FOURTH SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/week	Credit	Full Marks
1.	Humanities Science - 3	HS 401	Engineering Economics and Accountancy	3	0	0	3	3	100
2.	Humanities Science - 4	HS 402	Universal Human Values-II: Understanding Harmony	2	1	0	3	3	100
3.	Program Core - 6	PC CE 403	Geotechnical Engineering	3	1	0	4	4	100
4.	Program Core - 7	PC CE 404	Solid Mechanics	3	1	0	4	4	100
5.	Program Core - 8	PC CE 405	Fluid Mechanics	3	0	0	3	3	100
6.	Program Core - 9	PC CE 406	Concrete Technology	3	0	0	3	3	100
7.	Program Core - 10	PC CE 407	Geotechnical Engineering Lab.	0	0	2	2	1	100
8.	Program Core - 11	PC CE 408	Solid Mechanics and Fluid Mechanics Lab.	0	0	2	2	1	100
9.	Program Core - 12	PC CE 409	Concrete Technology Lab.	0	0	2	2	1	100
10.	Mandatory Course - 4	MC 410	Essence of Indian Knowledge Tradition	2	0	0	2	0	100
			Total:	19	3	6	28	**23**	**1000**

Engineering Economics and Accountancy

Course Code	HS 401
Course Title	Engineering Economics and Accountancy
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Nil
Course Category	Humanities Science (HS)
Number of classes	38 hours

Course Outcomes:

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

CO Number	CO Description	K-level
CO-1	Understand the importance of engineering economics in business.	K-2
CO-2	Demonstrate the necessary knowledge and skills for running a business organisation.	K-2
CO-3	Understand the financial statement and position of an organisation.	K-2
CO-4	Analyze the accounting information for decision making.	K-4
CO-5	Develop the knowledge & skill on business and management.	K-3

Course Content:

Module 1: Engineering economics (9 hrs)

- Engineering economy and its importance;
- Demand & supply: Wants, satisfaction of wants, demand, supply, elasticity of demand, estimation of demand, supply chain economy;
- Production-Factors of production (land, labor, capital, and entrepreneurship), Laws of return.
- Money – Value of money, quantity theory; inflation and deflection.

Module 2: Business Skills for Engineers (9 hrs)

- Business Structure: Proprietorship, Partnership and Joint Stock Company;
- Basic management for businesses: Basic functions of management,
- Risk Management: Type of risk, Risk management steps
- Entrepreneur and Leadership: Leadership styles, Qualities of a good leader for a business;
- Financing and the business: Objectives and sources of funds;
- Taxation: Basics of Income tax & Goods and Services Tax (GST)

Module 3: Financial Accounting for Business (10 hrs)

- Transactions: Financial event, Features of transactions; Recording of transactions;
- Basic accounting: Ledger, Trail balance, Cash book (double column only);

- Final account: Objectives, Preparation of final accounts (Trading A/C, Profit & Loss A/C and Balance Sheet).

Module 4: Managerial Accounting for Decision-making (10 hrs)

- Cost classifications – Material cost control, labor cost control and overhead cost control (only theory);
- Cost sheet: Objective and preparation of Cost sheet (Basic problem);
- Capital budgeting: Objectives Pay-back period and NPV method for feasibility testing of investment
- Working capital management: Factors and sources of WC
- Ratio analysis: Interpretation for industrial control, Basic ratios- Current Ratio, Debt-equity ratio, proft ratio

References / Suggested Learning Resources:

- Fundamentals of Engineering Economics, 4th Edition, by Chan S. Park, Pearson Publishing;
- Engineering Economics And Financial Accounting Paperback, by Arasu, Scitech publication
- Engineering Economics and Financial Accounting for Anna University Paperback by A. Bagad, Technical Publications;
- Financial Management- An analytical framework , Nayak & Manna, Parul Library;
- Principles of Management, Ghose and Basu,ABS Publishing House;

