KCE301 Engineering Mechanics   (L-T-P 3-1-0)   Credit – 4

UNIT - I Introduction to Engineering Mechanics: Force Systems, Basic concepts, Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant-Moment of Forces and its Applications; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems.

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

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

UNIT - III Basic Structural Analysis, Equilibrium in three dimensions; Analysis of simple trusses by method of sections & method of joints, Zero force members, Simple beams and support reactions. [8 Hours]

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

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

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

COURSE OUTCOMES

Course Name: KCE-301:Engineering Mechanics Year of study: 2020-21

On completion of this course, the students will be able to	
KCE 301.1	understand analytical techniques for analysing forces in statically determinate structures and motion of the bodies.
KCE 301.2	apply theorem of area and mass moment of inertia for simple and composite sections.
KCE 301.3	apply concepts of structural analysis to solve trusses.
KCE 301.4	understand concepts of particle dynamics through work and energy and impulse momentum principles.
KCE 301.5	apply concepts of kinetics to define rigid body rotation.
KCE 301.6	apply principle of virtual work to particle systems and rigid bodies.

Mapping of Course Outcome and Program Outcome

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 301.1	3	-	-	-	-	3	-	-	1	-	-	3
KCE 301.2	3	1	-	-	-	3	-	-	1	-	-	3
KCE 301.3	3	3	-	-	-	3	-	-	1	-	-	3
KCE 301.4	2	-	-	-	-	3	-	-	1	-	-	3
KCE 301.5	2	1	-	-	-	3	-	-	1	-	-	3
KCE 301.6	2	1	-	-	-	3	-	-	1	-	-	3
Average	2.5	1.5	-	-	-	3	-	-	1	-	-	3

Mapping of Course Outcome and Program Specific Outcome

PSO / CO	PSO 1	PSO 2
KCE 301.1	2	2
KCE 301.2	3	3
KCE 301.3	3	3
KCE 301.4	2	2
KCE 301.5	3	3
KCE 301.6	3	3
Average	3	3

KCE302 Surveying & Geomatics   (L-T-P 3-1-0)   Credit – 4

UNIT - I

Introduction to Surveying: Definition, Classification, Principles, Survey stations and Survey lines; Introduction to measurement of distance, direction and elevation; Ranging and it methods, Meridians and Bearings, Methods of leveling, Booking and reducing levels, Reciprocal leveling, distance of visible horizon, Profile leveling and cross sectioning, Errors in leveling; Introduction to methods of plane table surveying; Contouring: Characteristics, methods, uses, computation of areas and volumes. Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Methods of horizontal and vertical control, Triangulation: Figures or systems, Signals, Satellite station, Baseline and its importance, corrections, Trigonometric leveling: Accessible and inaccessible objects. [8 Hours]

UNIT - II

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

UNIT - III

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

UNIT - IV

Photogrammetric Survey: basic principles, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, stereoscope and stereoscopic views, parallax equations. Introduction to digital photogrammetry. [8 Hours]

UNIT - V

Remote Sensing: Concepts and physical basis of Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics. Remote sensing systems, spectral signatures and characteristics spectral reflectance curves. Salient features of some of Remote Sensing satellites missions. Digital image processing: Introduction, image rectification and restoration, image enhancement, image transformation, image classification. Applications of remote sensing to civil engineering. [8 Hours]

COURSE OUTCOMES

Course Name: KCE-302:**Surveying & Geomatics Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 302.1	learn the principles and working of conventional surveying instruments, theodolite surveying, levelling, contouring and principles of triangulation systems.
KCE 302.2	apply the principles to set out simple circular curves, transition curves with introduction to vertical curves.
KCE 302.3	understand the concepts of GPS and GIS to analyze GIS data for various applications and applications of EDM in Civil Engineering problems.
KCE 302.4	apply the concept and principles of photogrammetry and stereoscopy to interpret aerial and satellite imagery.
KCE 302.5	understand the concepts of the remote sensing process and its application to Civil Engineering areas.
KCE 302.6	apply the image interpretation and enhancement techniques to extract useful information from digital images

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 302.1	3	1	-	1	1	2	-	1	2	-	-	2
KCE 302.2	3	1	-	1	1	2	-	1	2	-	-	2
KCE 302.3	3	1	-	1	3	3	-	1	2	-	-	2
KCE 302.4	3	1	-	1	3	3	-	1	2	-	-	2
KCE 302.5	3	1	-	1	3	3	-	1	2	-	-	2
KCE 302.6	2	1	-	1	2	3	-	1	2	-	-	2
Average	**2.83**	**1.00**	**-**	**1**	**2.17**	**2.67**	**-**	**1.00**	**2.00**	**-**	**-**	**2.00**

Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 302.1	3	3
KCE 302.2	2	2
KCE 302.3	3	3
KCE 302.4	3	3
KCE 302.5	2	2
KCE 302.6	2	2
Average	**2.50**	**2.50**

KCE303 Fluid Mechanics(L-T-P 3-0-0)   Credit – 3

UNIT I Fluid and continuum, Physical properties of fluids, Rheology of fluids. Pressure-density height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis. [8 Hours]

UNIT II Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, path lines, streak lines, stream tube, continuity equation for 1-D, 2-D and 3-D flows, circulation, stream function and velocity potential function. [8 Hours]

UNIT III Potential Flow: source, sink, doublet and half-body. Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks. [8 Hours]

UNIT IV Equation of motion for laminar flow through pipes, Stokes' law, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, displacement, momentum and energy thickness. Application of momentum equation. Laminar boundary layer, turbulent boundary layer, laminar sub-layer, separation and its control. Vortex Flow: Free & Forced. [8 Hours]

UNIT V Drag and lift, drag on a sphere, aerofoil, Magnus effect, Similarity Laws; geometric, kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance. Introduction to Computational Fluid Dynamics (CFD). [8 Hours]

COURSE OUTCOMES

Course Name: KCE-303**: Fluid Mechanics**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 303.1	learn physical properties and characteristic behaviour of fluids & principles of fluid mechanics.
KCE 303.2	measure pressure exerted by a fluid and perform stability analysis on submerged and floating bodies
KCE 303.3	analyse the performance and behaviour of fluid in motion.
KCE 303.4	perform flow measurements and analyse pipe network problems
KCE 303.5	interpret the behaviour of moving fluid under laminar and turbulent conditions and analyse boundary layer formation on submerged bodies
KCE 303.6	carry out model and dimensional analysis using concept of various forces acting on a moving body and the applications.

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 303.1	3	3	-	-	-	2	-	-	-	-	-	2
KCE 303.2	3	3	-	-	-	2	-	-	-	-	-	2
KCE 303.3	3	3	-	-	-	2	-	-	-	-	-	2
KCE 303.4	3	3	-	-	-	2	-	-	-	-	-	2
KCE 303.5	3	2	1	-	-	2	-	-	-	-	-	2
KCE 303.6	2	2	-	-	-	2	-	-	-	-	-	1
Average	**2.83**	**2.67**	**1.00**	**-**	**-**	**2.00**	**-**	**-**	**-**	**-**	**-**	**1.83**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO1	PSO2
KCE 303.1	3	3
KCE 303.2	3	3
KCE 303.3	3	3
KCE 303.4	3	3
KCE 303.5	3	3
KCE 303.6	2	2
Average	**2.83**	**2.83**

KAS301 Technical Communication

Unit -1 Fundamentals of Technical Communication:
Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.

Unit - II Forms of Technical Communication:
Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration, C.V./Resume writing; Technical Proposal: Types, Structure & Draft.

Unit - III Technical Presentation: Strategies & Techniques
Presentation: Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Unit - IV Technical Communication Skills:
Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication
problems with verbal and non-verbal means.

Unit - V Dimensions of Oral Communication & Voice Dynamics:
Code and Content; Stimulus & Response; Encoding process; Decoding process; Pronunciation
Etiquette; Syllables; Vowel sounds; Consonant sounds; Tone: Rising tone; Falling Tone; Flow in Speaking; Speaking with a purpose; Speech & personality; Professional Personality Attributes: Empathy; Considerateness; Leadership; Competence.

COURSE OUTCOMES

Course Name: KAS-301**: Technical communication**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KAS 301.1	Students will be enabled to understand the nature and objective of Technical Communication relevant for the work place asEngineers.
KAS 301.2	Students will utilize the technical writing for the purposes of Technical Communication and its exposure in variousdimensions.
KAS 301.3	Students would imbibe inputs by presentation skills to enhance confidence in face of diverse audience.
KAS 301.4	Technical communication skills will create a vast know-how of the application of the learning to promote their technical competence.
KAS 301.5	It would enable them to evaluate their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Mapping of Course Outcome and Program Outcome

CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KAS 301.1	-	-	-	-	-	2	-	2	-	3	2	3
KAS 301.2	-	-	-	-	-	-	-	-	2	3	-	3
KAS 301.3	-	-	-	-	-	-	-	-	2	3	2	3
KAS 301.4	-	-	-	-	-	-	-	2	-	3	-	3
KAS 301.5	-	-	-	-	-	-	-	2	2	3	-	3
Average	-	-	-	-	-	2	-	**2**	-	**3**	**2**	**3**

Mapping of Course Outcome and Program Specific Outcome

CO \ PSO	PSO 1	PSO 2
KAS 301.1	-	-
KAS 301.2	-	-
KAS 301.3	-	-
KAS 301.4	-	-
KAS 301.5	-	-
Average	-	-

KAS303 Mathematics –III (Integral Transform & Discrete Maths)

Module I
Laplace   Transform
(8)
Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

MODULE II
Integral   Transforms
(9)
Fourier integral, Fourier Transform, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one-dimensional heat transfer equations, wave equations and Laplace equations,
Z- Transform and its application to solve difference equations.

Module-   III
(8)
Formal Logic ,Group, Ring and Field: Introduction to First order logic, Proposition, Algebra of Proposition, Logical connectives, Tautologies, contradictions and contingency, Logical implication, Argument, Normal form, Rules of inferences, semi group, Monoid Group, Group, Cosets, Lagrange's theorem , Congruence relation , Cyclic and permutation groups, Properties of groups, Rings and Fields (definition, examples and standard results only)

Module- IV(10)
Set, Relation, function and Counting Techniques - Introduction of Sets, Relation and Function, Methods of Proof, Mathematical Induction, Strong Mathematical Induction, Discrete numeric function and Generating functions, recurrence relations and their solution, Pigeonhole principle.

Module- V(10)
Lattices and Boolean Algebra: Introduction, Partially ordered sets, Hasse Diagram, Maximal and Minimal element, Upper and Lower bounds, Isomorphic ordered sets, Lattices, Bounded Lattices and , Distributive Lattices.
Duality, Boolean Algebras as Lattices, Minimization of Boolean Expressions, prime Implicants, Logic Gates and Circuits, Truth Table, Boolean Functions, Karnaugh Maps.

COURSE OUTCOMES

Course Name: KAS-303**: Maths-III**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KAS 303.1	Understand the concept of analytic functions and singularities and apply for the evaluations of definite integrals.
KAS 303.2	Understand the concept of Fourier and Z-transform and apply for solving partial differential equations and difference equations.
KAS 303.3	Remember the concept of statistics, probability and sampling theory. Also apply for analysis of nature of distribution and illustrate the test of significance using t-test and chi square test.
KAS 303.4	Understand the concept of iterative methods and interpolation. Also apply for solving algebraic and transcendental equations.
KAS 303.5	Illustrate the working methods of numerical techniques and apply for solving system of linear equations, numerical integrations and ordinary differential equations.

