DR.A.P.J.ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Evaluation Scheme & Syllabus
For
B.Tech. 2nd Year

CIVIL ENGINEERING

(Effective from session 2023-24)

DR.A.P.J.ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

SEMESTER –III

SN	Subject Code	Subject	Type	Category	Periods			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total SW+ESE	Credit Cr
					L	T	P	CT	TA	CT+TA	TE/PE		
1	BOE3** / BAS302	Science Based Open Elective/BSC (Maths-III/Math IV/ Math V)	T	ES/BS	3	1	0	20	10	30	70	100	4
2	BVE301 / BAS301	Universal Human Value and Professional Ethics/ Technical Communication	T	VA/HS	2	1	0	20	10	30	70	100	3
3	BCE301	Engineering Mechanics	T	PC	3	1	0	20	10	30	70	100	4
4	BCE302	Surveying and Geomatics	T	PC	3	1	0	20	10	30	70	100	4
5	BCE303	Fluid Mechanics	T	PC	2	1	0	20	10	30	70	100	3
6	BCE351	Building Planning & Drawing Lab	P	PC	0	0	2		50	50	50	100	1
7	BCE352	Surveying and Geomatics Lab	P	PC	0	0	2		50	50	50	100	1
8	BCE353	Fluid Mechanics Lab	P	PC	0	0	2		50	50	50	100	1
10	BCC301 / BCC302	Cyber Security/Python programming	T	VA	2	0	0	20	10	30	70	100	2
11	BCC351	Internship Assessment /Mini Project*	P							100		100	2
		Total			**15**	**5**	**6**						**25**

- **Mathematics –III** for CE / ENV and allied branches
- **Mathematics-IV** for Computer/Electronics/Electrical & allied Branches, Mechanical & Allied Branches Textile/Chemical & allied Branches
- **Mathematics-V** for Bio Technology / Agriculture Engineering

SEMESTER –IV

SN	Subject Code	Subject	Type	Category	Periods			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total SW+ESE	Credit Cr
					L	T	P	CT	TA	CT+TA	TE/PE		
1	BAS402 / BOE4**	BSC(Maths-III/Math IV/ Math V)/Science Based Open Elective	T	BS/ES	3	1	0	20	10	30	70	100	4
2	BAS401 / BVE401	Technical Communication / Universal Human Value and Professional Ethics	T	HS/VA	2	1	0	20	10	30	70	100	3
3	BCE401	Materials, Testing & Construction Practices	T	PC	3	1	0	20	10	30	70	100	4
4	BCE402	Introduction to Solid Mechanics	T	PC	3	1	0	20	10	30	70	100	4
5	BCE403	Hydraulic Engineering and Machines	T	PC	2	1	0	20	10	30	70	100	3
6	BCE451	Material Testing Lab	P	PC	0	0	2		50	50	50	100	1
7	BCE452	Solid Mechanics Lab	P	PC	0	0	2		50	50	50	100	1
8	BCE453	Hydraulics & Hydraulic Machine Lab	P	PC	0	0	2		50	50	50	100	1
9	BCC402 / BCC401	Python Programming/Cyber Security	P	VA	2	0	0	20	10	30	70	100	2
10	BVE451 / BVE452	Sports and Yoga - II / NSS-II	P	VA	0	0	3			100		100	0
		Total			**15**	**5**	**9**						**23**
		Minor Degree/ Honors Degree MT-1/HT-1											

*****The Mini Project or internship (4 weeks) will be done during summer break after 4th Semester and will be assessed during V semester.

BCE301- ENGINEERING MECHANICS

Course Outcomes: At the end of this course the student will be able to-

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Apply basic knowledge of mathematics and physics to solve real-world problems.
4. Apply basic dynamics concepts – force, momentum, work and energy.
5. Apply Newton's laws of motion for solving the problems.

UNIT - I Introduction to Engineering Mechanics: Rigid Body equilibrium; System of Forces: Coplanar Concurrent Forces, Resultant of forces, Moment of Forces and couples with applications; Free body diagrams, Equations of Equilibrium of Coplanar Systems.

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; [8 Hours]

UNIT- II Centroid and Centre of Gravity, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. [8 Hours]

UNIT - III Basic Structural Analysis, Equilibrium conditions in three dimensions; Analysis of simple trusses in 2-dimension by method of sections & method of joints, Zero force members.

