

**Semester III (Second year)**  
**Branch/Course Civil Engineering**

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Engineering Science Courses	ESC202	Basic Electronics	1	0	2	2
2	Basic Science courses	BSC109	Biology for Engineers	2	0	2	3
3	Engineering Science Courses	ESC203	Computer-aided Civil Engineering Drawing	1	0	2	2
4	Engineering Science Courses	ESC205	Engineering Mechanics	4	0	0	4
5	Professional Core courses	PCC-CE206	Surveying & Geomatics	2	0	2	3
6	Basic Science courses	BSC201	Mathematics-III (Probability, Theory & Statistics)	2	0	0	2
7	Humanities and Social Sciences including Management courses	HSMC201	Humanities-I (Effective Technical Communication)	3	0	0	3
8	Humanities and Social Sciences including Management courses	HSMC251	Introduction to Civil Engineering	2	0	0	2
9	Internship and Industrial Visit	INTC201	Internship				4
				<b>Total credits</b>			<b>25</b>

## 101 CE

ESC202	Basic Electronics	1L:0T:2P	2 credits
--------	-------------------	----------	-----------

The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in Civil Engineering applications. Lab should be taken concurrently. This course emphasizes more on the laboratory/practical use of the knowledge gained from the course lectures.

### What Will I Learn?

- a) Know broadly the concepts and functionalities of the electronic devices, tools and instruments
- b) Understand use, general specifications and deployabilities of the electronic devices, and assemblies
- c) Confidence in handling and usage of electronic devices, tools and instruments in engineering applications

### **Proposed Syllabus** (All modules to provide only broad overview)

**Module 1:** *Diodes and Applications* covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs,

Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications;

**Module 2:** *Transistor Characteristics* covering, Bipolar Junction Transistor (BJT) –

Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect

Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;

**Module 3:** *Transistor Amplifiers and Oscillators* covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;

**Module 4:** *Operational Amplifiers and Applications* covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground;

### **Practicals:**

**Module 1:** Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread

Boards and Printed Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;

**Module 2:** Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and

Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; (CRO);

**Module 3:** Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator,

Input and Output Characteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration;

**Module 4:** Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers, Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators; Module 5: Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation, Applications of 555 Timer – Astable and Monostable Multivibrators;

**Module 6:** Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop ICs; Serial-In-Serial-Out and Serial-In-Parallel-Out Shift operations using 4-bit/8-bit Shift Register ICs; Functionality of Up-Down / Decade Counter ICs; (15 Sessions)

**Text/Reference Books:**

1. David. A. Bell (2003), *Laboratory Manual for Electronic Devices and Circuits*, Prentice Hall, India
2. Santiram Kal (2002), *Basic Electronics- Devices, Circuits and IT Fundamentals*, Prentice Hall, India
3. Thomas L. Floyd and R. P. Jain (2009), *Digital Fundamentals* by Pearson Education, 4. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), *Basic Electronics – A Text-Lab. Manual*, TMH
5. R. T. Paynter (2009), *Introductory Electronic Devices & Circuits, Conventional Flow Version*, Pearson

BSC109	Biology (Biology for Engineers)	3L:0T:0P	3 credits
--------	---------------------------------	----------	-----------

[3 credit course; 2 (one hour) lectures and one (one hour) tutorial per week. Only lecture hours are shown]

**Module 1. (2 hours)- Introduction**

**Purpose:** To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18<sup>th</sup> Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

**Module 2. (3 hours)- Classification**

**Purpose:** To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S. cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

**Module 3. (4 hours)-Genetics**

**Purpose:** To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”

Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

**Module 4. (4 hours)-Biomolecules**

**Purpose:** To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

**Module 5. (4 Hours). Enzymes**

**Purpose:** To convey that without catalysis life would not have existed on earth

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

**Module 6. (4 hours)- Information Transfer**

**Purpose:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double

helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

**Module 7. (5 hours). Macromolecular analysis**

**Purpose:** How to analyse biological processes at the reductionistic level

Proteins- structure and function. Hierarchy in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

**Module 8. (4 hours)- Metabolism**

**Purpose:** The fundamental principles of energy transactions are the same in physical and biological world.

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of  $K_{eq}$  and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to  $CO_2 + H_2O$  (Glycolysis and Krebs cycle) and synthesis

of glucose from  $CO_2$  and  $H_2O$  (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

**Module 9. (3 hours)- Microbiology**

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

**Module 10: Plant Physiology covering, Transpiration; Mineral nutrition (3 Lectures)**

**Module 10B: Ecology covering, Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids; (3 Lectures)**

**References:**

- 1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
- 2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
- 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
- 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher  
Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishe

<b>ESC203</b>	<b>Computer-aided Civil Engineering Drawing</b>	<b>1L:0T:2P</b>	<b>2 credits</b>
---------------	---	-----------------	------------------

The students will be able to

- a) Develop Parametric design and the conventions of formal engineering drawing
- b) Produce and interpret 2D & 3D drawings
- 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 engineering artifact

●

**Proposed 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, coordinate 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 Modelling (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 and windows. 09
2. Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500 -700 words. 06
3. RCC framed structures 09