Mapping of Course Outcome and Program Outcome

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KAS 303.1	3	2	-	2	1	-	-	-	-	-	-	1
KAS 303.2	3	2	2	2	2	-	-	-	-	-	-	1
KAS 303.3	3	2	2	-	3	-	-	-	-	-	-	2
KAS 303.4	3	3	3	2	3	-	-	-	-	-	-	3
KAS 303.5	3	2	3	2	1	-	-	-	-	-	-	3
Average	**3.00**	**2.20**	**2.50**	**2.00**	**2.00**	-	-	-	-	-	-	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO / CO	PSO1	PSO2
KAS 303.1	1	1
KAS 303.2	2	2
KAS 303.3	2	2
KAS 303.4	2	2
KAS 303.5	2	2
Average	**1.80**	**1.80**

KCE351 Building Planning & Drawing Lab   **(L-T-P 0-0-2) Credit – 1**

Drawing and drafting of following with CAD/BIM software

1. Introduction to the tools and commands of drafting software.

2. Working in layers, blocks, x-ref, drawing layout and print setup.

3. 3D drafting and rendering

4. Planning and drafting of elevation and cross section of door and window

5. Planning and drafting of plan and cross section of Dog legged and open well staircase.

6. Planning and Drawings of Residential building of 1 room set (plan and section).

7. Planning and drawing of 3 room residential building with staircase.

8. Preparation of details general arrangement drawing of 4 room duplex house including planning and drafting

COURSE OUTCOMES

Course Name: KCE-351: Building Planning and Drawing Lab   Year of study: 2020-21

On completion of this Lab, the students will be able to	
KCE 351.1	learn symbols used in Civil Engineering drawings & drawings of masonry bonds.
KCE 351.2	draw parts of doors, windows and staircases, plumbing and electrical drawings learn to draw plumbing and electrical drawings and their applications.
KCE 351.3	make drawings of residential buildings & layout plans of various Civil Engineering Projects.

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 351.1	1	1	1	2	3	1	-	1	-	-	-	1
KCE 351.2	1	1	1	2	3	2	-	1	-	-	-	2
KCE 351.3	1	1	1	2	3	1	-	1	-	-	-	2
Average	**1.00**	**1.00**	**1.00**	**2.00**	**3.00**	**1.33**	**-**	**1.00**	**-**	**-**	**-**	**1.67**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO1	PSO2
KCE 351.1	3	1
KCE 351.2	3	2
KCE 351.3	3	2
Average	**3**	**1.67**

KCE352 Surveying & Geomatics Lab   (L-T-P 0-0-2)   Credit – 1

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

COURSE OUTCOMES

Course Name: KCE-352: Surveying & Geomatics LabYear of study: 2020-21

On completion of this Lab, the students will be able to	
KCE 352.1	develop the application of basic and conventional surveying instruments, their principles and working by prismatic compass, Auto/Dumpy level, Vernier & electronic theodolite to measure bearings, reduced level, horizontal & vertical angles.
KCE 352.2	measure the distance, horizontal and vertical angles by Total Station & learn to measure the area of a land parcel by Total Station.
KCE 352.3	Learn & work with mirror stereoscopes, parallax bar and aerial photographs for extracting useful information using FCC & use GPS to collect point and line data.

Mapping of Course Outcome and Program Outcome

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE352.1	3	2	-	1	3	1	-	1	2	-	-	2
KCE352.2	3	2	-	1	3	1	-	1	2	-	-	2
KCE352.3	3	2	-	1	3	1	-	1	2	-	-	2
Average	3.00	2.00	-	1.00	3.00	1.00	-	1.00	2.00	-	-	2.00

Mapping of Course Outcome and Program Specific Outcome

PSO / CO	PSO 1	PSO 2
KCE352.1	3	2
KCE352.2	2	1
KCE352.3	2	1
Average	2.33	1.33

KCE353 Fluid Mechanics Lab   (L-T-P 0-0-2) Credit – 1

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

1. To verify the momentum equation using the experimental set-up on impact of jet.

2. To determine the coefficient of discharge of an orifice of a given shape. Also, to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.

3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.

4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.

5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.

6. Verification of Bernoulli's Theorem

7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.

8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.

9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.

10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.

11. To determine Meta-centric height of a given ship model.

12. To determine the head loss for a sudden enlargement, sudden contraction and losses in bend.

13. Flow Visualization -Ideal Flow

14. To make studies in Wind Tunnel (Aerofoil and circular cylinder).

<div align="center">

COURSE OUTCOMES

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Course Name: KCE-353**: Fluid Mechanics Lab**   **Year of study: 2020-21**

On completion of this Lab, the students will be able to	
KCE 353.1	explore fundamental principles of Fluid Mechanics through experimentation to get practical knowledge in calibration of venturi meter, orifice meter and bend meter.
KCE 353.2	learn the application of the variance of the coefficient of discharge with Reynolds Number for venture meter, orifice meter and bend meter & to draw a flow-net using Electric Analogy method and its application part.
KCE 353.3	study the application part of transition from laminar to turbulent flow and to determine lower critical Reynolds Number & velocity distribution in a pipe and variance of friction factor for turbulent flow in commercial pipes.

<div align="center">

Mapping of Course Outcome and Program Outcome

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PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE353.1	3	2	-	1	-	-	-	1	1	-	-	2
KCE353.2	3	2	-	1	-	-	-	2	1	-	-	1
KCE353.3	3	3	-	2	-	-	-	2	1	-	-	2
Average	**3**	**2.33**	**-**	**1.33**	**-**	**-**	**-**	**1.67**	**1.00**	**-**	**-**	**1.67**

<div align="center">

Mapping of Course Outcome and Program Specific Outcome

</div>

PSO CO	PSO 1	PSO2
KCE 353.1	3	2
KCE 353.2	2	2
KCE 353.3	3	2
Average	**2.67**	**2**

KCE401 Materials, Testing & Construction Practices   (L-T-P 3-0-0)   **Credit – 3**

UNIT I Scope of Study of building Materials: building materials and their performance, economics of the building materials.
Stones: Requirement of good building stone, characteristics of building stone sand their testing. Common building stones.
Bricks: Manufacturing process of clay bricks, classification of clay bricks. Properties of clay bricks, testing methods for clay bricks. Problems of efflorescence & lime bursting in bricks & tiles. Different types of bricks.
Gypsum: properties of gypsum plaster, building products made of gypsum and their uses.
Cement: Raw materials used, Process of Manufacturing, Chemical composition, compounds formed and their effect on strength, Types of cement, Testing of cement properties, Uses of cement.
Cement Concrete: Constituent materials and their properties, Grades of concrete, Factors affecting strength, Properties of concrete at fresh and hardened stage, Testing of concrete, Methods of Curing of concrete.
Pozzolona: Chemical composition and requirements for uses, Natural and Artificial flyash, Surkhi(burnt clay pozzolona), rice husk and ash pozzolona, properties and specifications for use in construction. Timber: Classification and identification of timber, Fundamental Engineering Properties of timber, Defects in timber, Factor affecting strength of timber, Methods of seasoning and preservation of timber. Wood based products.
Asphalt: Bitumen and Tar: Terminology, specifications and uses, Bituminous materials. [8 Hours]

UNIT II Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in construction. Paints, varnishes and distempers: Common constituents, types and desirable properties, Cement paints. Ferrous metals: Desirable characteristics of reinforcing steel.
Principles of cold working. Strength,Telemechanical, physical Properties and chemical composition. Brief discussion on properties and uses of Aluminum and lead. Glass: Ingredients, properties types and use in construction. Insulating Materials: Thermal and sound insulating material, desirable properties and types. [8 Hours]

UNIT III Building Construction: Components of building area considerations, Construction Principle and Methods for layout, Damp proofing, anti-termite treatment in buildings, Vertical circulation: stair cases and their types and planning. Different types of floors, and flooring materials.Bricks and stone masonry construction. Cavity wall & hollow block construction.[8 Hours]

UNIT IV Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof and roof treatments, Lintel sand Chhajja, Principles of building Planning. [8 Hours]

UNIT V Natural Ventilation, Water Supply and Sanitary fittings (Plumbing), Electric Fittings. Heating Ventilation & Air conditioning (HVAC), Mechanical Lifts and Escalators, Fire Fighting and Fire Protection of Buildings. Acoustics. Plastering and its types, pointing, Distempering, Colour washing, Painting etc. Principles & Methods of building maintenance. [8 Hours]

COURSE OUTCOMES

Course Name: KCE 401**: Materials, Testing & Construction Practices**

Year of study: 2020-21

On completion of this course, the students will be able to	
KCE 401.1	learn the properties and characteristics of various building materials like stone, bricks, cement, cement concrete and their applications.
KCE 401.2	understand the properties and characteristics of materials used in buildings like plastics, paints, ferrous metals and glass.
KCE 401.3	understand the principles and methods of building construction and functional efficiency of buildings and their applications.
KCE 401.4	understand different types of floors in building construction and their applications in construction.
KCE 401.5	learn the various types of doors, windows and ventilators.
KCE 401.6	learn water supply and sanitary fittings in buildings and their applications.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 401.1	3	-	-	-	-	3	1	-	-	-	-	2
KCE 401.2	3	-	-	-	-	3	1	-	-	-	-	2
KCE 401.3	3	1	1	-	-	3	-	2	-	-	-	2
KCE 401.4	3	-	-	-	-	3	-	-	-	-	-	2
KCE 401.5	2	-	-	-	-	2	-	-	-	-	-	1
KCE 401.6	2	-	-	-	-	2	-	-	-	-	-	1
Average	**2.67**	**1.00**	**1.00**	**-**	**-**	**2.67**	**1.00**	**2.00**	**-**	**-**	**-**	**1.67**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 401.1	3	2
KCE 401.2	3	2
KCE 401.3	3	2
KCE 401.4	3	2
KCE 401.5	2	1
KCE 401.6	2	1
Average	**2.67**	**1.67**

KCE402 INTRODUCTION TO SOLID MECHANICS (L-T-P 3-1-0)   Credit – 4

UNIT I
Simple stress and strains:Concept of stress and strain, types of stresses and strains, Hook's law, stress and strain diagram for ductile and brittle metal. Lateral strain, Poission ratio, volumetric strain, elastic moduli and relation between them. Bar of varying cross section, composite bar and temperature stress. Strain energy for gradual, sudden and impact loading.Compound stress and strains:Normal stress and strain, shear stress and strain, stresses on inclines sections, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional state of stress & strain, equilibrium equations, generalized Hook's law-3D, Theories of failure and factor of safety.[8 Hours]

UNIT II
Shear force and bending moment diagramsShear force (SF) and Bending moment (BM) diagrams for simply supported, cantilevers, overhanging and fixed beams. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of   span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads. [8 Hours]

UNIT III
Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.
Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.
Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections. [8 Hours]

UNIT IV
Deflection of Beams: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.
Short Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules. [8 Hours]

UNIT V
Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs.
Thin cylinders, Thick cylinders & Spheres: Introduction, difference between thin walled and thick walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain. Radial, axial and circumferential stresses in thick cylinders subjected to internal or external   pressures,   compound   cylinders.   [8   Hours]

COURSE OUTCOMES
Course Name: KCE402**: Introduction to Solid Mechanics**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 402.1	On completion of this course, the students will be able to analyse stress and strain of composite bars, bars of varying cross section, temperature stresses, principal stress and strain
KCE 402.2	On completion of this course, the students will be able to analyse various beams with different loadings to draw Shear Force and Bending Moment Diagrams
KCE 402.3	On completion of this course, the students will be able to design beam section for bending stresses and shear stress distribution
KCE 402.4	On completion of this course, the students will be able to apply the concept of torsion for hollow and circular shafts and combined loading of bending and torsion.
KCE 402.5	On completion of this course, the students will be able to apply various methods to calculate slope and deflection for determinate beams and buckling of columns and struts.
KCE 402.6	On completion of this course, the students will be able to analyse the behaviour of springs, thin and thick cylinders and spheres

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 402.1	3	3	3	-	1	2	-	-	1	-	-	2
KCE 402.2	3	3	3	-	1	3	-	-	1	-	-	3
KCE 402.3	3	3	3	-	-	2	-	-	-	-	-	2
KCE 402.4	2	2	2	-	-	2	-	-	-	-	-	2
KCE 402.5	3	3	3	-	-	2	-	-	-	-	-	2
KCE 402.6	2	2	3	-	-	2	-	-	-	-	-	2
Average	**2.67**	**2.67**	**2.83**	**-**	**1**	**2.17**	**-**	**-**	**1**	**-**	**-**	**2.17**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 402.1	2	2
KCE 402.2	3	3
KCE 402.3	2	2
KCE 402.4	2	2
KCE 402.5	2	2
KCE 402.6	2	2
Average	**2.17**	**2.17**

