

**UNIVERSITY OF KERALA**

**B. TECH. DEGREE COURSE  
(2013 SCHEME)**

**SYLLABUS FOR  
IV SEMESTER  
CIVIL ENGINEERING**

## SCHEME -2013

### IV SEMESTER CIVIL ENGINEERING ( C )

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/P				
13.401	Engineering Mathematics III (BCHMNPSU)	4	3	1	-	50	3	100	150
13.402	Humanities (ACHPT)	3	3	-	-	50	3	100	150
13.403	Structural Analysis - I (C)	4	3	1	-	50	3	100	150
13.404	Fluid Mechanics II (C)	4	3	1	-	50	3	100	150
13.405	Surveying II (C)	5	4	1	-	50	3	100	150
13.406	Building Planning and Drawing (C)	5	3		2	50	3	100	150
13.407	Strength of Materials Lab. (C)	2	-	-	2	50	3	100	150
13.408	Fluid Mechanics Lab. (C)	2	-	-	2	50	3	100	150
	<b>Total</b>	<b>29</b>	<b>19</b>	<b>4</b>	<b>6</b>	<b>400</b>		<b>800</b>	<b>1200</b>

## 13.401 ENGINEERING MATHEMATICS - III (BCHMNPSU)

Teaching Scheme: 3(L) - 1(T) - 0(P)

Credits: 4

### Course Objective:

- To introduce the basic notion in complex analysis such as Analytic Functions, Harmonic functions and their applications in fluid mechanics and differentiations and integration of complex functions, transformations and their applications in engineering fields.
- Numerical techniques for solving differential equations are also introduced as a part of this course.

### Module – I

**Complex Differentiation:** Limits, continuity and differentiation of complex functions. Analytic functions – Cauchy Riemann equations in Cartesian form (proof of necessary part only). Properties of analytic functions – harmonic functions. Milne Thomson method.

**Conformal mapping:** Conformality and properties of the transformations  $w = \frac{1}{z}$ ,  $w = z^2$ ,  $w = z + \frac{1}{z}$ ,  $w = \sin z$ ,  $w = e^z$  - Bilinear transformations.

### Module – II

**Complex Integration:** Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – zeros and singularities – residues and residue theorem.

Evaluation of real definite integrals –  $\int_0^{2\pi} f(\sin x, \cos x) dx$ ,  $\int_{-\infty}^{\infty} f(x) dx$  (with no poles on the real axis). (Proof of theorems not required).

### Module – III

**Numerical techniques-**Solutions of algebraic and transcendental equations-Bisection method – Regula-falsi method – Newton - Raphson method. Solution of system of equations - Gauss elimination, Gauss- Siedel iteration. Interpolation – Newton's Forward and backward formulae - Lagrange's interpolation formula.

### Module – IV

**Numerical integration-**Trapezoidal Rule- Simpson's one third rule.

**Numerical solution of ODE** –Taylor's series method - Euler's method - Modified Euler's method – Runge-Kutta method of order Four.

**Numerical Solution of two-dimensional partial differential equation** (Laplace equation)- using finite difference method (five point formula)

**References:**

1. Bali N. P. and M. Goyal, *Engineering Mathematics*, 7/e, Laxmi Publications, India, 2012.
2. Kreyszig E., *Advanced Engineering Mathematics*, 9/e, Wiley India, 2013.
3. Grewal B. S., *Higher Engineering Mathematics*, 13/e, Khanna Publications, 2012.
4. Koneru S. R., *Engineering Mathematics*, 2/e, Universities Press (India) Pvt. Ltd., 2012.
5. Sastry S. S., *Introductory Methods of Numerical Analysis*, 5/e, PHI Learning, 2012.
6. Babu Ram, *Numerical Methods*, 1/e, Pearson Education, 2010.

