HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus & Examination Scheme

for

B. Tech.

Civil Engineering (CE)

3rd to 4th Semester

As per National Education Policy (NEP)-2020

(w.e.f. the Academic Year 2024-2025)

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H.P. Technical University
Hamirpur - 177 001, HP

Semester-III

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	BS	MAFC-311	Probability Theory and Statistics	3	1	0	4	40	60	100
2	PC	CEPC-311	Solid Mechanics	3	1	0	4	40	60	100
3	PC	CEPC-312	Fluid Mechanics	3	0	0	3	40	60	100
4	PC	CEPC-313	Civil Engineering Materials, Construction and Drawing	2	0	0	2	40	60	100
5	PC	CEPC-314	Surveying and Geomatics	3	0	0	3	40	60	100
6	HS	HS-311	Engineering Economics	2	0	0	2	40	60	100
Labs:										
1	PC	CE-312P	Fluid Mechanics laboratory	0	0	2	1	30	20	50
2	PC	CE-313P	Civil Engineering Materials Laboratory	0	0	2	1	30	20	50
3	PC	CE-314P	Surveying and Geomatics Laboratory	0	0	2	1	30	20	50
4	PC	CE-315P	Computer- Aided Civil Engineering Drawing Laboratory	0	0	2	1	30	20	50
			Total	**16**	**02**	**08**	**22**			**800**

Semester-IV

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme(Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	*CSPC-414	Artificial Intelligence in Engineering	3	0	0	3	40	60	100
2	PC	CEPC-411	Structure Analysis-I	3	1	0	4	40	60	100
3	PC	CEPC-412	Concrete Technology	3	0	0	3	40	60	100
4	PC	CEPC-413	Transportation Engineering	3	0	0	3	40	60	100
5	PC	CEPC-414	Geotechnical Engineering	3	1	0	4	40	60	100
6	PC	CEPC-415	Water Supply and Treatment Technology	3	0	0	3	40	60	100
7	IKS	IKS - 311	Indian Knowledge system	2	0	0	2	40	60	100
Labs:										
1	PC	CE-412P	Concrete Technology Laboratory	0	0	2	1	30	20	50
2	PC	CE-413P	Transportation Engineering Laboratory	0	0	2	1	30	20	50
3	PC	CE-414P	Geotechnical Engineering Laboratory	0	0	2	1	30	20	50
4	PC	CE-415P	Water supply and Treatment Technology Laboratory	0	0	2	1	30	20	50

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			Total	**20**	**02**	**08**	**26**			**900**
Exit Option to 2- Year UG Diploma:										
1	INT	CE-416P	Internship-I	8 weeks/2 months			**6**	30	20	50

Note:

***Common Subject**

****Exit Option (as per NEP)**: These **6 credits** shall be counted only for those taking Exit Option for 2-year diploma.

- Direct entry students (not applicable for lateral entry students) may exercise exit option after 2nd Year for which he/she will be awarded UG diploma provided they secure an additional 6 credits through summer internships/ apprenticeship for two months/8 weeks after 4th Semester.
- The student concerned has to apply for UG diploma exit option at the time of filling up of end semester examination of 4th Semester (provided he has no back log up to 3rd semester). The evaluation of such candidates shall be done by the concerned department of Institution after successful completion of internship by the candidate.
- The course Internship-I will be completed by students during summer vacations after 4th semester under the supervision of faculty of department. The internship should, preferably, be focused on site EXPERMENTIAL LEARNING and CONTRIBUTION TO COMMUNITY for the benefit of local industry, government/private organization, entrepreneurs, craft and skilled people.
- The evaluation and viva voce of such candidates (who opted for UG Diploma) shall be done at the earliest possible, preferably within one month of running next semester, *i.e.*, 5thsem (and not with end semester exams of 5th semester).
- The student will be recommended for 2-Years'Diploma if has cleared all the four semesters without any back log in accordance with fulfillment of above requirements.

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Semester-III

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	BS	MAFC-311	Probability Theory and Statistics	3	1	0	4	40	60	100
2	PC	CEPC-311	Solid Mechanics	3	1	0	4	40	60	100
3	PC	CEPC-312	Fluid Mechanics	3	0	0	3	40	60	100
4	PC	CEPC-313	Civil Engineering Materials, Construction and Drawing	2	0	0	2	40	60	100
5	PC	CEPC-314	Surveying and Geomatics	3	0	0	3	40	60	100
6	HS	HS-311	Engineering Economics	2	0	0	2	40	60	100
Labs:										
1	PC	CE-312P	Fluid Mechanics laboratory	0	0	2	1	30	20	50
2	PC	CE-313P	Civil Engineering Materials Laboratory	0	0	2	1	30	20	50
3	PC	CE-314P	Surveying and Geomatics Laboratory	0	0	2	1	30	20	50
4	PC	CE-315P	Computer- Aided Civil Engineering Drawing Laboratory	0	0	2	1	30	20	50
			Total	**16**	**02**	**08**	**22**			**800**

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SEMESTER-III

MAFC-311 Probability Theory and Statistics

Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each (Each subdivided into at least two equal sub-parts) and section E has short answer type questions consisting of six parts of 02 marks each or twelve parts of 01 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the section E will be compulsory. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus

Course Objective:

- To understand the basic probability concepts.
- To have an in-depth knowledge of standard distribution which can describe real life phenomena.
- To understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- To analyse the response of random inputs to linear time invariant systems.

Unit-I:

Probability Theory: Counting principles, probability axioms, sample space and events, conditional probability & Baye's Theorem. Random variable, discrete & continuous probability distribution, expectation, variance, standard deviation. Joint probability distribution, mass function, distribution function, marginal distribution function, covariance.

Probability Distributions: Discrete Probability Distributions: Uniform, Bernoulli, Binomial Distribution and Poisson distribution. Continuous Probability Distributions: Normal and exponential distribution.

Unit-II:

Sampling and Testing of Hypothesis:

Basic sampling models, sampling distribution of mean and standard deviation, testing of hypothesis, level of significance, confidence intervals for known and unknown means, simple sampling of attributes, tests of significance for large samples, comparison of large samples, central limit theorem, test of significance for two large samples. Student's t- test, Chi-square test, Goodness of fit, F-distribution..

Unit-III:

Solution of System of Linear, Transcendental Equations & Interpolation

Bisection method, Regula-Falsi method Newton Raphson's method, Gauss elimination method, LU factorization method.

Introduction to Interpolation, Lagrange's interpolation, Newton's divided difference interpolation, Difference operators and relations.

Unit-IV:

Numerical Differentiation& Integration: Numerical differentiation using forward difference, backward difference and central difference formula. Integration by trapezoidal and Simpson's rules $1/3^{rd}$ and $3/8^{th}$ rule.

Numerical Solution of Ordinary Differential Equations: Picard's method, Taylor series method, Euler's method, Modified Euler's method, Runge's and Runge- Kutta method..

Course Learning Outcomes (CLOs):

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

1. Develop understanding of basics of probability theory.

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2. Identify different distribution functions and their relevance.
3. Apply the concepts of probability theory to different problems.
4. Understand different numerical integration techniques, and numerically solve differential equations.

Textbooks:

1. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics (2003), 2nd ed.
2. B.S. Grewal, —Higher Engineering Mathematic, Khanna Publishers.
3. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
4. K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989.
5. S.S. Sastry , Introductory Methods of Numerical Analysis, fifth Edition ,PHI learning Pvt. Ltd.

References:

1. Seymour Lipschutz, and John J. Schiller, Introduction to Probability and Statistics, Schaum's Outlines by Mc Graw Hill Education.
2. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
3. H.K. Dass and Rajnish Verma, —Engineering Mathematic, S. Chand Publications.

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CEPC-311 Solid Mechanics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To understand the basic concepts of the stresses and strains for different materials and the strength of structural elements.
- To understand the development of internal forces and equilibrium
- To apply principles of mechanics to solve problems involving beams, columns, and other structural elements
- To analyse and understand principal stresses due to the combination of two- dimensional stresses on an element and failure mechanisms in materials.
- To evaluate the behavior of torsional members, columns and struts

Unit-I
Introduction to Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and their applications; Centroid of plane and composite bodies, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems **Properties of materials :** Introduction, normal stress, strain, tension test for mild steel, specification of specimen, stress-strain curve for tension, actual curve versus engineering curve intention, properties of metals (ductility, brittleness malleabilityand hardness), creep, elasticity (proof stress), toughness fatigue.
Unit-II
Simple Stress & Strain: Hooke's law, stress and elongation produced in various types of bars due to its own weight and applied axial force, Poisson's ratio, relationship between elastic constants, stresses and elongation produced in simple & composite bars due to axial, thermal loading. **Principle Stress**: Principal plane, principal stresses in beams, analytical method, Mohr's circle method: propertiesof Mohr's circle, construction of Mohr's circle
Unit-III
Bending Moment and Shear Force Diagrams: Type of supports and loading, Shear force and Bending moment, Sign convention, SF and BM diagrams for cantilevers, simply supported and overhanging beams under point loads, UDL, UVL and Couples, Point of contraflexure **Bending Stresses and Shear Stresses in Beams**: Theory of pure bending, position of neutral axis, Bending equation, practical application of bending equation, variation of bending stress in Rectangular & I sectional beams, shear stresses in beams, variation of shear stresses for Rectangular & I sectional beams.