Analysis of simple beams(Cantilever and Simply supported) for support reactions, shear force and bending moment at a section due to loading (Point load, udl and combination of both)[8 Hours]

UNIT - IV Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). [8 Hours]

UNIT - V Introduction to Kinetics of Rigid Bodies, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies.[8 Hours]

Books and References

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II,
– Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications
11. Strength of Materials by Timoshenko and Yσungs, East West Press.
12. Textbook of Applied Mechanics-Dynamics and Statics by Prasad I.B, Khanna Publications.
13. **Link for aicte book portal : https://ekumbh.aicte-india.org/allbook.php.**

BCE302- SURVEYING & GEOMATICS

Course Outcomes: At the end of this course the student will be able to-

1. Apply concepts of survey to prepare plan, profile, and cross-section for computations.
2. Calculate, design and layout horizontal and vertical curves.
3. Operate modern survey instrument for recording of data for scientific uses.
4. Apply principles of photogrammetry for surveying.
5. Apply principles of Remote Sensing and Digital Image Processing for Civil Engineering problems.

UNIT - I

Introduction to Surveying: Definition, Classification, Principles, Survey stations and Survey lines; Introduction to measurement of distance, direction and elevation; Ranging and it methods, Meridians and Bearings. Methods of leveling, Booking and reducing levels, Profile leveling and cross sectioning, Contouring: Characteristics, methods, uses, computation of areas and volumes. Triangulation: Figures or systems, Signals, Satellite station, Baseline and its importance, tape corrections. [8 Hours]

UNIT - II

Curves: Elements of simple circular curves, Theory and methods of setting out simple circular curves, Transition curves- types, characteristics and equations of various transition curves; Introduction to vertical curves. [8 Hours]

UNIT - III

Modern Field Survey Systems: Principle and types of Electronic Distance Measurement systems and instruments, Total Station- its advantages and applications; Global Positioning Systems Segments, working principle, errors and biases. Geographic Information System: Concepts and data types, data models, data acquisition. GIS applications in civil engineering. [8 Hours]

UNIT - IV

Photogrammetry: aerial and terrestrial, types and geometry of aerial photograph, scale and flying height, relief (elevation) displacement, parallax, stereo pair and stereovision, stereoscopes, 3D mapping, height determination, digital photogrammetry, photogrammetric mapping, applications of photogrammetry [8 Hours]

UNIT - V

Remote Sensing: Basic/ Ideal remote sensing, interaction mechanism with atmospheric and earth surface, atmospheric windows, multi concept of remote sensing, spectral signatures, various platforms and sensors, Digital image analysis: Supervised and unsupervised image classification methods, Accuracy assessment. Applications of remote sensing to civil engineering.

Introduction to LIDAR and Drone survey [8 Hours]

Books and References:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House.
7. Punmia BC et al: Surveying Vol. I, II, Laxmi Publication
8. Chandra AM and Ghosh SK: Remote Sensing and Geographical Information System, Alpha Science
9. Ghosh SK: Digital Image Processing, Alpha Science
10. Lillesand T M et al: Remote Sensing & Image Interpretation, John Wiley & Sons
11. Bhatta B: Remote Sensing and GIS, Oxford University Press, 2008

Link for aicte book portal : https://ekumbh.aicte-india.org/allbook.php

BCE303- FLUID MECHANICS

Course Outcomes: At the end of this course the student will be able to-

1. Explain principles of fluid statics, kinematics and dynamics.
2. Explain the terms used in fluid mechanics to describe fluid and flow properties.
3. Explain classifications of fluid flow.
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

UNIT I Fluid and continuum, Physical properties of fluids, Rheology of fluids. Pressure-density height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies. [8 Hours]
UNIT II Types of fluid flows: Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows one, two and three dimensional flows, streamlines, path lines, streak lines, stream tube, continuity equation for 1-D, 2-D and 3-D flows, circulation, stream function and velocity potential function. [8 Hours]
UNIT III Potential Flow: source, sink, doublet. Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, [8 Hours]
UNIT IV Equation of motion for laminar flow through pipes, Stokes' law,, Boundary layer thickness, boundary layer over a flat plate, displacement, momentum and energy thickness. Application of momentum equation. Laminar boundary layer, turbulent boundary layer, laminar sub-layer, separation and its control. Mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces. [8 Hours]
UNIT V Drag and lift, drag on a sphere, aerofoil, Similarity Laws; geometric, kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance. Introduction to Computational Fluid Dynamics (CFD). [8 Hours]

