For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Civil Engineering) IV– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	HS 103CM	Finance and Accounting	3	-	-	30	70	3
2	HS102 EG	Effective Technical Communication in English	2	-	-	30	70	2
3	ES 304 CE	Engineering Geology	3	-	-	30	70	3
4	PC 405CE	Mechanics of Materials	3	-	-	30	70	3
5	PC 406CE	Hydraulic Engineering	3	-	-	30	70	3
6	PC 407 CE	Design of Reinforced Concrete Structures	3	-	-	30	70	3
7	PC408 CE	Hydrology	3	-	-	30	70	3
Practical/ Laboratory Courses								
8	ES 355 CE	Engineering Geology Laboratory	-	-	2	25	50	1
9	PC 453 CE	Mechanics of Materials Laboratory	-	-	2	25	50	1
10	PC 454 CE	Hydraulic Engineering Laboratory	-	-	2	25	50	1
		Survey Camp *						
			20	**-**	**6**			**23**

* Survey Camp is to be conducted after the IV Semester in the Summer Vacation. To be evaluated in V Sem

FINANCE AND ACCOUNTING

HS 103 CM

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

The objectives of this course is to impart knowledge of:

- Basic understanding of Financial and Accounting aspects of a business unit
- Inputs to evaluate the viability of projects
- Skills necessary to analyse the financial statements

Outcomes:

After successful completion of the course the students will be able to:

- Evaluate the financial performance of the business unit.
- Take decisions on selection of projects.
- Compute the procurement of finances
- Analyze the liquidity, solvency and profitability of the business unit.
- Evaluate the overall financial functioning of an enterprise.

UNIT – I

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)

UNIT – II

Final Accounts*:* Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit- Balance Sheet (including problems with minor adjustments)

UNIT – III

Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)

UNIT – IV

Basics of Capital Budgeting techniques: Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities- Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).

UNIT – V

Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis- liquidity, solvency, turnover and profitability ratios.

Suggested Reading:

1 Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, Pearson Education
2 Rajasekharan, Financial Accounting, Pearson Education
3 Sharma.S.K. and Rachan Sareen, Financial Management, Sultan Chand
4 Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education
5 Sharan, Fundamentals of Financial Management, Pearson Education

For the academic years 2020-2024

EFFECTIVE TECHNICAL COMMUNICATION IN ENGLISH

HS 103 EG

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 2

Course Objectives

The objectives of this course is to impart knowledge of:

- Features of technical communication
- Techniques of report writing and manual writing
- Aspects of data transfer and presentations.

Course Outcomes

After successful completion of the course, the students would be able to:

- Develop technical communication effectively
- Utilize different types of professional correspondence
- Make use of various techniques of report writing
- Adapt adequate skills of manual writing
- Enhance their skills of information transfer and presentations

UNIT I

Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)

UNIT II

Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.

UNIT III

Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.

UNIT IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.

UNIT V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested Readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication: Principles and Practice* (3rd ed.). New Delhi, OUP.
2. Rizvi, Ashraf, M. (2017). *Effective Technical Communication* (2nd ed.). New Delhi, Tata McGraw Hill Education.
3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). New Delhi, Tata McGraw Hill Education.
4. Tyagi, Kavita &Misra, Padma. (2011). *Advanced technical communication*. New Delhi, PHI Learning.
5. Jungk, Dale. (2004). *Applied writing for technicians*. New York, McGraw-Hill Higher Education.

For the academic years 2020-2024

ENGINEERING GEOLOGY

ES 304 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

The objectives of this course is to impart knowledge of:

- Mineralogy, rock formation & types and geological structures
- Utility of rocks as a construction material with qualifying properties
- Geological problems associated with dams, reservoirs, tunnels and other geological hazards

Outcomes:

After completing this course, the student will be able to:

- Identify various minerals, rocks and analyse geological structures.
- Explain rock weathering, classify various soils and understand hydrogeology.
- Classify landforms based on their geomorphology and evaluate the engineering properties of rocks**.**
- Examine rocks for their suitability in various construction applications.
- Investigate and identify the geological problems in dams, reservoirs and tunnels, and explain the geological causes of earthquakes, tsunamis and landslides.

