

PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

B.E. CIVIL ENGINEERING

REGULATION 2016

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM

SEMESTER III

S. No	Category	Course Code	Course Title	L	T	P	C
<b>Theory</b>							
1	BS	MA16301	Transforms and Boundary Value Problems	3	2	0	4
2	ES	CE16301	Engineering Geology	3	0	0	3
3	PC	CE16302	Construction Materials	3	0	0	3
4	ES	CE16303	Strength of Materials I	3	0	0	3
5	PC	CE16304	Fluid Mechanics	3	0	0	3
6	PC	CE16305	Surveying I	3	0	0	3
<b>Practical</b>							
7	PC	CE16306	Survey Practical I	0	0	4	2
8	ES	CE16307	Strength of Materials Laboratory	0	0	4	2
9	EEC	CE16308	Computer Aided Building Drawing	0	0	4	2
<b>Total</b>				<b>18</b>	<b>2</b>	<b>12</b>	<b>25</b>

**SEMESTER IV**

<b>S. No</b>	<b>Category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Theory</b>							
1	BS	MA16404	Numerical Methods	3	2	0	4
2	PC	CE16401	Surveying II	3	0	0	3
3	PC	CE16402	Applied Hydraulic Engineering	3	0	0	3
4	PC	CE16403	Construction Techniques, Equipments and Practices	3	0	0	3
5	PC	CE16404	Concrete Technology	3	0	0	3
6	ES	CE16405	Strength of Materials II	3	0	0	3
7	HS	CH16403	Environmental Science and Engineering	3	0	0	3
<b>Practical</b>							
8	PC	CE16406	Hydraulic Engineering Laboratory	0	0	4	2
9	PC	CE16407	Survey Practical II	0	0	4	2
10	HS	EN16401	Business English Course Laboratory	0	0	2	1
<b>Total</b>				<b>21</b>	<b>2</b>	<b>10</b>	<b>27</b>

**SEMESTER III**  
**TRANSFORMS AND BOUNDARY VALUE PROBLEMS**  
**(COMMON TO ALL BRANCHES)**

MA16301 3 2 0 4

**COURSE OBJECTIVES**

- To introduce fourier series analysis which is central to many applications in engineering apart from solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in many engineering systems..
- To familiarize effective application of mathematical tools for the solutions of partial differential equations that model several physical processes.
- To apply one dimensional equation of heat conduction and study about wave equation.
- To learn and apply Z transform techniques for discrete time systems.

**UNIT I FOURIER SERIES 15**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

**UNIT II FOURIER TRANSFORMS 15**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT III PARTIAL DIFFERENTIAL EQUATIONS 15**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard four types of first order partial differential equations - Linear partial differential equations of second and higher order with constant, coefficients.

**UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 15**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 15**

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

**TOTAL PERIODS 75**

**COURSE OUTCOMES**

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

- comprehend fourier series, their different possible forms and the frequently needed practical harmonic analysis from discrete data.
- describe the concept of a function as a double integral under certain conditions and apply in the fourier transform pair and their properties.
- solve certain boundary value problems and apply the methods and results in engineering applications.
- employ partial differential equations to solve one dimensional wave and heat equations.
- demonstrate the knowledge of differential equations gained and solve them using Z transforms.

### **TEXT BOOKS**

1. Veerarajan T., “Transforms and Partial Differential Equations”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G “Advanced Mathematics for Engineering Students” ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998

### **REFERENCES**

1. Larry C. Andrews, Bhimsen K. Shivamoggi, “Integral Transforms for Engineers”, SPIE Optical Engineering press, Washington USA (1999).
2. Ramana.B.V., “Higher Engineering Mathematics”, Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
3. Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education (2007).
4. Erwin Kreyszig., “Advanced Engineering Mathematics” 10<sup>th</sup> Edition,Wiley Publications
5. Ray Wylie C and Barrett.L.C, “Advanced Engineering Mathematics”, Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

### **WEB LINKS**

1. <https://www.youtube.com/watch?v=coe-UA5ONI0>
2. <https://www.youtube.com/watch?v=gZNm7L96pfY>
3. <http://172.16.100.200/NPTEL/displayweb.html?type1=111103021%2F35.pdf>
4. <https://www.youtube.com/watch?v=4GHY8sRKPu>
5. <http://172.16.100.200/NPTEL/displayweb.html?type1=111104031%2Flectures.pdf%23page%3D101>.

**COURSE OBJECTIVES**

- To describe weathering process and mass movements
- To gain knowledge about various properties of minerals and their engineering significance.
- To acquire knowledge of various classification of rocks.
- To interpret the importance of different geological features and their effects.
- To apply the principles of geological investigations in civil engineering structures.

**UNIT I PHYSICAL GEOLOGY 9**

Geology in civil engineering – branches of geology – structure of earth and its composition – weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering- Plate tectonics.

**UNIT II MINEROLOGY 9**

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

**UNIT III PETROLOGY 9**

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks - Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist

**UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD 9**

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

**UNIT V GEOLOGICAL INVESTIGATION 9**

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Coastal protection structures. Investigation of Landslides and earthquakes - causes and mitigation , seismic zonation – seismic zones of India.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- classify the various geological agents and processes involved.
- identify the available minerals by their properties and behavior.
- classify and identify the available rock in the construction site.
- interpret the different geological features and their engineering importance.
- apply the geological concepts in civil engineering projects.

