Course No.	Course Name	L-T-P - Credits	Year of Introduction
MA202	Probability distributions, Transforms and Numerical Methods	3-1-0-4	2016

Prerequisite: Nil

Course Objectives

- To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in various Engineering and social life situations.
- To know Laplace and Fourier transforms which has wide application in all Engineering courses.
- To enable the students to solve various engineering problems using numerical methods.

Syllabus

Discrete random variables and Discrete Probability Distribution.
Continuous Random variables and Continuous Probability Distribution.
Fourier transforms.
Laplace Transforms.
Numerical methods-solution of Algebraic and transcendental Equations, Interpolation.
Numerical solution of system of Equations. Numerical Integration, Numerical solution of ordinary differential equation of First order.

Expected outcome .

After the completion of the course student is expected to have concept of
(i) Discrete and continuous probability density functions and special probability distributions.
(ii) Laplace and Fourier transforms and apply them in their Engineering branch
(iii) numerical methods and their applications in solving Engineering problems.

Text Books:

1. Miller and Freund's "Probability and statistics for Engineers"-Pearson-Eighth Edition.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley, 2015.

References:

1. V. Sundarapandian, "Probability, Statistics and Queuing theory", PHI Learning, 2009.
2. C. Ray Wylie and Louis C. Barrett, "Advanced Engineering Mathematics"-Sixth Edition.
3. Jay L. Devore, "Probability and Statistics for Engineering and Science"-Eight Edition.
4. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers"-Sixth Edition-Mc Graw Hill.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**Discrete Probability Distributions.** (Relevant topics in section 4.1,4,2,4.4,4.6 Text1)		
	Discrete Random Variables, Probability distribution function, Cumulative distribution function.	2	
	Mean and Variance of Discrete Probability Distribution.	2	
	Binomial Distribution-Mean and variance.	2	
	Poisson Approximation to the Binomial Distribution. Poisson distribution-Mean and variance.	2	15%

II	**Continuous Probability Distributions.** (Relevant topics in section 5.1,5.2,5.5,5.7 Text1) Continuous Random Variable, Probability density function, Cumulative density function, Mean and variance. Normal Distribution, Mean and variance (without proof). Uniform Distribution.Mean and variance. Exponential Distribution, Mean and variance.	 2 4 2 2	15%
FIRST INTERNAL EXAMINATION			
III	**Fourier Integrals and transforms. (**Relevant topics in section 11.7, 11.8, 11.9 Text2) Fourier Integrals. Fourier integral theorem (without proof). Fourier Transform and inverse transform. Fourier Sine & Cosine Transform, inverse transform.	 3 3 3	15%
IV	**Laplace transforms. (**Relevant topics in section 6.1,6.2,6.3,6.5,6.6 Text2**)** Laplace Transforms, linearity, first shifting Theorem. Transform of derivative and Integral, Inverse Laplace transform, Solution of ordinary differential equation using Laplace transform. Unit step function, second shifting theorem. Convolution Theorem (without proof). Differentiation and Integration of transforms.	 3 4 2 2 2	15%
SECOND INTERNAL EXAMINATION			
V	**Numerical Techniques**.(Relevant topics in section.19.1,19.2,19.3 Text2) Solution Of equations by Iteration, Newton- Raphson Method. Interpolation of Unequal intervals-Lagrange's Interpolation formula. Interpolation of Equal intervals-Newton's forward difference formula, Newton's Backward difference formula.	 2 2 3	20%
VI	**Numerical Techniques**. (Relevant topics in section 19.5,20.1,20.3, 21.1 Text2) Solution to linear System- Gauss Elimination, Gauss Seidal Iteration Method. Numeric Integration-Trapezoidal Rule, Simpson's 1/3 Rule. Numerical solution of firstorder ODE-Euler method, Runge-Kutta Method (fourth order).	 3 3 3	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks : 100 Exam Duration: 3 hours

The question paper will consist of 3 parts.

Part A will have 3 questions of 15 marks each uniformly covering modules I and II. Each question may have two sub questions.