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Unit-IV
Torsion of Circular Shafts- Introduction – Pure torsion-torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus. **Theory of Columns and Struts** Types of Columns, Failure of Column, Euler's Column Theory, Slenderness Ratio, End Conditions for Long Columns, Equivalent Length of Columns, Limitation of Euler's Formula, Factor of Safety

Course Learning Outcomes (CLOs):

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

- Comprehend the fundamental concepts and principles of engineering mechanics, including system of forces, friction, centroid
- Identify the mechanical properties and behaviour of materials
- Apply concepts of stress, strain, and principle stresses in various elements
- Plot the variation of shear force and bending moments over the beams under different types of loads
- Assess bending and shear stresses in beams subjected to different loadings
- Evaluate the behavior of torsional members, columns and struts

Textbooks:

- R Engineering Mechanics: Nelson, McGraw Hill
- Popov, E. P., -Engineering Mechanics of Solids‖, SI Version, Prentice Hall, New Delhi
- Timoshenko, S. P. and Young, D. H., -Elements of Strength of Materials‖, East West Press, New Delhi
- Subramanyam, -Strength of Materials‖, Oxford University Press, Edition, 2008

Reference Books:

- Strength of Materials by Timoshenko, Mcgraw Hill
- Mechanics of Materials by E.J. Hearn, Butterworth-Heinemann
- Mechanics of Materials by Beer & Johnston, Mcgraw Hill
- Advanced Mechanics of Solids by L.S Srinath, Mcgraw Hill

e-Learning Resources:

- *NPTEL courses, http://nptel.iitm.ac.in/courses.php, web and video courses on Strength of Materials by Sharma, S. C., and Harsha, S. P*

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CEPC-312 Fluid Mechanics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- Gain a comprehensive understanding of the fundamental principles governing fluid statics, kinematics, and dynamics, including the behavior of fluids at rest and in motion.
- Learn and accurately define essential terms and concepts used in fluid mechanics, such as viscosity, density, pressure, velocity, and flow rate.
- Identify and describe the different classifications of fluid flow, including laminar and turbulent flow, steady and unsteady flow, and compressible and incompressible flow.
- Utilize the principles of continuity, momentum, and energy to solve fluid mechanics problems, demonstrating the ability to apply these fundamental concepts to real-world scenarios.

Unit-I
Properties of Fluids; 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; vapor pressure, boiling point, cavitation; surface tension, capillarity. **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.
Unit-II
Fluid Kinematics- 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; one, two- and three-dimensional flows; Streamline, path line, streak line and stream tube; stream function, velocity potential function.
Unit-III
Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation, Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube; Momentum principle; Vortex Flow – Free and Forced
Unit-IV
Flow through Pipes- Introduction, Major and minor energy losses, Darcy-Weisbach equation for head loss due to friction in a pipe, hydraulic gradient line and total energy line, pipes in series and parallel, equivalent pipes, Power transmission through pipes, water hammer phenomenon. **Flow Measurements-** Introduction, Orifices - classification, hydraulic coefficients, Mouthpiece - classification, Borda's mouthpiece, Notches & Weirs –Introduction, classification, discharge over rectangular, triangular, trapezoidal notches, broad crested weirs, Cipolletti weir.

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Course Learning Outcomes (CLOs):

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

- Learn the broad principles of fluid statics, kinematics and dynamics.
- Understand definitions of the basic terms used in fluid mechanics.
- Understand classifications of fluid flow.
- Apply the continuity, momentum and energy principles.
- Estimate the discharge through pipe and fluid flow problems

Textbooks:

- Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
- Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
- Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
- Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, Mc Graw Hill.

e-Learning Resources:

- *https://nptel.ac.in/*
- *http://www.nitttrchd.ac.in/sitenew1/nctel/civil.php*
- *www.erp.himtu.ac.in (e-Library of HPTU)*

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CEPC-313 Civil Engineering Materials, Construction and Drawing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To learn the fundamental concepts relevant to properties of Civil Engineering materials and their application.
- Develop a foundational understanding of the properties and behavior of common civil engineering materials
- To familiarize with parts of buildings and methods of building construction

Pre-requisites: Chemistry

Unit-I	**(06 hours)**
Bricks: Classification, fire bricks- properties and application. **Cement:** Composition, special types, grades, manufacturing of Ordinary Portland Cement, hydration of cement. **Fine and Coarse aggregate:** Source, classification, characteristics, applications in structures and pavements **Mortar:** Properties and types (clay, lime, cement, gauged and surkhi mortar) **Cement Concrete:** Composition, grades, types (brief about plain, reinforced concrete)	
Unit-II	
Timber: Classification, seasoning, defects, market forms and products **Paints and Varnishes** – Composition, properties and applications **Introduction to other modern materials:** Fiber glass reinforced plastic, acoustic materials, geo-textiles, laminates and adhesives	
Unit-III	**(06 hours)**
Building Planning: Classification of buildings; Site selection for buildings; Orientation of Buildings; Principles of planning of buildings; overview and importance of building Bye-Laws for planning of buildings **Structural Building Components:** Stone masonry: Types: Rubble Masonry and Ashlar Masonry; Brick masonry: Bonds (English, Flemish, Rat Trap); Floors: types of flooring (cement concrete, terrazzo, tiled, timber & stone flooring); Flat and Sloped roofs: types; Sill and Lintel bands; Staircases: types	
Unit-IV	**(06 hours)**
Non-Structural Building Components: Doors, Windows: types; Dampness and Water Proofing: causes of dampness, prevention methods. Electrical Services: requirements, components **Building Services:** Water supply and drainage: requirements, components; Fire protection: types of construction as per fire resistance, Fire resistive properties of materials, Requirement in buildings for safety against fire;	

Course Learning Outcomes (CLOs):

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

- Identify the properties of different materials used in civil engineering applications
- Assess the suitability and functional aspect of the materials
- Measure physical properties of common construction materials
- Evaluate the materials as per the specific requirements
- Identify and understand the specifications of various components of buildings
- Recognize the purposes of the primary building services and the corrective actions offered in building

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Textbooks:

- Surendra Singh, "Building Materials", Vikas Publishing Company, New Delhi, 2002.
- Rajput, R.K., "Engineering Materials", S.Chand & Co. Ltd., New Delhi, 2000.
- Sharma S.K., "Civil Engineering Construction Materials", Khanna Publishing House.

Reference Books:

- Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand & Bros
- Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications.
- Er. M.K. Gupta (2019), Practical Handbook on Building Construction, A Nabhi Publication
- P.C. Varghese, Building Construction, PHI Learning
- Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117)
- SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095) 4.
- N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990)
- Building bye laws (local bodies)

e-Learning Resources:

- *https://archive.nptel.ac.in/courses/105/106/105106206/*
- *NPTEL courses, https://archive.nptel.ac.in/courses/105/102/105102088, web and video courses on Building Materials and Construction*

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CEPC-314 Surveying and Geomatics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To describe the function of surveying in civil engineering construction
- To work with survey observations, and perform calculations
- To identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements

Unit-I
Introduction to Surveying: Principles, classification, units, scales, Linear measurement, ranging, Chain and tape measurement, Survey stations. Obstacles in chaining on sloping ground, errors and corrections-uses of cross staff and optical square. Maps - scale, coordinate system. **Compass Survey:** Prismatic compass, surveyor _s compass, whole circle and reduced bearing-true and magnetic bearing -dip and declination -local attraction, traversing -plotting -error of closure
Unit-II
Plane Table Surveying: Definitions, uses and advantages, temporary adjustments. Different methods of plane table surveying; Two point and three-point problems. Errors in plane table survey. **Levelling:** Definition, mean sea level, reduced level, types of levelling, bench marks, levelling instruments, sensitivity of bubble tube, temporary and permanent adjustments, corrections for refraction and curvature, longitudinal and cross sectioning levelling. **Contour Survey**: definition, characteristics of contour, uses of contour, methods of contouring, direct and indirect interpolation
Unit-III
Curves: Types of curves, Simple curves: elements of a simple curve, different methods for setting out of simple curves –linear and angular methods Transition curves; introduction, superelevation, equation of transition curve, length & types of transition curve. Horizontal and Vertical curves–types, characteristics, length and setting out
Unit-IV
Theodolite Surveying: Various parts and axis of transit theodolite, technical terms, temporary adjustments Measurement of horizontal and vertical angles -method of repetition and reiteration; Theodolite traverse - Different methods of running theodolite traverses, Gales _traverse table, balancing of traverse by Bow-Ditch _s transit and modified transit rules **Areas of Figures:** Area of an irregular figure by Trapezoidal rule, average ordinate rule Simpson _s 1/3 rule, various coordinate methods; Planimeter - types of planimeter including digital planimeter. Computation of volume by trapezoidal and prismoidal formula, volume from spot levels.