**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

*After successful completion of this course, the students will be able to use numerical methods to solve problems related to engineering fields. This course helps students to master the basic concepts of complex analysis which they can use later in their career.*

## 13.402 HUMANITIES (ACHPT)

Teaching Scheme: 3(L) - 0(T) - 0(P)

Credits: 3

### Course Objectives:

- *To explore the way in which economic forces operate in the Indian Economy.*
- *The subject will cover analysis of sectors, dimensions of growth, investment, inflation and the role of government will also be examined.*
- *The principle aim of this subject is to provide students with some basic techniques of economic analysis to understand the economic processes with particular reference to India.*
- *To give basic concepts of book keeping and accounting*

### PART I ECONOMICS (2 periods per week)

#### Module – I

Definition of Economics –Central Economic Problems – Choice of techniques –Production possibility curve – Opportunity Cost-Micro & Macro Economics

Meaning of Demand – Utility-Marginal Utility and Law of Diminishing Marginal Utility-Law of demand - Determinants of Demand – Changes in Demand – Market Demand—Demand, forecasting-Meaning of supply-Law of Supply- Changes in Supply-- Market Price Determination – Implications of Government Price Fixation

Production function – Law of Variable proportion – Returns to scale – Iso-quants and Isocost line- Least cost combination of inputs – Cost concepts – Private cost and Social Cost -

Short run and Long run cost- cost curves – Revenue – Marginal, Average and Total Revenue-Break even Analysis

#### Module – II

National Income concepts - GNP – GDP – NNP– Per Capita Income – Measurement of National Income-Output method- Income method and Expenditure method -Sectoral Contribution to GDP– Money-Static and Dynamic Functions of Money-Inflation – causes of inflation – measures to control inflation – Demand Pull inflation – cost push inflation – Effects of Inflation – Deflation.

Global Economic Crisis India's Economic crisis in 1991 – New economic policy – Liberalization – Privatization and Globalization-Multinational Corporations and their impacts on the Indian Economy- Foreign Direct Investment (FDI) Performance of India-Issues and Concerns. Industrial sector in India – Role of Industrialization -Industrial Policy Resolutions- Industry wise analysis – Electronics – Chemical – Automobile – Information Technology.

Environment and Development – Basic Issues – Sustainable Development- Environmental Accounting – Growth versus Environment – The Global Environmental Issues- Poverty- Magnitude of Poverty in India- -Poverty and Environment

## **PART-II- ACCOUNTANCY (1 Period per week)**

### **Module – III**

Book-Keeping and Accountancy- Elements of Double Entry- Book –Keeping-rules for journalizing-Ledger accounts-Cash book- Banking transactions- Trial Balance- Method of Balancing accounts-the journal proper(simple problems).

Final accounts: Preparation of trading and profit and loss Account- Balance sheet (with simple problems) - Introduction to accounting packages (Description only).

### **References**

1. Dewett K. K., *Modern Economic Theory*, S Chand and Co. Ltd., New Delhi, 2002.
2. Todaro M., *Economic Development*, Addison Wesley Longman Ltd., 1994.
3. Sharma M. K., *Business Environment in India*, Commonwealth Publishers, 2011.
4. Mithani D. M., *Money, Banking, International Trade and Public Finance*, Himalaya Publishing House, New Delhi, 2012.
5. Dutt R. and K. P. M. Sundaran, *Indian Economy*, S. Chand and Co. Ltd., New Delhi, 2002.
6. Varian H. R., *Intermediate Micro Economics*, W W Norton & Co. Inc., 2011.
7. Koutsoyiannis A., *Modern Micro-economics*, MacMillan, 2003.
8. Batliboi J. R., *Double Entry Book-Keeping*, Standard Accountancy Publ. Ltd., Bombay, 1989.
9. Chandrasekharan Nair K. G., *A Systematic approach to Accounting*, Chand Books, Trivandrum, 2010.

### **Internal Continuous Assessment (Maximum Marks-50)**

*50% - Tests (minimum 2)*

*30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.*

*20% - Regularity in the class*

### **University Examination Pattern:**

*Examination duration: 3 hours*

*Maximum Total Marks: 100*

*The question paper shall consist of 2 parts. Part I and Part II to be answered in separate answer books.*

**Part I Economics (70 marks)** – Part I shall consist of 2 parts.

*Part A (20 Marks) - Ten short answer questions of 2 marks each, covering entire syllabus of Part I (five questions each from Module I and Module II). All questions are compulsory.*

*Part B (50 marks) - Candidates have to answer one full question out of the two from Part I (Module I and Module II). Each question carries 25 marks.*

**Part II Accountancy (30 marks)**

*Candidates have to answer two full questions out of the three from Part II (Module III). Each question carries 15 marks.*

**Course outcome:**

- *The students will be acquainted with its basic concepts, terminology, principles and assumptions of Economics.*
- *It will help students for optimum or best use of resources of the country.*
- *It helps students to use the understanding of Economics of daily life.*
- *The students will get acquainted with the basics of book keeping and accounting.*

## 13.403 STRUCTURAL ANALYSIS - I (C)

Teaching Scheme: 3(L) - 1(T) - 0(P)

Credits: 4

### Course Objectives:

*To equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary structures.*

#### Module – I

Introduction to structural analysis – Concept of determinate, indeterminate structures and stability – deflection of beams – Moment-curvature relation – Load-deflection differential equation – Slope and deflection of beams by the method of successive integration – Macaulay's method – Principle of superposition. - Moment-area method and Conjugate beam method-Slope and deflection of beams with non-uniform flexural rigidity.