### **TEXT BOOKS**

1. Parbin Singh, "Engineering and General Geology", S.K.Kataria& Sons, 2008.
2. Venkatareddy. D. Engineering Geology, Vikas Publishing House Pvt. Ltd. 2010.

### **REFERENCES**

1. Muthiayya, V.D.(1969), " A Text of Geology", Oxford IBH Publications, Calcutta.
2. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
3. F.G.Bell. Fundamentals of Engineering Geology, B.S. Publications. Hyderabad 2011.
4. Dobrin, M.B An introduction to geophysical prospecting, McGraw-Hill, New Delhi, 1988
5. Varghese, P.C., Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi, 2012.
6. MarlandP.Billings, "Structural Geology", PHI Learning Pvt. Ltd. New Delhi, 2012

### **WEB LINKS**

1. <http://studentsuvidha.com/forum/Forum-Engineering-Geology-btech-Notes-study-material>
2. <https://www.examrace.com/IES/IES-Free-Study-Material/Civil-Engineering/Engineering-Geology>

**COURSE OBJECTIVES**

- To identify the characteristics of various building materials.
- To analyse various materials commonly used in civil engineering construction and their properties
- To gain knowledge about various processes involved in the manufacturing of concrete
- To study the importance and benefits of timber and other products
- To gain knowledge of various modern materials used in construction.

**UNIT I STONES – BRICKS – CONCRETE BLOCKS 9**

Stones as building material – Criteria for selection - Test on stones – Deterioration and preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Test on bricks – Compressive strength – Water Adsorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, Concrete blocks –Light weight concrete blocks.

**UNIT II LIME – CEMENT – AGGREGATES – MORTAR 9**

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and cement mortar – Hydration – Compressive strength – Tensile strength – Fineness – Soundness and consistency – Setting time – Industrial by products – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance - Grading – Sand Bulking.

**UNIT III CONCRETE 9**

Concrete – Ingredients – Manufacturing process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction factor – Properties of hardened concrete – Compressive, Tensile and shear strength - Modulus of rupture - Tests - High strength concrete and HPC – Self compacting concrete – Other types of concrete – Durability of Concrete.

**UNIT IV TIMBER AND OTHER MATERIALS 9**

Timber - Market forms – Industrial timber – Plywood –Veneer – Thermacole – Panels of laminates – Steel - Aluminum and Other metallic materials – Composition – Aluminum composite panel – Uses – Market forms - Mechanical treatment –Paints – Vanishes – Distempers – Bitumens.

**UNIT V MODERN MATERIALS 9**

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- identify the various construction materials
- familiarize themselves with the characteristics of basic building materials
- understand the behavior and manufacture of cement and concrete.
- identify the timber materials.
- understand and conserve the modern materials.

### **TEXT BOOKS**

1. Varghese.P.C, “Building Materials”, PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Rajput. R.K., “Engineering Materials”, S. Chand and Company Ltd., 2008.

### **REFERENCES**

1. Jagadish.K.S, “Alternative Building Materials Technology”, New Age International, 2007.
2. Gambhir. M.L., &NehaJamwal., “Building Materials, products, properties and systems”, Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. Shetty.M.S., “Concrete Technology (Theory and Practice)”, S. Chand and Company Ltd.,2008.
4. Gambhir.M.L., “Concrete Technology”, 3rd Edition, Tata McGraw Hill Education, 2004
5. Duggal.S.K., “Building Materials”, 4th Edition, New Age International, 2008.

### **WEB LINKS**

1. <http://ceae.colorado.edu/~saouma/Lecture-Notes/s4a.pdf>
2. <http://pareto.uab.es/xmg/Docencia/IO-en/IO-Introduction.pdf>



**COURSE OBJECTIVES**

- To understand the fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin shells.
- To analyze the truss elements under complex state of stress by means of analytical methods.
- To acquire knowledge about shear force and bending moment for all statically determinate beams by recognizing the beam type and loading.
- To know the behavior of members subjected to pure torsion and also to develop knowledge about springs.
- To find deflection of beam with different load and different method and to provide exposure of the concepts of internal stress in beams of various cross sections.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Rigid and deformable bodies – Stability, strength and stiffness - Axial and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Biaxial state of stress – Elastic Constants – Stresses and deformation of thin cylindrical and spherical shells – Stresses at a point – Stresses on inclined planes - Principal stresses and principal planes – Mohr’s circle of stress

**UNIT II ANALYSIS OF PLANE TRUSSES 9**

Stability and equilibrium of plane frames – Perfect frames - Types of trusses – Analysis of forces in truss members – Method of joints – Method of tension co-efficient – Method of sections.

**UNIT III BENDING OF BEAMS 9**

Beams – Types and transverse loading on beams – Shear force and bending moment in beams – Cantilever beams – Simply supported beams and over-hanging beams - Theory of simple bending – Bending stress distribution – Load carrying capacity – Proportioning of sections – Leaf springs – Flitched beams – Shear stress distribution

**UNIT IV TORSION 9**

Theory of simple torsion - Stresses and deformation in circular and hollow shafts – Stepped shafts – Shafts fixed at both ends – Stresses and deflection in helical springs- introduction to torsion of rectangular sections- Warping.

