

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
				Total credits			25

Semester III [Second year]
Branch/Course: Mechanical Engineering

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				L	T	P		
1	Basic Science Courses	BSC 202	Mathematics III (PDE, Probability & Statistics)	3	1	0	4	4
2	Basic Science Courses	BSC 203	Biology	2	1	0	3	3
3	Engineering Science courses	ESC 201	Basic Electronics Engineering	3	1	0	4	4
4	Engineering Science courses	ESC 202	Engineering Mechanics	3	0	2	4	4
5	Professional Core courses	PCC- ME 201	Thermodynamics	3	1	0	4	4
6	Professional Core courses	PCC-ME 202	Machine Drawing	0	0	4	4	2
7	Summer Internship	INST-ME 203	Inter/Intra Institutional Activities (Summer Vacation after 2 nd Sem.)	Four Week				4
8	Employability Enhancement	--	Professional Courses (Spoken Tutorial, KYP, etc.)	12				0
							Total credits:	25

103 EE

**Semester III [Second
year] Branch/Course:
Electrical Engineering**

Sl. No	Course Code	Course Title	Hours per week			Total contact hours	Credits
			Lecture	Tutorial	Practical		
1	PCC-EE01	Electrical Circuit Analysis	3	1	0	4	4
2	PCC-EE02	Electrical Circuit Analysis Laboratory	0	0	2	2	1
3	PCC-EE03	Analog Electronics	3	0	0	3	3
4	PCC-EE04	Analog Electronics Laboratory	0	0	2	2	1
5	PCC-EE05	Electrical Machines – I	4	0	0	4	4
6	PCC-EE06	Electrical Machines Laboratory - I	0	0	2	2	1
7	PCC-EE07	Electromagnetic Fields	3	1	0	4	4
8	ESC 201	Engineering Mechanics	3	1	0	4	4

9	MC	Environmental Sc./ Indian Constitution	0	0	0	4	0
10	PROJ- EE01	1. Industrial Visit/Internship (4 Weeks)	0	0	0	0	4
11		Software Training	0	0	0	4	0
TOTAL						33	26

104 ECE

Semester III (Second year)
Branch/Course Electronics & Communication Engineering

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs./wk.	Credits
1	EC101	Network Theory	3	1	0	4	4
2	EC102	Signals and Systems	3	0	0	3	3
3	BS101	Mathematics-III	3	0	0	3	3
4	EC103	Object Oriented Programming	3	0	0	3	3
5	EC103P	Object Oriented Programming Lab	0	0	2	2	1
6	ES101	Basic Electronics	3	0	0	3	3
7	ES101P	Basic Electronic Science Lab	0	0	2	2	1
8	ES102	Electrical and Electronic Material	3	0	0	3	3
9	ES102P	Electrical and Electronic Material Lab	0	0	2	2	1
10	ECP1	1. Language Lab. (1 Week) 2. Industrial Visit/Internship (2 Weeks) 3. Fundamental Electronics Lab Training (1 Week)	0	0	12	12	4
TOTAL						37	26

105 CS

Semester III (Second year)

Sl. No	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
1	Engineering Science Course	ESC 301	Analog Electronic Circuits	3	0	4	5
2	Professional Core Courses	PCC CS 301	Data Structure & Algorithm	3	0	4	5
3	Professional Core Courses	PCC CS 302	Object Oriented Programming using C++	3	0	4	5
4	Basic Science Courses	BSC 301	Mathematics-III (Differential Calculus)	2	0	0	2
5	Humanities & Social Sciences including Management courses	HSMC 301	Technical Writing	3	0	0	3
6	Summer Industry Internship	SI 301	Summer Industry Internship - 1	-	-	-	4
				Total credits			24

106 IT

Semester III (Second year)

Sl. No	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
1	Professional Core Course	PCC-IT301	Discrete Mathematics	3	1	0	4
2	Professional Core Course	PCC-IT302	Data structure & Algorithms	3	0	4	5
3	Engineering Science Courses	ESC301	Digital Electronics	3	0	4	5

4	Professional Core Course	PCC-IT303	Object Oriented Programming using C++	3	0	4	5
5	Basic Science Course	BSC301	Mathematics-III (Differential Calculus)	2	1	0	3
6	Humanities & Social Sciences including Management Courses	HSMC 301	Technical Writing	3	0	0	3
7	Summer Industry Internship	SI- IT301		-	-	-	4
Total credits							29