#### Module – II

Introduction to energy methods – Strain energy and complementary energy – Castigliano's theorems - Application of theorem to statically determinate beams and rigid-jointed plane frames. Principle of virtual work and its application to statically determinate beams, rigid-jointed frames and pin-jointed frames –Clark-Maxwell's reciprocal theorem – Betti's theorem – Principle of minimum total potential energy.

#### Module – III

Arches – Behaviour and types of arches – Analysis of three hinged arches – Axial force, shear force and bending moment in circular and parabolic three hinged arches. Elastic stability of slender columns – Euler's formula for long columns with different end conditions – Limitations of Euler's formula – Rankine's formula – Columns subjected to eccentric loading.

#### Module – IV

Moving loads and Influence lines – Influence line diagram for reactions, shear force and bending moment in simply supported and cantilever beams and overhanging beams-Moving loads – Maximum effects under distributed loads, two concentrated loads and series of concentrated loads – Absolute maximum shear force and bending moment – Shear force and bending moment envelope – Equivalent uniformly distributed load – Influence lines for member forces in statically determinate trusses. Analysis of three dimensional pin-jointed frames by the method of tension coefficients.

### References:

1. Junnarkar S. B. and S. J. Shah, *Mechanics of Structures-II*, 23/e, Charotar Publishing House Pvt. Ltd., New Delhi, 2013.

2. Devdas Menon, *Advanced Structural Analysis*, Narosa Publishing House, New Delhi, 2013.
3. Norris, C. H. and J. B. Wilbur, *Elementary Structural Analysis*, McGraw Hill, New York, 1976.
4. Hibbeler R. C., *Structural Analysis*, Pearson Education, New Delhi, 2002.
5. Bhavikatti S. S., *Structural Analysis-I*, Vikas Publications House Pvt. Ltd, New Delhi, 2013.

**Internal Continuous Assessment** (*Maximum Marks-50*)

*50% - Tests (minimum 2)*

*30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.*

*20% - Regularity in the class*

**University Examination Pattern:**

*Examination duration: 3 hours*

*Maximum Total Marks: 100*

*The question paper shall consist of 2 parts.*

*Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.*

*Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.*

**Course Outcome:**

*The student will get a good grasp of all the fundamental issues related to Structural Analysis.*

## 13.404 FLUID MECHANICS - II (C)

Teaching Scheme: 3(L) - 1(T) - 0(P)

Credits: 4

### Course Objective:

- *Application of the Basic principles and laws governing fluid flow to open channel flow including hydraulic jump & gradually varied flow.*
- *An understanding of basic modeling laws in fluid mechanics and dimensional analysis.*
- *An ability to apply the fundamental theories of fluid mechanics for the analysis and design of hydraulic machines*

### Module – I

Flow in open channels-types of channels, types of flow, geometric elements of channel section, velocity distribution in open channels, uniform flow in channels, Chezy's equation, Kutters and Bazin's equations, Manning's formula, Most economic section for rectangular, trapezoidal and triangular channels. Condition for maximum discharge and maximum velocity through circular channels, computations for uniform flow, normal depth, conveyance of a channel section, section factor for uniform flow.

Specific energy, critical depth, discharge diagram, Computation of critical flow, Section factor for critical flow. Specific force, conjugate or sequent depths, hydraulic jump, expression for sequent depths and energy loss for a hydraulic jump in horizontal rectangular channels, types of jump, length of jump, height of jump, uses of hydraulic jump.

### Module – II

Gradually varied flow - dynamic equation for gradually varied flow, different forms of dynamic equation, classification of surface profiles, Backwater and drawdown curves, characteristics of surface profiles in prismatic channels. Computation of length of surface profiles, direct step method.

Surges in open channel flow - Classification- positive surges moving upstream - positive surges moving downstream, negative surges moving upstream - negative surges moving downstream, problems from positive surges.