Books and References

1. Hibbler, "Fluid Mechanics in SI Units" 1/e Pearson Education, Noida.
2. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley &Sons Pvt Ltd,
3. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
4. Katz, "Introductory Fluid Mechanics" Cambridge University Press
5. Pnueli & Gutfinger, "Fluid Mechanics" Cambridge University Press
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.
7. Gupta, "Fluid Mechanics & Hydraulic Machines" Pearson Education, Noida
8. Graebel, "Engineering Fluid Mechanics", CRC Press Taylor & Francis Group.
9. Janna, "Introduction to Fluid Mechanics" 4/e, CRC Press Taylor & Francis Group.
10. White,F.M. "Fluid Mechanics" TMH, New Delhi.
11. Munsen et al , "Fundamental of Fluid Mechanics" Wiley Newyork Ltd
12. Garde, R.J., " Fluid Mechanics", SciTech Publications Pvt. Ltd
13. I.H. Shames, "Mechanics of Fluids", McGraw Hill, Int. Student.
14. RK Bansal "Fluid Mechanics and Hydraulic Machines" Laxmi Publication
15. Jagdish Lal "Fluid Mechanics"
16. N Narayan Pillai " Principles of Fluid Mechanics & Fluid Machines" Universities Press.
17. Esposito, Fluid Power & Applications" 7/e Pearson Education, Noida. DR Malhotra & Malhotra, "Fluid Mechanics Hydraulics & Hydraulic Machines" Satya Prakas
18. **Fluid Mechanics : Dr Shreenivas Londhe (Avilable on aicte ekumbh portal)**
    Link for aicte book portal : https://ekumbh.aicte-india.org/allbook.php

BCE351- BUILDING PLANNING & DRAWING LAB

Introduction to commands and tools of BIM software.
Introduction to commands and tools of Auto CAD software.

Drawing and drafting of following with CAD/BIM software

1. Introduction to the tools and commands of drafting software.
2. Working in layers, blocks, x-ref, drawing layout and print setup.
3. 3D drafting and rendering
4. Planning and drafting of elevation and cross section of door and window
5. Planning and drafting of plan and cross section of Dog legged and open well staircase.
6. Planning, drawing and modeling of residential building of 1 room set.
7. Planning, drawing and modeling of 3 room residential building with staircase.
8. Preparation of details general arrangement drawing of 4 room duplex house including planning and drafting.

BCE352- SURVEYING & GEOMATICS LAB

1. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
2. To find out reduced levels of given points using Auto/dumpy level.
3. To study parts of a Vernier and electronic theodolite and measurement of horizontal and vertical angle.
4. To measure horizontal angle between two objects by repetition/reiteration method.
5. To determine the height of a vertical structure (e.g. chimney/ water tank etc.) using trigonometrical leveling by taking observations in single vertical plane.
6. To set out a simple circular curve by Rankine's method.
7. Demonstration and working on Electronic Total Station. Measurement of distances, horizontal & vertical angles, coordinates and area of a land parcel.
8. Demonstration and working with Mirror stereoscopes, Parallax bar and Aerial photographs.
9. Visual Interpretation of standard FCC (False colour composite).
10. Digitization of physical features on a map/image using GIS software.
11. Coordinates measurement using GPS.
12. Demonstrate working of a Drone for survey of given field.

BCE353- FLUID MECHANICS LAB

Note: Students will perform minimum 10 experiments from the following:

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. Verification of Bernoulli's Theorem
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement, sudden contraction and losses in bend.
13. Flow Visualization -Ideal Flow
14. To make studies in Wind Tunnel (Aerofoil and circular cylinder).

BCE401- MATERIALS, TESTING & CONSTRUCTION PRACTICES

Course Outcomes: At the end of this course the student will be able to-

1. Explain various building materials based on their properties.
2. Explain use of non-conventional civil engineering materials.
3. Select suitable type of flooring and roofing in the construction process.
4. Characterize the concept of plastering, pointing and various other building services.
5. Exemplify the various building services and modern construction practices.

Unit 1

Scope of Study of building Materials, economics of the building materials.

Stones: Classification of Stones–Properties of stones in structural requirements

Bricks: Composition of good brick earth, Various methods of manufacturing of bricks & Testing of Bricks.

Blocks: Cement and Concrete hollow blocks, Light weight concrete blocks

Cement: chemical composition, Manufacturing process, Types and Grades, Properties of cement and Cement mortar, Hydration, Compressive strength, Tensile strength, Soundness and consistency, Setting time

Concrete: compositions and grades of concrete various steps in concrete construction – batching, mixing, transporting, compacting, curing, shuttering, jointing. tests and quality control of concrete.