UNIT-I

Introduction: Engineering geology useful to civil engineering

Mineralogy: Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to weathering, Rock forming minerals.

Rocks: Igneous, sedimentary and metamorphic rocks Geological description and Indian occurrence of Granite, Basalt, Dolerite, Gabbro, Laterite, Sandstone Shale, Limestone Slate, Gneiss, Quartzite, Marble, Khondalite and chamockite.

Geological Structures: Folds, joints and faults: Fundamental types, mechanism origin and classification; Field identification and Engineering analysis of geological structures

UNIT-II

Rock Weathering: Processes and end-products of weathering; susceptibility of rocks to weathering, Assessment of the degree of weathering and its classification.

Geology of Soils**:** Formation, geological classification, description and Engineering use of soils Types of Indian soils.

Hydrogeology: Hydrologic cycle, water table, aquifers, occurrence of ground water in various lithological formations, geological control for ground water movement, springs, ground water exploration and ground water provinces of India.

UNIT–III

Geomorphology: Evolution, characteristics features and Engineering, considerations of fluviatile, Aeolian, glacial and marine land forms.

Rock Mechanics: Engineering properties of rocks Stress-Strain behaviour of rocks. Site Investigation: Aerial Photographs, Electrical: Resistivity and Seismic refraction methods.

UNIT- IV

Rock as a Construction Material: Geological considerations for the selection of Concrete aggregate, Highway and Runway aggregates, building stones, Decorative stones, Roofing and facing stones.

Geology of Dams and Reservoirs: Types of Dams, Problems associated with Dam foundations and reservoirs, Engineering Geological investigations for demand water tightness in reservoir site, Analysis of dam failure; Engineering Geology of major Dam sites of India

UNIT–V

Tunnels: Stand-up time of different rocks, Engineering Geological investigations of tunnels in rock, problems in tunnelling.

Geological Hazards: Geological aspects of Earthquakes, Tsunamis and Landslides;

Suggested Readings:

1. F.G. Bell, *Engineering Geology*, Elsevier, 2007.
2. Dimitri P. Krynine and William R. Judd, *Principles of Engineering Geology & Geotechnics*, CBS Publishers & Distributors, First Edition, 1998.
3. B.P. Attewel and I.W. Fanner, *Principles of Engineering Geology*, Chapman and Hall 1976.
4. Officers of the Geological Survey of India, *Engineering Geology Case Histories*, Miscellaneous Pub. No. 29, 1975

MECHANICS OF MATERIALS

PC405CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of and problem solving skills in

- Methods of evaluation of deflections of beams due to transverse loads, Phenomenon of buckling of columns.
- Analysis of Unsymmetrical Bending, Concept of Shear centre, Static and Kinematics Indeterminacy
- Analysis of indeterminate beams, Concept of strain energy principle and its applications to evaluate the displacements and redundant forces using energy principles

Outcomes:

After completing this course, the student will be able to:

- Calculate the deflections of determinate beams due to transverse loads by various methods
- Evaluate the crippling load of columns for various end conditions using different formulas
- Analyze the Unsymmetrical Bending, Locating the Shear centre, Determining Static and Kinematics Indeterminacy
- Analyze statically indeterminate beams such as propped cantilever, fixed beams and continuous beams and draw the shear force and bending moment diagrams
- Analyze the beams and frames and to find deflections by energy principle

UNIT – I

***Deflections in Beams*:** Slope and deflection by double integration method for cantilever, simply supported beams and overhanging beams carrying one, two point loads, uniformly distributed load and uniformly varying load over entire span. Moment area method and conjugate beam method.

UNIT – II

***Columns and Struts*:** Euler's theory for long columns, different end conditions, equivalent length, Rankine's theory, Secant & Perry formula for eccentrical loading.

***Unsymmetric bending*:** Centroidal principal axes of section, moments of inertia referred to any set of rectangular axes, Stresses in beams subjected to unsymmetrical bending, principal axes, Resolution of bending moment into two rectangular axes through the centroid, Location of neutral axis.

UNIT – III

***Shear Centre*:** Concept and importance of shear center, shear flow and determination of shear center of simple sections such as T sections and Channel sections with one axis of symmetry

***Static and Kinematic indeterminacy*:** Determination of static and kinematic indeterminacy of beams, pin jointed and rigid jointed frames.