KCE403 HYDRAULIC ENGINEERING & MACHINES   (L-T-P 3-1-0)   Credit – 4

UNIT I Introduction: Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels critical, sub-critical and super-critical type of flows. Critical depth, concepts of specific energy and specific force. Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section, compound sections. [8 Hours]

UNIT II Energy-Depth relationship: Application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods. Measurments of discharge & velocity – Venturi flume, Standing wave flume, Parshall flume, Broad crested weir, Current meter and Floats. [8 Hours]

UNIT III Rapidly varied flow: Hydraulic jump; Evaluation of the jump elements in rectangular channels on horizontal and sloping beds, energy dissipater, open channel surge, celerity of the gravity wave, deep and shallow water waves. [8 Hours]

UNIT IV Impulse momentum equation- Impact of Jets-plane and curved- stationary and moving plates. Pumps: Positive displacement pumps - reciprocating pumps , centrifugal pumps, operation, velocity triangles, performance curves, Cavitation, Multi staging, Selection of pumps.[8 Hours]

UNIT V Rotodynamic Machines, Pelton Turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation, characteristic curves. [8 Hours]

COURSE OUTCOMES
Course Name: KCE403: Hydraulic Engineering and Machines   Year of study: 2020-21

On completion of this course, the students will be able to	
KCE 403.1	On completion of this course, the students will be able to differentiate between open channel and pipe flow by understanding the concepts of open channel flow
KCE 403.2	On completion of this course, the students will analyse geometrical parameters of an open channel & evaluate efficient channel sections for different conditions.
KCE 403.3	On completion of this course, the students will analyse the nature of flow and flow profiles using concept of specific energy and GVF equation
KCE 403.4	On completion of this course, the students will understand and apply the principle of hydraulic jump to analyse various open channel surges and its applications
KCE 403.5	On completion of this course, the students will understand and apply the working principle of pumps and their characteristic curves
KCE 403.6	On completion of this course, the students will analyse the working of turbines and evaluate various performance metrics

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 403.1	2	1	-	-	-	1	-	-	-	-	-	1
KCE 403.2	3	3	-	1	-	2	-	-	-	-	-	2
KCE 403.3	3	3	1	1	-	2	-	-	-	-	-	2
KCE 403.4	3	3	-	1	-	3	-	-	-	-	-	2
KCE 403.5	3	3	-	-	-	3	-	-	-	-	-	2
KCE 403.6	3	3	-	-	-	3	-	-	-	-	-	2
Average	**2.83**	**2.83**	**1.00**	**1.00**	**-**	**2.17**	**-**	**-**	**-**	**-**	**-**	**1.83**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 403.1	3	3
KCE 403.2	3	3
KCE 403.3	3	3
KCE 403.4	3	3
KCE 403.5	3	3
KCE 403.6	2	2
Average	**2.83**	**2.83**

KOE043 Energy Science and Engineering

Unit-I
Energy and its Usage: Units and scales of energy use, Mechanical energy and transport,Heat energy: Conversion between heat and mechanical energy, Electromagnetic energy: Storage, conversion, transmission and radiation, Introduction to the quantum, energy quantization, Energy in chemical systems and processes, flow of CO2, Entropy and temperature, carnot and Stirling heat engines, Phase change energy conversion, refrigeration and heat pumps, Internal combustion engines, Steam and gas power cycles, the physics of power plants. Solid-state phenomena including photo, thermal and electrical aspects.

Unit-II
Nuclear Energy: Fundamental forces in the universe, Quantum mechanics relevant fornuclear physics, Nuclear forces, energy scales and structure, Nuclear binding energy systematics, reactions and decays, Nuclear fusion, Nuclear fission and fission reactor physics, Nuclear fission reactor design, safety, operation and fuel cycles

Unit-III
Solar Energy: Introduction to solar energy, fundamentals of solar radiation and itsmeasurement aspects, Basic physics of semiconductors, Carrier transport, generation andrecombination in semiconductors, Semiconductor junctions: metal-semiconductor junction & p-n junction, Essential characteristics of solar photovoltaic devices, First Generation Solar Cells, Second Generation Solar Cells, Third Generation Solar Cells

Unit-IV
Conventional & non-conventional energy source: Biological energy sources andfossil fuels, Fluid dynamics and power in the wind, available resources, fluids, viscosity, types of fluid flow, lift, Wind turbine dynamics and design, wind farms, Geothermal power and ocean thermal energy conversion, Tidal/wave/hydro power

Unit-V
Systems and Synthesis: Overview of World Energy Scenario, Nuclear radiation, fuelcycles, waste and proliferation, Climate change, Energy storage, Energy conservation.Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts, LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energyconsumption.

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COURSE OUTCOMES
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Course Name: KOE043:**Energy Science & Engg.**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KOE043.1	Understand various energy and its usage.
KOE043.2	Understand the fundamental forces in universe aspects of nuclear energy
KOE043.3	Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.
KOE043.4	Demonstrate the generation of energy from various Conventional and Non-Conventional sources of energy.
KOE043.5	Illustrate ocean energy and explain the operational methods of their utilization and acquire the knowledge on Geothermal energy.
KOE043.6	Explore the concepts involved in systems and synthesis by studying its components, types and performance.

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Mapping of Course Outcome and Program Outcome
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PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KOE043.1	2	2	2	2	-	1	2	-	-	-	-	-
KOE043.2	2	2	2	2	-	1	2	-	-	-	-	-
KOE043.3	2	2	2	2	-	1	2	-	-	-	-	-
KOE043.4	2	2	2	2	-	1	2	-	-	-	-	-
KOE043.5	2	2	2	2	-	1	2	-	-	-	-	-
KOE043.6	2	2	2	2	-	1	2	-	-	-	-	-
Average	**2**	**2**	**2**	**2**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**-**

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Mapping of Course Outcome and Program Specific Outcome
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PSO CO	PSO 1	PSO 2
KOE043.1	-	-
KOE043.2	-	-
KOE043.3	-	-
KOE043.4	-	-
KOE043.5	-	-
KOE043.6	-	-
Average	-	-

KVE401 Universal Human Values

UNIT-1 Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities-the basic requirements for fulfillment of aspirations of every human being with their correct priority,
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-2 Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3 Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (societybeing an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in societyUndivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT-4 Understanding Harmony in the Nature and Existence – Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutuallyinteracting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT-5 Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy fortransition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

COURSE OUTCOMES

Course Name: KVE401**: Univarsal Human Values**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KVE401.1	Understand the need, concept and content of value-education in individual's life and modifies their aspirations for happiness & prosperity.
KVE401.2	Comprehend the term self-exploration and its application for self-evaluation and development.
KVE401.3	Reconstruct the concepts about different values & discriminate between them.
KVE401.4	Analyze the concept of co-existence & evaluate the program to ensure self regulation.
KVE401.5	Identify the holistic perception of harmony at level of self, family, society, nature and explain it by various examples.
KVE401.6	Apply professional ethics in their future profession & contribute for making a value based society.

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KVE401.1	-	-	-	-	-	3	3	3	3	2	-	3
KVE401.2	-	-	-	-	-	3	3	3	3	2	-	3
KVE401.3	-	-	-	-	-	3	3	3	2	2	-	3
KVE401.4	-	-	-	-	-	3	3	3	2	2	-	3
KVE401.5	-	-	-	-	-	3	3	3	3	2	-	3
KVE401.6	-	-	-	-	-	3	3	3	3	2	-	3
Average	-	-	-	-	-	**3**	**3**	**3**	**2.67**	**2**	**-**	**3.00**

Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KVE401.1	3	3
KVE401.2	3	3
KVE401.3	2	2
KVE401.4	2	2
KVE401.5	2	2
KVE401.6	2	2
Average	**2.33**	**2.33**

KCE451 MATERIAL TESTING LAB   **(L-T-P 0-0-2)**   **Credit – 1**

Testing of various properties of following materials as per BIS specifications
I. Cement
1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier's apparatus.
5. Soundness of cement.
6. Tensile strength
II. Coarse Aggregate
1. Water absorption of aggregate
2. Sieve Analysis of Aggregate
3. Specific gravity &bulk density
4. Grading of aggregates.
III Fine Aggregate:
1. Sieve analysis of sand
2. Silt content of sand
3. Bulking of sand
IV Bricks:
1. Water absorption.
2. Dimension Tolerances
3. Compressive strength
4. Efflorescence

Course Name: KCE-451**: Material Testing Lab**   **Year of study: 2020-21**

On completion of this Lab, the students will be able to	
KCE 451.1	Test various properties of cement.
KCE 451.2	Test properties of coarse and fine aggregates
KCE 451.3	Test water absorption, dimension tolerances and compressive strength of bricks.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12
KCE 451.1	3	2	-	-	-	2	1	1	1	-	-	2
KCE 451.2	3	2	-	-	-	3	1	2	1	-	-	2
KCE 451.3	3	2	-	-	-	3	1	2	1	-	-	2
Average	**2.00**	**2.00**	-	-	-	**2.67**	**1.00**	**1.67**	**1.00**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO1	PSO2
KCE 451.1	2	2
KCE 451.2	2	2
KCE 451.3	2	2
Average	**2**	**2**

KCE452 SOLID MECHANICS LAB   (L-T-P 0-0-2)   **Credit – 1**

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

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

COURSE OUTCOMES

Course Name: KCE-452**: Solid Mechanics Lab**   **Year of study: 2020-21**

On completion of this Lab, the students will be able to	
KCE 452.1	To determine the tension test on Mild Steel
KCE 452.2	To determine the Hardness Test (Brinnel's and Rockwell) of diffrent metals
KCE 452.3	To determine the Impact test (Charpy and IZOD)

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 452.1	3	2	-	-	-	2	1	1	1	-	-	2
KCE 452.2	3	2	-	-	-	3	1	2	1	-	-	2
KCE 452.3	3	2	-	-	-	3	1	2	1	-	-	2
Average	**3.00**	**2.00**	-	-	-	**2.67**	**1.00**	**1.67**	**1.00**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 452.1	2	2
KCE 452.2	2	2
KCE 452.3	2	2
Average	**2**	**2**

KCE453 Hydraulics & Hydraulic Machine Lab   (L-T-P 0-0-2)   **Credit – 1**

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

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

COURSE OUTCOMES

Course Name: KCE-453**: Hydraulics & Hydraulic Machine LabYear of study: 2020-21**

On completion of this Lab, the students will be able to	
KCE 453.1	determine Manning coefficient & the velocity distribution in an open channel.
KCE 453.2	analyse experimentally the study of flow characteristics over a hump & the study of flow characteristics through a horizontal contraction in a rectangular channel.
KCE 453.3	analyse experimentally flow characteristics of a free hydraulic jump & study characteristics of pumps and turbines.