Part B will have 3 questions of 15 marks each uniformly covering modules III and IV. Each question may have two sub questions.

Part C will have 3 questions of 20 marks each uniformly covering modules V and VI. Each question may have three sub questions.

Any two questions from each part have to be answered.

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE202	STRUCTURAL ANALYSIS -I	3-1-0-4	2016

Prerequisite: CE201 Mechanics of Solids

Course objectives:

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

Syllabus :

Truss analysis, Displacement response of statically determinate structural systems using energy methods, Principle of virtual work, Statically indeterminate structures, Strain Energy methods, Moving loads and influence lines, Cables and Suspension bridges, Arches.

Expected Outcomes:

The students will be able to

i. analyse trusses and study displacement response of statically determinate structural systems using energy methods:
ii. apply unit load method and strain energy method for determination of deflection of statically determinate beams, frames & pin jointed trusses
iii. analyse statically indeterminate structures using strain energy method and method of consistent deformation
iv. know about moving loads and influence lines
v. know about Statically determinate and indeterminate suspension bridges and arches

Text Books:

1. Gere and Timoshenko, Mechanics of materials, CBS. Publishers
2. Kenneth Leet,Chia M Uang& Anne M Gilbert., Fundamentals of Structural Analysis, McGraw Hill
3. R.Vaidyanathan and P.Perumal, Comprehensive Structural Analysis Volume I & II, Laxmi Publications (P) Ltd
4. Wang C.K., Intermediate Structural Analysis, McGraw Hill

References:

1. Aslam Kassimali., Structural Analysis, Cenage Learning
2. Chandramouli P N, Structural Analysis I –Analysis of Statically Determinate Structures, Yes DeePublishing Pvt Ltd.,Chennai,Tamil Nadu.
3. DevdasMenon, Structural Analysis, Narosa Publications
4. Hibbeler., Structural Analysis, Pearson Education
5. Kinney S., Indeterminate Structural Analysis, Oxford & IBH
6. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India
7. Reddy C.S., Indeterminate Structural Analysis, Tata McGraw Hill
8. Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks
I	**TRUSS ANALYSIS:** Analysis of determinate truss-Methods of	8	15%

	joints and sections (Numerical problems) Elastic theorems and energy principles - strain energy due to axial load, bending moment, shear and torsion - strain energy method, Castigliano's method for deflection (Derivations only)		
II	**Principle of virtual work** – Unit load method-Betti's theorem – Maxwell's law of reciprocal deflections - principle of least work - application of unit load method and strain energy method for determination of deflection of statically determinate beams, frames - pin jointed trusses (simple numerical problems) Concepts of temperature effects and lack of fit.(No numerical problems) **Statically indeterminate structures:** Degree of static and kinematic indeterminacies – Introduction to force and displacement method(step by step procedure)	9	15%
FIRST INTERNAL EXAMINATION			
III	**Strain Energy methods:** Analysis of beams, frames and trusses with internal and external redundancy – (Simple problems with maximum two redundants) Concepts of effect of prestrain, lack of fit, temperature changes and support settlement.(No numerical problems) **Method of Consistent deformations:** Analysis of beams frames and trusses with internal and external redundancy(Simple problems with maximum two redundants) Concepts of effect of prestrain, lack of fit, temperature changes and support settlement.(No numerical problems)	9	15%
IV	**Moving loads and influence lines**. Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams - analysis for different types of moving loads - single concentrated load - several concentrated loads, uniformly distributed load on shorter and longer than the span.	10	15%
SECOND INTERNAL EXAMINATION			
V	**Cables:** Analysis of forces in cables under concentrated and uniformly distributed loads - Anchor Cables **Suspension Bridges :** Un-stiffened suspension bridges, maximum tension in the suspension cable and backstays, pressure on towers.	10	20%
VI	**Arches :** Theory of arches - Eddy"s theorem - analysis of three hinged arches-Support reactions-normal thrust and Radial shear at any section of a parabolic and segmental arch due to simple cases of loading. Moving loads on three hinged arches (simple problems)	10	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination) :