UNIT - IV

***Propped Cantilevers*:** Cantilever beams on elastic and rigid props for point loads and uniformly distributed load only. Calculation of reactions, Bending moment and Shear force diagrams, and deflections.

***Fixed Beams*:** Determination of shear force, bending moment slope and deflection in fixed beams with and without sinking of supports for point loads uniformly distributed load.

***Continuous Beams*:** Determination of moments in continuous beams with and without sinking of supports by theorem of three moments, bending moment and shear force diagrams.

UNIT – V

***Energy Methods*:** Elastic Strain energy for various types of loading, Determination of deflections in statically determinate beams and trusses using Work-energy principle, Castigliano's theorems, Unit load method. Maxwell's theorem of reciprocal deflections

***Redundant Trusses and Frames*:** Analysis of plane trusses with one degree of redundancy (internal /external) and plane frames with one degree of redundancy, Lack of fit and temperature effect.

Suggested Reading:

1. D.S. Prakash Rao, *Strength of Materials- A Practical Approach*, Universities Press, Hyderabad, 1999.
2. R.K. Rajput, *A Textbook of Strength of Materials*, S. Chand Publications, New Delhi, 2007.
3. R.K. Bansal, *Strength of materials*, Laxmi Publications, New Delhi, 2010.
4. S. S. Bhavikatti, *Strength of materials*, Vikas Publishing House, Delhi, 2002
5. S. S. Bhavikatti, *Structural Analysis I & II*, Vikas Publishing House, Delhi, 2002.
6. Devdas Menon, *Structural Analysis*, Narosa Publishing House, New Delhi, 2009.

For the academic years 2020-2024

HYDRAULIC ENGINEERING

PC 406 CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:
The objectives of this course is to impart knowledge of:

- Various hydraulic engineering problems in open channel flows
- Principles of turbines and pumps
- Theory and practice problems in hydraulic engineering

Outcomes:
After completing this course, the student will be able to:

- Illustrate the flow through pipes and losses in pipe floe
- Solve various engineering problems in open channels
- Describe the hydraulic jump and its uses.
- Discuss the dimensional analysis
- Apply their knowledge of fluid mechanics in addressing problems in hydraulic machinery.

UNIT – I

***Flow through Pipes*:** Reynolds experiment and its significance, laminar and turbulent flow, lower critical Reynolds number, characteristics of laminar and turbulent flow.
Velocity and shear distribution in laminar flow through circular pipes-Hagen Poiseuille equation, head loss in laminar flow.
Loss of head through pipes –Darcy Wiesbach equation, Darcy friction factor for laminar flow, velocity profile of turbulent flow, empirical equations for turbulent flows, hydro dynamically smooth and rough boundaries, Moody's diagram.
Minor losses, hydraulic gradient line, Pipe flow systems-pipes in series, equivalent pipes, pipes in parallel.
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UNIT – II

***Dimensional Analysis and Hydraulic Similitude*-** Buckingham pi theorem, Rayleigh method, dimensionless groups, similitude, model studies, types of models. Application of dimensional analysis and model studies to fluid flow problem.
Unsteady flow in pipes: Water hammer phenomenon, pressure rise due to gradual and sudden valve closure, critical period of the pipeline, rigid and elastic pipes.

UNIT – III

Introduction to Open Channel Flow - Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, velocity and pressure distribution across channel section.
Uniform Flow - Characteristics and development of uniform flow, Chezy's formula, Manning's

formula. Factors affecting Manning's Roughness Coefficient "n". Most economical section of channel. Computation of normal depth in rectangular and trapezoidal channels

Hydraulic jump and its applications.

UNIT – IV

Turbines: Classification of turbines. Work done and efficiency in Pelton Wheel, Francis turbine and Kaplan turbine. Unit quantities and specific speed. Performance characteristics of turbines.

UNIT – V

Centrifugal Pumps: Components and functioning of a centrifugal pump- manometric head and efficiency, work done by impeller, priming of pump and minimum starting speed, specific speed and performance of centrifugal pumps.

