SEMESTER-III

S. No.	Subject Code	Subject	L	T	P	Credit
1	ESC-305	Computer-aided Civil Engineering Drawing	1	0	4	3
2	ESC-306	Engineering Mechanics	3	1	0	4
3	ESC-307	Energy Science & Engineering	2	1	0	3
4	BSC-235	Mathematics-III	3	1	0	4
5	HSMC-303	Human Value & Professional Ethics	2	1	0	3
6	PCC-CE301	Introduction to Solid Mechanics	3	1	2	5
		Total				**22**

ESC-305	**Computer-aided Civil EngineeringDrawing**	**1L:0T:4P**	**3 credits**

Objectives:

The students will be able to

- a) Develop Parametric design and the conventions of formal engineeringdrawing
- b) Produce and interpret 2D & 3Ddrawings
- c) Communicate a design idea/concept graphically/visually
- d) Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- e) Get a Detailed study of an engineeringartifact

Syllabus (No. of lectures shown within brackets)

Module 1:*INTRODUCTION***;** Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.(2)

Module 2:*SYMBOLS AND SIGN CONVENTIONS*: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards (2)

Module 3: *MASONRY BONDS:*English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall (1)

Module 4: *BUILDING DRAWING*: Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity (7)

Module 5:*PICTORIAL VIEW*: Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modeling (BIM) (3)

Total 15 sessions

It may be advisable to conduct Theory sessions along with Lab demonstrations.

List of Drawing Experiments:

1. Buildings with load bearing walls including details of doors andwindows.
2. Taking standard drawings of a typical two storeyed building includingall

MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500 -700 words.

3. RCC framed structures09
4. Reinforcement drawings for typical slabs, beams, columns and spread footings.09
5. Industrial buildings - North light roof structures - Trusses06
6. Perspective view of one and two storey buildings06

Total L: 15 + P:45=60

Text/ReferenceBooks:

1. Subhash C Sharma &Gurucharan Singh (2005), "Civil Engineering Drawing", StandardPublishers.

2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, NewDelhi

3. Sham Tickoo Swapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education,

4. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt.Ltd.,

5. Balagopal and Prabhu (1987), " Building Drawing and Detailing" , Spades publishing KDR building,Calicut,

6. (Corresponding set of) CAD Software Theory and UserManuals.

7. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech PublicationLtd NewAsian.

8. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria&Sons,

Outcomes:

The course should enable the students to

i) To develop graphical skills for communicating concepts, ideas and designs of engineering products graphically/ visually as well as understand anotherperson's designs,

ii) get exposure to national standards relating to technical drawings using Computer Aided Design and Draftingpractice

iii) Develop Parametric design and the conventions of formal engineeringdrawing

iv) Produce and interpret 2D & 3Ddrawings

v) Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3Dsoftware.

vi) Do a detailed study of an engineeringartefact

vii) Develop drawings for conventional structures using practicalnorms.

ESC306	**Engineering Mechanics**	**3L:1T:0P**	**4 credit**

The objective of this Course is to provide an introductory treatment of *Engineering Mechanics* to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions. Lab should be taken concurrently

What Will I Learn?

a) Confidently tackle equilibrium equations, moments and inertiaproblems

b) Master calculator/computing basic skills to use to advantage in solving mechanics problems.

c)Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering

Syllabus

Module 1: *Introduction to Engineering Mechanics covering,* Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

Module 2: *Friction covering,* Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Module 3: *Basic Structural Analysis covering,* Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension

or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines; **Module 4**: *Centroid and Centre of Gravity covering,* 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.