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2. Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE204	CONSTRUCTION TECHNOLOGY	4-0-0-4	2016

Prerequisite : Nil

Course objectives:

- To study details regarding properties and testing of building materials,
- To study details regarding the construction of building components
- To study properties of concrete and concrete mix design
- To impart the basic concepts in functional requirements of building and building services.
- To develop understanding about framed construction and building failures

Syllabus:

Construction Materials –. Timber -Mortar – Iron and Steel –. Structural steel – Modern materials. Concrete–Admixtures –Making of concrete -Properties of concrete– mix proportioning

Building construction - foundations -Introduction to Cost-effective construction –Masonry – Lintels and arches –Floors and flooring –

Roofs and roof coverings -Doors, windows and ventilators -Finishing works. Tall Buildings – steel and concrete frame –prefabricated construction – slip form construction. Vertical transportation – Stairs –Elevators – Escalators –ramps.

- Building failures and Retrofitting–failures in RCC and Steel structures– Foundation failure-

Expected Outcomes:

The students will be able to

i. understand construction materials, their components and manufacturing process
ii. know the properties of concrete and different mix design methods
iii. understand the details regarding the construction of building components
iv. analyse and apply learning of materials, structure, servicing and construction of masonry domestic buildings.
v. define and describe the concepts and design criteria of tall framed and load bearing buildings.

Text books

1. Arora and Bindra, Building construction, Dhanpath Rai and Sons.
2. Punmia B. C, Building construction. Laxmi Publications
3. Rangwala S C., Engineering Materials, Charotar Publishers
4. Shetty M.S., Concrete Technology, S. Chand & company.

Reference Books

1. Adler R, Vertical Transportation for Building, American Elsevier Pub.
2. G C Sahu & Joygopal Jena., Building Materials and construction, McGraw Hill Education
3. Gambhir M L, Concrete Technology, Tata McGrawHill.
4. Krishna Raju N, Design of Concrete Mixes, CBS publishers.
5. Mcking T.M, Building Failures, Applied Science Pub.
6. National Building Code.
7. Neville A.M. and Brooks.J.J, Concrete Technology, Pearson Education.
8. Smith P & Julian W. Building services, Applied Science Pub.
9. Tall building systems & concepts, Monograph on planning and design of Tall building,

COURSE PLAN			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Properties of masonry materials – review of specifications; **Mortar** – Types – Sand – properties – uses. **Timber products**: properties and uses of plywood, fibre board, particle board. **Iron and Steel** –Reinforcing steel – types – specifications. **Structural steel** – specifications **Miscellaneous materials** (only properties, classifications and their use in construction industry): Glass, Plastics, A.C. Sheets, Bitumen, Adhesives, Aluminium	9	15%
II	**Concrete** – Aggregates – Mechanical & Physical properties and tests – Grading requirements – Water quality for concrete – **Admixtures** – types and uses – plasticizers – accelerators – retarders –water reducing agents **Making of concrete** - batching – mixing – types of mixers – transportation – placing – compacting – curing **Properties of concrete** – fresh concrete – workability – segregation and bleeding - factors affecting workability & strength – tests on workability – tests for strength of concrete in compression, tension & flexure **Concrete quality control** – statistical analysis of results – standard deviation –acceptance criteria – **mix proportioning** (B.I.S method) – nominal mixes.	9	15%
FIRST INTERNAL EXAMINATION			
III	**Building construction** - Preliminary considerations for shallow and deep foundations **Masonry** – Types of stone masonry – composite walls - cavity walls and partition walls -Construction details and features – scaffoldings **Introduction to Cost-effective construction** - principles of filler slab and rat-trap bond masonry	9	15%
IV	**Lintels and arches** – types and construction details. **Floors and flooring** – different types of floors and floor coverings **Roofs and roof coverings** – different types of roofs – suitability – types and uses of roofing materials **Doors, windows and ventilators** – Types and construction details **Finishing works** – Plastering, pointing, white washing, colour washing, distempering, painting. Methods of providing DPC. Termite proofing	9	15%
SECOND INTERNAL EXAMINATION			