****

Universal Human Values-II: Understanding Harmony

Course Code	HU-402
Course Title	Universal Human Values-II: Understanding Harmony
Number of Credits	3(L: 2, T: 1, P: 0)
Prerequisites	Induction Programme and Universal Human Values -I
Course Category	Humanities Science (HS)
Number of classes	36 hours

Course Outcome: At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	Explain the term self-exploration and its application for self-evaluation and development.	K-2
CO-2	Identify the holistic perception of harmony at level of self, family, society, nature and explain it by various examples.	K-3

CO-3	Illustrate the role of a human being in ensuring harmony in society and nature.	K-2
CO-4	Distinguish between ethical and unethical practices, and start identifying a strategy to actualize a harmonious environment wherever they work.	K-4

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education (8 Hrs)

Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
Continuous Happiness and Prosperity- A look at basic Human Aspirations.
Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority.
Understanding Happiness and Prosperity correctly- A critical appraisal of thecurrent scenario.
Method to fulfill the above human aspirations: understanding and living inharmony at various levels.

Module 2: Understanding Harmony in the Human Being (10 Hrs)

Understanding human being as a co-existence of the sentient 'I' and the material'Body'.
Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
Understanding the characteristics and activities of 'I' and harmony in 'I'.
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
Understanding the meaning of Trust; Difference between intention and competence
Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.

Module 3: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence (8 Hrs)

Understanding the harmony in the Nature
Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature.
Understanding Existence as Co-existence of mutually interacting unitsin all-pervasive space.
Holistic perception of harmony at all levels of existence.

Module 4: Implications of the above Holistic Understanding of Harmony on Professional Ethics (10 Hrs)

Natural acceptance of human values. Definitiveness of Ethical Human Conduct.
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Competence in professional ethics:
a. Ability to utilize the professional competence for augmenting universal human order
b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

References / Suggested Learning Resources:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of My Experiments with Truth - by Mohandas KaramchandGandhi.
5. Bharat Mein Angreji Raj - PanditSunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)

****

Geotechnical Engineering

Course Code	PC CE 403
Course Title	Geotechnical Engineering
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	Engineering Mechanics
Course Category	Program Core
Number of classes	48 hours

Course Outcome:

CO Number	CO Description	K-level
CO-1	To Classify the soil and determine the Plasticity Characteristics of Soil	K-2 & K-3
CO-2	To assess the permeability of soil, and analyze the seepage characteristics and effective stress.	K-3 & K-4
CO-3	To analyze the consolidation and compaction characteristics, and stresses distribution in soil	K-4
CO-4	To assess the shear strength characteristics of soil along with stability of slopes and illustrate the soil exploration	K-3 & K-4

Course Content:

Module 1: Classification and Plasticity Characteristics of Soil (12 hours)

Introduction–Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio-moisture content, unit weight- percent air voids, saturation- moisture content, moisture content- specific gravity etc.

Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system.

Plasticity Characteristics of Soil - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Use of consistency limits.

Module 2: Permeability, Seepage and Effective Stress Analysis (12 hours)

Permeability of Soil - Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping-out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil.

Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

Effective Stress Principle - Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

Module 3: Compaction, Consolidation and Stresses distribution in soil (12 hours)

Compaction of Soil-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

Consolidation of Soil - Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Stresses in soils – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.

Module 4: Shear Strength, Stability of Slopes and Soil Exploration (12 hours)

Shear Strength - Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test,

triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters, unconfined compression test, vane shear test.

Stability of Slopes - Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Soil Exploration- Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods.

References / Suggested Learning Resources:

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Soil mechanics and Foundations by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications (p) Ltd.
3. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers Distributors
4. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
5. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
6. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
7. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
8. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy
9. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
10. Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series) by V.N.S. Murthy.