Course Learning Outcomes (CLOs):

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

- Define Surveying and basic concepts of surveying.
- Use different method of surveying, Analyze and interpret survey data for computing area and volume
- Collect field data so a map or plan can be prepared basis on the calculations of the field parameters before an engineering operation is actually executed to begin a construction project.
- Apply different technic of surveying in field.
- Design different structure with the help of field data
- Predict the appropriate method for any survey project

Textbooks:

- N.N.Basak, -Surveying and Levelingǁ, 1st edition, Tata McGraw Hill.
- A Banniister, -S. Raymond and R Baker, —Surveyingǁ, seventh edition, Pearson.

Reference Books:

- Kanetkar and Kulkarni, —Surveying and Levelingǁ, Vol I & II, 24th edition, Pune VidyarthiGriha, Pune.
- R.Agor, —Surveyingǁ, Khanna Publishers.

e-Learning Resources:

- *https://archive.nptel.ac.in/courses/105/104/105104101*

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HS-311 Engineering Economics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Learning Objectives:

- Understand the basic definitions, nature, scope, and significance of economics.
- Learn about the elasticity of demand, its types, methods of measurement, and its importance in economic analysis.
- Examine price determination under different market structures, including perfect competition, monopoly, monopolistic competition, and oligopoly.
- Explore the meaning, types, theories, causes, effects, and control measures of inflation.

Unit-I
Introduction: Definition, Nature, Scope, Importance and significance of Economics, Distinction between Microeconomics and Macroeconomics. Concept of Utility and Its Types.**Demand and Supply:** Meaning, Demand Function, Law of Demand. Elasticity of Demand, Types, Measurement and importance. Demand Forecasting and its techniques. Concept of Supply, Law of supply.
Unit-II
Production Function: Concept and types, Returns to Factor and Returns to Scale, Law of Variable Proportions. **Cost and Revenue:** Concept of Cost, Short run and Lung-run Cost Curves, Relationships among various costs, Break-even Analysis. Revenue: Concept and its types.
Unit-III
Market Structure: Price Determination under Different Market Structure i.e. Perfect Competition, Monopoly, Monopolistic Competition Oligopoly. **Reserve Bank of India:** Nature, Organisation Structure, Objectives, Function of RBI.**Monetary Policy and Fiscal Policy:** Meaning, Objectives and Its tools and Techniques of Monetary and Fiscal Policy.
Unit-IV
National Income: Definition of National Income and its Aggregates, Methods of Calculating National Income. **Inflation:** Meaning, Types, Theories, Causes, Effects and Control. **Business Cycle** – Meaning- Phases of business cycle.

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Course Learning Outcomes (CLOs):

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

- Identify the determinants of supply and demand; demonstrate the impact of shifts in both marketsupply and demand curves on equilibrium price and output.
- Determine the roles that prices and markets play in organizing and directing economic activity Calculate and graph the short-run and long-run costs of production, supply and demand elasticities. Describe governmental efforts to address market failure such as monopoly power, externalities, and public goods.
- Examine and interpret a nation's economic performance indicators such as economic growth,unemployment and inflation from a macroeconomic perspective.
- Articulate the mechanics and institutions of international trade and their impact on the macro economy.

Textbooks:

1. Steven A. Greenlaw, David Shapiro, **"Principles of Economics"**,2nd Edition, Rice University OpenStax, 2020.ISBN-13: 978-1947172371.
2. Managerial Economics, 8/e, D N Dwivedi, Vikas Publishing.

Reference Books:

1. N. Gregory Mankiw, **"Principles of Economics"**,8th Edition, Cengage Learning, 2016.ISBN-13:978-0357038314.
2. Niall Kishtainy, **"The Economics Book: Big Ideas Simply Explained"**,1st Edition, DK Publishers,2012.ISBN-13:978-0756698270.

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CE-312P Fluid Mechanics Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- To learn the fundamental concepts relevant to Fluid mechanics
- To provide exposure to a variety of established fluid mechanics testing procedures and techniques

Sr. No.	List of Experiments
1	Measurement of viscosity
2	Study of Pressure Measuring Devices
3	Stability of Floating Body
4	Hydrostatics Force on Flat Surfaces/Curved Surfaces
5	Verification of Bernoulli's Theorem
6	Venturimeter
7	Orifice meter
8	Impacts of jets
9	Flow Visualisation -Ideal Flow
10	Length of establishment of flow
11	Velocity distribution in pipes
12	Laminar Flow

The students shall conduct 7-8 experiments during the semester

Course Learning Outcomes (CLOs):

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

- Estimate the friction and measure the frictional losses in fluid flow.
- Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design
- Predict the coefficient of discharge for flow through pipes.
- Conduct experiments in pipe flows and interpreting
- Anayse data from model studies to prototype cases, as well as documenting them in engineering reports

Suggested References:

- Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
- Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
- Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
- Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, Mc Graw Hill

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CE-313P Civil Engineering Materials Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- To learn the fundamental concepts relevant to properties of Civil Engineering materials and their application.
- To provide exposure to a variety of established material testing procedures and techniques.

Sr. No.	List of Experiments
1	Tests on cement - Fineness, Normal consistency, setting time, soundness, compressive strength, specific gravity.
2	Test on bricks: Water absorption, efflorescence, compressive strength
3	Tests on aggregate: Grain size distribution, specific gravity, bulking of sand, fineness modulus, water absorption
4	Tests on concrete: Workability tests – Slump, Compaction factor, Vee-bee and Flow table test
5	Test on steel bars: Tensile strength test
6	Tests on plywood: Water resistance test

Course Learning Outcomes (CLOs):

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

- Learn the various test procedures carried out for a Civil Engineering materials
- Understanding of common measurement instruments, equipment, devices.
- Perform the various tests of the Civil Engineering materials
- Measure physical properties of common construction materials
- Draw inference from the observations

Suggested References:

- Various related recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to testing of materials used for Civil Engineering applications.

e-Learning Resources:

- *https://archive.nptel.ac.in/courses/105/102/105102088/*

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CE-314P Surveying and Geomatics Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- To learn the fundamental concepts of surveying use in Civil Engineering and their application
- To collect field data, prepare plan or map of the area surveyed, analyse and to calculate the field parameters for setting out operation of actual engineering works, set out field parameters at the site for further engineering works

Sr. No.	List of Experiments
1	Chain and tape measurement and Traversing and plotting of Details.
2	Compass Traversing and plotting of Details
3	Plane table Survey - Method of Radiation and intersection.
4	Plane table Survey - Solving Two Point and Three Point Problems
5	Plane table Survey – Traverse
6	Levelling with HI and rise and fall method
7	Levelling with Longitudinal and cross sectioning and Contour surveying.
8	Setting out of foundation plan for load bearing and framed structure with 3-4-5 method.
9	Theodolite: temporary adjustments, measurement of horizontal and vertical angles
10	Theodolite traversing.
11	Checking verticality of high-rise structures.
12	Study of Minor instruments: Planimeter, pantagraph, clinometer, hand levels, Quick setting level, CylonGhat Tracer, Sextent, etc

The students shall conduct 7-8 experiments during the semester

Course Learning Outcomes (CLOs):

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

- Provide knowledge of basic surveying instruments.
- Develop skill in using chain, compass, plane table, levelling and theodolite.
- Apply the knowledge of different instrument operation in civil engineering works.
- Formulation the setting out of foundation plan of building etc.

Suggested Textbooks:

- N.N.Basak, —Surveying and Levelingǁ, 1stedition,Tata McGraw Hill.
- A Banniister, S. Raymond and R Baker, —Surveyingǁ, seventh edition, Pearson.

Suggested References:

- Kanetkar and Kulkarni, —Surveying and Levelingǁ, Vol I & II, 24th edition, VidyarthiGriha, Pune.
- R.Agor, —Surveyingǁ, Khanna Publishers.