Suggested Reading:

1 *Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House, 2017*
2 *Fluid Mechanics And Hydraulic Machines, K. Subramanya, Tata McGraw Hill, 2018*
3 *Flow in Open channel, K. Subramanya, Tata McGraw Hill, 2019*

For the academic years 2020-2024

DESIGN OF REINFORCED CONCRETE STRUCTURES

PC407 CE

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of:

- IS codal provisions as applicable for the design
- Solid background of principles of structural design of Reinforced Concrete Members
- Hands- on- experience and skill to design structural Reinforced Concrete elements

Outcomes:

After completion of course student will be able to:

- Analyse and Design a single reinforced section by applying the design philosophy of working and Limit state method of Design.
- Analyse and Design a doubly reinforced section and Tee section and apply check for deflection..
- Analyse and Design a section subjected to shear and Torsion, and apply check for development length.
- Analyse and Design one way and two way slabs
- Analyse and design of columns and Footings

UNIT – I

Introduction: Materials used in reinforced concrete (Cement, sand, coarse aggregate, water and reinforcing bars). Introduction to Relevant IS codes (IS 456-2000, IS 875 part I to IV). Dead load, imposed load, wind load and earthquake load.

***Working stress method*:** Design of RCC beams: Balanced, under-reinforced and over reinforced sections

Limit State Method of Design: Introduction to the design of Concrete Structures using Limit state method of design. Design philosophies. Partial safety factors for material strength and Loads. Limit State of Collapse and Limit State of Serviceability.

Limit state of Collapse – Flexure: Assumption made in Limit state of collapse- flexure. Stress blocks Parameters, Moment of Resistance of a singly reinforced section. Analysis and design of a singly reinforced section for flexure:

UNIT – II

Limit state of Collapse – Flexure

Design of Doubly Reinforced Beams*:* Analysis and Design for flexure a doubly reinforced Rectangular section.

Design of T- Beams: Analysis and Design of Singly Reinforced T Beams for flexure

Limit states of serviceability: Check for deflection and cracking.

UNIT – III

***Limit State of Collapse – Shear & Torsion*:**

***Design of beam for Shear*:** Types of Shear failure of an R.C.C beam, Shear carrying capacity of a reinforced concrete Beam. Analysis and Design of a reinforced section for Shear.

Design of Beam for Torsion: Analysis of R.C.C beams for Torsion. Equivalent Shear and Equivalent Bending Moment. Design and detailing of R.C.C beam subjected to Torsion

***Design of Beam for Bond*:** Flexural Bond, Anchorage (Development) Bond, Check for Bond Failure.

UNIT – IV

Design of Slabs: Types of Slabs: Design of one way and two-way slabs - Simply supported and continuous slabs subjected to uniformly distributed loads, Detailing of reinforcement, Check for serviceability of slabs.

Design of stair cases*:* Types of stairs: Design and detailing of dog-legged stair cases

UNIT – V

Design of columns*:* Assumptions, Design of axially loaded circular, square and rectangular columns, Design of columns with uni-axial and bi-axial bending, interaction diagrams.

Design of footings: Design of isolated square, rectangular and circular footings and Design & Detailing of combined Rectangular RCC footings

Suggested Reading:

1. David Darwin, Charles W. Dolan, Arthur H. Nilson, "*Design of Concrete Structures*" , 15th Edition, McGraw Hill, 2016.
2. Krishna Raju N. and Pranesh R.N., *Reinforced Concrete Design*, New Age International Pvt.2003Ltd., 2003..
3. H. J. Shah, "*Reinforced Concrete (Elementary reinforced concrete)",* 11th Edition, Volume I, Charotar Publications, 2016.
4. B. C. Punmia, *"Reinforced concrete structures*", 7th Edition, Laxmi Publications, 1992
5. A.K Jain, *"Reinforced Concrete- Limit State Design",* 7th edition, Nem Chand and Bros publications, 2012.
6. Neelam Sharma, *"Reinforced Cement concrete Design"* S.K. Kataria and Sons publications 2017

Relevant IS Codes:

1) IS: 456-2000, *"Code of Practice for Plain and Reinforced concrete",* Bureau of IndianStandards, New Delhi, India.