### Module – III

Boundary layer theory-no slip condition, boundary layer thickness, boundary layer growth over long thin plate, laminar, turbulent boundary layer, laminar sub layer, Momentum integral equation of boundary layer (no derivation), Blasius boundary layer equations for

laminar and turbulent boundary layer, computation of drag on a flat plate. Separation of boundary layer and control.

Dimensional analysis and model studies - dimensions, dimensional homogeneity, methods of dimensional analysis, Rayleigh method, Buckingham method, dimensionless numbers, Similitude - geometric, kinematic and dynamic similarities. Model laws - Reynold's and Froude model laws, scale ratios, types of models, distorted and undistorted models, scale effect in models.

#### **Module – IV**

Hydraulic Machines - Impulse momentum principle, impact of jets, force of a jet on fixed and moving vanes. Turbines- classification and comparison of velocity triangles for Pelton wheel and reaction turbines (Francis and Kaplan), work done and efficiency, specific speed, draft tube- different types, penstock, surge tank - types, cavitation in turbines.

Pumps- classification of pumps - Centrifugal pumps- types, work done, efficiency, minimum speed, velocity triangle for pumps, specific speed, priming, limitation of suction lift, net positive suction head, cavitation in centrifugal pump.

#### **References:**

1. Modi P. N. and S. M. Seth, *Hydraulics and Fluid Mechanics (Including Hydraulic Machines)*, Standard Book House, New Delhi, 2013.
2. Streeter V. L. and E. B. Wylie, *Fluid Mechanics*, 9/e, McGraw Hill, 1998.
3. Kumar D.S., *Fluid Mechanics and Fluid power Engineering*, S. K. Kataria & Sons, New Delhi, 2013.
4. Subramanya K., *Open Channel Hydraulics*, Tata McGraw Hill, 2009.
5. Douglas J. F., J. M. Gasoriek, J. Swaffield and L. B. Jack, *Fluid Mechanics*, 5/e, Pearson Education, 2013.
6. Bansal R. K., *A Textbook of Fluid Mechanics and Hydraulic Machines*, 9/e, Laxmi Publications, 2010.
7. Chow V.T., *Flow through Open Channels*, McGraw Hill, 1959.
8. Rangaraju K.G., *Flow through Open Channels*, Tata McGraw Hill, 1994.
9. Srivastava R., *Flow through Open Channels*, Oxford Publishers, 2012.
10. Liggett J. A., *Fluid Mechanics*, McGraw Hill, 1994.

#### **Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*

*Maximum Total Marks: 100*

*The question paper shall consist of 2 parts.*

*Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.*

*Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.*

**Note:** *No charts, tables, codes are permitted in the Examination hall. If necessary, relevant data shall be given along with the question paper by the question paper setter.*

**Course Outcome:**

- *The students become capable of analysis of open channel flows & design of open channels.*
- *They get an insight into the working of hydraulic machines.*
- *They become capable of studying advanced topics such as design of hydraulic structures.*

## 13.405 SURVEYING - II (C)

Teaching Scheme: 4(L) - 1(T) - 0(P)

Credits: 5

### Course Objectives:

- *To impart awareness on the advanced surveying techniques.*
- *To understand the errors associated with survey measurements.*
- *To provide a basic understanding on geospatial data acquisition and its process.*

### Module – I

**Triangulation** - Triangulation figures, Strength of figure, Triangulation stations, intervisibility of stations - Towers and signals, Satellite Stations and reduction to centre.

**Theory of errors** – Types, theory of least squares, weighting of observations, most probable value, application of weighting, computation of indirectly observed quantities, Method of normal equations, conditioned quantities.

### Module – II

**Traverse Surveying** - Methods of traversing, Checks in closed traverse, Traverse computations, balancing the traverse

**Curves** - Elements of simple and compound curves, Method of setting out, Elements of Reverse curve (Introduction only), Transition curve, length of curve, Elements of transition curve, Vertical curve, types, Length of vertical curve.

### Module – III

**Electromagnetic distance measurement (EDM)** - Principle of EDM, Modulation, Types of EDM instruments, Distomat.

**Total Station** - Parts of a Total Station, Accessories, On Board calculation, Field Procedure, Errors in Total Station Survey, Good Practices in Using Total Station, Advantages of Using Total Station. **GPS** – Components, principles, applications.