****

Solid Mechanics

Course Code	PC CE 404
Course Title	Solid Mechanics
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	Engineering Mechanics
Course Category	Professional core courses (PCC)
Number of classes	48 hours

Course Outcomes: After completion of the course students will be able to-

CO No	CO Description	K-level
CO-1	Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components	K-2
CO-2	Draw SFD and BMD of Determinate Structures	K-4

CO-3	Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading	K-3
CO-4	Solve torsion problems in bars	K-3

Module 1: Simple Stresses and Strains (12 hours)

Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

Compound Stresses and Strains- Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

Module 2: Bending Moment and Shear Forces Diagrams (12 hours)

Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads,uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Module 3: Bending Stress and Shear Stress in Beams (12 hours)

Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Module 4: Slope, Deflection and Torsion (12 hours)

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 determinantbeams.

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.

References / Suggested Learning Resources:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.

2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
5. Laboratory Manual of Testing Materials - William Kendrick Hall
6. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.
7. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

****

Fluid Mechanics

Course Code	PC CE 405
Course Title	Fluid Mechanics
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Nil
Course Category	Program Core (PC)
Number of classes	36 hours

Course Outcome: After completing this course, student will be able to:

CO Number	CO Description	K-level
CO-1	Understand definitions of the basic terms used in fluid mechanics.	K2
CO-2	Understand the broad principles of fluid statics, kinematics and dynamics.	K2
CO-3	Understand classifications of fluid flow.	K2
CO-4	Apply the continuity, momentum and energy principles.	K3
CO-5	Apply dimensional analysis.	K3

Course Content:

Module 1: Introduction to Fluid Mechanics (9 hours)

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Module 2: Fluid Statics (9 hours)

Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer,

Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Module 3: Fluid Kinematics (9 hours)

Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; continuity equation; velocity and acceleration; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function, three-dimensional continuity equations in Cartesian coordinates.

Module 4: Fluid Dynamics (9 hours)

Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number. Flow through different notches and weirs, Time of emptying a reservoir with rectangular and triangular notches.

References / Suggested Learning Resources:

1. Modi, P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi.
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Company, New Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

****

Concrete Technology

Course Code	PC-CE 406
Course Title	Concrete Technology
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Building Materials
Course Category	Professional core courses (PCC)
Number of classes	36 hours

Course Outcomes: After completion of the course students will be able to-

CO No	CO Description	K-level
CO-1	Examine the properties of ingredients of concrete.	K-4

CO-2	Illustrate the properties of fresh and hardened concrete.	K-2
CO-3	Designed the mix proportion of concrete.	K-6
CO-4	Apply the results of Non-Destructive testing of concrete.	K-3

Course contents:-

Module 1: Properties of Concrete (9 hours)

Properties of Ingredients-Properties of coarse and fine aggregates and their influence on concrete, types of cement and their use, physical properties of 33 Grade, 43 Grade, 53 Grade ordinary Portland cement, Portland pozzolana cement, rapid hardening Portland cement, hydrophobic cement, low heat Portland cement and sulphate resisting Portland cement as per relevant I.S. codes. Stone types and properties, preservative treatments, stone aggregates. Grades of concrete- Concrete for ordinary work, light weight concrete, high density concrete, workability, durability and strength requirements, effect of w/c ratio, acceptability criteria, laboratory testing of fresh and hardened concrete.

Module 2: Concrete Mix Design (9 hours)

Mix design for compressive strength by I.S. methods, road note method and British method, mix design for flexural strength. High performance concrete-Constituents of high grade concrete, various tests and application of high performance concrete.

Module 3: Admixtures and Ready Mix Concrete (9 hours)

Admixtures-Plasticizers, retarders, accelerators and other admixtures, test on admixtures, chemistry and compatibility with concrete. Ready mix concrete: requirements of ready mix concrete, transit mixer details, mix design of RMC.