Module 5: *Virtual Work and Energy Method-* Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Module 6: *Review of particle dynamics-* Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Module 7:*Introduction to Kinetics of Rigid Bodies covering,* 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;

Module 8:*Mechanical Vibrations covering,* Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;

Tutorials *from the above modules covering*, Tofind the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screwjack

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4thEdition, PrenticeHall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol. I - Statics, Vol. II, – Dynamics, 9th Ed, Tata McGrawHill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, PearsonPress.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics,OxfordUniversityPress
5. Shanes and Rao (2006), Engineering Mechanics, PearsonEducation,

6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) byPearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's EngineeringMechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, LaxmiPublications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand &Co.
10. Tayal A.K. (2010), Engineering Mechanics, UmeshPublications

Upon successful completion of the course, student should be able to:

Use scalar and vector analytical techniques for analyzing forces in statically determinate structures

- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practicalproblems
- Apply basic knowledge of math's and physics to solve real-worldproblems
- Understand measurement error, and propagation of error in processeddata
- Understand basic kinematics concepts – displacement, velocity and acceleration(and their angularcounterparts);
- Understand basic dynamics concepts – force, momentum, work andenergy;
- Understand and be able to apply Newton's laws ofmotion;
- Understand and be able to apply other basic dynamics concepts - the Work-Energyprinciple, Impulse-Momentum principle and the coefficient ofrestitution;
- Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments offorces)
- Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy;and
- Attain an introduction to basic machine parts such as pulleys and mass-spring systems.

ESC307	Energy Science & Engineering	2L:1T:0P	3credit

The objective of this Course is to provide *an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alter- native energy sources and their technology and application. The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternatives, renewable energy sources such as solar, biomass (conversions), wind power, waves and tidal, geothermal, ocean thermal, hydro and nuclear. Energy conservation methods will be emphasized* from Civil Engineering perspective. The knowledge acquired lays a good foundation for design of various civil engineering systems/ projects dealing with these energy generation paradigms in an efficientmanner.

Syllabus

Module 1: Introduction to Energy Science: Scientific principles and historical interpretation to *place ener*gy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment

Module 2: *Energy Sources:* Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energysystems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiencybatteries)

Module 3:*Energy & Environment:* Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environ- mental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy

Module 4: *Civil Engineering Projects connected with the Energy Sources:* Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems

Module 5: *Engineering for Energy conservation:* Concept of Green Building and Green Architecture;Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); *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 energy consumption

S.	Module	No of	Tutorial- to be derived for each module; typical

No		Lectures	Examples given below.
1	Introduction to Energy Science	3	Compile a World map showing Energy Reserves by source, Total Energy consumption, Per capita energy consumption and Carbon Footprint

2	Energy Sources	4	Compile a Word Map showing Alternative Energy source usage; Compile a Process diagram for a Pumped Storage project; Collect details of a typical North Sea oil platform. Compile a map of India showing exiting potential and utilized potential for hydro power. List the pros and cons for Thermal, hydro, nuclear and solar power projects.
3	Energy & Environment	5	Study the functioning of an Electro Static Precipitator in a thermal power plant; study the uses of coarse and fine Fly Ash from thermal power plants. Compile the safety provisions in design and construction of a reactor containment building
4	Civil Engg. projects connected with Energy Sources	10	Compile a process diagram for a typical underground hydro power project; Collect details of a model solar chimney project; collect details of a wave energy project at Vizhinjam; Collect details of the Kalpasar (Tidal energy) project
5	Engineering for Energy Conservation	8	Draw a typical geometrical orientation of a house in your area to avoid sun's radiation in the bed room in the evening; Identify typical examples of Indian buildings having various LEED ratings; List various building materials with their embodied energy content. Do an Energy Audit of your Departmental Building in the college
	TOTAL	**30**	**30**

Text/Reference Books:

1. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford UniversityPress
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford UniversityPress
3. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The CompleteGuide to Renewable Energy Technologies and Sustainable Living,Gaiam
4. Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Math- ematics of Decision Making, Loulou, Richard; Waaub,XVIII,
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, JohnWiley
6. UNDP (2000), Energy and the Challenge of Sustainability, World Energyassessment
7. EHThorndike(1976),Energy&Environment:APrimerforS

cientistsand Engineers, Addison-Wesley PublishingCompany

8. Related papers published in internationaljournals

Upon successful completion of the course, the students will be able to:

a) List and generally explain the main sources of energy and their primary applications nationally andinternationally

b) Have basic understanding of the energy sources and scientific concepts/principles behind them

c) Understand effect of using these sources on the environment andclimate

d) Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on theenvironment.

e) List and describe the primary renewable energy resources andtechnologies.

f) To quantify energy demands and make comparisons among energy uses, resources, and technologies.

g) Collect and organize information on renewable energy technologies as a basis for further analysis andevaluation.

h) Understand the Engineering involved in projects utilising thesesources.