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CE-315P Computer Aided Civil Engineering Drawing Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- Understand the principles and benefits of CAD for civil engineering applications.
- Become proficient in using CAD software for 2D drafting tasks.
- Learn essential drawing techniques for civil engineering projects, including plans, sections, elevations, and details.
- Apply dimensioning, annotation, and layering techniques to create professional drawings.
- Gain experience in creating basic 3D models of civil engineering structures

Sr. No.	List of Exercises
1	Learn interface and tools of CAD software
2	Practice simple mechanical drawings using tools/commands of CAD software
3	Preparation of detailed construction plan of residential building: front elevation, side elevation, floorplan, detailed sectional view, site plan, foundation plan
4	Preparation of line plans of *any one* public buildings like: • Building for Education – School, College. Library • Building for health –Dispensary, Hospital Industrial structure • Building for entertainment-Theatre, Club House, Sports Club • Other Structure- Office, Hostel, Guest house
5	Draft details of parts of *any one* door and window of the following: • Door: Fully Paneled Door, Paneled and glazed door • Window: Paneled and glazed window, fully glazed window with sash bars
6	Draft details of parts of steel roof truss
7	Draft details of parts of *any one* of the following stairs: • Straight run stairs • Dog legged stairs
8	Prepare layout showing *any one* building services like water supply and drainage, electrical fittings, firefighting
9	Prepare site plan for a building project, including property lines, existing structures, and proposed development
10	Creating 3D models of simple building components

The students shall conduct 7-8 exercises during the semester

Course Learning Outcomes (CLOs):

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

- Apply the concepts of engineering drawing and recognize the annotations and symbols of software
- Realize the function of basic tools used in AutoCAD and significance of AutoCAD as a drafting tool for civil engineering
- Choose the appropriate tools/commands for drafting any drawing or part of drawing
- Prepare detailed engineering drawings for components of civil engineering structures

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- Apply basic CAD commands to develop different views of buildings, layout plans, site plans, buildingservices etc.
- Understand and visualize the 3-D view of a structure component

Suggested References:

- Bureau of Indian Standards," Hand Book of Functional Requirements of Buildings, (SP-41 & SP-32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117)
- Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095)
- N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990)
- M. Chakraborti (2017), Civil Engineering Drawing Including Architectural Aspects, UBS publication

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B.Tech (SEMESTER –III)

Probability Statistical and Numerical Techniques (MAFC-311)

Time Allowed: 03 (Three hours) **Max. Marks: 60**

Note: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in section E. Use of statistical tables and non-programmable calculator is allowed.

Section-A

1. (a) A problem in statistics is given to two students A and B the odds in favour of A solving the problem are 6 to 9 and against B solving the problem are 12 to 10. If both A and B attempt find the probability of the problem being solved. (6)

(b) If x and y are two independent random variables having joint density function:

$$f(x,y) = \begin{cases} \frac{1}{8}(6-x-y); & 0 \le x < 2,\ 2 \le y < 4 \\ 0, & Otherwise \end{cases}$$

Find (i) $P(x < 1 \cap y < 3)$ (ii) $P(x + y < 3)$ (iii) $P(x < 1 | y < 3)$. (6)

2. (a) If 5% of the electric bulbs manufactured by a company are defective, use Poisson distribution to find the probability that in a sample of 100 bulbs (i) none is defective (ii) 5 bulbs will be defective.
(6)

(b) In a distribution exactly normal 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution? (Use normal table) (6)

Section-B

3. (a) A coin was tossed 400 Times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. (6)

(b) The mean of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the sample be regarded as drawn from the same population of standard deviation 2.5 inches? (Test at 5% level of significance). (6)

4. (a) A drug is given to 10 patients, and the increments in their blood pressure were recorded to be 3, 6, -2, 4, -3, 4, 6, 0, 0, 2. Is it reasonable to believe that the drug has no side effect on change of blood pressure? (6)

(b) In one sample of 8 observations, the sum of the squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this difference is significant at 5 per cent level using F- test. (6)

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Section-C

5. (a) Using, Newton's Raphson method, find the real root of the equation $3x = cosx + 1$. Also, evaluate the value of $\sqrt{5}$ by using Newton's method. (6)

(b) Solve the system of equations $10x - 7y + 3z + 5u = 6$,
$-6x + 8y - z - 4u = 5$,
$3x + y + 4z + 11u = 2$,
$5x - 9y - 2z + 4u = 7$
by using Gauss elimination method. (6)

6. (a) Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for the given data:

x	0	1	2	5
$f(x)$	2	3	12	147

(6)

(b) Find the missing term by using Newton's divided difference formula

x	0	1	2	3	4
y	1	3	9	...	81

(6)

Section-D

7. (a) Evaluate $\int_0^1 \frac{1}{1+x^2}$ by using Simpson's $\frac{1}{3}rd$ rule , taking $h = 1/4$ and by Simpson's $\frac{3}{8}th$ rule , taking $h = 1/6$. (6)

(b) Evaluate $\int_0^6 xsecx\ dx$ using six intervals by Trapezoidal rule.

(6)

8. (a) Using Taylor series method of order four to solve the initial value problem $y' = (x - y)/2$, on $[0, 3]$ with $y(0) = 1$. Compare solutions for $h = 1, \frac{1}{2}, \frac{1}{4}$ and $\frac{1}{8}$. (6)

(b) Consider an ordinary differential equation $\frac{dy}{dx} = x^2 + y^2$, $y(1) = 1.2$. Find $y(1.05)$ using the fourth order Runge-Kutta method. (6)

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Section-E

9. (i) State Bayes theorem for probability.

(ii) Write the importance of Normal distribution.

(iii) A card is drawn from a well shuffled pack of cards. What is the probability that it is a heart or a queen?

(iv) Differentiate between null and alternate hypothesis?

(v) Define F- distribution.

(vi) Write Newton iterative formula to find the value of $\sqrt[3]{N}$.

(vii What is nth difference of a polynomials of degree n.

(viii) Out of Regula-Falsi and Newton –Raphson method whose rate of convergence is faster and why?

(ix) How Gauss Quadrature formula for two point and three point scale varies?

(x) Find the value of $E^{-1}\nabla$.

(xi) Define discrete distribution?

(xii) Explain the term Covariance.

$(12 \times 1 = 12)$

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SEMESTER-IV
Civil Engg.

Semester-IV

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	*CSPC-414	Artificial Intelligence in Engineering	3	0	0	3	40	60	100
2	PC	CEPC-411	Structure Analysis-I	3	1	0	4	40	60	100
3	PC	CEPC-412	Concrete Technology	3	0	0	3	40	60	100
4	PC	CEPC-413	Transportation Engineering	3	0	0	3	40	60	100
5	PC	CEPC-414	Geotechnical Engineering	3	1	0	4	40	60	100
6	PC	CEPC-415	Water Supply and Treatment Technology	3	0	0	3	40	60	100
7	IKS	IKS - 311	Indian Knowledge system	2	0	0	2	40	60	100
Labs:										
1	PC	CE-412P	Concrete Technology Laboratory	0	0	2	1	30	20	50
2	PC	CE-413P	Transportation Engineering Laboratory	0	0	2	1	30	20	50
3	PC	CE-414P	Geotechnical Engineering Laboratory	0	0	2	1	30	20	50
4	PC	CE-415P	Water supply and Treatment Technology Laboratory	0	0	2	1	30	20	50
			Total	**20**	**02**	**08**	**26**			**900**
Exit Option to 2- Year UG Diploma:										
1	INT	CE-416P	Internship-I	8 weeks/2 months			**6**	30	20	50

Note:

***Common Subject**

****Exit Option (as per NEP)**: These **6 credits** shall be counted only for those taking Exit Option for 2-year diploma.

- Direct entry students (not applicable for lateral entry students) may exercise exit option after 2nd Year for which he/she will be awarded UG diploma provided they secure an additional 6 credits through summer internships/ apprenticeship for two months/8 weeks after 4th Semester.
- The student concerned has to apply for UG diploma exit option at the time of filling up of end semester examination of 4th Semester (provided he has no back log up to 3rd semester). The evaluation of such candidates shall be done by the concerned department of Institution after successful completion of internship by the candidate.
- The course Internship-I will be completed by students during summer vacations after 4th semester under the supervision of faculty of department. The internship should, preferably, be focused on site EXPERMENTIAL LEARNING and CONTRIBUTION TO COMMUNITY for the benefit of local industry, government/private organization, entrepreneurs, craft and skilled people.
- The evaluation and viva voce of such candidates (who opted for UG Diploma) shall be done at the earliest possible, preferably within one month of running next semester, *i.e.*, 5th sem (and not with end semester exams of 5th semester).
- The student will be recommended for 2-Years'Diploma if has cleared all the four semesters without any back log in accordance with fulfillment of above requirements.

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Artificial Intelligence in Engineering (CSPC-414)							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Exam	Total	
3	0	0	3	MaximumMarks:40	MaximumMarks:60	100	3 Hours
				MinimumMarks:16	MinimumMarks:24	40	

Instructions for question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and Section-E will cover the whole syllabus.