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 453.1	2	2	-	2	-	1	-	1	2	-	-	2
KCE 453.2	3	3	-	2	-	1	-	1	2	-	-	2
KCE 453.3	3	3	-	2	-	2	-	1	2	-	-	1
Average	**2.67**	**2.67**	**-**	**2.0**	**-**	**1.33**	**-**	**1.00**	**2.00**	**-**	**-**	**1.67**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 453.1	2	1
KCE 453.2	3	2
KCE 453.3	2	2
Average	**2.33**	**1.67**

RCE501 Geotechnical Engineering　　　　　**(L-T-P 3-0-0)**　　　　　**Credit - 3**

Unit I Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standard soil classification system. [8]

Unit II Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping; [8]

Unit III Soil compaction, water content – dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method. Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation, Contact pressure [8]

Unit IV Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients. Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and c-φ soils, inclined backfill, Graphical methods of earth pressure determination, Stability of slopes, Culman method & Method of slices, Stability number & chart. [8]

Unit V Sub surface structure: Bearing capacity of shallow foundations, SPT, Plate load test; Effect of water table. Deep foundations: Types of piles, Static and dynamic formulae, Pile group, Settlement of Pile Group, Negative skin friction. [8]

COURSE OUTCOMES

Course Name:RCE-501:**Geotechnical Engineering   Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 501.1	understand basic terminology of soil mechanics and soil classification.
RCE 501.2	understand various laboratory tests.
RCE 501.3	analyse interaction between soil and water systems to understand capillary flow, permeability and seepage etc.
RCE 501.4	understand to apply relationships of dry unit weights and theory of compaction and consolidation
RCE 501.5	understand to analyse the shear strength and earth pressure theories.
RCE 501.6	understand to analyse bearing capacity of shallow and deep foundations

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 501.1	2	2	-	-	-	2	-	-	-	-	-	1
RCE 501.2	3	-	-	-	-	3	-	-	-	-	-	2
RCE 501.3	3	2	1	1	-	2	-	-	-	-	-	2
RCE 501.4	3	2	1	1	-	3	-	-	-	-	-	2
RCE 501.5	3	2	1	1	-	3	-	-	-	-	-	2
RCE 501.6	3	2	1	1	-	3	-	-	-	-	-	2
Average	**2.83**	**2**	**1**	**1**	**-**	**2.67**	**-**	**-**	**-**	**-**	**-**	**1.83**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 501.1	2	2
RCE 501.2	3	3
RCE 501.3	3	2
RCE 501.4	3	3
RCE 501.5	3	2
RCE 501.6	3	3
Average	**2.83**	**2.50**

RCE502 Design of Structure 1   (L-T-P 3-1-0)   Credit- 4

Unit I Analysis of fixed beams, Continuous beams and simple frames with and without translation ofjoint by Slope-Deflection method, Moment Distribution method and Strain Energy method. [8]

Unit II Muller-Breslau's Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged and fixed arches, Influence line diagrams for maximum bending moment, Shear force and thrust in two hinge arches. Analysis of two and three hinged stiffening girders. [8]

Unit III Introduction to Suspension Bridges, Analysis of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders. [8]

Unit IV Basic Force and Displacement Matrix method for analysis of beams, frames and trusses. [8]

Unit V Basics of Plastic Analysis. Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Single Storied Frames. [8]

COURSE OUTCOMES

Course Name: RCE 502: **DESIGN OF STRUCTURE 1**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 502.1	analyse the indeterminate beams and frames by slope deflection and moment distribution methods.
RCE 502.2	analyse the indeterminate beams to draw the influence line diagrams.
RCE 502.3	analyse two hinged arches for different loading conditions.
RCE 502.4	analyse the beams and frames by Plastic theory to calculate collapse load.
RCE 502.5	analyse the suspension bridges and stiffening girders.
RCE 502.6	analyse the beams and frames by force and displacement methods.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 502.1	3	3	-	-	-	3	-	-	-	-	-	3
RCE 502.2	3	3	-	-	-	3	-	-	-	-	-	3
RCE 502.3	3	3	-	-	-	3	-	-	-	-	-	3
RCE 502.4	3	3	-	-	-	2	-	-	-	-	-	2
RCE 502.5	2	2	-	-	-	3	-	-	-	-	-	3
RCE 502.6	3	3	1	1	-	3	-	-	-	-	-	3
Average	**2.83**	**2.83**	**1**	**1**	**-**	**2.83**	**-**	**-**	**-**	**-**	**-**	**2.83**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 502.1	3	3
RCE 502.2	3	3
RCE 502.3	3	2
RCE 502.4	3	3
RCE 502.5	2	2
RCE 502.6	3	3
Average	**2.83**	**2.67**

KCE503 Quantity Estimation & Management   **(L-T-P 3-0-0)**   **Credit - 3**

UNIT I: Quantity Estimation for Buildings Measurement units for various building materials, Centreline method, Long and short wall method of estimates, PWD schedule of rate, Delhi schedule of rate. [8]

UNIT II: Rate Analysis, Specification and Tenders Analysis of rates knowing cost of material, labour, equipment, overheads, profit, taxes etc, Specifications – Preparation of detailed and general specifications, Legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items. [8]

UNIT III: Elements of Management & Network Techniques Project cycle, Organization, planning, scheduling, monitoring, updating and management system in construction, Bar charts, milestone charts, work break down structure and preparation of networks. Network Techniques like PERT & CPM in construction management. Project monitoring and resource allocation through network techniques. [8]

UNIT IV: Equipment Management Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction Equipment for earth moving, earth compaction, Hauling Equipment, Hoisting Equipment, Conveying Equipment, Concrete Production Equipment, Tunnelling Equipment [8]

UNIT V: Project Cost Management Budgeting, Cost planning, Direct Cost, Indirect cost, Total Cost Curve, Cost Slope. Time value of money, Present economy studies, Equivalence concept, financing of projects, economic comparison, present worth method Equivalent annual cost method, discounted cash flow method, Depreciation and break even cost analysis. [8]

COURSE OUTCOMES

Course Name:KCE 503**:Quantity Estimation & Management**   **Year of study:2020-21**

On completion of this course, the students will be able to	
KCE 503.1	learn estimation of quantities of buildings by different methods
KCE 503.2	analyse rates as per specifications of works
KCE 503.3	apply network techniques of CPM and PERT
KCE 503.4	understand the practical aspect of construction equipment management including earth moving, hauling and conveying equipment
KCE 503.5	learn the project cost control, budgeting and cost planning
KCE 503.6	understand the present economic studies and method of analysis including discounted cash flow and break even cost analysis

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 503.1	3	2	-	-	-	2	-	-	-	-	2	2
KCE 503.2	2	2	-	-	-	3	-	2	-	-	2	2
KCE 503.3	3	3	1	1	-	3	-	-	-	-	3	3
KCE 503.4	3	3	-	-	-	3	1	-	-	-	3	3
KCE 503.5	3	3	-	-	-	2	-	-	-	-	3	3
KCE 503.6	3	3	-	-	-	2	-	-	-	-	3	3
Average	2.83	2.67	0.16	0.16	-	2.50	0.16	0.33	-	-	2.67	2.67

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 503.1	2	2
KCE 503.2	2	2
KCE 503.3	3	3
KCE 503.4	3	3
KCE 503.5	3	3
KCE 503.6	3	3
Average	2.67	2.67

KCE051 Concrete Technology   (L-T-P 3-0-0)   Credit - 3

Unit I Cement: production, composition properties, types and cement chemistry. Introduction to supplementary cementitious materials. Aggregates: mineralogy, properties, test and standards. Quality of water for use in concrete. [8]

Unit II Introduction & study of accelerators, retarders, water reducers, air entrainers, water proofers, super plasticizers. Study of supplementary cementing materials like fly ash, silica fume, ground granulated blast furnace slag, metakaoline and pozzolana; their production, properties and effect on concrete properties. [8]

Unit III Principle of mix proportioning, properties related to mix design, mix design method (IS method and ACI method). Mix design of concrete: packing density, Rheology, mix design examples. [8]

Unit IV Concert production, batching, mixing and transportation of concrete. Workability: test for workability of concrete (slump test, compacting factor test and Vee Bee test). Segregation and bleeding in concrete, curing of concrete and its methods. Determination of compressive and flexural strength as per BIS. Mechanical properties of concrete: elastic modules, poisson's ratio, creep, shrinkage and durability of concrete. [8]

Unit V Study and uses of high strength concrete, self-compacting concrete, fiber reinforced concrete, ferro cement, ready Mix Concrete, recycled aggregate concrete and status in India. [8]

COURSE OUTCOMES

Course Name:KCE 051**:Concrete Technology**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 051.1	learn the cement composition and its hydration process
KCE 051.2	understand the effect of chemical admixtures on concrete properties
KCE 051.3	learn the applicability aspects of supplementary cementing materials on properties of concrete
KCE 051.4	design a concrete mix by using IS and ACI method
KCE 051.5	determine the mechanical properties of concrete.
KCE 051.6	learn the special types of concrete

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 051.1	3		-	-	-	2	1	-	-	-	-	3
KCE 051.2	3		-	-	-	3	-	-	-	-	-	2
KCE 051.3	3		-	2	-	3	1	-	-	-	-	3
KCE 051.4	3	3	2	2	-	3	-	2	-	-	-	3
KCE 051.5	3		-	-	-	3	-	-	-	-	-	3
KCE 051.6	3		-	-	-	3	-	-	-	-	-	3
Average	**3.00**	**3.00**	**0.16**	**0.16**	**-**	**2.83**	**0.16**	**0.33**	**-**	**-**	**-**	**2.83**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 051.1	2	2
KCE 051.2	2	2
KCE 051.3	3	3
KCE 051.4	3	3
KCE 051.5	3	3
KCE 051.6	3	3
Average	**2.67**	**2.67**

KCE055 Engineering Hydrology   **(L-T-P 3-0-0) Credit - 3**

UNIT – I Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities indices, measurement&estimation. **[8]**

UNIT – II Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneousunithydrographs. **[8]**

UNIT – III Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method offloodrouting. **[8]**

UNIT – IV Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology & aquifers, Ground watermovement.
Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single& Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses,specificcapacity. **[8]**

UNIT – V Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells.
Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, Artificial discharge and Recharge of Ground Water, Roof-top rainwater harvestingandrecharge. **[8]**

COURSE OUTCOMES

Course Name: KCE-055**: Engineering Hydrology**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 055.1	understand the various aspects of hydrological cycle & definitions, hydrologic systems precipitation, evaporation, infiltration and evapotranspiration.
KCE 055.2	analyse the direct runoff, unit hydrographs ,s-curve hydrograph, synthetic and instantaneous unit hydrographs used for the analysis of runoff.
KCE 055.3	analyse and estimate hydrologic and hydraulic flood routing, flood frequencies and flood forecasting.
KCE 055.4	analyse steady and unsteady flow through confined and unconfined aquifers, Dupuits theory, well hydraulics, mutual interference of wells, well losses, specific capacity.
KCE 055.5	design the water wells and pumping equipment for water wells.
KCE 055.6	understand ground water quality, contamination of groundwater and its control, ground water modeling techniques and ground water exploration, rain water harvesting.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 055.1	2	2	-	-	-	2	-	-	-		-	2
KCE 055.2	2	2	-	-	-	2	2	-	-		-	2
KCE 055.3	3	2	2	1	-	2	2	2	-		-	2
KCE 055.4	3	3	-	-	-	2	2	-	-		-	2
KCE 055.5	2	2	2	1	-	2	2	-	-		-	2
KCE 055.6	2	2	-	-	1	2	2	-	-		-	2
Average	**2.33**	**2.17**	**2.00**	**1.00**	**1.00**	**2.00**	**2.00**	**2.00**	**-**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 055.1	2	2
KCE 055.2	2	3
KCE 055.3	3	2
KCE 055.4	2	2
KCE 055.5	3	2
KCE 055.6	3	3
Average	**2.5**	**2.33**

KCE552 Geotechnical Engineering Lab **(L-T-P 0-0-2)** **Credit- 1**

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis).
7. Determination of shear strength of soil by Direct shear test.
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.
9. Determination of permeability of a remoulded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remoulded soil sample by an odometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Triaxial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

Note: Any 8 experiments are to be performed from the list of experiments.