V	**Tall Buildings –** Framed building – steel and concrete frame – structural systems –erection of steel work–concrete framed construction– formwork – construction and expansion. joints Introduction to prefabricated construction – slip form construction **Vertical transportation:** **Stairs** – types - layout and planning- **Elevators** – types – terminology – passenger, service and goods elevators – handling capacity - arrangement and positioning of lifts – **Escalators** – features –use of ramps	10	20%
VI	**Building failures –** General reasons – classification – Causes of failures in RCC and Steel structures, Failure due to Fire, Wind and Earthquakes. **Foundation failure** – failures by alteration, improper maintenance, overloading. Retrofitting of structural components - beams, columns and slabs	10	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination):

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1. Each part should have at least one question from each module

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE206	FLUID MECHANICS -II	3-0-0-3	2016

Prerequisite : CE203 Fluid Mechanics I

Course objectives

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

Syllabus

Hydraulic machines, Turbines, Pumps, Open channel flow, uniform flow, Hydraulic Jump, Gradually varied flow, Dimensional analysis and model testing.

Expected Outcome

The students will

i. become capable of analysing open channel flows & designing open channels.
ii. get an insight into the working of hydraulic machines.
iii. become capable of studying advanced topics such as design of hydraulic structures.

Text Books:

1. Kumar D.S., Fluid Mechanics and Fluid power Engineering, S. K. Kataria & Sons, New Delhi, 2013
2. Modi P. N. and S. M. Seth, Hydraulics and Fluid Mechanics (Including Hydraulic Machines), Standard Book House, New Delhi, 2013.
3. Narayana Pillai,N. Principles of Fluid Mechanics and Fluid Machines, University Press, 2011.

References:

1. Arora.K.R. Fluid Mechanics, Hydraulics and Hydraulic Machines, Standard Publishers, 2005.
2. Bansal R. K., A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 2010.
3. C S P Ojha, P N Chandramouli and R Brendtsson, Fluid Mechanics and Machinery, Oxford University Press , India , New Delhi
4. Hanif Choudhary, Open channel flow, Prentice Hall, 2010
5. Jain A. K., Fluid Mechanics, Khanna Publishers, Delhi, 1996.
6. Subramanya K., Open Channel Hydraulics, Tata McGraw Hill, 2009.
7. Ven Te Chow, Open channel Hydraulics, 2009.

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks
I	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 (Concepts only).	7	15%

II	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 (Concepts only).	7	15%
FIRST INTERNAL EXAMINATION			
III	Introduction : Open channel flow and its relevance in Civil Engineering , Comparison of open channel flow and pipe flow . 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, Kutter's and Manning's formula, Most economic section for rectangular and trapezoidal 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.	6	15%
IV	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.	6	15%
SECOND INTERNAL EXAMINATION			
V	Gradually varied flow - dynamic equation for gradually varied flow, different forms of dynamic equation, Approximation for a wide rectangular channel, classification of surface profiles, Backwater and drawdown curves, characteristics of surface profiles in prismatic (Rectangular and trapezoidal only). Computation of length of surface profiles, direct step method. Design of lined open channels : trapezoidal cross-sections only	8	20%
VI	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, Concepts of distorted and undistorted models.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination) :

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1. Each part should have at least one question from each module

2. Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE208	GEOTECHNICAL ENGINEERING I	3-0-0 -3	2016

Prerequisite : CE 205 Engineering Geology

Course objectives:

- To impart to the fundamentals of Soil Mechanics principles;
- To provide knowledge about the basic, index and engineering properties of soils.