Course Contents:

Unit-I:
Fundamentals of Artificial Intelligence (AI): Introduction to AI, History of AI, General applications of AI, Need of AI in Engineering, Problem solving, Process of problem solving, breadth first search, depth first search, heuristics search techniques, best first search, Introduction to intelligent systems, Various approaches to AI: Cybernetics and brain simulation, Symbolic, Sub-symbolic, Statistical. **Ethical and Social Implications of AI:** Ethical considerations in AI development and deployment, Impact of AI on jobs and society, Regulatory and policy issues.
Unit-II:
Fundamentals of Machine Learning (ML): Introduction to Machine Learning, datasets, Forms of Learning: Supervised and Unsupervised Learning, reinforcement learning, processes involved in Machine Learning, Applications of ML in Engineering. **Data Preprocessing, cleaning and normalization Approaches in Machine Learning (ML):** Data preprocessing, Data cleaning, Feature selection and extraction, Data normalization and scaling.
Unit-III:
Artificial Neural Networks: Introduction to Artificial Neural Networks (ANNs): Definition and history of ANNs, Types of ANNs architectures, Basic architecture of ANNs, Activation functions, Singled- Layered and Multi-Layered Perceptron, Backpropagation algorithms, Applications of ANNs in Engineering.
Unit-IV:
Fuzzy Logic and Genetic Algorithm: Introduction to Fuzzy Logic: Basic concepts, history, and fuzzy set theory. Processes in a fuzzy logic system, Applications of Fuzzy Logic in Engineering. **Genetic Algorithm (GA):** Basics of GA, Main operations of GA, Flowchart of GA, Working principle of GA in step by step, Applications in Engineering.

Course Outcomes (COs): After the completion of the course, the student will be able to:

- Remember the fundamentals, history, and applications of AI in mechanical engineering.
- Understand various AI approaches, including cybernetic, symbolic, sub-symbolic, and statistical methods, in mechanical engineering.
- Apply data preprocessing techniques like cleaning, feature selection, and normalization in machine learning.
- Analyze the ethical and social implications of AI, including job impacts and regulatory issues.
- Evaluate machine learning algorithms, neural networks, and fuzzy logic systems for mechanical engineering applications.

Text Books:

- Deisenroth, Faisal, Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
- B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.
- Parag Kulkarni and Prachi Joshi, Artificial Intelligence – Building Intelligent Systems, PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015.

Reference Books:

- Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
- Mohri, Rostamizdeh, Talwalkar, Foundations of Machine Learning, MIT Press, 2018.
- Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering, CRC Press, 2021.
- Zsolt Nagy - Artificial Intelligence and Machine Learning Fundamentals-Apress (2018).
- Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH.

CEPC-411 Structure Analysis-I							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40 Minimum Marks: 16	Maximum Marks: 60 Minimum Marks: 24	100 40	3 Hours

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover the whole syllabus.

Course Objectives:

- Define and differentiate between various types of structures
- Understand the concepts of loads, supports, reactions, internal forces
- Determine internal forces and slopes/deflections in statically determinate beams, trusses, cables,arches etc.
- Determine slopes/deflection in statically determinate beams, trusses, frames, cables, arches etc.using various methods.

Unit-I

Introduction: Support system, Stability and Determinacy of structures (Static and Kinematic), Stability of structures (internal, external and overall), Principle of superposition, Maxwell's reciprocal theorems; Computation of internal forces in statically determinate beams

Analysis of statically determinate Plane Truss: Method of Joints and Method of Sections, Virtual work method for finding deflection and displacement of truss.

Unit-II

Determination of deflection and slopes in determinate Beams: Relationship Between Slope, Deflection and Radius of Curvature, Slope and Deflection of Various Types of Beams (Simply supported & Cantilever Beam with Various Loadings by Double Integration Method, Macaulay 's Method, Moment Area Method Conjugate Beam Method,

Determination of deflection and slopes in determinate Frames: Strain energy method and virtual work method.

Unit-III

Arches: Introduction, Behaviour of arches, Analysis of three-hinged Parabolic arch, Circular arc. Concept of radial shear and Horizontal thrust, BMD of arches

Cable and suspension bridges: Introduction equilibrium of cable subjected to concentrated load and uniformly distributed load, cable with end at different levels, forces on anchor cables and Towers

Unit-IV
Influence Lines and Rolling Loads Introduction to moving loads - concept of influence lines; Muller Breslau principle; Applications of ILD, Effects of rolling loads (Single point load, uniformly distributed load longer than span, shorter than span, series of point loads, finding reaction, shear force and bending moment, Absolute maximum bending moment: for simply supported and overhanging beams.

Course Learning Outcomes (CLOs):

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

- Identify different types of structural elements (beams, trusses, frames, cables, arches) and their behaviorunder load.
- Classify structures as determinate, indeterminate, stable, or unstable
- Apply the principles of statics to solve for internal forces in determinate beams and trusses
- Choose suitable method to determine slope/deflections in beams and frames
- Apply suitable methods of analysis for various types of structures including cables, suspension bridgesand arches
- Utilize the concept of influence lines to assess the impact of moving loads on structures

Textbooks:

- Hibbeler (2011), Structural Analysis, Prentice Hall of India Pvt. Ltd
- Reddy C S (2017), Basic structural Analysis, Tata Mc Graw Hill, New Delhi.

Reference Books:

- Thandavamoorthy, T.S. (2011). Structural Analysis, Oxford University Press.
- Ramamrutham , S. and Narayan , R. (2014). Theory of Structures, Dhanpat Rai & Sons.
- Menon Devdas (2010). Structural Analysis, Narosa Publishing House
- Mete A. Sozen, Toshikatsu Ichinose (2008), Understanding Structures: An Introduction to StructuralAnalysis, CRC Press

e-Learning Resources:

- *https://onlinecourses.nptel.ac.in/noc24_ce31*
- *https://www.youtube.com/playlist?list=PLJoALJA_KMOCPOh7iJRVeBqvvhq-Fsmo_*

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CEPC-412 Concrete Technology							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To identify the physical and chemical properties of concrete ingredients
- To comprehend the workability of concrete, manufacturing processes of concrete, and the behavior offresh, hardened concrete.
- To gain knowledge about NDT methods, quality control of concrete, and how to conduct tests onhardened concrete.
- To identify the different types of concrete and their applications in the diverse construction field.
- To acquire practical knowledge of mixed design principles, concepts and methods

Unit-I
Introduction to Concrete Technology: Introduction to concrete and its basic ingredients; Batching of ingredients; mixing, transport, and placement; compaction, finishing, and curing of concrete; initial and final set significance and measurement; workability of concrete and its measurement; Behavior of concrete in tension and compression **Mix design:** IS method; new approaches based on rheology and particle packing approach; Sampling and acceptance criteria of concrete as per IS code
Unit-II
Chemical Admixtures: Classification of chemical admixtures, water reducers, air entrainers, set controllers and effects on concrete properties, applications of chemical admixtures, cost and compatibility of admixtures to concrete **Supplementary cementing materials and pozzolans:** Fly ash, blast furnace slag, silica fume, and metakaolin – their production, properties, and effects on concrete properties
Unit-III
Properties of Hardened Concrete: Compressive strength and parameters affecting it; Tensile strength – direct and indirect; Modulus of elasticity and Poisson's ratio; Stress strain response of concrete; Creep and relaxation – parameters affecting; Shrinkage of concrete: types and significance, parameters affecting shrinkage, measurement of creep and shrinkage **Durability of Concrete**: Relation between durability and permeability; factors affecting durability and permeability; Chemical attack of concrete corrosion of steel rebars; other durability issues, IS code provision for durability; measurement of durability

Unit-IV
Special Concrete: High strength, high performance concrete, lightweight concrete, heavyweight concrete, mass concrete, roller compacted concrete, pavement quality concrete, self-compacting concrete, fiber reinforced concrete; polymer concrete, ready-mix concrete **Non-Destructive Testing**: Rebound Hammer test, Ultrasonic Pulse Velocity Test, Pull out Test, Windsor probe test, Core test, Impact echo test, Half-cell potentiometer Test; evaluation criteria of existing structures.