BSC235	Mathematics-III	3L:1T:0P	4 credit

Syllabus:

Module 8a: *Transform Calculus* **-1** (Prerequisite 2c, 5b-d, 6b) (10 hours)

Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials;

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Module 8b:*Transform Calculus***-2** (10 hours)

Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications.

Module 9a:*Sets, relations and functions***:** (8 hours)

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

Module 9b:*Propositional Logic:* (6 hours)

Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem, etc. Decision problems of propositional logic. Introduction to first order logic and first order theory.

Module 9c: *Partially ordered sets:* (6 hours)

Complete partial ordering, chain, and lattice, complete, distributive, modular and complemented lattices. Boolean and pseudo Boolean lattices.

Module 9d: *Algebraic Structures:* (6 hours)

Algebraic structures with one binary operation-semigroup, monoid and group. Cosets, La- grange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).

Module 9e: *Introduction to counting :* (6 hours)

Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.

Module 9f: *Introduction to Graphs:* (8 hours)

Graphs and their basic properties – degree, path, cycle, sub graph, isomorphism, Eulerian and Hamiltonian walk, trees.

Textbooks/References:

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,2000.
2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific,1999.
3. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addi- son-Wesley, 1994.
4. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill, 2007.
5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones andBartlett, 2010.
6. N. Deo, Graph Theory, Prentice Hall of India,1974.
7. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,1999.
8. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Com- puter Science, Tata McGraw-Hill,1997.

PCC-CE301	Introduction to Solid Mechanics	3L:1T:2P	5 credits

The objective of this Course is to introduce to continuum mechanics and material modelling of engineering materials based on first energy principles: deformation and strain; momentum balance, stress and stress states; elasticity and elasticity bounds; plasticity and yield design. The overarching theme is a unified mechanistic language using thermodynamics, which al- lows understanding, modelling and design of a large range of engineering materials. The subject of mechanics of materials involves analytical methods for determining the strength,

stiffness (deformation characteristics), and stability of the various members in a structural sys- tem. The behaviour of a member depends not only on the fundamental laws that govern the equilibrium of forces, but also on the mechanical characteristics of the material. These mechanical characteristics come from the laboratory, where materials are tested under accurately known forces and their behaviour is carefully observed and measured. For this reason, mechanics of materials is a blended science of experiment and Newtonian postulates of analytical mechanics.

Syllabus

Module1: *Simple Stresses and Strains-* Concept of stress and strain, St. Venant's principle, stress and strain diagram,Elasticity and plasticity – Types of stresses and strains, Hooke's law

– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simpleapplications.

Module 2: Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

Module 3: Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Module 4: *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.

Module 5: *Shear Stresses- Derivation of formula* – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Module 6: 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.

Module 7: Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.

Module 8: Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

List of Experiments:

- Tension test
- Bending tests on simply supported beam and Cantileverbeam.
- Compression test onconcrete
- Impacttest
- Sheartest
- Investigation of Hook's law that is the proportional relation between force and stretching in elasticdeformation,
- Determination of torsion anddeflection,
- Measurement of forces on supports in statically determinatebeam,
- Determination of shear forces inbeams,
- Determination of bending moments inbeams,
- Measurement of deflections in statically determinatebeam,
- Measurement of strain in abar
- Bend test steelbar;
- Yield/tensile strength of steelbar;

Text/Reference Books:

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

Outcomes:

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

- Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanicalcomponents;
- Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energymethods;
- Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams; and

Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walledmembers.