Syllabus:

Major soil deposits of India, Basic soil properties, Relationship between basic soil properties, Index properties-Sieve analysis, Hydrometer analysis, Atterberg Limits and Relative density, Soil classification, Permeability of soils, Principle of effective stress, Quick sand condition, Critical hydraulic gradient, Shear strength of soils, Mohr-Coulomb failure criterion, Different types of shear tests, Liquefaction of soils, Compressibility and Consolidation, Void ratio versus pressure relationship, Normally consolidated, under consolidated and over consolidated states, Estimation of magnitude of settlement, Terzaghi's theory of one-dimensional consolidation, Coefficient of consolidation , Stability of finite slopes, Swedish Circle Method- Friction circle method ,use of Stability, Compaction of soils, light and heavy compaction tests , Control of compaction

Expected Outcomes:

The students will be able to

i. understand the basic principles governing soil behavior.

ii. understand the procedure, applicability and limitations of various soil testing methods.

Text Books:

1. Das B. M., Principles of Geotechnical Engineering, Cengage India Pvt. Ltd., 2010.
2. Ranjan G. and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2002.

References:

1. A V Narasimha Rao and C Venkatramaiah, Numerical Problems, Examples and Objective questions in Geotechnical Engineering, Universities Press (India) Ltd., 2000
2. Arora K. R., Geotechnical Engineering, Standard Publishers, 2006.
3. Purushothamaraj P., Soil Mechanics and Foundation Engineering, Dorling Kindersley(India) Pvt. Ltd., 2013
4. Taylor D.W., Fundamentals of Soil Mechanics, Asia Publishing House, 1948.
5. Terzaghi K. and R. B. Peck, Soil Mechanics in Engineering Practice, John Wiley, 1967.
6. Venkatramaiah, Geotechnical Engg, Universities Press, 2000.

COURSE PLAN			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Introduction to soil mechanics -Major soil deposits of India Basic soil properties - Void ratio, porosity, degree of saturation, air content, percentage air voids, moisture content, specific gravity, unit weight - Relationship between basic soil properties – Sensitivity – Thixotropy - numerical problems	6	15%
II	Index properties - Sieve analysis – Well graded, poorly graded and gap graded soils - Stoke's law - Hydrometer analysis (no derivation required for percentage finer and diameter) - numerical problems- – Relative density Consistency-Atterberg Limits - Practical Applications - numerical problems I.S. classification of soils.	6	15%
FIRST INTERNAL EXAMINATION			
III	Permeability of soils - Darcy's law – Factors affecting permeability - Practical Applications - Constant head and falling head permeability tests - Average permeability of stratified deposits (no derivation required) - numerical problems. Principle of effective stress - Total, neutral and effective stress variation diagrams - Quick sand condition - Critical hydraulic gradient - - numerical problems– Definition of phreatic line and exit gradient	7	15%
IV	Shear strength of soils- Practical Applications - Mohr-Coulomb failure criterion – Mohr circle method for determination of principal planes and stresses- numerical problems – relationship between shear parameters and principal stresses [no derivation required} Brief discussion of direct shear test, tri-axial compression test, vane shear test and unconfined compression test – Applicability - numerical problems -UU and CD tests [Brief discussion only]	7	15%
SECOND INTERNAL EXAMINATION			
V	Compressibility and Consolidation - Void ratio versus pressure relationship - Coefficient of compressibility and volume compressibility – Compression index Practical Applications - Change in void ratio method - Height of solids method - Normally consolidated, under consolidated and over consolidated states - Estimation of pre consolidation pressure - Practical Applications - Estimation of magnitude of settlement of normally consolidated clays - Numerical problems Terzaghi's theory of one-dimensional consolidation(no derivation required) - average degree of consolidation – Time	8	20%

	factor - Coefficient of consolidation - Practical Applications - Square root of time and logarithm of time fitting methods - Numerical problems		
VI	Stability of finite slopes - Toe failure, base failure, slip failure - Swedish Circle Method- Friction circle method- Factor of safety with respect to cohesion and angle of internal friction - Stability number - Stability charts. Compaction of soils - Standard Proctor, Modified Proctor, I.S. light & Heavy Compaction Tests – OMC - Zero Air voids line - Control of compaction - numerical problems	8	20
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination):

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1. Each part should have at least one question from each module

2. Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE232	MATERIAL TESTING LAB -I	0-0-3-1	2016

Prerequisite : CE201 Mechanics of Solids

Course objectives:
The experimental work involved in this laboratory should make the student understand the fundamental modes of loading of the structures and also make measurements of loads, displacements and strains. Relating these quantities, the student should be able to obtain the strength of the material and stiffness properties of structural elements.