Aggregates –Natural stone aggregates, Industrial by-products (EAF Slag, Steel Slag), Crushing strength, Impact strength, Flakiness, Abrasion Resistance, Grading

Wood- Structure–Properties–Seasoning of timber–Classification of various types of woods used in buildings – Defects in timber.

UNIT II Paints varnishes and distempers: Common constituents, types and desirable properties, Cement paints.

Glass: Ingredients, properties types and use in construction.

Insulating Materials Thermal and sound insulating material, desirable properties and types.

Paints: Purpose, types, technical terms, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

Supplementary cementitious materials: Fly ash, GGBS, Silica fume, Rice husk ash, Calcinated ash (Basic properties and their contribution to concrete strength)

Modern Materials: Glass and plastic composites, Plywood, laminates, wall and roof panels, **Introduction to noise barrier materials for bridges**.

UNIT III Building Construction:

Components of building area considerations, Principles of building Planning

Foundation: Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation , types of foundation

Masonry: Definition and terms used in masonry. Brick and stone masonry, Bonds in brick and stone masonry work.

Types of walls; load bearing, partition walls, cavity walls.

Floors: Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring,

Stairs: Definitions, technical terms and types of stairs, requirements of good stairs; Geometrical

design of RCC dog legged and open-well stairs. Construction Principle and Methods for layout. **Introduction to Smart Building construction**
Unit IV Building Components **Lintels, arches, stair cases** – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, **Pitched, flat roofs**. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre fabricated roofs. **Doors and Windows:** Construction details, types of doors and windows **Formwork:** Introduction to form work, scaffolding, shoring, under pinning.
Unit V: Plumbing Services: Water Distribution, Sanitary – Lines & Fittings; **Ventilations:** Functional requirements systems of ventilations. Air-conditioning - Essentials and Types; **Acoustics** – characteristic-absorption – Acoustic design; **Fire protection** – Fire Hazards – Classification of fire resistant materials and constructions. **Plastering and Pointing:** Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, and defects in plastering. Water proofing with various thicknesses. **Damp proofing:** causes, effects and methods. Principles & Methods of building maintenance **Introduction to current construction practices such as :Expanded Polystyrene (EPS), 3D Printing, Pre-Fabricated Panel System**

Books and References

1. SK Duggal, “Building Materials” New Age International
2. Purushothama Raj, “Building Construction Materials & Techniques” Pearson Edu.
3. PC Varghese, “Building Materials” PHI
4. Rangwala, “Building Materials” Charotar Publishing House.
5. Sushil Kumar, “Building Construction” Standard Publisher.
6. Domone, “Construction Materials” 4/e, CRC Press Taylor & Francis Group.
7. Adams, “Adams’ Building Construction Adams” CRC Press Taylor & Francis Group.
8. BC Punmia, “Building Construction” Laxmi Publication.
9. Jha & Sinha, “Building Construction” Khanna Publishers
10. Sahu, “Building Materials and Construction” Mc Grew Hill Education
11. Deodhar, “Civil Engineering Materials” Khanna Publishers
12. Mehta, “Building Construction Principles, Materials & Systems” 2/e, Pearson Education Noida.
13. Sandeep Mantri, “Practical building Construction and its Management” Satya Publisher, New Delhi.
14. Khanna S. K., Justo C.E.G, & Veeraragavan A., “Highway Materials and Pavement Testing”, Nem Chand and Bros.
15. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO etc.
16. Chudley, R. Greeno, Building Construction Handbook, Butterworth
17. Building Construction : Dr Rinku Kumar **(Avilable on aicte ekumbh portal)**
    Link for aicte book portal : https://ekumbh.aicte-india.org/allbook.php

BCE402- INTRODUCTION TO SOLID MECHANICS

Course Outcomes: At the end of this course the student will be able to-

1. Describe the concepts and principles of stresses and strains.
2. Calculate the deflections at any point on a beam subjected to a combination of loads
3. Analyze the given beam section for stresses.
4. Analyze structural members subjected to axial loading and combined stresses
5. Analyze the behavior of shafts, and cylinders against loads.

