridging the gaps", The World Bank, Washington DC.

CLIMATE CHANGE ASSESSMENT AND MITIGATION MEASURES

Paper Code: ETEN-416

L T/P C

Paper: Climate Change Assessment and Mitigation Measures

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: After successful completion of this course students are expected to be able to:

1. *Demonstrate an understanding of how the threats and opportunities of predicted climate change will influence specific sectors at global and regional scale;*
2. *Critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts;*
3. *Understand and critically evaluate the scientific insights underlying the assessment reports of the IPCC, with a focus on impacts, adaptation and mitigation.*

UNIT – I

Introduction: Resource management, Carrying Capacity, Green house gas emission- sources, control, trends, projections, Carbon sequestration, Causes and impacts of Climate change, Negotiations of UNFCCC, Kyoto Protocol, Montreal Protocol, Climate change conventions, Climate Policy Analysis- costs of inaction and costs of action, Clean Air Act, Market based Policies- cap and trade mechanism.

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

UNIT – II

Climate Change Problem. International response to climate change- Emergence of Climate change regime, Berlin Mandate, Post Kyoto era. Regime Participants-Parties, NGOs, International Organizations, UN bodies and specialized agencies. Principles- Common Concern of Humankind, Principle 21 of Stockholm Conference and Principle 2 of Rio Declaration, Common but Differentiated responsibilities, Precautionary Principle, Right to sustainable Development.

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

UNIT – III

Mitigation Commitments- Annex I Parties, Kyoto quantified emission limitation or reduction commitments, calculating assigned amount, use of Kyoto Flexibility Mechanisms.

CDM- Eligibility criteria for projects, project cycle, institutions and Procedures, monitoring and certification, issuance of CERs.

Joint Implementation- Institutions, Participation/ eligibility, Track 1 and Track 2 Procedure, small scale and nuclear projects.

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

UNIT – IV

IPCC- role, procedures, assessment process. Transport policies for climate change. Adaptation: National programs and Adaptation measures, planning and integration, adaptation financing. Mitigation measures in Developed and Developing countries.

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

Text Books:

[T1] Yamin F. and Depledge J., “The International Climate Change Regime- a Guide to Rules, Institutions and Procedures”, Cambridge University Press, New York.

[T2] Luterbacher U. and Spriz D.F., “International Relations and Global Climate Change”, Massachusetts Institute of Technology, USA.

Reference Books:

[R1] Davoudi S., Crawford J., Mehmood A., “Planning for Climate Change”, Earthscan, London.

[R2] Mann M.E., Kump L.R., “Dire Predictions: Understanding Global Warming”, Dorling Kindersley Publishing, London.

[R3] Posner E.A., Weisbach D., “Climate Change Justice”, Princeton University Press, New Jersey.

GROUND WATER CONTAMINATION AND REMEDIATION

Paper Code: ETEN-418

L T/P C

Paper: Ground Water Contamination and Remediation

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 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 Storage, 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.

[No. of Hours: 12]

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: 12]

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: 12]

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/ [Computer mediated Distance learning course on 'Modeling Groundwater flow and Contaminant transport' by Jacob Bear].
- [R5] 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

BIO AND CHEMICAL TECHNOLOGY APPLICATIONS IN WASTE MANAGEMENT

Paper Code: ETEN-420	L	T/P	C
Paper: Bio and Chemical Technology Applications in Waste Management	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: This course aims to describe biotechnological solutions to address environmental issues including pollution, water recycling and other key areas. The course also deals with Bio Sensors for detection of pollution, analysis of dose-effect relationship and risk assessment.

UNIT I

Environmental Biotechnology: Principles and concepts, Degradation of highly concentrated toxic pollutants. Mechanisms of detoxification, Oxidation, Dehalogenation, Biotransformation of metals, Bio absorption of metals.

Use of microscopy in environmental application.

Bio-fuel (Biodiesel and Ethanol): Preparation/ Production of bio-fuel., Advantages of bio-fuel, Evaluation of toxicity of bio-fuel.

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

UNIT II

Use of Biotechnology for Pest Control, Desulphurization of coal and oil, hazardous waste treatment, solid waste management and treatment of Wastewater.

Bioremediation: In situ and ex situ techniques, Biosparging, Bioventing, Injection recovery, Land farming, Soil banking and soil slurry reactor techniques, Planning and management of bioremediation and environmental biotechnology processes.

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

UNIT III

Phytotechnology: Plants as bioreactors, Phyto-remediation, Phyto-extraction, Rhizo-filtration, Phyto-stabilisation, Phyto-degradation and phyto-volatilisation, Phyto-mining, Macrophyte based waste- water treatment systems, Algal effluent treatment systems and their limitations.

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

UNIT IV

Biosensors in detection of Environmental Pollutants: BOD sensor, Methane sensor, Ammonia and nitrate sensor, modeling of Bioreactors.

Bio-depollution of soils contaminated by radio elements.

Environmental impacts of pollutants and analysis of dose-effect relationship.

Environmental effects and ethics in microbial technology, Genetically engineered organisms, Microbial containment, Risk assessment.

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

Text Books:

- [T1] Mohapatra P.K., "Textbook of Environmental Biotechnology", I.K. International Publishing House (P) Ltd., New Delhi.
- [T2] Thakur I.S., "Environment Biotechnology basic concepts and applications", I.K. International Publishing House (P) Ltd., New Delhi.

Reference Books:

- [R1] Wang L.K., Ivanov V., Tay J., Hung Y., "Environmental Biotechnology", Humana Press.
- [R2] Martin .A.M, "Biological degradation of wastes", Elsevier Applied Science, London.
- [R3] Aggarwal S.K., "Advanced Environmental Biotechnology", APH Publishing, New Delhi.
- [R4] Jee C., Shagufta, "Environmental Biotechnology", APH Publishing, New Delhi.

ESTIMATION OF ENVIRONMENTAL PROJECTS

Paper Code: ETEN-452

L T/P C

Paper: Estimation of Environmental Projects

0 2 1

List of Experiments:

1. Detailed Estimate (Duration and Cost) for Sanitary and water supply works of two storey buildings.
2. Detailed Estimate for following projects:-
 - (a) Septic Tank with soak pit.
 - (b) Sanitary pit Latrine
 - (c) Manhole
 - (d) Surface Drain Sanitary Fittings.
 - (e) Sewer line
 - (f) Draining Scheme
 - (g) Water Supply Scheme
3. Estimation of water Treatment plant for the population of the City 10 Lakhs.
4. Estimation of Sewage Treatment plant for the 100mgD with sludge digestine Tank and its gas
5. Design and Estimation of Landfill site for MSW of 2000 TPD.
6. Estimation of CETP for the capacity of 25MLD for Dye/Textile/Tannery industry.
7. Estimation of ECSandETP for pulp and Paper/Tannery of 100 TPD.

Text Books and Suggested Readings:

- 1 B.N.Dutta – “Estimating and Costing in Civil Engineering”.
- 2 Delhi Schedule Rates (C.P.W.D.)

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

ENVIRONMENT MODELLING APPLICATIONS

Paper Code: ETEN-454	L	T/P	C
Paper: Environment Modelling Applications	0	2	1

Atleast six case studies using appropriate software based on the course ETEN-406.

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



MAJOR PROJECTS**Paper code: ETEN-460****Paper: Major Projects**

L	T/P	C
0	12	8

Students may choose a project based on any subject of Environmental 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 environmental 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 Environmental 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*******