COURSE OUTCOMES

Course Name:KCE-552:**Geotechnical Engineering Lab**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 552.1	perform specific gravity of a given soil sample & in-situ dry density of soil mass.
KCE 552.2	perform tests and applicability of complete distribution of soil grain size distribution & consistency limits of a given soil sample.
KCE 552.3	perform tests and applicability of compaction characteristics of a given soil sample & consolidation characteristics of a remoulded soil sample.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 552.1	3	1	-	2	-	2	-	1	2	-	-	2
KCE 552.2	3	1	-	2	-	3	-	2	2	-	-	2
KCE 552.3	3	1	-	2	-	3	-	1	2	-	-	2
Average	**3.00**	**1.00**	**-**	**2.00**	**-**	**2.67**	**-**	**1.33**	**2.00**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 552.1	3	2
KCE 552.2	3	2
KCE 552.3	3	2
Average	**3**	**2**

RCE552 CAD LAB 1   **(L-T-P0-0-2)**   **Credit- 1**

1. Working on Latest Version of ANALYSIS SOFTWARE LIKE ANSYS, ADINA, NISA, MATLAB
2. Working on Latest Version of DESIGN SOFTWARE LIKE STAAD PRO / STRUDS / SAP / ETAB / STRAP
3. Working on Latest Version of GEOTECHNICAL SOFTWARES like GEO-5 / PLAXIS

COURSE OUTCOMES

Course Name: RCE 552 CAD LAB 1   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 552.1	carry out analysis of a steel bridge by STAAD PRO & design of a steel bridge by STAAD PRO
RCE 552.2	perform to carry out analysis of a multi-storeyed frame by STAAD PRO & design of a multi-storeyed frame by STAAD PRO
RCE 552.3	carry out analysis of a water tank by STAAD PRO.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 552.1	3	3	-	2	3	-	-	2	-	-	-	3
RCE 552.2	3	3	-	2	3	-	-	1	-	-	-	3
RCE 552.3	3	3	-	2	3	-	-	2	-	-	-	3
Average	**3.00**	**3.00**	**-**	**2.00**	**3.00**	**-**	**-**	**1.67**	**-**	**-**	**-**	**3.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 552.1	3	2
RCE 552.2	2	3
RCE 552.3	3	3
Average	**2.67**	**2.67**

KCE553Quantity Estimation & ManagementLab   **(L-T-P 0-0-2)**   **Credit-1**

1. Estimation of quantities for any one of the followings: Building/ Septic tank/Water supply pipe line/road/bridge.
2. Preparation of Bill of Quantities (BOQ) for above project.
3. Practice of MS Project/Primavera software for same problem.
4. Study of any full set of tender documents (Institute shall provide the set from ongoing/ completed tenders).

These exercises will be done through use of software and spread in 8-10 classes.

COURSE OUTCOMES

Course Name:KCE 553**:Quantity Estimation & Management Lab   Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE553.1	to estimate the quantities of a residential building.
KCE553.2	to estimate the Bill of Quantities for a residential building.
KCE553.3	to learn the practical aspects of of tender documents,

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE553.1	3	-	-	2	-	2	-	1	-	-	-	2
KCE553.2	3	-	-	2	-	2	-	2	-	-	-	2
KCE553.3	3	-	-	2	-	2	-	1	-	-	-	2
Average	**3.00**	**-**	**-**	**2.00**	**-**	**2.00**	**-**	**1.33**	**-**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE553.1	3	2
KCE553.2	3	3
KCE553.3	3	3
Average	**3**	**2.67**

KCE601 Design of Concrete Structure   (L-T-P 3-0-0)   **Credits -3**

Unit – 1

Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State DesignMethod. **[8]**

Unit – 2

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear.
Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments.**[8]**

Unit – 3

Design of one way, One way continuous and cantilever solid slabs by Limit State Design Method, Design of RCC staircases.
Design of lintels and chajjas. Design of two way slabs by limit state method, Serviceability Limit States, Control of deflection, crackingandvibrations.   **[8]**

Unit – 4

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts.   **[8]**

Unit – 5

Structural behaviour of footings, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings.
Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of cantilever retaining wall by Limit State Method. **[8]**

COURSE OUTCOMES

Course Name: KCE-601**: Design of Concrete Structure**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 601.1	design various kind of beams by limit state method.
KCE 601.2	design different kinds of beam due to shear.
KCE 601.3	design one and two way slabs using limit state method.
KCE 601.4	design the various types of columns.
KCE 601.5	design various types of foundations.
KCE 601.6	analyze the structural behavior of cantilever retaining wall to design it.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 601.1	3	3	-	-	-	3	-	2	-	-	-	3
KCE 601.2	3	3	-	-	-	3	-	2	-	-	-	3
KCE 601.3	3	3	-	-	-	3	-	2	-	-	-	3
KCE 601.4	3	3	-	-	-	3	-	2	-	-	-	3
KCE 601.5	3	3	1	1	-	3	-	2	-	-	-	3
KCE 601.6	2	2	-	-	-	2	-	2	-	-	-	2
Average	**2.83**	**2.83**	**1.00**	**1.00**	**-**	**2.83**	**-**	**2.00**	**-**	**-**	**-**	**2.83**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 601.1	2	2
KCE 601.2	2	2
KCE 601.3	3	3
KCE 601.4	3	3
KCE 601.5	3	3
KCE 601.6	3	3
Average	**2.67**	**2.67**

KCE602 TRANSPORTATION ENGINEERING   (L-T-P 3-0-0)   Credit- 3

UNIT-1
Introduction: Role of Transportation, Modes of Transportation History of road development, Road types and pattern, Nagpur road plan, Bombay road plan & 3rd 20 Year Road Plan, Highway Alignment & Location Survey: Horizontal Profile, Vertical Profile, FactorsControlling the alignment, Survey forroutelocation, [8]

UNIT-2
Geometric Design(IRC:73-Latest revision): Cross sectional elements, camber, shoulder,sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit andvalleycurves. [8]

UNIT-3
Traffic Engineering: Traffic Characteristics, Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, traffic capacity, density, traffic control devices: signs, Island, signal design by Webster's and IRC method . Intersection at grade and grade separated intersections, design of roundabouts as per IRC: 65-2017. Highway capacity and level of service of rural highways and urban roads as per latestIRC recommendation [8]

UNIT-4
Highway Materials: Properties of Subgrade, Aggregates & Binding materials, Various tests and specifications, Design of Highway Pavement : Types of Pavements, Design factors, Design of bituminous paving mixes; Design of Flexible Pavement by CBR method (IRC : 37- Latest revision), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavementdesign (IRC:58-2015) [8]

UNIT-5
Highway Construction: Construction of Subgrade, Water Bound Macadam (WBM), Wet mix macadam (WMM), Granular Sub Base (GSB),Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Semi dense bituminous concrete (SDBC) andBituminous concrete, Dry lean concrete (DLC), Cement Concrete (CC) road construction, Roller Compacted ConcreteRoads. [8]
Note: All designs and procedure are to be done with reference to latest revision of IRC as given below in reference section

COURSE OUTCOMES

Course Name: KCE-602**: Transportation Engineering**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 602.1	understand role of transportation and history of road development
KCE 602.2	design geometric elements of highways.
KCE 602.3	understand applicability aspects of traffic engineering
KCE 602.4	design rotary intersections, grade separated intersections and signals.
KCE 602.5	learn about various highway materials for road construction.
KCE 602.6	apply various road constructions methods.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
KCE 602.1	2	2	-	-	-	2	2	-	-	-	-	1
KCE 602.2	3	3	1	1	-	2	-	1	-	-	-	2
KCE 602.3	3	3	1	-	-	2	-	1	-	-	-	2
KCE 602.4	3	3	1	-	-	2	-	1	-	-	-	2
KCE 602.5	3	3	-	-	-	2	-	-	-	-	-	2
KCE 602.6	2	2	-	-	-	2	1	-	-	-	-	2
Average	**2.67**	**2.67**	**1.00**	**1.00**	**-**	**2.00**	**1.50**	**1.00**	**-**	**-**	**-**	**1.83**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 602.1	2	2
KCE 602.2	2	2
KCE 602.3	3	3
KCE 602.4	3	3
KCE 602.5	3	3
KCE 602.6	3	3
Average	**2.67**	**2.67**

KCE603ENVIRONMENTAL ENGINEERING   (L-T-P 3-1-0)   Credit - 4

Unit-I
Fresh water, water demands, variation in demands, population forecasting by various methods, basic needs and factors affecting consumption, design period.
Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakagesandcontrol.[8]

Unit-2
Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, Concept of service and balancing reservoirs.
Capacity of distribution reservoirs: general design guidelines fordistributionsystem.[8]

Unit-3
Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds,BOD, COD etc. quality requirements, standards of water and waste water, disposal of wastewater on land andwaterbodies.[8]

Unit-4
Objectives of water treatment: unit operations, processes, and flow sheets.
Water treatment: screening, sedimentation, determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber.
Primary sedimentation and coagulation, filtration: theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sandfilters.
Disinfection: requirements of an ideal disinfectant; various disinfectants, chlorination and practices of chlorination, water softening andion-exchange process[8]

Unit-5
Objectives of waste water treatment: unit operations, processes, and flow sheets.
Secondary and tertiary treatment: secondary sedimentation and theory of organic matter removal. Working of activated sludge process, trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, rotating biological contactors (RBC).
Anaerobic digestion of sludge: design of low and high rate anaerobic digesters and septic tank. Working of up flow anaerobic sludge blanket (UASB) reactor and other emerging technologies forwastewatertreatment

COURSE OUTCOMES

Course Name: KCE-603**: Environmental Engineering**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
KCE 603.1	identify water demands, methods of population forecasting and factors affecting consumption of water.
KCE 603.2	analyze water storage and distribution systems.
KCE 603.3	Classify different water and wastewater quality parameters.
KCE 603.4	formulate a primary design of a water treatment plant.
KCE 603.5	design filtration and disinfection units.
KCE 603.6	design waste water treatment units.

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 603.1	2	2	-	-	-	3	3	1	-	-	-	2
KCE 603.2	3	3	-	-	-	3	3	1	-	-	-	2
KCE 603.3	2	2	-	-	-	3	3	1	-	-	-	2
KCE 603.4	3	3	1	-	-	2	3	1	-	-	-	2
KCE 603.5	3	3	1	-	-	3	3	1	-	-	-	2
KCE 603.6	3	3	1	-	-	3	3	1	-	-	-	1
Average	**2.67**	**2.67**	**1.00**	**-**	**-**	**2.83**	**3.00**	**1.00**	**-**	**-**	**-**	**1.83**

Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 603.1	2	2
KCE 603.2	2	2
KCE 603.3	3	3
KCE 603.4	3	3
KCE 603.5	3	3
KCE 603.6	3	3
Average	**2.67**	**2.67**

KCE 651TRANSPORTATION ENGINEERING LAB   **(L-T-P 0-0-2)   Credit - 1**

1. To Determine the Crushing Value of CoarseAggregates.
2. To Determine the Impact Value of CoarseAggregates.
3. To determine the Flakiness Index and Elongation Index of CoarseAggregates.
4. To determine the Los Angeles Abrasion Value of CoarseAggregates.
5. To determine the Stripping Value of CoarseAggregates.
6. To determine the penetration Value ofBitumen.
7. To determine the Softening Point of Bituminousmaterial.
8. To determine the Ductility Value of Bituminousmaterial.
9. To determine the Flash and Fire Point of Bituminousmaterial.
10. To determine the Stripping Value of Bituminousmaterial.
11. Classified both directional Traffic VolumeStudy.
12. Traffic Speed Study. (Using Radar Speedometer orEnoscope).
13. Determination of CBR Value of soil sample in the Lab or inField.

Note: A minimum of 8 experiments are to be performed from the list of Experiments.

COURSE OUTCOMES

Course Name: RCE-653**: Transportation Engineering LabYear of study: 2020-21**

On completion of this Lab, the students will be able to	
KCE 651.1	perform the tests of crushing value & impact value of coarse-aggregate.
KCE 651.2	perform the tests of Los Angeles Abrasion value of coarse aggregate & penetration value of bitumen.
KCE 651.3	perform the tests of determination of softening point of bituminous material & flash fire point of bituminous material

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 651.1	3	2	-	2	-	3	-	2	2	-	-	2
KCE 651.2	3	2	-	2	-	2	-	2	2	-	-	2
KCE 651.3	3	1	-	2	-	3	-	1	2	-	-	2
Average	**3**	**1.67**	**-**	**2.00**	**-**	**2.67**	**-**	**1.67**	**2.00**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 651.1	3	2
KCE 651.2	2	2
KCE 651.3	3	2
Average	**2.67**	**2**

KCE 652 ENVIRONMENTAL ENGINEERING LAB   (L-T-P 0-0-2)   Credit -1

1. Determination of turbidity andconductivity.
2. Determination of pH, alkalinity andacidity.
3. Determination of hardness andchlorides.
4. Determination of residualchlorine.
5. Determination of MPN (most probable number) ofcoliforms.
6. Measurement of SPM and PM10 with high volumesampler.
7. Measurement of sound level with sound levelmeter.
8. Determination of total, suspended and dissolvedsolids.
9. Determination ofBOD.
10. Determination ofCOD.
11. Determination of kjeldahlnitrogen.
12. Determination offluoride.
13. Determination of optimum dose of coagulants by Jar TestApparatus.
14. Field Visit of Water/ Sewage Treatment Plant of a nearbyarea.