**UNIT V DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay’s method – Area moment method – Conjugate beam method for computation of slopes and deflections in determinate beams- deflection due to shear.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- understand the fundamental concepts of stresses and strains in one and two dimensional states.
- analyse determinate beams and plane trusses.
- understand the bending of different types of beams.
- get sufficient knowledge about designing shafts to transmit required power and also springs for its maximum energy storage capacities.
- find the deflection of beams.

**TEXT BOOKS**

1. Bansal R.K, Strength of Materials (Mechanics of Solids), Laxmi publishing PvtLtd,New Delhi, 2012
2. Rajput.R.K. Strength of Materials, S.Chand& Company Ltd., New Delhi 2014.

**REFERENCES**

1. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
2. Punmia B.C, Ashok K. Jain and Arun K. Jain, Theory of Structures (SMTS II), Laxmi publishing Pvt Ltd, New Delhi,2004.
3. Punmia B.C, Ashok K. Jain and Arun K. Jain, Mechanics of Structures (SMTS I), Laxmi publishing pvt Ltd,New Delhi,2011
4. Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014

**WEB LINK**

1. <http://www.esm.psu.edu/courses/emch213d/tutorials/animations>.

**COURSE OBJECTIVES**

- To understand the importance, application and inter-relationship of various properties of fluid.
- To obtain knowledge in kinematic and dynamics flow of fluid and various devices used to measure the velocity and discharge of fluid.
- To gain knowledge of dimensional analysis of fluid.
- To interpret the applications of the conservation laws to flow through pipes (both laminar and turbulent)
- To gain knowledge about boundary layers

**UNIT I FLUIDS PROPERTIES AND FLUID STATICS 9**

Scope of fluid mechanics - Definitions of a fluid - Methods of analysis - Dimensions and units - viscosity, density, perfect gas, vapour pressure and surface tension - Basic equation of fluid statics - Pressure measurements - Manometers - Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies - Relative equilibrium.

**UNIT II BASIC CONCEPTS OF FLUID FLOW 9**

(a) Kinematics – Methods of describing fluid motion - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets; (b) Dynamics - Dimensional Concepts of System and Control volume - Application of control volume to continuity, energy and momentum - Euler's equation of motion along a stream line - Bernoulli's equation - Applications to velocity and discharge measurements - Linear momentum equation and moment – of – momentum equations and their applications.

**UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 9**

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models.

**UNIT IV INCOMPRESSIBLE VISCOUS FLOW 9**

Laminar flow between parallel plates, and pipes - Development of laminar and turbulent flows in pipes - Reynolds experiment – Darcy-Weisbach equation - Moody diagram - Major and minor losses of flow in pipes - Pipes in series and in parallel.

**UNIT V BOUNDARY LAYERS AND TRANSPORT BY ADVECTION AND DIFFUSION 9**

Definition of boundary layers - Displacement, momentum and energy thickness - Laminar and turbulent boundary layers - Momentum integral equation – Steady molecular diffusion and conduction – Turbulent transport equations – Channel diffusion and Dispersions and Applications.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- attain a thorough knowledge about various fundamental properties of fluids.
- apply the continuity, energy and momentum equations to fluid flow.
- gain knowledge about various dimensional analysis of fluid.
- distinguish laminar and turbulent flow through pipes and compute the energy losses in pipe flow.
- select appropriate model to provide solution to a real time problem related to hydraulics.

### **TEXT BOOKS**

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 9th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2017.
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi, 20th edition, 2015.

### **REFERENCES**

1. Jain A. K. "Fluid Mechanics", Khanna Publishers, 2010
2. R.K.Rajput., "A text book of Fluid Mechanics", S.Chand and Company, NewDelhi, 2007.
3. Roberson J.A and Crowe C.T., Engineering Fluid Mechanics. Jaico Books Mumbai, 2000.
4. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th ed) Tata McGraw Hill, New Delhi, 1998

### **WEB LINKS**

1. <http://bookboon.com/en/engineering-fluid-mechanics-ebook>
2. [http://www.engineeringtoolbox.com/fluid-mechanics-t\\_21.html](http://www.engineeringtoolbox.com/fluid-mechanics-t_21.html)
3. <http://www.efunda.com/formulae/fluids/overview.cfm>
4. <http://nptel.ac.in/courses/105101082/>
5. <http://nptel.ac.in/courses/105103095/>

**COURSE OBJECTIVES**

- To understand the importance of surveying in the field of civil engineering
- To gain knowledge of chain surveying, compass surveying and plane table surveying.
- To find the elevation of points by using various leveling methods.
- To use the basics of leveling application in civil engineering field
- To gain knowledge about theodolite survey in elevation and angular measurements.

**UNIT I FUNDAMENTALS AND CHAIN SURVEYING 9**

Definition- Classifications - Basic principles-Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing - Plotting – applications- enlarging the reducing the figures – Areas enclosed by straight line irregular figures- digital planimetre.

**UNIT II COMPASS AND PLANE TABLE SURVEYING 9**

Compass – Basic principles - Types - Bearing - Systems and conversions- Sources of errors- Local attraction - Magnetic declination – Dip-Traversing - Plotting - Adjustment of closing error – applications - Plane table and its accessories - Merits and demerits - Radiation - Intersection - Resection – Traversing- sources of errors – applications.