- |    |   |    |
|----|---|----|
| 4. | Reinforcement drawings for typical slabs, beams, columns and spread footings. | 09 |
| 5. | Industrial buildings - North light roof structures - Trusses                  | 06 |
| 6. | Perspective view of one and two storey buildings                              | 06 |

**Total L: 15 + P: 45=60**

**Text/Reference Books:**

1. Subhash C Sharma & Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 2001", Tata- Mc Graw-Hill Company Limited, New Delhi
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 User Manuals.
7. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian.  
Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons

ESC205	Engineering Mechanics	4L:0T:0P	4 credits
--------	-----------------------	----------	-----------

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 behaviour of materials under various load conditions. Lab should be taken concurrently

#### What Will I Learn?

- a) Confidently tackle equilibrium equations, moments and inertia problems
- 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

#### **Proposed 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*, To find 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 screw jack

**Text/Reference Books:**

1. Irving H. Shames (2006), Engineering Mechanics, 4<sup>th</sup> Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics 8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.  
Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

PCC-CE206	Surveying and Geomatics	2L:0T:2P	3 credits
-----------	-------------------------	----------	-----------

### Course Objectives

With the successful completion of the course, the student should have the capability to: a) describe the function of surveying in civil engineering construction,

- b) Work with survey observations, and perform calculations,
- c) Customary units of measure. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements,
- d) Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods,
- e) Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses,
- f) Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check levelling measurements,
- g) Effectively communicate with team members during field activities; identify appropriate safety procedures for personal protection; properly handle and use measurement instruments. Be able to identify hazardous environments and take measures to insure one's personal and team safety,
- h) Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments,
  
- i) Calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse,
- j) Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse. Use appropriate software for calculations and mapping,
- k) Operate a total station to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system,
- l) Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion,
- m) Calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

### Proposed Syllabus:

**Module 1: Introduction to Surveying (8 hours):** Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes.

*Triangulation and Trilateration (6 Hours):* Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation network- Signals. Baseline - choices - instruments and accessories - extension of base lines corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric leveling - Axis single corrections.

**Module 2:** Curves (6 hours) Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves

**Module 3: Modern Field Survey Systems (8 Hours):** Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and

Applications,

Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

**Module 4: Photogrammetry Surveying (8 Hours):** Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotters instruments, mosaics, map substitutes.

**Module 5: Remote Sensing (9 Hours):** Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

**Text/Reference Books:**

- 1 Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
- 2 Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
- 3 Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010 4 Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
- 5 Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 2001.
- 6 Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 201

<b>BSC202</b>	<b>Mathematics III (PDE, Probability &amp; Statistics)</b>	<b>2L:0T:0P</b>	<b>2 credits</b>
---------------	--	-----------------	------------------

**Objectives:**

- (1) To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- (2) To provide an overview of probability and statistics to engineers

**Contents:**

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. **(14 hours)**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule. **(12 hours)**

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. **(12 hours)**

**Course Outcomes:**

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

**Textbooks/References:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.  
N Publications, Reprint, 2010.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall,  
2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. .P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi

<b>HSMC201</b>	<b>Humanities – I (Effective Technical Communication)</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
----------------	---	-----------------	------------------

**Module 1:** Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

**Module 2:** Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

**Module 3:** Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

**Module 4:** Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

**Module 5:** Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

**Text/Reference Books:**

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

<b>HSMC251</b>	<b>Introduction to Civil Engineering</b>	<b>2L:0T:0P</b>	<b>2 credits</b>
----------------	--	-----------------	------------------

When the students enter the college to pursue a degree in Civil Engineering and as well pursue a career in Civil Engineering after graduation, they need to understand the breadth and depth available in this field for possible engagement. When many alternative disciplines of engineering appear to offer apparently more glamorous avenues for advancement, the Civil Engineering student should realize the solid foundations available in this mother of all engineering disciplines. The students should understand the enormous possibilities available for creative and innovative works in this all pervasive field of engineering.

This course is designed to address the following:

- to give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
- to motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

### **Proposed Syllabus**

What is Civil Engineering/ Infrastructure, History of Civil Engineering, Overview of ancient & modern civil engineering marvels, current national planning for civil engineering/ infrastructure projects, scope of work involved in various branches of Civil Engineering – Architecture & Town planning, Surveying & Geomatics, Structural Engineering, Construction Management, Construction materials, Hydrology and Water Resources Engineering, Hydraulic Engineering, Environmental Engineering & Sustainability, Pavement Engineering and construction, Traffic & Transportation Engineering and Management, Geotechnical Engineering, Ocean Engineering, Building Energy Efficiency, Basics of

Contract Management, Professional Ethics, Avenues for entrepreneurial working, Creativity & Innovativeness in Civil Engineering,

### **Modules**

1. **Basic Understanding:** What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career
2. **History of Civil engineering:** Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers
3. **Overview of National Planning for Construction and Infrastructure Development;** Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;
4. **Fundamentals of Architecture & Town Planning:** Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities
5. **Fundamentals of Building Materials:** Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes

6. **Basics of Construction Management & Contracts Management:** Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management
7. **Environmental Engineering & Sustainability:** Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;
8. **Geotechnical Engineering:** Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling
9. **Hydraulics, Hydrology & Water Resources Engineering:** Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multipurpose reservoir projects
10. **Ocean Engineering:** Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures
11. **Power Plant Structures:** Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects
12. **Structural Engineering:** Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies;
13. **Surveying & Geomatics:** Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;
14. **Traffic & Transportation Engineering:** Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples.
15. **Repairs & Rehabilitation of Structures:** Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; NonDestructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs.
16. **Computational Methods, IT, IoT in Civil Engineering:** Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,...GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM, ...)
17. **Industrial lectures:** Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning;
18. **Basics of Professionalism:** Professional Ethics, Entrepreneurial possibilities in Civil Engineering, Possibilities for creative & innovative working, Technical writing Skills enhancement; Facilities Management; Quality & HSE Systems in Construction



## ORGANISATION OF COURSE (2-1-0)

S. No.	Module [No of Lectures within brackets]	Tutorials
1	Basic Understanding (1)	Develop a matrix of various disciplines and possible roles for engineers in each
2	History of Civil engineering (1)	Identify 10 ancient monuments and ten modern marvels and list the uniqueness of each
3	Overview of National planning for Construction and Infrastructure Development (1)	Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project in each area
4	Architecture & Town Planning(1)	Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City
5	Building Materials (2)	Identify three top new materials and their potential in construction; Visit a Concrete Lab and make a report
6	Construction Management, Contracts management (2)	Identify 5 typical construction methods and list their advantages/ positive features
7	Environmental Engineering & Sustainability (2)	Environmental Engineering & Sustainability: Sustainability principles, Sustainable built environment, water treatment systems, good practices of wastewater management. examples of Solid and hazardous waste management, Air pollution and control
8	Geotechnical Engineering (2)	List top five tunnel projects in India and their features; collect and study geotechnical investigation report of any one Metro Rail (underground) project; Visit a construction site and make a site visit report
9	Hydraulics, Hydrology & Water Resources Engineering (1)	Identify three river interlinking projects and their features; visit a Hydraulics Lab and make a report
10	Ocean Engineering, Ports & Harbours (1)	Identify 5 typical ports in India and list the structures available in them; Visit a related/similar facility, if possible in nearby place and make a report
11	Power Plant Structures (1)	Collect the typical layout for a large thermal power plant and a large hydro power plant and identify all the structures and systems falling in them.
12	Structural Engineering (3)	Identify 5 unique features for typical buildings, bridges, tall structures and large span structures; Visit Structures Testing Lab/facility and make a report
13	Surveying & Geomatics (1)	Collect visual representations prepared by a Total Station and LIDAR and compare; Study typical Google street map and Google Earth Map and study how each can facilitate the other

14	Traffic & transportation (1)	Investments in transport infrastructure; Developments and challenges; Intelligent Transport Systems; Smart Cities, Urban Transport; Road Safety; Sustainable and resilient highway design principles; Plan a sustainable transport system for a city; Identify key features/components in the planning and design of a green field highway/airport/port/railway and the cost – economics.
15	Repairs & rehabilitation of Structures (1)	Collect the history of a major rehabilitation project and list the interesting features
16	Computational Methods, IT, IoT in Civil Engineering (2)	Visit an AutoCad lab and prepare a report; Identify ten interesting software systems used in Civil Engg and their key features
17	Industrial lectures (2)	For each case study list the interesting features
18	Basics of Professionalism (3)	List 5 cases of violation of professional ethics and list preventive measures; Identify 5 interesting projects and their positive features; Write 400 word reports on one ancient monument and a modern marvel of civil engineering
	<b>TOTAL NO LECTURES =30</b>	<b>15</b>

#### Text/Reference Books:

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. The National Building Code, BIS, (2017)
3. RERA Act, (2017)
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R.(1979), Law of Contract, Oxford University Press
9. Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Avtarsingh (2005), Law of Arbitration and Conciliation, Eastern Book Co.
11. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
12. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency
13. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
14. Bare text (2005), Right to Information Act
15. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
16. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
17. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
18. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss. 2, pp 117-127, MCB UP Ltd
18. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
19. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill

20. Engineering Ethics, National Institute for Engineering Ethics, USA
21. [www.ieindia.org](http://www.ieindia.org)
22. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
23. Resisting Bureaucratic Corruption: Alacrity Housing Chennai (Teaching Case Study) -S. Ramakrishna Velamuri -CEIBS
24. CONSTRUCTION CONTRACTS, <http://www.jnormanstark.com/contract.htm>
25. Internet and Business Handbook, Chap 4, CONTRACTS LAW, <http://www.laderapress.com/laderapress/contractslaw1.html>
26. Contract &Agreements , <http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm>
27. Contracts, <http://206.127.69.152/jgretch/crj/211/ch7.ppt>
28. Business & Personal Law. Chapter 7. “How Contracts Arise”, <http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt>
29. Types of Contracts, <http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt>
30. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, <http://www.worldbank.org/html/opr/consult/guidetxt/types.html> Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), <http://www.sandia.gov/policy/14g.pdf>