Note: 1. Experiment at S.NO. 14 is mandatory.
2. Any 8 Experiments out of the S.NO 1 to 13 are to be performed.

COURSE OUTCOMES

Course Name: KCE-652**: Environmental Engineering Lab**   **Year of study: 2020-21**

On completion of this Lab, the students will be able to	
KCE 652.1	Determine turbidity and conductivity & pH, alkalinity and acidity of a waste water sample.
KCE 652.2	Determine hardness and chlorides & residual chlorine of a waste water sample
KCE 652.3	Determine BOD and COD & total, suspended and dissolved particles of a waste water sample

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KCE 652.1	3	3	2	2	-	2	3	2	2	-	-	2
KCE 652.2	3	2	2	2	-	3	3	2	2	-	-	3
KCE 652.3	3	3	2	2	-	3	3	2	2	-	-	3
Average	**3.00**	**2.67**	**2**	**2**	**-**	**2.67**	**3.00**	**2**	**2**	**-**	**-**	**2.67**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
KCE 652.1	2	2
KCE 652.2	3	3
KCE 652.3	3	2
Average	**2.67**	**2.33**

KCE 653   STRUCTURAL DETAILING LAB   (L-T-P 0-0-2) Credit - 1

1. Study of SP34/IS13920/IS456:2000 for detailing of structuralelements.
2. Preparation of working hand sketches and Auto CAD drawings for thefollowing-
   - RC Beams- Simply supported, Continuous,Cantilever
   - T – beam / L-beamfloor
   - Slabs – Simply supported, Continuous, One way and two wayslabs.
   - Columns – Tied Columns and Spirally reinforcedcolumns.
   - Isolated footings for RCColumns.
   - Combined rectangular and trapezoidalfootings.
3. Preparation of bar bendingschedule
4. Detailing of Buildings with respect to Earthquake ResistantDesign
5. Study of full set of structural drawing of a building as made available byInstitute.

COURSE OUTCOMES

Course Name: RCE-654**: Structural Detailing Lab**   **Year of study: 2020-21**

On completion of this Lab, the students will be able to	
RCE 654.1	learn preparation of working drawing for simply supported, continuous and cantilever RC beams & T- beams.
RCE 654.2	learn preparation of working drawing for simply supported one way and two-way slabs & reinforced columns.
RCE 654.3	learn preparation of working drawing for isolated footings for RC Columns & combined footings.

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
RCE 654.1	3	1	-	2	-	2	-	1	-	-	-	2
RCE 654.2	3	1	-	2	-	2	-	2	-	-	-	2
RCE 654.3	3	1	-	2	-	2	-	1	-	-	-	2
Average	**3.00**	**1.00**	**-**	**2.00**	**-**	**2**	**-**	**1.33**	**-**	**-**	**-**	**2**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 654.1	2	2
RCE 654.2	2	2
RCE 654.3	2	2
Average	**2.00**	**2.00**

RCE701 Design of Structure-III   (L-T-P 3-1-0)   **Credit – 4**

NOTE: All design is to be carried as per IS:800-2007

UNIT - I Introduction to steel structures. Advantages and Disadvantages of Steel as a Structural Material. Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Convention for Member Axes, Loads, Dead Load, Live Loads, Environmental Loads, Seismic Forces, Snow and Rain Loads, Erection Loads, Basis for Design, Design Philosophies, Local Buckling of Plate Elements. Introduction to Limit State Design Limit States of Strength, Limit States of Serviceability, Actions
(Loads), Probabilistic Basis for Design.   [8]

UNIT - II Introduction to Riveted, Bolted and Pinned Connections, Riveted Connections, Patterns of Riveted Joints, Bolted Connections, Types of Bolts, Types of Bolted Joints, Load Transfer Mechanism, Failure of Bolted Joints, Specification for Bolted Joints, Bearing-Type Connections, Prying Action, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Slip-Critical Connections, Combined Shear and Tension for Slip-Critical Connections, Working Load Design, Design of eccentric bolted connections . Simple Welded Connections, Types, Symbols, Welding Process, Weld Defects, Inspection of Welds, Assumptions in the Analysis of Welded Joints, Design of Groove Welds, Design of Fillet Welds, Fillet Weld Applied to the Edge of A Plate Or Section, Fillet Weld for Truss Members, Design of Intermittent Fillet Welds, Plug and Slot Welds, Stresses Due To Individual Forces, Combination of Stresses, Failure of Welds, Distortion of Welded Parts, Fillet Weld Vs Butt Weld, Welded Jointed Vs Bolted and Riveted Joints, Design of eccentric welded connections.
                                                                                                     [8]
UNIT – III Introduction to Tension Members, Types of Tension Members, Net Sectional Area, Effective Net Area, Types of Failure, Design Strength of Tension Members, Slenderness Ratio (λ),
Displacement, Design of Tension Member, Lug Angles, Splices, Gusset Plate.   [8]

UNIT – IV Introduction to Compression Members, Effective Length, Slenderness Ratio (λ), Types of Sections, Types of Buckling, Classification of Cross Sections, Column Formula, Design Strength, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Lacing, Batten, Compression Member Composed of Two Components Back-to-Back, Splices, Design of Column Bases.   [8]

UNIT – V Introduction to Beams, Types of Sections, Behaviour of Beam in Flexure, Section Classification, Lateral Stability of Beams, Lateral-Torsional Buckling, Bending Strength of Beams, Laterally Supported Beams, Laterally Unsupported Beams, Shear Strength of Beams, Web Buckling, Bearing Strength, Web Crippling, Deflection, Design Procedure of Rolled Beams, Built-Up Beams (Plated Beams), Purlins, Beam Bearing Plates, Effect of Holes in Beam, Introduction to Plate Girder, Introduction to Gantry Girder.
          [8]

COURSE OUTCOMES

Course Name: RCE-701**: Design of Structure-III**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 701.1	learn the design philosophies of steel structures
RCE 701.2	design riveted, bolted and pinned connections for steel structures.
RCE 701.3	design welded connections for steel structures.
RCE 701.4	design of tension steel members.
RCE 701.5	design of compression steel members.
RCE 701.6	design of various types of steel beams and plate girders.

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
RCE 701.1	2	2	-	-	-	2	-	-	-	-	-	2
RCE 701.2	3	3	-	-	-	2	-	2	-	-	-	2
RCE 701.3	3	3	-	-	-	2	-	2	-	-	-	2
RCE 701.4	3	3	-	-	-	2	-	2	-	-	-	2
RCE 701.5	3	3	1	1	-	2	-	1	-	-	-	2
RCE 701.6	3	2	-	-	-	2	-	2	-	-	-	2
Average	**2.83**	**2.67**	**1.00**	**1.00**	**-**	**2.00**	**-**	**1.80**	**-**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 701.1	2	2
RCE 701.2	3	3
RCE 701.3	3	2
RCE 701.4	3	3
RCE 701.5	3	3
RCE 701.6	3	3
Average	**2.83**	**2.67**

RCE702 Water Resources   (L-T-P 3-0-0)   **Credit - 3**

UNIT – I Hydrology: Hydrological Cycle and its components; Water Budget Equation, Precipitation: Types, measurements and analysis, Evaporation and consumptive use: estimation and measurement techniques.

Irrigation: Necessity and types, Advantages & disadvantages of irrigation; Functions of water in plant growth, Methods of Irrigation, Water requirement of crops, Duty and Delta relationship; Irrigation frequency; Irrigation efficiencies; Principal crops and crop season, crop rotation.

Canal irrigation: Classes and alignment, Parts of a canal system, Command area, curves in channels, channel losses.

Introduction to Sediment Transportation: Suspended and Bed load and its estimation   [8]

UNIT – II Irrigation channels and Design: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, longitudinal cross section, Schedule of area statistics and channel dimensions, cross sections of an Irrigation channel, Lining of Irrigation Canals: Advantages and types; factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining. Water Logging and Drainage Design: effects, causes and anti-water logging measures, Drainage of water logged land. [8]

UNIT – III Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspectsIrrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion.

River Training: Objective and need, classification of rivers, and river training works, meandering,stages, methods of river training, bank protection, Methods for measurement of discharge.

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's theory, Khosla's theory for determination of pressure and exit gradient.

Regulation Works: Falls, Classification; Introduction to design principle of falls, Design of Sarda type and straight glacis tall.Principle and design of Distributory head regulator and cross regulator, canal escape, Bed bars   [8]

UNIT – IV

Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.

Cross drainage works: Necessity and types; Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. [8]

UNIT – V

Dams: classification and selection criteria.

Earth Dams: Classification, causes of failure, Phreatic line, and its determination Introduction to stability analysisGravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks.

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.Hydro-Electric Power: assessment of potential in reference to India, classification of power plants,important terms, types of turbines and their suitability; Power House layout and important structures of a powerhouse.   [8]

COURSE OUTCOMES

Course Name: RCE-702**: Water Resources**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 702.1	analyse the hydrologic cycle, learn the irrigation systems and sediment transport theories
RCE 702.2	design of irrigation channels, canal lining and drainage design
RCE 702.3	design of the regulation and control systems of canal and types of canal irrigation works
RCE 702.4	Learn river training works
RCE 702.5	Design of canal head works and cross drainage works
RCE 702.6	Analyse earth and gravity dams and hydroelectric power plant in India

Mapping of Course Outcome and Program Outcome

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 702.1	2	-	-	-	-	1	-	-	-	-	-	2
RCE 702.2	3	-	-	-	-	2	1	-	-	-	-	2
RCE 702.3	3	-	-	-	-	2	1	-	-	-	-	1
RCE 702.4	3	-	-	-	-	3	1	-	-	-	-	2
RCE 702.5	3	1	2	1	-	2	1	-	-	-	-	2
RCE 702.6	3	-	-	-	-	2	1	-	-	-	-	2
Average	**2.83**	**1.00**	**2.00**	**1.00**	**-**	**2.00**	**1.00**	**-**	**-**	**-**	**-**	**1.83**

Mapping of Course Outcome and Program Specific Outcome

PSO / CO	PSO 1	PSO 2
RCE 702.1	2	2
RCE 702.2	2	2
RCE 702.3	3	2
RCE 702.4	3	3
RCE 702.5	3	3
RCE 702.6	3	3
Average	**2.67**	**2.50**

RCE071 Geology and Soil Mechanics   (L-T-P 3-0-0)   Credit - 3

UNIT- I Minerals: Their physical and detailed study of certain rock forming minerals. Rocks structure of earth and formation of rocks. Texture and classification of rocks. Engineering properties, weathering and suitability of rocks as Engg. materials.   [8]

UNIT- II Stratification and Lamination bedding of rocks. Dip and strike of bed. Rock deformation, Folds, Faults, joints unconformity and their classification, causes and relation to engg. behaviour of rock masses.   [8]

UNIT- III Earthquake, its causes, classification, seismic zones of India and geological consideration for construction of building, projects in seismic areas. Landslides: Causes, classification and preventive measures.   [8]

UNIT –IV Geological investigations for site selection of dams, reservoirs tunnels, bridges and highways. Principles of geophysical explorations methods for subsurface structures. [8]

UNIT- V Clay Mineralogy, index properties of soil, IS classification of soil, shear strength of soil, Effective stresses in soil, stress in soil (Boussiensq, Westergaard theories) & Earth pressure theories and their application.   [8]