Course Outcomes:
The students will be able to undertake the testing of materials when subjected to different types of loading.

List of Experiments: (10 Experiments mandatory)

1. Tension test on Structural Materials: Mild Steel and Tor steel (HYSD bars) (Universal Testing machine and suitable extensometer)
2. Shear test on mild steel rod (Compression Testing Machine and Shear Shackle)
3. Bending test on mild steel (I sections) (Universal Testing Machine)
4. Torsion test on Mild steel circular bars (Torsion Testing Machine)
5. Torsion test on Steel/Copper/ Aluminum wires
    a. Using Torsion Pendulum with Central disk
    b. Using Torsion Pendulum with distributed Mass
6. Impact test
    a. Izod test (Impact Testing Machine)
    b. Charpy test (Impact Testing Machine)
7. Hardness test
    a. Brinell Hardness test (Brinnel Hardenss Testing Machine)
    b. Rockwell Hardness test (Rockwell Hardness Testing Machine)
    c. Vickers Hardness test (Vickers Hardness Testing Machine)
8. Test On Springs
    a. Open coil (Spring Testing Machine)
    b. Close coil (Spring Testing Machine)
9. Bending Test on Timber (Universal Testing Machine and dial Gauge)
10. Bend & Rebend test on M S Rods
11. Verification of Clerk Maxwells Theorem
12. Demonstration of Fatigue Test
13. Study/demonstration of Strain Gauges and load cells

Books/Manuals /References:-

1. Testing of Engineering Materials by George E Troxell, Harmer E Davis, G Hauck,McGraw-Hill,Newyork
2. Testing of Metallic Materials by Prof. A V K Suryanaraya, Prentice Hall, India, Pvt Ltd.
3. Mechanical Behavior of Materials, by N Dowling,Prentice Hall, 1993.

Internal Continuous Evaluation - 100 marks

Record/output (Average) - 60 marks Viva-voce (Average) - 10 marks

Final practical exam – 30 marks

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE234	FLUID MECHANICS LABORATORY	0-0-3-1	2016

Prerequisite : CE203 Fluid Mechanics- I

Course objectives

1. Students should be able to verify the principles studied in theory by performing the experiments in laboratory

Expected Outcome

1. The students will be able to understand the different flow measurement equipment's and their procedures.
2. The students will be able to analyze the performance characteristics pumps/turbines.
3. Able to develop the skill of experimentation techniques for the study of flow phenomena in channels/pipes.

List of Experiments (Minimum 12 nos. mandatory)

1. Study of taps, valves, pipe fittings, gauges, pitot tubes, water meters and current meters.
2. Calibration of Pressure gauges
3. Determination of metacentric height and radius of gyration of floating bodies.
4. Verification of Bernoulli's theorem
5. Hydraulic coefficients of orifices and mouth pieces under constant head method and time of emptying method.
6. Calibration of Venturimeter.
7. Calibration of Orifice meter
8. Calibration of water meter.
9. Calibration of rectangular and triangular notches.
10. Time of Emptying : unsteady flow
11. Determination of Darcy's and Chezy's constant for pipe flow.
12. Determination of Chezy's constant and Manning's number for open channel flow.
13. Plotting Specific Energy Curves in Open Channel flow
14. Study of Parameters of Hydraulic Jump in Open channel Flow.
15. Determination of friction co-efficient in pipes
16. Determination of loss co-efficient for pipe fittings

17. Performance characteristics of centrifugal pump.
18. Performance characteristics of Pelton wheel.
19. Performance characteristics of Francis turbine.
20. Performance characteristics of Kaplan turbine.

Internal Continuous Evaluation - 100 marks

Record/output (Average) - 60 marks

Viva-voce (Average) - 10 marks

Final practical exam -30 marks