UNIT I Simple stress and strains: Concept of elasticity, Types of stresses & strains–Hooke's law– stress– strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.
UNIT II Shear Force and Bending Moment: Relation between S.F., B.M and rate of loading at a section of a beam, S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads, points of contra flexure. **Deflection of Beams**: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinate beams. [8 Hours]
Unit III Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R Neutral axis – Determination of bending stresses and section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections, Simple numerical problems on beam sections. **Shear Stresses:** Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections. Simple numerical problems on beam sections.
Unit IV Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses, Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses, Principal stresses and strains – Analytical and graphical solutions. **Theories of Failure**: Introduction – Various theories of failure – Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory). **Short Columns and Struts**: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules.
UNIT V Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: T/J = q/r = Nθ/L and simple numerical problems. Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure. **Thin Cylinders:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

Books and References:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILL INDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Yσungs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson
8. Mechanics of material by Pytel, Cengage Learning
9. An Introduction to Mechanics of Solids by Crandall, MCGRAW HILL INDIA
10. Strength of Materials by Jindal, Pearson Education
11. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
12. Kazmi, S. M. A., “Solid Mechanics” TMH, Delhi, India.

BCE403- HYDRAULIC ENGINEERING & MACHINES

Course Outcomes: At the end of this course the student will be able to-

1. Apply their knowledge of fluid mechanics in addressing problems in open channels.
2. Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
3. Apply impulse momentum equation for estimating thr performance of pumps.
4. Draw performance curve for the turbines.

UNIT I Introduction: Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels critical, subcritical and super-critical type of flows. Critical depth, concepts of specific energy and specific force. Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section, [8 Hours]
UNIT II Energy-Depth relationship: Application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods. [8 Hours]
UNIT III Rapidly varied flow: Hydraulic jump; Evaluation of the jump elements in rectangular channels on horizontal beds, energy dissipaters, open channel surge, celerity of the gravity wave, deep and shallow water waves. [8 Hours]
UNIT IV Impulse momentum equation- Impact of Jets-plane stationary and moving plates. Pumps: - reciprocating pumps , centrifugal pumps: operation, velocity triangles, performance curves, cavitation, multi staging, selection of pumps. [8 Hours]
UNIT V Impulse and reaction turbines; Pelton Turbine, equations for jet and rotor size, efficiency, Francis and Kaplan type, unit quantities, similarity laws and specific speed, cavitation, characteristic curves. [8 Hours]

Books and References:

1. Chow,V.T. "Open Channel hydraulics" McGraw Hill Publication
2. Subramanya, K., Flow through Open Channels, TMH, New Delhi
3. Ranga Raju, K.G., Flow through open channels, T.M.H. New Delhi
4. Rajesh Srivastava, Flow through Open Channels , Oxford University Press
5. Streeter, V.L.& White E.B., "Fluid Mechanics" McGraw Hill Publication
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.
7. RK Bansal "Fluid Mechanics and Hydraulic Machines" Laxmi Publication
8. AK Jain "Fluid Mechanics" Khanna Publication.
9. Houghtalen, "Fundamentals of Hydraulics Engineering Systems" 4/e Pearson Education, Noida

BCE451- MATERIAL TESTING LAB

Testing of various properties of following materials as per BIS specifications

I. Cement

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier's apparatus.
5. Soundness of cement.
6. Tensile strength

II Course Aggregates

1. Water absorption of aggregate
2. Sieve Analysis of Aggregate
3. Specific gravity &bulk density
4. Grading of aggregates.

III Fine Aggregates

1. Sieve analysis of sand
2. Silt content of sand
3. Bulking of sand

IV Bricks

1. Water absorption.
2. Dimension Tolerances
3. Compressive strength
4. Efflorescence

BCE452- SOLID MECHANICS LAB

Note: Students will perform minimum 10 experiments from the following:

1. Tension test on Mild Steel
2. Bending tests on simply supported beam and Cantilever beam.
3. Determination of torsion and deflection,
4. Measurement of forces on supports in statically determinate beam,
5. Determination of shear forces in beams,
6. Determination of bending moments in beams,
7. Measurement of deflections in statically determinate beam.
8. To determine Flexural Rigidity (EI) of a given beam
9. To find deflection of curved members.
10. To find Critical load in Struts with different end conditions.
11. Hardness Test (Brinnel's and Rockwell)
12. Impact test (Charpy and IZOD)

BCE453- HYDRAULICS & HYDRAULIC MACHINE LAB

Note: Students will perform minimum 10 experiments from the following:

1. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
2. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors.
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study centrifugal pump and their characteristics
8. To study characteristics of Pelton Turbine.
9. To study characteristics Francis Turbine.
10. To study characteristics of Kaplan Turbine.
11. To study the free over-fall phenomenon in an open channel and to determine the end depth
12. To determine coefficient of discharge for given rectangular notch.