Course Name: RCE071**: Geology and Soil Mechanics**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 071.1	Understand about minerals, rocks and engg. properties
RCE 071.2	Learn Stratification and Lamination bedding of rocks, Dip and strike of bed and Rock deformation
RCE 071.3	Understand about Earthquake, geological consideration for construction of building and Landslide
RCE 071.4	Learn site selection of dams geologically and geophysical explorations.
RCE 071.5	learn Clay Mineralogy, index properties of soil, IS classification of soil and shear strength of soil
RCE 071.6	understand the Effective stresses in soil & Earth pressure theories and their applications.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 071.1	3	2	-	-	-	2	-	-	-	-	2	3
RCE 071.2	2	2	-	-	-	3	-	-	-	-	2	3
RCE 071.3	3	2	1	1	-	3	-	-	-	-	3	3
RCE 071.4	3	2	-	-	-	3	1	-	-	-	3	3
RCE 071.5	3	2	-	-	-	2	-	-	-	-	3	2
RCE 071.6	3	2	-	-	-	2	-	-	-	-	3	2
Average	**2.83**	**2**	**1**	**1**	**-**	**2.50**	**1**	**-**	**-**	**-**	**2.67**	**2.67**

**Mapping of Course   Outcome and Program
  Specific Outcome**

PSO CO	PSO 1	PSO 2
RCE 071.1	3	3
RCE 071.2	3	3
RCE 071.3	3	3
RCE 071.4	3	3
RCE 071.5	3	3
RCE 071.6	3	3
Average	**3**	**3**

RCE076 Railways, Airport & Water Ways   (L-T-P 3-1-0)   Credit - 4

UNIT –I Introduction to Permanent Way and its Components: History and administrative setup of Indian Railways; Rails, Type of rails, rail gauges, permanent way formation,– functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, defect in rails, rail fastenings, Fish plates, spikes, chairs, keys, bearing plates. sleepers, Timber, steel, cast iron, concrete and prestressed concrete sleepers, sleeper density, ballast: material, specifications.   [8]

UNIT-II Track Geometrics, Turnouts and Crossings, Stations and Yards: Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings. Different types of stations and Yards: classification and functioning.   [8]

UNIT –III Signalling and Interlocking, Urban Railways: Classification of Signals, method of train working, absolute block system, Centralized train control system, ATS, interlocking of track, principle of interlocking, types of interlocking, high speed track – track requirement, speed limitations, high speed technologies, Urban railway- railway system in urban areas.   [8]

UNIT – IV Introduction to Airport Engineering Air craft characteristics affecting airport planning & design, selection of site for an airport. Airports - layout and orientation, Runway and taxiway design consideration and geometric design. Airport drainage management, Zoning laws, Visual aids and air traffic control, Runway lighting, Runway operation Helipads, hangers, service equipment.   [8]

UNIT – V Water Transport Harbours and ports, Types of Harbours; Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses. Inland waterways: advantages and disadvantages; Development in India. Inland water operation.   [8]

COURSE OUTCOMES

Course Name: RCE-076**: Railways, Airport & Water Ways**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 076.1	understand the various aspects of permanent way and component of Indian Railways.
RCE 076.2	design track geometrics, turnouts, crossings, stations and yards.
RCE 076.3	understand the signalling and interlocking systems of Indian Railways and their applications.
RCE 076.4	understand the urban Railways and their planning.
RCE 076.5	learn the applicability aspects of various components of Airport, runway designs and design parameters of various components of Airport.
RCE 076.6	learn the concept of the harbours and ports for their detailed design.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 076.1	2	2	-	-	-	1	-	-	-	-	-	2
RCE 076.2	3	3	-	-	-	2	-	-	-	-	-	2
RCE 076.3	3	2	1	-	-	2	-	-	-	-	-	2
RCE 076.4	2	2	-	-	-	2	-	-	-	-	-	1
RCE 076.5	3	2	-	-	-	2	-	-	-	-	-	1
RCE 076.6	2	2	-	-	-	2	2	-	-	-	-	1
Average	**2.50**	**2.17**	**1.00**	**-**	**-**	**1.83**	**2.00**	**-**	**-**	**-**	**-**	**1.50**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 076.1	2	2
RCE 076.2	3	3
RCE 076.3	3	2
RCE 076.4	2	2
RCE 076.5	3	3
RCE 076.6	3	3
Average	**2.67**	**2.50**

ROE071 Modelling and Simulation of Dynamic Systems

Unit 1- Introduction to modeling and simulation:
Introduction to modeling, Examples of models, modeling of dynamic system, Introduction to simulation, MATLAB as a simulation tool, Bond graph modeling, causality, generation of system equations,

Unit 2- Bond graph modeling of dynamic system:
Methods of drawing bond graph model- Mechanical systems & Electrical systems, some basic system modelsMechanical systems, Thermal systems, hydraulic systems, pneumatic systems and electrical systems.

Unit 3- System models of combined systems: Linearity and non linearity in systems combined rotary and translatory system, electro mechanical system, hydromechanical system,

Unit 4- Dynamic Response and System Transfer Function:
Dynamic response of 1st order system and 2nd order system, performance measures for 2nd order system, system transfer function, transfer function of 1st and 2nd order system Block diagram algebra, signal flow diagram, state
variable formulation, frequency response and bode plots.

Unit 5- Simulation and simulation applications:
Simulation using SIMULINK, examples of simulation problems- simple and the compound pendulum, planner mechanisms, validation and verification of the simulation model, parameter estimation methods, system
identifications, introduction to optimization,

COURSE OUTCOMES

Course Name: ROE071: Modelling and Simulation of Dynamic Systems

Year of study: 2020-21

	On completion of this course, the students will be able to
ROE 071.1	Define, describe and apply basic concepts related to modeling and simulation.
RCE 076.2	Construct bond graphs for the type of systems mentioned above, simplify and analyze the bond graph according to causality conflicts, and from a given bond graph without conflicts.
ROE 071.3	Use conservation laws and constitutive relationships and other physical relations to model mechanical, electrical and flow systems, and combinations of these.
ROE 071.4	Find dynamic response and transfer function using various tools for system modelling.
ROE 071.5	Model and simulate mechanical and electrical systems using the computer tools Simulink.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ROE 071.1	3	2	1	-	-	2	2	-	-	-	-	3
RCE 076.2	3	2	1	-	-	2	2	-	-	-	-	3
ROE 071.3	3	2	1	-	-	2	2	-	-	-	-	3
ROE 071.4	3	2	1	-	-	2	2	-	-	-	-	3
ROE 071.5	3	2	1	-	-	2	2	-	-	-	-	3
Average	**3**	**2**	**1**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**3**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
ROE 071.1	1	1
RCE 076.2	1	1
ROE 071.3	1	1
ROE 071.4	1	1
ROE 071.5	1	1
Average	**1**	**1**

RCE751 Non Destructive Testing Laboratory   **(L-T-P 0-0-2)**   **Credit - 1**

NOTE: Student will have to perform minimum 3 test on concrete & two test on structural steel

1. **Non Destructive Testing of reinforced cement concrete**
   a. Strength assessment using rebound hammer
   b. Quality assessment using ultrasonic puls velocity test
   c. Strength assessment using pull out method
   d. Assessment of corrosion of reinforcing bars using half cell potentiometer
   e. To determine thickness of concrete cover, diameter & spacing of reinforcing bars using rebar scanner.
2. **Testing of structural steel**
   a. Testing for corrosion of structural steel
   b. Assessment of thickness of pipes/tubes/structural steel
   c. Test for welding performance with Di-penetration test, ultrasonic test & magnetic particle test

<div align="center">

COURSE OUTCOMES

</div>

Course Name: RCE-751**: Non Destructive Testing Laboratory**   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 751.1	determine the compressive strength of the concrete by using rebound hammer, ultrasonic puls velocity test and pull out method
RCE 751.2	assess the corrosion in the reinforcement bar and determine thickness of concrete cover, diameter & spacing of reinforcing bars
RCE 751.3	analyse the characteristic of structural steel by using various laboratory test such as corrosion and welding performance.

<div align="center">

Mapping of Course Outcome and Program Outcome

</div>

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 751.1	3	-	-	-	2	3	2	1	2	-	-	1
RCE 751.2	3	-	-	-	2	3	2	1	2	-	-	1
RCE 751.3	3	-	-	-	2	3	3	1	2	-	-	1
Average	**3**	**-**	**-**	**-**	**2**	**3**	**2.33**	**1**	**2**	**-**	**-**	**1**

<div align="center">

Mapping of Course Outcome and Program Specific Outcome

</div>

PSO CO	PSO 1	PSO 2
RCE 751.1	2	2
RCE 751.2	2	2
RCE 751.3	2	2
Average	**2**	**2**

RCE753Industrial Training   **Credit – 1**

COURSE OUTCOMES

Course Name : RCE 753: Industrial Training   **Year of study:2020-21**

On completion of this course, the students will be able to	
RCE 753.1	understand basic terminology of a particular Civil Engineering Industry & its components
RCE 753.2	understand the relationship between components of a particular Civil Engineering Industry & its system of working
RCE 753.3	apply appropriate practical experience in various working procedures related to Civil Engineering Industry

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 753.1	2	2	-	-	-	2	1	1	3	2	2	3
RCE 753.2	3	2	-	-	-	2	1	1	3	2	2	3
RCE 753.3	2	2	-	-	-	2	1	1	3	2	2	3
RCE 753	**2.33**	**2.00**	**-**	**-**	**-**	**2.00**	**1.00**	**1.00**	**3.00**	**2.00**	**2.00**	**3.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 753.1	1	1
RCE 753.2	2	2
RCE 753.3	2	2
RCE 753	**1.67**	**1.67**

RCE754 Project-I   (L-T-P 0-0-4)   **Credit – 8**

COURSE OUTCOMES

Course Name: RCE 875: Project   **Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 754.1	Identify complex civil engineering problems based on current state of art and demonstrate knowledge of mathematics, science, engineering fundamentals and domain knowledge in Civil Engineering to the solution of complex engineering problems
RCE 754.2	demonstrate an ability to understand the design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations
RCE 754.3	demonstrate the research-based knowledge to systematize the research methods including design and conduct of experiments, analysis and interpretation of data with an understanding of the limitation and synthesis of the information to provide valid conclusions within the specified time frame
RCE 754.4	understand the impact of professional engineering solutions in social, ethical, environmental, and cultural contexts and demonstrate the knowledge of and need for sustainable development
RCE 754.5	understand and apply engineering principles and modern tools to achieve the specified objectives.
RCE 754.6	able to communicate effectively on complex engineering activities with the engineering community and society at large, such as, being able to comprehend and write effective reports and design documents, make effective presentations, and give /receive clear instructions as an individual and as team member.

Mapping of Course Outcome and Program Outcome

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 754.1	3	3	3	1	1	2	1	1	2	1	1	2
RCE 754.2	3	3	3	1	2	2	1	2	3	1	1	2
RCE 754.3	3	3	3	1	3	1	1	2	2	1	1	2
RCE 754.4	3	2	2	1	2	3	3	3	2	1	1	2
RCE 754.5	3	2	2	1	3	2	1	2	2	1	2	2
RCE 754.6	3	2	2	1	2	2	1	2	2	3	1	2
RCE 754	**3.00**	**2.50**	**2.50**	**1.00**	**2.17**	**2.00**	**1.33**	**2.00**	**2.17**	**1.33**	**1.17**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO / CO	PSO 1	PSO 2
RCE 754.1	1	1
RCE 754.2	3	3
RCE 754.3	3	3
RCE 754.4	2	2
RCE 754.5	3	3
RCE 754.6	1	1
RCE 754	**2.17**	**2.17**

ROE086 RENEWABLE ENERGY RESOURCES   L T P 3 0 0

Introduction:Variousnon-conventionalenergyresources-Introduction, availability, classification, relative merits and demerits. **Solar Cells**: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling,limitations.