2) SP 16, *"Design Aids for Reinforced Concrete to IS 456:1978",* Bureau of Indian Standards, New Delhi, India

3) SP 24, *"Explanatory Handbook on Indian Standard Code of Practice for Plain andReinforced Concrete to IS 456:1978",* Bureau of Indian Standards, New Delhi, India

4) SP 34, *"Handbook on Concrete Reinforcement and Detailing (With Amendment 1)",*Bureau of Indian Standards, New Delhi, India

5) IS: 875-1987, *"Code of Practice For Design Loads (Other Than Earthquake) ForBuildings And Structures Parts (1, 2, 3, 4 & 5)",* Bureau of Indian Standards, New Delhi,India.

HYDROLOGY

PE 408 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Course Objectives:

The objectives of this course is to impart knowledge of:

- Importance of Hydrology and its applications
- Introduction to Hydrological processes and estimation of Design flood
- Assessment of soil-water-plant relationship

Course Outcomes

After completion of course student will be able to:

- Outline the interaction among various processes in the hydrologic cycle.
- Estimate the Design flood for Water Resources structures
- Evaluate drawdown and yield in aquifers
- Develop the Rainfall – Runoff relationship
- Determine of crop – water requirements

UNIT – I

Introduction – Hydrologic cycle, Importance and scope of hydrology, Application of hydrology. **Precipitation**-Forms of precipitation, types of rainfall, Characteristics of precipitation in India, measurement of rainfall, types of rain gauges, rain gauge network design, mean rainfall over an area, estimation of missing precipitation data, presentation of rainfall data, probable maximum precipitation(PMP), rainfall data in India.

UNIT – II

Abstractions from Precipitation- Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction; Transpiration process; Evapotranspiration- measurement of evapotranspiration, evapotranspiration equations; Infiltration, infiltration capacity, measurement of infiltration, infiltration indices.

UNIT – III

Runoff- Definition, runoff process, factors affecting runoff, determination of runoff volume by-empirical formulae, rational method, SCS-CN method, UNIT hydrograph method (def, limitation, application, derivation of unit hydrograph from direct runoff hydrograph and vice versa).

Floods: Definition, causes and impact of floods, control measures of floods, estimation of floods, flood frequency studies- Weibul's and Gumble's method.

UNIT – IV

Ground Water-Forms of sub surface water, vertical distribution of sub surface water, geologic formations of aquifers, saturated formation, types of aquifers, aquifer properties, Darcy's law, types of wells, steady radial flow into wells in confined and unconfined aquifer, yield of open wells, safe yield, constant level pumping test and recuperation test.

UNIT – V

Irrigation-Definition, necessity of irrigation, frequency of irrigation, types of irrigation methods, advantages and ill-effects of irrigation.

Soil water-plant Relationship-Water requirement of crops, crops and crop seasons in India, cropping pattern. Vertical distribution of soil moisture, soil moisture tension, soil moisture stress, soil moisture constants, plant water relationship, moisture stress and plant response, consumptive use, crop factor, duty and delta, factors affecting duty.

Suggested Reading:

1) K. Subramanya, ***Engineering Hydrology,*** Tata McGraw Hill Publishing Co.Ltd. 1996.

2) H.M. Raghunath, ***Hydrology – Principles, Analysis and Design***, New Age International Publishers, 1996.

3) Michael, A.M, ***Irrigation Theory & Practice***, Vikas Publishing House, New Delhi, 1978

4) Ray K. Linsley, Jr, Max A. Kohler, Joseph L. H. Paulhus, ***Hydrology for Engineers***, McGraw-Hill Book Company, 1980

5) Ven Te Chow, ***Hand book of Applied Hydrology***, McGraw-Hill Book Company, New York, 1964

ENGINEERING GEOLOGY LABORATORY

ES 355 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:
The objectives of this course is to impart knowledge of:

- Hands-on experience to study the geological aspects of various rocks.
- Evaluate the physical and engineering properties of minerals and rocks
- Provides exposure to various geological tests.