Course Learning Outcomes (CLOs):

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

- Realize the importance of proper concreting practices for achieving desired concrete properties
- Utilize relevant standards to design concrete mixes for various strengths and applications.
- Analyze the effects of admixture and supplementary cementitious materials on fresh and hardenedconcrete properties
- Identify the mechanical properties of hardened concrete and the factors influencing the strength anddurability of concrete
- Select appropriate special concretes based on requirements and performance considerations
- Identify the principles and applications of various non-destructive testing methods for concrete structures

Textbooks:

- M.S. Shetty, -Concrete Technology, Theory And Practice‖, S. Chand Publication, Sixth Edition
- Neville, A.M., "Properties of Concrete", Pitman
- Mehta, P.K., "Concrete Structure, Material and Properties" Prentice Hall Inc

Reference Books:

- M.L. Gambhir, -Concrete Technology‖, McGraw Hill Book Company, Fifth Edition,
- Neville, A.M. and Brooks, J.J.," Concrete Technology", ELBS
- Brandt, A.M., "Cement Based Composites: Materials, Mechanical Properties and Performance", E & FNSpon
- Newman, K., "Concrete Systems In Composite Materials" .EDT BY L .Holliday. Elsevier PublishingCompany
- Powers, T.C., "The Properties Of Fresh Concrete". John Wiley & Sons, Inc.
- Building Materials, P.C. Varghese, Prentice-Hall India, 2555

Suggested Codes/Standards:

- IS 10262-(2019), Concrete Mix Proportion - Guidelines, Bureau of Indian Standards, New Delhi
- IS 456 (2000), Plain and reinforced concrete - Code of practice (Fourth Revision), Bureau of IndianStandards, New Delhi
- IS 516, Hardened Concrete - Methods of Test, Bureau of Indian Standards, New Delhi

e-Learning Resources:

- *https://onlinecourses.nptel.ac.in/noc23_ce50/ Concrete Technology*
- *https://onlinecourses.nptel.ac.in/noc22_ce58/preview Advanced Concrete Technology*

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CEPC-413 Transportation Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- Equip students to conduct and analyze surveys for optimal highway alignment, considering environmental and economic factors.
- Develop skills to design geometric elements of highways ensuring safety and efficiency.
- Train students to perform and interpret traffic studies to improve road safety and traffic flow.
- Educate on designing flexible and rigid pavements per IRC standards, focusing on material selection and structural performance.

Unit-I
Highway Classification: Introduction: History of highway development in India, detailed classification of highways, role of NHAI in development of roads, role of the Pradhan Mantri Gram Sadak Yojana **Highway Alignment:** Factors affecting highway alignment, engineering surveys for alignment–conventional and modern methods, basics of saturation system for highway (or Maximum utility system).
Unit-II
Geometric Design of Highways: Typical cross-sections of highway, cross sectional elements– pavement structure, camber, width of carriageway, width of formation, road margins, widening of pavements at horizontal curves, right of way, super elevation, design speed, sight distances. Design of horizontal and Vertical alignments, IRC specifications.
Unit-III
Traffic Studies in Highway: Introduction to Traffic Engineering, Road user characteristics, Vehicular Characteristics, Volume studies, O & D studies, Accident studies, Speed studies, Peak hour factor, Classification of road signs & road marking as per IRC. **Traffic Signals:** Types, Location of signals, computation of signal time using Trial Cycle method and webster method.
Unit-IV
Pavement Design of Highway: Introduction of Highway Pavements, Difference between flexible and rigid pavements, CBR test and its significance in design of pavements. Flexible pavement design as per IRC: 37 (Latest edition) Rigid pavement design as per IRC: 58 (Latest edition)

Course Learning Outcomes (CLOs):

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

- Understand the fundamentals of highway alignment, geometric design, traffic and highway pavement.
- Apply knowledge of highway fundamentals for determining optimal alignment options for highways by incorporating geometric features to improve traffic flow.
- Analyze the types and locations of traffic signals and markings, considering factors such as traffic volume and road geometry.
- Design flexible and rigid pavements by integrating insights from traffic and geometric studies as per IRC.

Textbooks:

- Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand &Bros, 2017
- Kadiyali, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

Reference Books:

- Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning,
- Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering andTraffic Analysis', 4th Edition, John Wiley
- Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
- Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

e-Learning Resources:

- *https://onlinecourses.nptel.ac.in/noc24_ce68/preview*
  https://onlinecourses.nptel.ac.in/noc23_ce95/preview
- *https://nptel.ac.in/courses/105107220 web courses on Geometric Design of Highways*

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CEPC-414 Geotechnical Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

The question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To learn the fundamental concepts relevant to soil properties.
- To provide exposure to behavior of soil under different conditions of moisture and stresses

Unit-I

Introduction: Introduction to soil mechanics, origin and formation of soil, phase diagram, basic relationships of soil properties and their inter - relationships; various soil properties and the methods of their determination such as specific gravity, moisture content, in-situ density, particle size analysis & sedimentation analysis, Atterberg limits, relative density, thixotropy, activity and sensitivity; Classification of soils as per Unified soil classification system, Indian standard soil classification system and HRB, BIS Plasticity chart and its practical application.

Soil Structure and Clay Mineralogy: Single grained, honey combed, flocculent and dispersed structures; Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution; Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

Unit-II

Permeability of Soils: Darcy's law- assumptions and validity, coefficient of permeability and its determination (laboratory and field methods), permeability of stratified soils, seepage velocity, superficial velocity and coefficient of percolation, quick sand phenomena, capillary phenomena, factors affecting permeability of soil; Seepage analysis - Laplace equation, assumptions, limitations and its derivation; stream and potential functions, Flow nets- characteristics and applications

Effective Stress: Introduction to effective stress principle, effective stress concept-total stress, effective stress,
effect of water table, fluctuations of effective stress, effective stress in soils saturated by capillary action, neutral stress, seepage pressure, quick sand condition and impact of the effective stress in construction of structures.

Unit-III

Compaction & Consolidation of Soils: Introduction, comparison between compaction and consolidation, determination of optimum moisture content and maximum dry density by Proctor tests, methods of compaction of different types of soil in field; Mechanism of consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, e-log(p) curves, Terzaghi's theory of consolidation, computation of final settlement of soil deposits, consolidation settlement - one-dimensional method, secondary consolidation. Primary and secondary compression for normally and over consolidated clays, consolidation of partially saturated soils,

creep/secondary compression in soils.
Unit-IV
Shear Strength of Soils: Concept of shear strength, typical response of soils to shearing forces - Effects of increasing the normal effective stress, over consolidation ratio in soils, drainage of excess pore water pressure, cohesion, tension and cementation; Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr- Coloumb theory, concept of pore pressure, total and effective shear strength parameters, factors affecting shear strength of soils; Lambe's p-q diagram; Measurement of shear strength –Direct shear test, Unconfined compression test, Triaxial compression tests, Vane shear test, Tests under different drainage conditions, Total and effective stress paths. **Stability of Slopes:** Introduction, different factors of safety, types of slope failures, analysis of finite and infinite slopes, wedge failure, Swedish circle method, Friction circle method, stability numbers and charts

Course Learning Outcomes (CLOs):

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

- Learn the index properties of soil and their relationship with each other.
- Understand the phenomena of permeability and effective stress in the soil mass
- Use compaction and consolidation theory and to carry out settlement analysis.
- Analyze shear strength of given sample of soil.
- Evaluate factor of safety of infinite slopes based on different ground conditions.

Textbooks:

- Punmia B C, -Soil Mechanics and Foundation Engineering‖, Laxmi Publications.
- Arora K R, -Soil Mechanics and Foundation Engineering‖, Standard Publishers
- Braja, M. Das, -Geotechnical Engineering‖, Thomson Business Information India (P) Ltd., India

Reference Books:

- Taylor, -Fundamentals of Soil Engineering‖, John Wiley & Sons
- Holtz R.D., -An Introduction to Geotechnical Engineering‖, Prentice Hall, NJ
- Craig R.F., -Soil Mechanics‖, Chapman & Hall.
- T.W. Lambe and R.V. Whitman, -Soil Mechanics‖, John Wiley & Sons, 1969.

e-Learning Resources:

- *https://archive.nptel.ac.in/courses/105/101/105101201/*

CEPC-415 Water Supply & Treatment Technology							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

The question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- Study and understand various water resources and methods of water harvesting.
- Determine the future population and the water demand for a city.
- Study various water purification techniques and their application.
- Basic knowledge about water conveyance, distribution methods and plumbing services.

Unit-I

Sources of Water: Surface, Ground Water Sources and Rooftop Rainwater Harvesting. Intakes structures for surface water sources—lakes, streams/rivers, Reservoir and canals. **Quality of Water:** physical, chemical and biological characteristics of water, IS- 10500: 2012 and WHO drinking water quality standards, Water Pollution, water borne diseases, common impurities in water, Water Act 1974, Role of regulatory bodies & local bodies

Unit-II

Water Demand: Design Period, Population forecast—Graphical methods, arithmetic, incremental, geometric methods, decreased rate of growth and logistic curve method.

Per capita consumption, factors affecting per capita demand and fluctuations in demand pattern, estimation of water requirement.

Unit-III

Water Purification: Objectives of water treatment, unit operations and processes. Screening, aeration, sedimentation, coagulation, flocculation.

Filtration: slow and rapid sand filters.

Membrane Techniques: RO, Micro, Nano and Ultrafiltration.