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo- thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.

Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. **Fuel Cells**: Principle of working of various types of fuel cells and their working, performance andlimitations.

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. **Wind Energy**: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. performance and limitations of energy conversionsystems.

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

COURSE OUTCOMES

Course Name: ROE086: RENEWABLE ENERGY RESOURCES   Year of study: 2020-21

On completion of this course, the students will be able to	
ROE 086.1	Understand the Various non-conventional energy resources and their merits and demerits.
ROE 086.2	Illustrate the concept of Solar Cells and Solar Thermal Energy utilization in various applications.
ROE 086.3	Comprehend the concept of Geothermal, Magneto-hydrodynamics (MHD) power plants and Fuel Cells & their applications.
ROE 086.4	Identify Winds energy as alternate form of energy and to know how it can be tapped.
ROE 086.5	Describe the Biomass resources and its conversion.
ROE 086.6	Understand and analyze the Ocean Thermal Energy Conversion (OTEC) and Wave and Tidal Wave energy resources.

Mapping of Course Outcome and Program Outcome

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ROE 086.1	3	2	1			2	2					3
ROE 086.2	3	2	1			2	2					3
ROE 086.3	3	2	1			2	2					3
ROE 086.4	3	2	1			2	2					3
ROE 086.5	3	2	1			2	2					3
ROE 086.6	3	2	1			2	2					3
Average	3.00	2.00	1.00			2.00	2.00	-	-	-	-	3.00

Mapping of Course Outcome and Program Specific Outcome

PSO / CO	PSO 1	PSO 2
ROE 086.1	1	1
ROE 086.2	1	1
ROE 086.3	1	1
ROE 086.4	1	1
ROE 086.5	1	1
ROE 086.6	1	1
Average	1	1

RCE084 SolidWasteManagement　　　　　**(L-T-P 3-1-0)**　　　　　**Credit -4**

UNIT-I Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal. Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. Storage: movable bins, fixed bins. Collection: home to home collection,
communitybinsystem.Theoryanddesignofhauledcontainersystem,stationarycontainersystem.

UNIT-II Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing,pelletingequipments.　　　　　**[8]**

UNIY-III Landfilling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate, Introduction toengineeredlandfills.　　　　　**[8]**

UNIT-IV Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system. Overview of solid waste management practicesinIndia.　　　　　**[8]**

UNIT-V Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization　and resource recovery, Transportation of hazardous waste, Disposal of hazardous waste.
Introduction to Electronic waste and Biomedical waste and theirdisposal.　　　　　**[8]**

COURSE OUTCOMES

Course Name: RCE-084: Solid Waste Management　　　　**Year of study: 2020-21**

On completion of this course, the students will be able to	
RCE 084.1	understand solid waste management sources, types, functional elements and to explain the hierarchical structure in solid waste management and a requirement for an integrated solution.
RCE 084.2	select the appropriate method for transportation and handling of solid waste.
RCE 084.3	explain the operation and maintenance of landfill
RCE 084.4	examine the operation of composting and energy recovery from waste
RCE 084.5	describe hazardous waste and its disposal
RCE 084.6	gain knowledge on E-Waste and biomedical waste and their disposal

Mapping of Course Outcome and Program Outcome

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
RCE 084.1	2	1	3	-	-	-	2	-	1	-	1	2
RCE 084.2	2	1	3	-	2	2	2	2	2	-	1	2
RCE 084.3	2	1	2	-	-	2	2	-	2	-	1	2
RCE 084.4	2	1	2	-	-	-	2	-	2	-	1	2
RCE 084.5	2	1	2	-	-	2	3	2	1	-	1	2
RCE 084.6	2	1	2	-		2	3	2	1	-	1	2
Average	**2**	**1**	**2.3**	**-**	**2**	**2**	**2.33**	**2**	**1.5**	**-**	**1**	**2**

Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 084.1	1	1
RCE 084.2	1	1
RCE 084.3	1	1
RCE 084.4	1	1
RCE 084.5	1	1
RCE 084.6	1	1
Average	**1**	**1**

RCE085 Engineering Hydrology & Groundwater Management (L-T-P 3-0-0) Credit - 3

UNIT – I Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities indices, measurement&estimation. **[8]**

UNIT – II Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneousunithydrographs. **[8]**

UNIT – III Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method offloodrouting. **[8]**

UNIT – IV Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology & aquifers, Ground watermovement.
Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single& Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses,specificcapacity. **[8]**

UNIT – V Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells.
Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, Artificial discharge and Recharge of Ground Water, Roof-top rainwater harvestingandrecharge. **[8]**

COURSE OUTCOMES

Course Name: RCE-085**: Engineering Hydrology and Ground Water Management**

Year of study: 2020-21

On completion of this course, the students will be able to	
RCE 085.1	understand the various aspects of hydrological cycle & definitions, hydrologic systems precipitation, evaporation, infiltration and evapotranspiration.
RCE 085.2	analyse the direct runoff, unit hydrographs ,s-curve hydrograph, synthetic and instantaneous unit hydrographs used for the analysis of runoff.
RCE 085.3	analyse and estimate hydrologic and hydraulic flood routing, flood frequencies and flood forecasting.
RCE 085.4	analyse steady and unsteady flow through confined and unconfined aquifers, Dupuits theory, well hydraulics, mutual interference of wells, well losses, specific capacity.
RCE 085.5	design the water wells and pumping equipment for water wells.
RCE 085.6	understand ground water quality, contamination of groundwater and its control, ground water modeling techniques and ground water exploration, rain water harvesting.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 085.1	2	2	-	-	-	2	-	-	-		-	2
RCE 085.2	2	2	-	-	-	2	2	-	-		-	2
RCE 085.3	3	2	2	1	-	2	2	2	-		-	2
RCE 085.4	3	3	-	-	-	2	2	-	-		-	2
RCE 085.5	2	2	2	1	-	2	2	-	-		-	2
RCE 085.6	2	2	-	-	1	2	2	-	-		-	2
Average	**2.33**	**2.17**	**2.00**	**1.00**	**1.00**	**2.00**	**2.00**	**2.00**	**-**	**-**	**-**	**2.00**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 085.1	2	2
RCE 085.2	2	3
RCE 085.3	3	2
RCE 085.4	2	2
RCE 085.5	3	2
RCE 085.6	3	3
Average	**2.5**	**2.33**

RCE086 Urban Transportation System&Planning　　　　(L-T-P 3-0-0)　　　　**Credit -3**

UNIT-I Introduction to transportation planning, the planning concept, Goals, objective and Importance of transportation planning. Nature of traffic problems in cities. Present Scenario of road transport and rail transport assets. Role of transportation: Social, Political, Environmental. Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation,FutureDevelopments. **[8]**

UNIT- II Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Types of transport systems, evolution of transport modes, transport problems and mobility issues. Public Transport: Intermediate Public Transport (IPT) Rapid and mass transport system like MRTS & bus rapid transit. Transport Planning Process, Problem Definition, SolutionGeneration. **[8]**

UNIT- III Travel demand: Estimation and fore casting, trip classification, trip generation: factor and methods, multiple regression analysis. Trip distribution methods, modal split, tripassignment. **[8]**

UNIT- IV Studying travel behavior. Analyzing urban travel markets. Traffic and transportation surveys and studies, traffic and travel characteristics, urban transport planning process – stages, study area,zoning,database, **[8]**

UNIT-V Evaluation of transport planning proposals: Land Use Transport Planning, Economic Evaluation methods like Net present Value methods, Benefit Cost method. Transport system management: Long term and shorttermplanning. **[8]**

COURSE OUTCOMES

Course Name: RCE-086**: Urban Transportation System & Planning**

Year of study: 2020-21

On completion of this course, the students will be able to	
RCE 086.1	understand the various aspects of social, political, and environmental role of transportation.
RCE 086.2	understand objective, goal and need of transportation planning.
RCE 086.3	learn the type of transportation systems and their applications.
RCE 086.4	analyse the travel demand and trip generation.
RCE 086.5	understand the evaluation of transport planning proposals and long and short term planning.
RCE 086.6	understand the various aspects of the transport management system and their applications.

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 086.1	1	-	-	-	-	1	-	-	-	-	-	2
RCE 086.2	2	-	-	-	-	2	-	-	-	-	-	3
RCE 086.3	2	2	-	-	-	3	-	-	-	-	-	2
RCE 086.4	3	3	-	-	-	2	-	1	-	-	-	3
RCE 086.5	3	2	2	-	-	2	-	1	-	-	-	2
RCE 086.6	2	2	-	-	-	2	-	-	-	-	-	2
Average	**2.17**	**2.25**	**2.00**	**-**	**-**	**2.00**	**-**	**1.00**	**-**	**-**	**-**	**2.33**

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 086.1	2	2
RCE 086.2	2	2
RCE 086.3	3	2
RCE 086.4	3	3
RCE 086.5	3	3
RCE 086.6	3	3
Average	**2.67**	**2.5**

RCE851 Seminar   **(L-T-P 0-0-4)**   **Credit – 1**

COURSE OUTCOMES

Course Name : RCE 851: Seminar   **Year of study:2020-21**

On completion of this course, the students will be able to	
RCE 851.1	understand the process of selection of a Technical topic & gathering the technical information related with the topic with relevant engineering knowledge.
RCE 851.2	understand the methodology to systematize the gathered information on the topic & organize the presentation
RCE 851.3	identifying the most relevant technical aspects for a preparation of effective presentation with use of graphics and ppt

Mapping of Course Outcome and Program Outcome

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 851.1	2	1	-	-	1	2	1	1	1	3	-	1
RCE 851.2	2	1	-	-	1	2	1	1	1	3	-	1
RCE 851.3	2	1	-	-	1	2	1	1	1	3	-	1
RCE 851	2.00	1.00	-	-	1.00	2.00	1.00	1.00	1.00	3.00	-	1.00

Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
RCE 851.1	1	1
RCE 851.2	3	2
RCE 851.3	1	1
RCE 851	**1.67**	**1.33**

RCE852Project   (L-T-P 0-0-4)   Credit – 8
COURSE OUTCOMES

Course Name: RCE 852: Project   Year of study: 2020-21

On completion of this course, the students will be able to	
RCE 852.1	Identify complex civil engineering problems based on current state of art and demonstrate knowledge of mathematics, science, engineering fundamentals and domain knowledge in Civil Engineering to the solution of complex engineering problems
RCE 852.2	demonstrate an ability to understand the design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations
RCE 852.3	demonstrate the research-based knowledge to systematize the research methods including design and conduct of experiments, analysis and interpretation of data with an understanding of the limitation and synthesis of the information to provide valid conclusions within the specified time frame
RCE 852.4	understand the impact of professional engineering solutions in social, ethical, environmental, and cultural contexts and demonstrate the knowledge of and need for sustainable development
RCE 852.5	understand and apply engineering principles and modern tools to achieve the specified objectives.
RCE 852.6	able to communicate effectively on complex engineering activities with the engineering community and society at large, such as, being able to comprehend and write effective reports and design documents, make effective presentations, and give /receive clear instructions as an individual and as team member.

Mapping of Course Outcome and Program Outcome

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 852.1	3	3	3	1	1	2	1	1	2	1	1	2
RCE 852.2	3	3	3	1	2	2	1	2	3	1	1	2
RCE 852.3	3	3	3	1	3	1	1	2	2	1	1	2
RCE 852.4	3	2	2	1	2	3	3	3	2	1	1	2
RCE 852.5	3	2	2	1	3	2	1	2	2	1	2	2
RCE 852.6	3	2	2	1	2	2	1	2	2	3	1	2
RCE 852	3.00	2.50	2.50	1.00	2.17	2.00	1.33	2.00	2.17	1.33	1.17	2.00

Mapping of Course Outcome and Program Specific Outcome

PSO / CO	PSO 1	PSO 2
RCE 852.1	1	1
RCE 852.2	3	3
RCE 852.3	3	3
RCE 852.4	2	2
RCE 852.5	3	3
RCE 852.6	1	1
RCE 852	2.17	2.17