Module 4: Concrete for Repairs and Rehabilitation of Structures (9 hours)

Concrete for repairs and rehabilitation of structures-Polymer concrete, fiber reinforced concrete, polymer impregnated concrete, polymer modified cement concrete and Ferro cement, different tests. Non-Destructive testing of concrete-hammer test, ultrasonic pulse velocity test, load test, carbonation test, half-cell potentiometer, corrosion of steel, core test and relevant provision of I.S. codes.

References / Suggested Learning Resources:

1. Plain & reinforced concrete, Vol. I, O.P. Jain & Jaikrishna,
2. Concrete technology, theory and practice, M.S. Shetty.
3. Properties of concrete, Neville, El, Society & Pub.
4. Relevant I.S. codes.
5. Special Publication of ACI on Polymer concrete and FRC.
6. Proceedings of International Conferences on Polymer Concrete and FRC.

****

Geotechnical Engineering Lab.

Course Code	PC CE 407
Course Title	Geotechnical Engineering Lab.
Number of Credits	1 (L:0, T: 0, P: 2)
Prerequisites	Engineering Mechanics
Course Category	Program Core
Number of classes	26 hours

Course Outcome:

CO Number	CO Description	K-level
CO-1	Determine the basic properties of soil like field density, moisture content, specific gravity, grain size analysis along with field identification of soil.	K-3
CO-2	Determine the permeability of soil using Constant-head and variable head test method	K-3
CO-3	Determine the consistency limits of soil	K-3
CO-4	Assess the compaction and consolidation characteristics of soil	K-3
CO-5	Compute the shear strength characteristics of soil by using different laboratory test	K-3

Course Content:

List of Experiments (*Minimum 6 or more experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Determination of Field Density of soil using Core Cutter method.
2. Determination of Field Density of soil using Sand replacement method.
3. Determination of Natural moisture content using Oven Drying method.
4. Field identification of Fine-Grained soils.
5. Determination of Specific gravity of Soils.
6. Grain size distribution by Sieve Analysis.
7. Grain size distribution by Hydrometer Analysis.
8. Determination of Consistency limits by Liquid limit
9. Determination of Consistency limits by Plastic limit
10. Determination of Consistency limits by Shrinkage limit.
11. Permeability test using Constant-head test method.
12. Permeability test using Falling-head method.
13. Compaction test: Standard Proctor test.
14. Compaction test: Modified Proctor test.
15. Determination of Relative density.
16. Determination of consolidation characteristics of soil by Oedometer Test.
17. Determination of shear strength parameter by Triaxial Test (UU)
18. Determination of shear strength by laboratory Vane shear test
19. Determination of shear strength parameter Direct Shear Test
20. Unconfined Compression Strength Test**.**

References / Suggested Learning Resources:

1. Soil mechanics and Foundations by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications (p) Ltd.
2. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers Distributors
3. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
4. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
5. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
6. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
7. Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series) by V.N.S. Murthy.

****

Solid Mechanics and Fluid Mechanics Lab.

Course Code	PC CE 408
Course Title	Solid Mechanics and Fluid Mechanics Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Professional core courses (PCC)
Number of classes	20 hours

Course Outcome:

CO No	CO Description	K-level
CO-1	Determine compressive strength of concrete	K-2
CO-2	Investigate Hook's law that is the proportional relation between force and stretching in elastic deformation	K-3
CO-3	Compare Tension test, Impact test, Shear test, Bend test steel bar	K-4
CO-4	Percieve the broad principles of fluid statics, Kinematics and dynamics.	K-5
CO-5	Characterize laminar and turbulent flows	K-4
CO-6	Determine flow and flow properties.	K-4

Solid Mechanics

List of Experiments (*Minimum 3 or more experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Tension test
2. Bending tests on simply supported beam and Cantilever beam.
3. Compression test on concrete
4. Impact test
5. Shear test
6. Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation,
7. Measurement of deflections in statically determinate beam,
8. Measurement of strain in a bar
9. Bend test steel bar;