### Module – IV

**Photogrammetry** - Terrestrial and Aerial photogrammetry, Heights and distances from photographic measurement, Flight planning, Vertical Photograph, Geometry and scale of vertical photographs, Ground coordinates from vertical photographs, Relief displacement, Stereoscopy and parallax

**Remote Sensing** - Electromagnetic Spectrum, Energy interaction with the Earth, Types of Remote sensing, Advantages, Applications

**Geographic Information System** - Components of GIS, GIS Data, Database Management Systems (DBMs).

## References:

1. Gopi S., Madhu N. and Sathikumar R., *Advanced Surveying*, Pearson Education, 2004.
2. Kenetkar T. P. and Kulkarni S. V., *Surveying and Levelling - II*, Pune Vidyarthi Griha Prakashan, 2004.
3. Punmia B. C., Ashok K. Jain and Arun K. Jain – *Surveying (Vol. II and III)*, Laxmi Publications (P) Ltd., New Delhi, 2005.
4. Agor R, *A Text book of Advanced Surveying*, Khanna Publishers, 2011.
5. Duggal S. K., *Surveying (Vol. I and II)*, Tata Mc Graw Hill, 2006.
6. Bhavikatti S. S., *Surveying and Levelling (Vol. I and II)*, I. K. International Publishing House Pvt. Ltd., 2011.
7. Gopi S., *Global Positioning System: Principles and Applications*, Tata McGraw Hill, 2005.
8. Joseph G., *Fundamentals of Remote Sensing, 2/e*, Universities Press, 2011.
9. Rampal K. K., *Textbook of Photogrammetry*, Oxford and IBH Publishing Co., 1982.
10. Heywood I., S. Cornelius and S. Carver, *An Introduction to Geographical Information Systems, 2/e*, Pearson Education Ltd., 2003.

## Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

## University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** No charts, tables, codes are permitted in the Examination hall. If necessary, relevant data shall be given along with the question paper by the question paper setter.

## Course Outcome:

After successful completion of the course, the students will possess knowledge on the advanced methods of surveying, the instruments, and the spatial representation of data.

## 13.406 BUILDING PLANNING & DRAWING (C)

Teaching Scheme: 3(L) - 0(T) - 2(P)

Credits: 5

### Course Objective:

- To familiarize the students to various building planning aspects, standards & rules.
- To equip the students to prepare quantity estimation of general items for simple buildings.
- To train the students how to prepare working drawings of various types of buildings.

### Module – I

Building Planning:- Development of Concepts, Various types of buildings - General standards, Building Rules - Introduction, setback rules, FAR, FSI , Coverage, Access & Parking rules, safety rules, Brief introduction to Environmental Protection rules, CRZ.

### Module – II

Computation of Plinth Area, Carpet Area, Covered Area ratio, Floor Area Ratio, Computation of storage capacity of rain water harvesting system as per norms,

Estimation of Quantities of general items –Earthwork excavation, PCC, Foundation and Basement, Brick work for superstructure. Estimation of simple residential buildings.

### Module – III

Preparation of working drawings (from line sketches or from specifications) of different types of buildings namely,

1. Single storeyed buildings with flat roof, pitched roof and partly pitched and partly flat roof
2. Two–storeyed and multi–storeyed buildings
3. Public utility buildings like hostel, hospital, library etc. and
4. Industrial building.
5. Preparation of lay- out plan of house drainage for a given building.
6. Preparation of site plans and service plans as per building rules.
7. Preparation of working drawings of Residential building from Specification.

**Note 1:** *The student should know the local (Panchayath/Corporation) building rules and should be in a position to prepare sketch design for clients and submission drawing for approval. As a term paper, at the end of the semester, each student should design and prepare a submission drawing for a proposed residential building.*

**Note 2:** *Minimum 10 sheets must be drawn.*

## References:-

1. National Building Code of India (SP 7:2005), BIS, New Delhi, 2005.
2. Kerala Municipal Building Rules, LSGD, Govt. of Kerala, 2013.
3. Shah M. G., C. M. Kale and S. Y. Patki, *Building Drawing*, 4/e, Tata McGraw Hill, 2002.
4. Prabhu B. T. S., K. V. Paul and C. Vijayan, *Building Drawing and Detailing*, Spades, Calicut, 1987.
5. Dutta B. N., *Estimating and Costing in Civil Engineering*, USB publishers and Distributers Ltd., New Delhi, 2008.
6. Chakraborti M, *Estimating Costing Specification and Valuation in Civil Engineering*, 24/e, Chakraborti, 2012.