**UNIT III LEVELLING 9**

Level line - Horizontal line - Datum - Bench marks - Levels and staves - temporary and permanent adjustments – Methods of levelling - Fly levelling - Check levelling - Procedure in levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling – Sources of Errors in leveling - Precise levelling - Types of instruments - Adjustments - Field procedure

**UNIT IV LEVELLING APPLICATIONS 9**

Longitudinal and Cross-section-Plotting - Contouring - Methods - Characteristics and uses of contours – Plotting – Methods of interpolating contours – Computations of cross sectional areas and volumes - Earthwork calculations - Capacity of reservoirs - Mass haul diagrams.

**UNIT V THEODOLITE SURVEYING 9**

Theodolite - Types - Description - Horizontal and vertical angles - Temporary and permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense method - Stadia constants - Anallactic lens.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- understand the working principles of survey instruments.
- calculate included angles and bearings by using compass, plotting and adjustment of traverse by plane table survey.
- describe the uses of levelling instruments
- interpret survey data and compute areas and volumes.
- calculate horizontal angles and vertical angles by using tacheometer.

### **TEXT BOOKS**

1. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 2010.
2. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2013.

### **REFERENCES**

1. Chandra A.M., "Plane Surveying", New Age International Publishers, 2015.
2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 2008.
3. Alak De, "Plane Surveying", S. Chand & Company Ltd., 2014.
4. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
5. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
6. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2011.

### **WEB LINKS**

1. [nptel.ac.in/courses/105104101/1](https://nptel.ac.in/courses/105104101/1)
2. <https://sites.google.com/a/mitr.iitm.ac.in/iitmcivil/ce2080>

**COURSE OBJECTIVES**

- To impart knowledge about measuring area and offset by using chain surveying.
- To familiarize themselves with the concepts of bearing and area measurement using different compass.
- To provide training in different methods of plane table surveying.
- To acquire the knowledge of finding the reduced levels using different methods of leveling.
- To plot LS and CS

**LIST OF EXPERIMENTS**

1. Study of chains and its accessories
2. Aligning, Ranging and Chaining
3. Chain Traversing
4. Compass Traversing
5. Plane table surveying: Radiation
6. Plane table surveying: Intersection
7. Plane table surveying: Traversing
8. Plane table surveying: Resection –Three point problem
9. Plane table surveying: Resection – Two point problem
10. Study of levels and levelling staff
11. Fly levelling using Dumpy level
12. Fly levelling using tilting level
13. Check leveling
14. LS and CS
15. Contouring

**TOTAL PERIODS 60****COURSE OUTCOMES**

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

- handle the conventional surveying instruments such as chain/tape, compass, plane table, and theodolite in the field of civil engineering.
- undergo traverse using various instruments
- prepare contour using levelling instrument.
- use the theodolite effectively for various applications
- plot longitudinal section and cross section.

**COURSE OBJECTIVES**

- To understand the technical concepts and ways to solve engineering problems through theoretical calculations by conducting experiments.
- To apply the concepts of mechanics of materials to determine the behaviour of materials under load.
- provide the skill sets required to perform experiments and write lab reports.

**LIST OF EXPERIMENTS**

1. Tension test on mild steel rod
2. Double shear test on metal
3. Torsion test on mild steel rod
4. Impact test on metal specimen (Izod and Charpy)
5. Hardness test on metals (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Compression test on helical spring
8. Tension test on helical spring
9. Compression test on wood

**TOTAL PERIODS 60****COURSE OUTCOMES**

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

- apply the concepts of mechanics for determining stresses and strains from the member forces.
- determine the behavior of structural elements such as bars, beams and columns subjected to tension, compression, shear, bending and torsion by means of experiments.
- understand the behavior of materials under various loading conditions.



**COURSE OBJECTIVES**

- To provide knowledge of different views of components of a building.
- To familiarize the students with creating, modifying and annotating commands using software.
- To create plan, section and elevation of buildings using drafting software.

**LIST OF EXPERIMENTS**

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)
2. Buildings with load bearing walls
3. Buildings with sloping roof
4. R.C.C. framed structures
5. Industrial buildings – North light roof structures
6. Perspective view of single storey building

**TOTAL PERIODS 60****COURSE OUTCOMES**

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

- have fundamental understanding of 2D and 3D views of buildings and understand the different views of the components of a building.
- use, create, modify and annotation commands.
- create plan, section and elevation of different buildings and take the print out.

**TEXT BOOKS**

1. Sikka V.B., A Course in Civil Engineering Drawing, 4TH Edition, S.K.Kataria and Sons, 2015.
2. George Omura, Mastering in Autocad 2005 and Autocad LT 2005– BPB Publications, 2008

**REFERENCES**

1. Shah.M.G.,Kale.C.M. andPatki.S.Y., Building Drawing with an Integrated Approach to Built Environment, Tata McGraw Hill Publishers Limited, 2007.
2. Verma.B.P., Civil Engineering Drawing and House Planning, Khanna Publishers, 2010.
3. Marimuthu V.M., Murugesan R. and Padmini S., Civil Engineering Drawing-I, Pratheeba Publishers, 2008.