10. Yield/tensile strength of steel bar;

Fluid Mechanics

List of Experiments (*Minimum 3 or more experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. To find critical Reynold's number for a pipe flow.
2. To verify Bernoulli's theorem.
3. To determine metacentric height of a floating body.
4. To determine the coefficient of discharge of venturimeter.
5. To determine the coefficient of discharge, contraction and velocity of an orifice.
6. To determine the coefficient of discharge of venturimeter.
7. To determine the coefficient of impact for vanes.
8. To determine the friction factor for the pipes (major losses).
9. To determine the minor losses due to sudden enlargement , sudden contraction and bends.
10. To determine the coefficient of discharge of Notch (V and rectangular types).
11. To measure viscosity of fluid.

References / Suggested Learning Resources:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, NewYork, USA.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Laboratory Manual of Testing Materials - William Kendrick Hall
4. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf –TMH 2002.
5. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
6. Applied Fluid Mechanics Lab Manual.2019 , Habib Ahmari, Shah Md. Imran Kabir , Ginny Bowers.
7. Theory and Applications of Fluid Mechanics, K Subramaniya. Tata Mc Graw Hill.
8. Lab Manual.

****

Concrete Technology Lab.

Course Code	PC CE 409
Course Title	Concrete Technology Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Professional core courses (PCC)
Number of classes	24 hours

Course Outcomes: After completion of the course students will be able to-

CO No	CO Description	K-level
CO-1	Evaluate the properties of concrete in plastic and hardened state	K-6
CO-2	Estimate the quantity of admixture and other additives in concrete	K-6
CO-3	Designed the mix proportion of concrete.	K-6
CO-4	Apply the results of Non-Destructive testing of concrete.	K-3

List of Experiments (*Minimum 6 or more experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

(a) Effect of w/c ratio on workability (slump cone, compaction factor, V-B test, flow table)
(b) Effect of w/c ratio on strength of concrete,
(c) Mix design in laboratory
(d) Non-destructive testing of concrete – some applications (hammer, ultrasonic)
(e) Compressive, Flexural and tensile strength of Mortar.
(f) Study of admixtures & their effect on workability and strength of concrete.
(g) Modulus of rupture of concrete.
(h) Initial drying shrinkage, moisture movement, and coefficient of expansion of concrete.
(i) Stress strain curve of concrete.
(j) Tests on fiber-reinforced concrete.
(k) Flexure test on beam (central point load and two point load) (plotting of load deflection curve and finding value of E).

References / Suggested Learning Resources:

1. Plain & reinforced concrete, Vol. I, O.P. Jain &Jaikrishna,
2. Concrete technology, theory and practice, M.S. Shetty.
3. Properties of concrete, Neville, El, Society & Pub.
4. Relevant I.S. codes.
5. Special Publication of ACI on Polymer concrete and FRC.
6. Proceedings of International Conferences on Polymer Concrete and FRC.

****

Essence of Indian Knowledge Tradition

Course Code	MC-410
Course Title	Essence of Indian Knowledge Tradition
Number of Credits	0 (L: 2, T: 0, P: 0)
Prerequisites	Nil
Course Category	Mandatory Course (MC)
Number of classes	26 hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Outline Vedic literature, Puranic Literature and other ancient knowledge tradition of India.	K-2
CO-2	Explain about scientific heritage of ancient India along with comprehending its relevance and application in various modern scientific disciplines.	K-2

CO-3	Demonstrate Indian Philosophical systems with a conscious emphasis on their relevance and application in modern scientific enquiry.	K-2
CO-4	Illustrate Indian Linguistic tradition along with its branches.	K-2
CO-5	Critically analyse the worth of Indian intellectual heritage, traditional practices and Indian lifestyle from scientific lenses.	K-4

Course Content:

Module 1: Introduction to Vedic Literature, Dharmaśāstra and Purāṇas (08 hrs)