Softening of Water: Definition, methods of removal of hardness by lime soda process, zeolite process and deionization process.

Disinfection of Water: Definition, methods of disinfection (physical and chemical methods), Advantages and disadvantages of chlorination, various forms of application of chlorine, chlorine demand, residual chlorine, dosage of chlorine, use of bleaching powder.

Unit-IV

Conveyance of Water: Pipes materials, corrosion in pipes, pipe appurtenances, laying of mains and pipes, jointing. **Distribution of Water:** Requirements of distribution system, methods of distribution (gravity, pumping and combined system), System of supply (continuous and intermittent), layouts of distribution system, basic fundamentals of Hardy Cross method. **Water supply Plumbing system**: Material for service pipes, service connection, water meters, valves in domestic supply.

Course Learning Outcomes (CLOs):

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

- Identify different sources of water, intake structures, rain water harvesting methods.
- Evaluate different water quality characteristics as per standard guidelines.
- Estimate population forecasting and water demands.
- Implement different water treatment processes/operations for purification of water.
- Explain the conveyance system for water distribution.
- Select appropriate distribution network/method for water distribution in an area upto consumer point.

Textbooks:

- Garg, S.K., -Water Supply Engineering‖, Vol.I (37th edition), Khanna Publishers, New Delhi.
- Punmia, B.C., Jain A.K., Jain A.K., -Water Supply Engineering‖, Laxmi Publications 2nd Edition 2022, New Delhi.
- M.P. Poonia, SC. Sharma, Santosh Kumar, -Environmental Engineering‖ Khanna Book Publishing Co. 2nd edition, 2023, New Delhi.
- Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. -Environmental Engineering‖, Indian Edition, McGraw-Hill Education 1st indian Edition, 2017, Delhi

Reference Books:

- IS 10500 (2012): Indian Standard for DRINKING WATER SPECIFICATION, 2nd revision.
- Manual on Water Supply and Treatment. Ministry of Housing & Urban Affairs, Government of India.
- SP-35 (1987): Handbook of Water Supply & Drainage-BIS
- Water Act 1974.
- CPCB Water Quality Standards - Designated Best Use Water Quality Criteria
- WHO Guidelines for Drinking Water Quality. 4th Edition, 2022.

e-Learning Resources:

- *https://archive.nptel.ac.in/courses/105/105/105105201/ (NPTEL course on Water Supply Engineering)*
- *https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/TREATMENT/Documents/nesc-techbrief-membrane.pdf*
- *https://www.membracon.co.uk/blog/whats-the-difference-between-microfiltration-ultrafiltration-and-nanofiltration/*
- *https://www.safewater.org/fact-sheets-1/2017/1/23/ultrafiltrationnanoandro*

IKS-311 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section- E will cover whole syllabus.

Course Objectives:

- To equip the students with the knowledge and understanding related to Indian knowledge systems, origin, evolution and the approaches used in ancient and modern times.
- To promote the youths to do research in the various fields of Bhāratīya knowledge system.

Unit-I
Bhartiya Civilization and Development of Knowledge System.
Genesis of the Bharat bhumi and Civilization, Discovery of the Saraswatī River, The Saraswatī - Sindhu civilization, Traditional knowledge system, The ancient education system, Brief introduction of the Takṣaśilā University, The Nalanda University, Knowledge export from Bharata
Unit-II
Art, Literature and Scholars
Natraja- A master piece of Bhartiya Art, Introduction to Vedas and Vedic Literature, Life and works of Agastya, Vālmīki, Patañjali, Vedvyāsa, Loapmudra, Maitreyi, Gārgī, Caraka, Suśruta, Kaṇāda, Kauṭīlya, Pāṇini, Āryabhaṭa, Varahmihira,Bhāskarācārya
Unit-III
Engineering Science and Technology
Engineering, science and technology in the Vedic Age, Post-Vedic period, History ofMathematics in Bharata, Concepts of Zero, History and Culture of Astronomy in India, Kerala School of Astronomy and Mathematics.
Unit-IV
Cultural Heritage and Indian Traditional Practices
Temple architecture in ancient India, Fairs and festivals, Yoga, Āyurveda, Integrated approach to healthcare, Agriculture in Ancient India, Approaches and strategies to the protection and conservation of environment.

Course Outcomes (COs):

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

- Explore the genesis of Bharatbhumi, Saraswati River discovery, and Saraswati-Sindhu civilization, emphasizing traditional knowledge systems and ancient educational structures.
- Analyze masterpiece's like Natraja, delve into Vedas, and study the lives and works of prominent figures such as Agastya, Valmiki, Patanjali, and Aryabhatta, highlighting their contributions to Indian culture.
- Study engineering and technology during the Vedic and post-Vedic ages, trace the history of mathematics and astronomy in India, and explore the contributions of scholars from institutions like Takshashila and Nalanda.
- Examine temple architecture, festivals, yoga, Ayurveda, and ancient agricultural practices, emphasizing integrated healthcare approaches and environmental conservation strategies derived from Indian traditions.

Text/Reference Books:

- Bhag Chand Chauhan, IKS: The Knowledge of Bharata, Garuda Prakashan, 2023.
- Pradeep Kohle et. Al. Pride of India- A Glimpse of India's Scientific Heritage edited by Sanskrit Bharati, 2006.
- Suresh Soni, India's Glorious Scientific Tradition, Ocean Books Pvt. Ltd., 2010.
- Sibaji Raha, et al, History of Science in India Volume-1, Part-I, Part-II, Volume VIII, National Academy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata, 2014.

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CEPC-412P Concrete Technology Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- To familiarize students with the physical and mechanical properties of concrete constituents
- To recognize the importance of material characteristics and their contributions to strength development in Concrete
- To proportion ingredients of Concrete to achieve the most desirable mechanical properties of concrete.
- To understand factors effecting various properties of concrete

Sr. No.	List of Experiments
1	Prepare concrete mix as per Mix Design Standards
2	Study the effect of w/c ratio on fresh properties of concrete using slump cone test, compaction factor test, Vee Bee test
3	Determine the workability of self-compacting concrete using L Box, U Box, V Funnel, J Ring test
4	Study the effect of w/c ratio on the hardened properties of concrete: compressive strength, flexural strength and split tensile strength
5	Study the effect of admixture or fibers on workability or compressive strength of concrete
6	Evaluate Modulus of elasticity and Poisson's ratio of concrete
7	Determine the optimum dosage of chemical admixtures using marsh cone and mini slump test.
8	Study the effect of supplementary cementing materials (fly ash, rice husk ash, metakaolin etc.) on the durability properties of concrete using Rapid chloride permeability test (RCPT), Accelerated carbonation test
9	Study the effect of supplementary cementing materials (Bagasse ash, Silica fumes etc.) on durability properties of concrete using Water Permeability Test, Oxygen Permeability test, Water absorption test
10	Determine creep and shrinkage values of concrete
11	Evaluate the condition of existing structural members using NDT methods (rebound hammer, Ultrasonic pulse velocity, corrosion meter, cover and rebar locator)
12	Study the micro structural properties of concrete

The students shall conduct 7-8 experiments during the semester

Course Learning Outcomes (CLOs):

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

- Design different grades of concrete and achieve quality control
- Perform strength tests and analyze the results to determine concrete's mechanical behavior.
- Conduct durability tests to assess concrete's resistance to degradation.
- Analyse the behavior of concrete due to the influence of concrete ingredients, admixtures and supplementary materials
- Assess the quality of existing concrete members by using non-destructive methods
- Choose the appropriate proportion of materials and assess the performance of concrete by using relevant standards and procedures

Suggested References:

Relevant IS/BIS/ASTM codes as per the experiment.

CEPC-413P Transportation Engineering Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- Road Aggregate Testing: Equip students with practical skills to conduct and analyze essential tests on road aggregates.
- Bituminous Material Evaluation: Train students to perform and interpret fundamental tests on bituminous materials.
- Pavement Evaluation Techniques: Enable students to conduct the CBR test and other pavement evaluations for design and maintenance.
- Traffic Studies and Highway Assessment: Develop skills in conducting traffic studies and inspecting highways to identify and suggest improvements.