**WEB LINKS**

1. [www.iitk.ac.in/cad/](http://www.iitk.ac.in/cad/)
2. [www.cadl.iiscx.ernet.in/](http://www.cadl.iiscx.ernet.in/)

## SEMESTER IV

### NUMERICAL METHODS

MA16404

(COMMON TO AERO,CIVIL,EEE,MECH & MCT)

3 2 0 4

#### COURSE OBJECTIVES

- To analyse different methods to find solution for a large system of linear equations
- To find the intermediate values for a series of given data
- To develop efficient algorithms for solving problems in science, engineering and technology
- To solve the non linear differential equations that cannot be solved by regular conventional method.
- To apply finite element method to increase the accuracy of second order differential equations

#### UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 15

Solution of equation – Iteration method : Newton Raphson method – Solution of linear system by Gauss elimination and Gauss - Jordan method – Iterative method – Gauss-Seidel method – Inverse of a matrix by Gauss Jordan method – Eigenvalue of a matrix by power method.

#### UNIT II INTERPOLATION AND APPROXIMATION 15

Lagrangian Polynomials – Divided differences – Newton's Divided Difference, Hermite Interpolation Polynomial and Interpolating with a cubic spline – Newton's forward and backward difference formulas.

#### UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 15

Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpson's 1/3– Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons' rule.

#### UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 15

Single step methods: Taylor series method – Modified Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

#### UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 15

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

**TOTAL PERIODS 75**

#### COURSE OUTCOMES

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

- comprehend the basics of linear equations.
- apply the interpolation methods for constructing approximate polynomials
- demonstrate the knowledge of numerical differential equations in computational and simulation process
- utilize the concept of initial value problems in the field of science and engineering
- describe the computational procedure of the amount of heat emitted or transferred from an object

### **TEXT BOOKS**

1. Erwin Kreyszig, “Advanced Engineering Mathematics” 10<sup>th</sup> edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, “Numerical Methods with programming in C”, 2<sup>nd</sup> ed., Tata McGraw-Hill, 2006.
3. Sankar Rao K “ Numerical Methods For Scientists And Engineers –3<sup>rd</sup> Edition Princtice Hall of India Private, New Delhi, 2007.

### **REFERENCES**

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, “Numerical Methods”, S.Chand Co. Ltd., New Delhi, 2003
2. Gerald C.F. and Wheatley, P.O., “Applied Numerical Analysis” 6<sup>th</sup> Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyengar , R.K.Jain , “Numerical Methods For Scientific & Engineering Computation”
4. New Age International ( P ) Ltd , New Delhi , 2005.
5. M.B.K. Moorthy and P.Geetha, “Numerical Methods” , Tata McGraw Hill Publications company, New Delhi, 2011.

### **WEB LINKS**

1. <https://www.youtube.com/watch?v=QTQ8bO1F-Dg>
2. <https://www.youtube.com/watch?v=AT7Olelic8U>
3. <https://www.youtube.com/watch?v=TH06N7Q7FJw>
4. <https://www.youtube.com/watch?v=DnBJLpdVHCY>
5. <https://www.youtube.com/watch?v=5TccPEz2nB8>

**COURSE OBJECTIVES**

- To understand the trigonometrical levelling.
- To adjust the errors encountered during surveying
- To work with total station
- To understand the concept of GPS
- To know the various types of advanced surveying methods.

**UNIT I CONTROL SURVEYING 9**

Working from whole to part - Horizontal and vertical control methods - Triangulation - Signals - Base line - Instruments and accessories - Corrections - Satellite station - Reduction to centre – Trigonometrical leveling-Single and reciprocal observations - Modern trends – Bench marking

**UNIT II SURVEY ADJUSTMENT 9**

Errors Sources- precautions and corrections – classification of errors – true and most probable values - weighed observations – method of equal shifts – principle of least squares - normal equation – correlates - level nets- adjustment of simple triangulation networks.

**UNIT III TOTAL STATION SURVEYING 9**

Basic Principle – Classifications -Electro-optical system: Measuring principle, Working principles, Sources of Error, Infrared and Laser Total Station instruments. Microwave system:Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments. Modern positioning systems – Traversing and Trilateration.

**UNIT IV GPS SURVEYING 9**

Basic Concepts - Different segments - space, control and user segments - satellite configuration -signal structure - Orbit determination and representation - anti spoofing and selective availability- Task of control segment – Hand Held and Geodetic receivers –data processing - Traversing and triangulation.

**UNIT V ADVANCED TOPICS IN SURVEYING 9**

Route Surveying-Reconnaissance- Route surveys for highways, railways and waterways- Curve ranging - Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite - Compound and reverse curves - Transition curves - Functions and requirements. Hydrographic surveying- Tides-MSL- Sounding methods- Three-point problem- Strength of fix-Sextants and station pointer- Astronomical Surveying-field observations and determination of Azimuth by altitude and hour angle methods- fundamentals of Photogrammetry and Remote sensing.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- distinguish between the stations calculated by single and reciprocal levelling.
- identify the errors and adjust them in the real time applications.
- gain knowledge about principles and methods of measurement using total station.

- understand the working principle of GPS, its components, signal structure, processing techniques used in GPS observations and error sources.
- demonstrate methods of survey in water bodies by hydrographic surveying, basic concepts adopted in photogrammetry.