- General structure of Vedic Literature,
- Different theories on the age of the Vedas,
- Educational system in the Vedic times
- Subject-matter of Ṛgveda-samhitā, *Sāmaveda -Saṁhitā, Yajurveda-Saṁhitā, Atharvaveda-Saṁhitā, Brāhmaṇa* and *Āraṇyaka* literature, Upaveda
- Vedāṅga Literature
- History of Dharmaśāstra
- Basic concepts of *Purāna*s

Module 2: Indian Knowledge System, Yoga and Health care (06 hrs)

- Origin and Development of Indian Knowledge System
- Concept of Dharma in Indian knowledge tradition
- General ideas about Yoga,
- Origin and Development of Pātañjala Yoga
- Origin and Development of Āyurveda and its relevance

Module 3: Introduction to Indian Philosophy (06 hrs)

- General introduction to Indian Philosophical systems, i.e. Orthodox and Heterodox
- Concept of *Puruṣārtha*s in Indian Philosophy
- General introduction of Upaniṣadic literature
- Indian Philosophy and Modern Science
- Principles in different philosophical systems
- Relevance of Indian Philosophy in Modern time

Module 4: Indian Linguistic and Artistic Tradition (06 hrs)

- Origin and Definition of Language
- Branches and aspects of Science of language
- Vedic and Classical Sanskrit
- Indo-European family of Language
- Role of Sanskrit in comparative Philology
- Sanskrit Phonology and Phonetic laws
- History of Sanskrit Grammar
- Introduction to Śikṣā literature
- Origin and Development of Artistic tradition

References / Suggested Learning Resources:

1) Capra, Fritjof. *The Tao of Phisics*. New York: Harpercollins, 2007.
2) Capra, Fritjof. *The Web of Life*. London: Harpar Collins Publishers, 1996.
3) Chaitanya, Krishna. *Arts of India*, Abhinav Publications, 1987.
4) Chatterjee, S.C & Datta, D.M. *An Introduction to Indian Philosophy*, Calcutta: University of Calcutta, 1984.
5) Cowell, E.B and Gough. A.E (Ed.), *Sarvadarśanasaṅgraha*. Sadguru Publications, 2008.
6) Dasgupta, Surendranath & De, Sushil Kumar. *A History of Sanskrit Literature.* Delhi: Motilal Banarsidass, 2017.
7) Dasgupta, Surendranath. *A History of Indian Philosophy*. Delhi: Motilal Banarsidass, 1991.
8) GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakashan, Delhi 2016.
9) Gonda, Jan. *A History of Vedic Literature*. Delhi: Monohar Publishers and Distributors, 2020.
10) Jha, R.N. *Science and Consciousness Psychotherapy and Yoga Practices*. Delhi: Vidyanidhi Prakashan, 2016.
11) Jha, V.N. Language, *Thought and Reality*.
12) Kane. P.V. *History of Dharmasastra*, Poona: Bhandarkar Oriental Research Institute, 1930.
13) Knowledge traditions and practices of India, CBSE Publications.
14) Max Muller. *Ancient Sanskrit Literature*, London: Spottiswoode and Co., 1859.
15) Nagaswamy, R. *Foundations of Indian Art*, Tamil Arts Academy, 2002.
16) Pride of India, New Delhi: Samskrita Bharati, 2006.
17) Shastri, Gourinath. *A History of Vedic Literature*, Kolkata: Sanskrit Pustak Bhandar, 2006.
18) Sinha, Jadunath. *Indian Philosophy*. Delhi: Motilal Banarsidass,1938.
19) Subrahmanialyer, K.S. *Vakyapadia of Bhrarthrihari*. Pune: Deccan College, 1965.
20) V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*. Mumbai: Bharatiya Vidya Bhavan, 5th Edition, 2014.
21) Wujastiyk, Dominik. *The Roots of Ayurveda*. India: Penguin India, 2000.

****