## Internal Continuous Assessment (Maximum Marks-50)

40% - Tests (minimum 2)

40% - Class work. (75% weightage should be given to the 10 drawings prepared and 25% weightage should be given to the term paper mentioned in Note1)

20% - Regularity in the class

## University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each from Modules I and II. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question from Modules I and II carries 20 marks. The questions from Module III shall be to prepare a drawing and carries 40 marks.

## Course Outcome:

- The students will be aware of the general planning aspects and building rules and will be capable of planning buildings.
- The students will be capable of estimating the quantities required for construction of a building.
- The capability of reading a drawing, generating sections, preparing detailed drawings to be submitted to the sanctioning authority will be imparted to the students.

## 13.407 STRENGTH OF MATERIALS LAB (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)

Credits: 2

### Course Objective :

- *To demonstrate the basic principles and important concepts in the area of strength and mechanics of materials and structural analysis to the students through a series of experiments.*

### List of Experiments:

1. Tension Test on MS and HYSD bars
2. Shear test on MS Rod
3. Torsion test on MS Rod
4. Toughness test (Izod and Charpy Impact tests)
5. Hardness test (Brinell and Rockwell Hardness tests)
6. Spring test – Open and closed coiled springs (Determination of spring stiffness and modulus of rigidity)
7. Bending test on wooden beams
8. Verification of Maxwell's Reciprocal theorem (Deflection test on timber and steel beams)
9. Determination of modulus of rigidity of wires using Torsion Pendulum

### Internal Continuous Assessment (*Maximum Marks-50*)

*40% - Test*

*40% - Class work and Record*

*20% - Regularity in the class*

### University Examination Pattern:

*Examination duration: 3 hours*

*Maximum Total Marks: 100*

*Questions based on the list of experiments prescribed.*

*80% - Procedure, conducting experiment, results, tabulation and inference*

*20% - Viva voce*

*Candidate shall submit the certified fair record for endorsement by the external examiner.*

### Course Outcome:

*This subject will lay foundation to the study of subjects viz. strength of materials and mechanics of materials. It also provides students a feel for how various engineering properties of materials are applied in engineering practice.*

## 13. 408 FLUID MECHANICS LABORATORY (C)

Teaching Scheme: 0(L) - 0(T) - 2(P)

Credits: 2

### Course Objective :

- *Getting practical experience in flow measuring devices, gauges, valves and various components used for house plumbing.*
- *Acquire practical knowledge and verify the theories learned in Courses on Fluid Mechanics (13.303 & 13.404).*

### Pre requisites :

*Basic Knowledge of Fluid Mechanics (13.303)*

### Part I : Preliminary study:

1. Flow measuring equipments - water meters, current meters, venturi meter, orifice meter and manometers
2. Gauges and valves - pressure gauge, vacuum gauge, stop valve, gate valve and foot valve.
3. Pumps - centrifugal and reciprocating type. (Description with layout)
4. Turbines - impulse and reaction types. (Pelton and Francis) (Description with layout)

### Part II: List of Experiments:

1. Determination of Darcy's coefficient and Chezy's constant on pipe friction apparatus.
2. Coefficient of discharge and calibration of
  - a) Notches
  - b) Venturi meters
  - c) Orifice meters.
3. Experimental determination of Hydraulic coefficients of a circular orifice.
4. Performance test [specific speed, economic running cost] on
  - a) Centrifugal pumps
  - b) Reciprocating pumps
5. Performance test [specific speed] on a) Impulse and b) Reaction turbines.

### Internal Continuous Assessment (Maximum Marks-50)

*40% - Test*

*40% - Class work and Record*

*20% - Regularity in the class*

**University Examination Pattern:**

*Examination duration: 3 hours*

*Maximum Total Marks: 100*

*Questions based on the list of experiments prescribed in Part II.*

*80% - Theory, Procedure and tabular column (30%);*

*Conducting experiment, Observation, Tabulation with Sample calculation (30%)*

*Graphs, Results and inference (20%)*

*20% - Viva voce ( Based on Part I and Part II)*

*Candidate shall submit the certified fair record for endorsement by the external examiner.*

**Course Outcome:**

- *The students gain practical experience of performances of flow devices and machines.*
- *The acquired knowledge would help the students in planning and executing civil engineering projects, and while supervising plumbing work.*