Outcomes:
After completing this course, the student will be able to:

- Identify the physical and engineering properties of minerals and rocks
- Analyze and measure structural aspects of rocks using models
- Carry out field experiment and studies such as VES
- Perform studies such as Stereoscopic study of photographs, seismic refraction survey and Slake durability test
- Study the topographical and GSI maps

LIST OF EXPERIMENTS

1. Identification and description of physical properties of minerals
2. Identification and description of geological and geotechnical characteristics of rocks
3. Determination of apparent specific gravity, porosity and water absorption of different rocks
4. Study of structural geology models (wooden models)
5. Measurement of dip of planar feature by clinometers compass
6. Vertical electrical sounding VES field experiment
7. Stereoscopic study of aerial photographs pertaining to landforms, vegetation and water bodies
8. Seismic refraction survey to determine depth to bedrock
9. Study of topographical maps
10. Structural geology problems (strike, dip, three point problems)
11. Study of geological survey of India (GSI works) maps and reports
12. Slake durability test on soft rock

Note: At least 10 experiments should be conducted in the semester

MECHANICS OF MATERIALS LABORATORY

PC453CE

Instruction: 2 periods per week
CIE: 25marks *SEE: 50marks*
Credits : 1

Objectives:
The objectives of this course is to impart knowledge of:

- Stress- strain behavior of ductile material and compressive strength of brick.
- Deflection for different types of beams for different materials.
- Rigidity modulus by conducting spring and torsion test, hardness number and Impact strength of different materials

Outcomes:
After the completion of the course, the student will be able to:

- Demonstrate the Stress-strain behavior of ductile material
- Compare Young's modulus of different materials by conducting deflection test on different types of beams
- Calculate rigidity modulus by spring test and torsion test.
- Evaluate compressive strength of brick.
- Find Hardness number and Impact strength of given Specimens.

List of Experiments:

1. Uni- axial tension test on a specimen of ductile material.
2. Stress – Strain characteristics of a ductile material.
3. Brinell`s hardness test.
4. Compression test on brick.
5. Bending test on simply supported beam of Timber.
6. Izod impact test
7. Compression test on close coiled helical spring.
8. Torsion test on a specimen of ductile material.
9. Bending test on Cantilever beam of Aluminum.
10. Bending test on Simply supported beam of Steel.
11. Bending test on Fixed beam of Copper.
12. Charpy impact test.

Note: At least 10 experiments should be conducted.

HYDRAULICS ENGINEERING LABORATORY

PC 454 CE

Instruction: 2periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits :1

Objectives:

The objectives of this course is to impart knowledge of:

- Practical applications of open and curved channels
- Application of force concepts on jets and hydraulic machines
- Determination of characteristic curves of turbines and pumps

Outcomes:

After the completion of the course, the student will be able to:

- Illustrate the flow phenomenon in open channels
- Analyze the force acting due to jets concept and its application in hydraulic machines
- Demonstrate working principles of hydraulic pumps and turbines
- Infer the specific energy diagram by tilting flume
- Determine minor losses in pipes

List of Experiments:

1. Study of Uniform flow in open channels-Smooth and Rough. Determination of Rugosity Coefficients.
2. Determination of a vane coefficient
3. Study of universal characteristic curves of a Pelton Wheel
4. Study of universal characteristic curves of a Francis turbine
5. Study of flow Characteristics over a broad crested weir
6. Determination of basic characteristics of a hydraulic jump
7. Study of flow Characteristics of venture flume.
8. Study of Specific Energy diagram- Tilting flume
9. Study of main characteristic curves of a Centrifugal pump
10. Determination of Minor losses in pipe

Suggested Reading:

1 *S. K. Som, and Biswas, G, 'Fluid Mechanics and Fluid Machines', Tata McGraw-Hill Publishing Co., New Delhi, 1998*
2 *Yuan, S. W., 'Foundation of Fluid Mechanics', Prentice-Hall India Pvt. Ltd., New Delhi, 1976*
3 *C.S.P. Ojha, R.Berndtsson, P.N. Chandramouli, 'Fluid Mechanics and Machinery', Oxford University Press, New Delhi, 2010*
4 *A.K.Mohanty, 'Fluid Mechnics', Prentice-Hall India Pvt. Ltd., New Delhi, 1994*
5 *P.N. Modi, 'Hydraulics and Fluid Mechanics Including Hydraulics Machines', Standard Book House, New Delhi, 2013.*