Sr. No.	List of Experiments
	Tests on Road Aggregates: (*Perform minimum 03 tests*)
1	**Aggregate Crushing Value Test**: Measures the resistance of aggregate to crushing under a gradually applied compressive load.
2	**Los Angeles Abrasion Test:** Determines the abrasion resistance of aggregate by subjecting it to impact and grinding actions.
3	**Aggregate Impact Test:** Assesses the impact resistance of aggregates by measuring the percentage of crushed material.
4	**Specific Gravity and Water Absorption Tests:** Evaluates the density and water absorption capacity of aggregates.
5	**Shape Test (Elongation & Flakiness):** Identifies the shape characteristics of aggregates, which affects the workability and stability of pavements.
6	**Stripping Value of Road Aggregate:** Measures the resistance of aggregate to stripping in the presence of water, indicating its adhesion properties with bitumen.
	Tests on Bitumen: (*Perform minimum 03 tests*)
7	**Penetration Test:** Determines the hardness or softness of bitumen by measuring the depth a standard needle penetrates under specific conditions.
8	**Softening Point Test:** Identifies the temperature at which bitumen reaches a particular degree of softness, indicating its thermal susceptibility.
9	**Specific Gravity Test:** Measures the density of bitumen, which is essential for mix design calculations.
10	**Viscosity Test:** Assesses the flow characteristics of bitumen at different temperatures, crucial for understanding its behavior during mixing and compaction.
11	**Ductility Test:** Evaluates the ability of bitumen to undergo significant deformation without breaking, which is vital for its performance in pavements.
	Other Tests: (*Perform minimum 02 tests*)
12	**California Bearing Ratio Test:** Determines the strength of subgrade soil and pavement materials by measuring their resistance to penetration under controlled condition
13	**Traffic Studies:** Involves the collection and analysis of data related to traffic flow, volume,

	speed, and other parameters to understand traffic patterns and inform road design and management decisions.
14	**Visual Inspection of Defects on Nearby Highway/Road:** Conduct on site assessments to Identify and document visible defects in highways or roads such as cracks, potholes and surface deformations, providing practical insights into pavement maintenance and repair.

Course Learning Outcomes (CLOs):

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

- Conduct various tests on road aggregates and analyze their results to determine their suitability for use in pavement construction.
- Perform essential tests on bitumen to assess its properties and applicability in different environmental conditions.
- Perform the California Bearing Ratio (CBR) test and understand its significance in pavement design.
- Gain practical experience in conducting traffic studies and performing visual inspections of highways to identify defects and suggest improvements.

Suggested References:

- Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition,Nem Chand &Bros, 2017
- Kadiyali, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
- Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning.
- Relevant IS/BIS/ASTM codes as per the experiment.

CEPC-414P Geotechnical Engineering Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- To learn the fundamental concepts relevant to soil properties
- To provide exposure to a variety of established soil testing procedures and techniques.

Sr. No.	List of Experiments
1	Field Density using Core Cutter method
2	Field Density using Sand replacement method
3	Natural moisture content using Oven Drying method
4	Field identification of Fine-Grained soils
5	Specific gravity of soils
6	Grain size distribution by Sieve Analysis.
7	Grain size distribution by Hydrometer Analysis
8	Consistency limits: Liquid limit, Plastic limit and Shrinkage limit
9	Permeability test using Constant-head method
10	Permeability test using Falling-head method
11	Compaction test: Standard Proctor test / Modified Proctor test.
12	CBR Test
13	Consolidation Test
14	Relative density test
15	Unconfined Compression Strength (UCS) Test
16	Direct Shear Test
17	Triaxial Test (UU)
18	Vane shear test

The students shall conduct 7-8 experiments during the semester

Course Learning Outcomes (CLOs):

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

- Learn the various procedures carried out for soil testing
- Understand the working of common measurement instruments, equipment, and devices for soil testing
- Perform the laboratory and field tests for soil samples as per standard guidelines.
- Evaluate the results with standard values required for recommendation in different Civil Engineering design applications

Suggested References:

- Various related recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to testing of soil used for Civil Engineering applications.
- *https://archive.nptel.ac.in/courses/105/101/105101160/*

CEPC-415P Water Supply & Treatment Technology Laboratory							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 8	20	

Course Objectives:

- Explain the fundamental theory of various experiments and their application in the real field applications.
- Conduct various experiments on water samples as per standard procedures individually & within a team.
- Interpret various data/results and analyze them along with the precautionary measures to be taken.
- Evaluate the test results & provide solutions/suggestions according to their quality for various usages according to the standard guidelines.

Sr. No.	List of Experiments
	To determine the following parameters for the given sample of water: -
1	Color, pH and turbidity.
2	Electrical Conductivity.
3	Total Solids, Suspended Solids and Dissolved Solids.
4	Concentration of major anions (Carbonate, Bi-carbonate, Chloride, Sulphate, Nitrate, Nitrite, Phosphate)
5	Concentration of major cations (Iron, Fluoride, Sodium, Potassium, Calcium, Magnesium)
6	Hardness.
7	Optimum Alum Dose through Jar Test.
8	Chlorine Demand & Residual Chlorine.
9	Available Chlorine Percentage in a given sample of bleaching powder.
10	Amount of Dissolved Oxygen (DO).
11	Biochemical Oxygen Demand (BOD) .
12	Chemical Oxygen Demand (COD).
13	Bacteriological quality of water: presumptive test, confirmatory test and determination of MPN.

The students shall conduct 7-8 experiments during the semester

Course Learning Outcomes (CLOs):

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

- Explain the fundamental theory of various experiments and their application in the real field applications.
- Conduct various experiments on water samples as per standard procedures individually & within a team.
- Interpret various data/results and analyze them along with the precautionary measures to be taken.
- Evaluate the test results & provide solutions/suggestions according to their quality for various usages according to the standard guidelines.

Suggested References:

- IS 10500 (2012): Indian Standard for DRINKING WATER SPECIFICATION, 2nd revision.
- CPCB Water Quality Standards - Designated Best Use Water Quality Criteria.
- WHO Guidelines for Drinking Water Quality. 4th Edition, 2022.
- Guide Manual: Water & Wastewater Analysis, 2011, CPCB.
- IS: 3025 -(Part 1 to Part 80) -Method of sampling and test for Different Physical & Chemical characteristics for Water & Wastewater.
- The Environment (Protection) Rules, 1986, [SCHEDULE – VI], GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS PART-A : EFFLUENTS.

Exit Option for UG Diploma in Civil Engineering

CE-416P Internship-I							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
0	0	0	6	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours

Eligibility for Exercising Exit Option and Pursuing Internship-I:

Those students without any backlogs who wish to leave the studies after completion/end of 2nd year, can exercise exit option for UG Diploma in Engineering during registration for 4th semester (only for regular students (admitted in first year) and not applicable for lateral entry students). They will be required to obtain additional 6 credits summer internship (Internship-I (Exit)) of 8-weeks/2-months duration during summer term/summer vacations after 4th semester. The evaluation of such candidates shall be done within the first-two months of the running next semester i.e. 5th sem. The internship shall be completed by student during summer vacations after 4th semester, in local industry, government/private organization, entrepreneurs, craft and skilled persons for on-site experiential learning.

List of activities/projects to be completed by student:

1. The appropriate ***area of internship shall be identified by student in consultation with the faculty mentor and industrial supervisor*** (if any) during the course of 4th semester, ***by learning all concepts being taught in previous semesters and demonstrating hard work and genuine desire to learn.***
2. The student shall clearly state in his brief report to faculty supervisor regarding (a)What he/she intends to learn, acquire and clarify through this internship? (b) Use of try to use concrete, measurable terms in listing his/her learning objectives under each of the following categories:
   a) ***Knowledge and Understanding***
   b) ***Skills***
3. The student will clearly state and describe in his brief reports regarding
   a) ***Learning Activities***: How will internship activities enable him/her to acquire the knowledge/understanding, and skills listed to be acquired by students (above)?
   b) ***On the job***: How internship activities will enable him/her to meet his/her learning objectives. Student should include *projects, research, report writing, conversations, etc., which student will do while working, relating them to what he/she intends to learn.*
   c) ***Teaching/Mentoring Activities:*** How his/her technical knowledge can be applied at the site of the internship to create value through mentoring/help people learn new things.
   d) ***Off the job:*** List of appropriate study material for reading, writing, method to keep contact with faculty supervisor, peer group discussion, field trips, observations, etc., he/she will make and carry out which will help him/her to meet his/her learning objectives.
   e) ***Evidences:*** *Student will describe* in detail what other evidence he/she will provide to attached faculty mentor to document what was learnt (e.g. journal, analytic paper, project, descriptive paper, oral presentation, etc.) Deadline dates should be included.
   f) ***Evaluation:*** The faculty or internship supervisor will provide a written evaluation, preferably in a tabular format, and by defining rubrics used for evaluation of internship.
   g) ***The Internship Job Description***: Student will describe about role and responsibilities while on his/her internship. (in as much detail as possible), about list of assigned /expected duties, project to be completed, deadlines, etc., and description of contribution expected by the organization/site of internship.
4. The internship will be defended by student during 5th semester in front of appropriate committee (including faculty/ internship supervisor) as per schedule notified by academic department. The concerned department will review the Internship-I rigorously to discourage low quality internship work and to avoid exit options as an escape route, rather than a genuine learning curve.