#### **TEXT BOOKS**

1. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 2010.
2. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2013.

#### **REFERENCES**

1. Chandra A.M., "Plane Surveying", New Age International Publishers, 2015.
2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 2008.
3. Alak De, "Plane Surveying", S. Chand & Company Ltd., 2014.
4. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
5. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
6. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2011.
7. Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 2004.

#### **WEB LINKS**

1. [nptel.ac.in/courses/105107122/](http://nptel.ac.in/courses/105107122/)
2. <http://nptel.ac.in/courses/105107122/20>

**COURSE OBJECTIVES**

- To identify the characteristics uniform flow
- To analyse gradually varied flow and their properties
- To gain knowledge about rapidly varied flow and hydraulic depth
- To understand about the pumps and its characteristics.
- To study the types and characteristics of turbine

**UNIT I UNIFORM FLOW 9**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

**UNIT II VARIED FLOWS 9**

Dynamic equations of gradually varied and spatially varied flows - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Applications

**UNIT III RAPIDLY VARIED FLOWS 9**

Application of the energy equation for RVF - Critical depth and velocity - Critical, Sub-critical and Super-critical flow - Application of the momentum equation for RVF - Hydraulic jumps - Types Energy dissipation - Surges.

**UNIT IV PUMPS 9**

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.

**UNIT V TURBINES 9**

Turbines - Classification - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Runaway speed - Similarity laws.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- know about the uniform flow and its computation
- familiarize themselves with the characteristics varied flow
- understand the behavior of rapidly varied flow
- understand the various type of pumps and its characteristics
- identify the turbine and its characteristics

### **TEXT BOOKS**

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, 9th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2017.
2. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2000

### **REFERENCES**

1. Jain A. K. "Fluid Mechanics", Khanna Publishers, 2010
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi, 20th edition, 2015.
3. Rajesh Srivastava, Flow through open channels, Oxford University Press, New Delhi, 2008

### **WEB LINKS**

1. <http://nptel.ac.in/courses/105103021/>
2. <http://nptel.ac.in/courses/105107059/>
3. [ebookbrowse.net](http://ebookbrowse.net) › ap › applied-hydraulic-engineering

**COURSE OBJECTIVES**

- To study the properties, testing and handling of concrete for the construction projects.
- To know the appropriate techniques and practices used in the construction according to the current scenario.
- To gain knowledge about various constructions methodology adopted for substructure construction.
- To acquire emerging ideas in the field of Super structure construction.
- To create awareness about the new construction equipment and its usage in the project.

**UNIT I CONCRETE TECHNOLOGY 9**

Cements – Grade of cements - concrete chemicals and Applications – Grade of concrete manufacturing of concrete – Batching – mixing – transporting – placing – compaction of concrete – curing and finishing - Testing of fresh and hardened concrete – quality of concrete – Extreme Weather Concreting - Ready Mix Concrete - Non-destructive testing.

**UNIT II CONSTRUCTION PRACTICES 9**

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick – weather and water proof – roof finishes – acoustic and fire protection.

**UNIT III SUB STRUCTURE CONSTRUCTION 9**

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement- Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam – cable anchoring and grouting- driving diaphragm walls, sheet piles - shoring for deep cutting - well points- Dewatering and stand by Plant equipment for underground open excavation.

**UNIT IV SUPER STRUCTURE CONSTRUCTION 9**

Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks.

**UNIT V CONSTRUCTION EQUIPMENT 9**

Selection of equipment for earth work - earth moving operations – types of earthwork equipment tractors, motor graders, scrapers, front end loaders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling.

**TOTAL PERIODS 45**



## **COURSE OUTCOMES**

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

- understand the material properties, strength and durability of concrete.
- use suitable construction techniques and practices for the particular project.
- gain exposure in the modern construction techniques adopted in the construction projects.
- use advanced techniques towards speedy and guaranteed projects.
- acquire knowledge about the usage & suitability of new construction equipment in large projects.

## **TEXT BOOKS**

1. Varghese, P.C. "Building construction", Eastern Economy Edition, Second Edition, 2016
2. Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.
3. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997

## **REFERENCES**

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.
2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2002
3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.
4. Dr. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi, 1983.
5. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004

## **WEB LINKS**

1. <https://www.youtube.com/watch?v=bA3OsOsrRgc>
2. <http://www.youtube.com/watch?v=-srRW8Gfvnk>



**REFERENCES**

1. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007
2. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, NewDelhi, 2007
3. IS10262-2009 Indian standard concrete mix design

**WEB LINK**

1. <http://nptel.ac.in/syllabus/syllabus.php?subjectId=105104030>

**COURSE OBJECTIVES**

- To understand the concept of energy principles.
- To learn the computation of deflection of beams using energy principles and to know the concept of analysis of indeterminate beams.
- To estimate the load carrying capacity of columns and analysis of three dimensional state of stress.
- To understand the concept of theories of failure of materials.
- To understand advanced concepts like unsymmetrical bending, shear center and fracture of materials.

**UNIT I ENERGY PRINCIPLES 9**

Strain energy and strain energy density – Strain energy in axial force - Shear, flexure and torsion – Castigliano’s and Engesser’s theorems – Principle of virtual work – Application of energy theorems for computing deflections in beams – Maxwell’s reciprocal theorem.

**UNIT II INDETERMINATE BEAMS 9**

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading – Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.

**UNIT III COLUMNS 9**

Behaviour of short and long columns. Euler’s theory of long columns – Critical loads for prismatic columns with different end conditions - Rankine-Gordon Formula - Eccentrically loaded long columns -Eccentrically loaded short columns - middle third rule – Core of section.

**UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9**

Determination of principal stresses and principal planes – Volumetric strain – Theories of failure –Principal stress, principal strain, shear stress, strain energy and distortion energy theories –Application in analysis of stress, load carrying capacity and design of members. Interaction problems - Interaction curves.

**UNIT V ADVANCED TOPICS 9**

Unsymmetrical bending of beams - symmetrical and unsymmetrical sections, shear centre – stresses on curved beams for simple solid sections – Winkler Bach Formula – Thick cylinders –Compound cylinders - residual stresses, stress concentration, fatigue, torsion of thin walled sections.

**TOTAL PERIODS 45****COURSE OUTCOMES**

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

- understand the fundamental concepts of energy principles.
- gain knowledge about analysis of indeterminate beams and use of energy method for estimating the slope and deflections.
- analyse behaviour of columns.
- describe the failure of materials.
- understand unsymmetrical bending, shear center and fracture of materials

**TEXT BOOKS**

1. Rajput.R.K. Strength of Materials, S.Chand& Company Ltd., New Delhi 2014.
2. Punmia, B.C.,Theory of Structures (SMTS) Vol.I and II, Lakshmi Publishing Pvt. Ltd., New Delhi,2004.

**REFERENCES**

1. Malhotra, D.R. Gupta, H.C., The Strength of Materials, SatyaPrakashan, No. (Tech.India Publications), New Delhi 1995.
2. William A.Nash, Schaum's Outline Series, McGraw Hill International Editions, Fifth Edition, 2011.
3. Rattan S.S., Strength of Materials, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011
4. Ramamrutham.SDhanapatRai Publishing Company (P) Ltd.,New Delhi 2009.
5. Elangovan.A, Porul Valimaiyiyal - II, Anna University, 2011.

**WEB LINKS**

1. <http://nptel.ac.in/courses/105105108/>
2. <http://studentskey.in/strength-of-materials-notes/>

## (COMMON TO AERO,CIVIL &amp; MECH )

**COURSE OBJECTIVES**

- To understand the constituents of the environment and the precious resources in the environment.
- To study all types of ecosystems and biodiversity.
- To familiarize the role of human being in maintaining a clean and green environment.
- To analyze social issues related to environment.
- To learn about the role of population explosion, family welfare programme and value education.

**UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9**

Environment: Definition- scope - importance – need for public awareness. Forest resources: Use –over exploitation- deforestation - case studies- mining - effects on forests and tribal people. Water resources: Use – over utilization of surface and ground water- floods – drought - conflicts over water. Mineral resources: Use – exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture- fertilizer-pesticide problems - water logging - salinity -case studies. Energy resources: Growing energy needs - renewable and non-renewable energy sources. Role of an individual in conservation of natural resources.

**UNIT II ECOSYSTEMS AND BIODIVERSITY 9**

Concept of an ecosystem: Structure and function of an ecosystem – producers - consumers -decomposers – energy flow in the ecosystem – ecological succession – food chains - food webs and ecological pyramids. Types of ecosystem: Introduction - characteristic features - forest ecosystem - grassland ecosystem - desert ecosystem - aquatic ecosystems (lakes, rivers, oceans, estuaries). Biodiversity: Introduction– definition (genetic - species –ecosystem) diversity. Value of biodiversity: Consumptive use productive use – social values – ethical values - aesthetic values. Biodiversity level: Global - national - local levels- India as a mega diversity nation- hotspots of biodiversity. Threats to biodiversity: Habitat loss poaching of wildlife – man wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**UNIT III POLLUTION 9**

Pollution: Definition –air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution – nuclear hazards. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution -Disaster management: Floods – earthquake - cyclone - landslides. Electronic waste-Sources-Causes and its effects.

**UNIT IV SOCIAL ISSUES AND ENVIRONMENT 9**

Sustainable development: Unsustainable to sustainable development – urban problems related to energy. Water conservation - rain water harvesting - watershed management. Resettlement and rehabilitation of people. Environmental ethics: Issues - possible solutions – climate change - global warming and its effects on flora and fauna - acid rain - ozone layer depletion - nuclear accidents - nuclear holocaust. Environment protection act: Air (Prevention and Control of Pollution) act – water (Prevention and control of Pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation.

**UNIT V HUMAN POPULATION AND ENVIRONMENT****9**

Human population: Population growth - variation among nations – population explosion – family welfare programme and family planning – environment and human health – Human rights – value education – HIV / AIDS, Swine flu – women and child welfare. Role of information technology in environment and human health.

**TOTAL PERIODS****45****COURSE OUTCOMES**

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

- comprehend the basic concepts of environment studies and natural resources.
- discuss about ecosystem and biodiversity.
- describe the causes, effects and control measures of various types of pollution.
- explain social issues and various environmental acts.
- debate on the relationship between the human population and environment.

**TEXT BOOKS**

1. T.G.Jr. Miller, Environmental Science, 10<sup>th</sup>Edn, Wadsworth Publishing Co., (2004).
2. Raman Sivakumar, Introduction to Environmental Science and Engineering, 2<sup>nd</sup>Edn, Tata McGraw Hill Education Private Limited, New Delhi, (2010).
3. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw Hill, (2010).

**REFERENCES**

1. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India, 2010.
2. S. Divan, Environmental Law and Policy in India, Oxford University Press, New Delhi, 2002.
3. K.D. Wager, Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.
4. W.P. Cunningham, Environmental Encyclopedia, JaicoPublishing House, Mumbai, 2004.
5. Clair Nathan Sawyer, Perry L. McCarty, Gene F. Parkin, “Chemistry for Environmental Engineering”, McGraw Hills

**WEB LINKS**

1. [www.chegg.com](http://www.chegg.com)
2. [www.vidhyarathiplus.com](http://www.vidhyarathiplus.com)

**COURSE OBJECTIVES**

- To understand various flow measuring techniques available to measure the discharge of liquids flowing through pipes and in open channels.
- To study the performance of various types of pumps.
- To acquire thorough knowledge about various types of turbines.

**LIST OF EXPERIMENTS**

1. Determination of co-efficient of discharge for orifice
2. Determination of co-efficient of discharge for notches
3. Determination of co-efficient of discharge for Venturimeter
4. Determination of co-efficient of discharge for orifice meter
5. Study of losses in pipes
6. Study of bernoulis theorem apparatus
7. Study on performance characteristics of Pelton turbine
8. Study on performance characteristics of Francis turbine
9. Study on performance characteristics of Kaplan turbine
10. Study on performance characteristics of Centrifugal pumps
11. Study on performance characteristics of Reciprocating pump.
12. Study on performance characteristics of Gear pump

**TOTAL PERIODS 60****COURSE OUTCOMES**

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

- determine the flow in pipes and in open channels..
- select an appropriate pump for a specific application.
- select a suitable type of turbine for the given situation

**REFERENCES**

1. Sarbajit Singh. Experiments in Fluid Mechanics, PHI Learning Private Ltd., New Delhi 2009.
2. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.
3. Modi P. N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House, New Delhi, 19<sup>th</sup> edition, 2013.



**COURSE OBJECTIVES**

- To apply geometric and trigonometric principles of surveying.
- To set out a curve by different methods.
- To give exposure to modern surveying instruments like GPS and Total station.

**LIST OF EXPERIMENTS**

1. Study of theodolite
2. Measurement of horizontal angles by reiteration and repetition and vertical angles
3. Theodolite survey traverse
4. Heights and distances - Triangulation - Single plane method.
5. Tacheometry - Tangential system - Stadia system - Subtense system.
6. Setting out works - Foundation marking - Simple curve (right/left-handed) - Transition curve.
7. Field work using Total Station.

**TOTAL PERIODS 60****COURSE OUTCOMES**

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

- determine the heights, distances, and gradient using trigonometric methods
- apply field procedures in setting out of a curve
- use modern surveying instruments like total station, GPS

**COURSE OBJECTIVES**

- To develop the reading skills of the students and to familiarize them in skimming and scanning.
- To instill the communication concepts and enhance the students' conversational skills through various practice sessions.
- To familiarize them with a variety of business correspondence.
- To develop the receptive skills such as listening and reading and to make the students well versed in the productive skills (writing and speaking).
- To assist them in improving their vocabulary and comprehension of grammar.

**UNIT I READING AND VOCABULARY 8**

Understanding short, notices, messages - detailed comprehension of factual material - skimming & scanning skills - interpreting visual information - reading for gist and specific information - reading for grammatical accuracy and understanding of text structure - reading and information transfer.

**UNIT II WRITING 7**

Fixing appointments - asking for permission - giving instructions - apologizing and offering compensation - making or altering reservations - dealing with requests - giving information about a product.

**UNIT III LISTENING 8**

Listening to short telephonic conversation - Listening to short conversation or monologue - Listening to specific information - Listening to recorded interview, discussion.

**UNIT IV SPEAKING 7**

Conversation between the interlocutor and the candidate - general interaction and social language - A mini presentation by each candidate on a business theme - organising a larger unit of discourse - giving information and expressing opinions - to way conversation between candidates followed by further prompting from the interlocutor- Expressing opinions - agreeing and disagreeing.

**TOTAL PERIODS 30****List of Experiments**

1. Reading
2. Writing
3. Listening
4. Speaking

**COURSE OUTCOMES**

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

- enrich the business vocabulary through reading.
- develop their pronunciation skills.
- speak effectively in english in various occasions.
- prepare flawless reports and proposals.
- understand and communicate as a professional.

**TEXT BOOKS**

1. Cambridge BEC Preliminary, Self Study Edition, Cambridge University Press, New York, 2012.
2. Whitby, Norman. Business Benchmark, Pre-intermediate to intermediate, Business Preliminary, Shree Maitrey Printech Pvt. Ltd., Noida, 2014.

**REFERENCES**

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice Oxford University Press, New Delhi. 2011.
2. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi.2005.
3. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi.

**WEB SOURCE**

1. <http://www.cambridge.org/us/cambridgeenglish/catalog/cambridge-english-exams-ielts/business-benchmark>