107 LT

Semester III (Second year]

Branch/Course Leather Technology

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Basic Science Courses	BSC- 201	Physics II (Optics & Waves)	3	1	0	4	4
2	Basic Science Courses	BSC- 202	Mathematics III (PDE, Probability & Statistics)	3	1	0	4	4
3	Engineering	ESC- 201	Basic Electronics	3	1	0	4	4

	Science courses		Engineering					
4	Engineering Science courses	ESC- 202	Engineering Mechanics	3	1	0	4	4
5	Professional Core courses	PCC- LT 201	Introduction to leather Technology	3	0	0	3	3
6	Inter/ Intra Institutional Activities	INTLT201	Internship					4
							Total credits	23

110 EEE

SEMESTER III [Second year]

Branch/Course: Electrical & Electronics Engineering

Sl. No	Course Code	Course Title	Hours per week			Total contact hours	Credits
			Lecture	Tutorial	Practical		
1	PCC-EEE01	Electrical Circuit Analysis	3	1	0	4	4
2	PCC-EEE02	Digital Electronics	3	0	0	3	3
3	PCC-EEE03	Electrical Machines – I	3	0	0	3	3
4	PCC-EEE04	Electrical Machines Laboratory - I	0	0	2	2	1
5	PCC-EEE05	Electromagnetic Fields	3	1	0	4	4
7	ESC 301	Engineering Mechanics	3	1	0	4	4
8	MOOC-EEE 01	MOOCs / SWAYAM / NPTEL Courses - 1	2	0	0	2	2
9	INT-EEE011	Internship	4 weeks				4
TOTAL CREDITS							25
10	MC 401	Human Values & Ethics	3	0	0	3	0
11	MC 402	Capstone Design Project	3	0	0	3	0

12	MC 403	NCC/ NSS/ other Clubs & Society Activity/ Sports	3	0	0	3	0
TOTAL CONTACT HOURS						31	

101 CE

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

- Know broadly the concepts and functionalities of the electronic devices, tools and instruments
- Understand use, general specifications and deployabilities of the electronic devices, and assemblies
- 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
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[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 18th 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- acquatic 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 catalyze reactions. 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 Publishers

ESC203	Computer-aided Civil Engineering Drawing	1L:0T:2P	2 credits
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The students will be able to

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- 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.
- 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:

- 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
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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 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, 4th 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
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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, 2015.

BSC202	Mathematics III (PDE, Probability & Statistics)	2L:0T:0P	2 credits
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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, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

HSMC201	Effective Technical Communication	3L:0T:0P	3 credits
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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)

HSMC251	Introduction to Civil Engineering	2L:0T:0P	2 credits
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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
	TOTAL NO LECTURES =30	15

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. Wadhwa (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
 19. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
 20. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
 21. Engineering Ethics, National Institute for Engineering Ethics, USA
 22. www.ieindia.org
 23. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
 24. Resisting Bureaucratic Corruption: Alacrity Housing Chennai (Teaching Case Study) -S. Ramakrishna Velamuri -CEIBS
 25. CONSTRUCTION CONTRACTS, <http://www.jnormanstark.com/contract.htm>
 26. Internet and Business Handbook, Chap 4, CONTRACTS LAW, <http://www.laderapress.com/laderapress/contractslaw1.html>
 27. Contract &Agreements , <http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm>
 28. Contracts, <http://206.127.69.152/jgretch/crj/211/ch7.ppt>
 29. Business & Personal Law. Chapter 7. “How Contracts Arise”, <http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt>
 30. Types of Contracts, <http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt>
 31. 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>

102 ME

BSC202	Mathematics III (PDE, Probability & Statistics)	3L:1T:0P	4 credits
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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:

Module 1:

(14 lectures)

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.

Module 2:

(12 lectures)

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.

Module 3:

(12 lectures)

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.

Textbooks/References:

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

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 analyzing experimental data.

BSC203	Biology 2 (one hour) lectures and one (one hour) tutorial per week. Only lecture hours are shown	2L:1T:0P	3 credits
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Module 1: Introduction

(2 lectures)

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 18th 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: Classification

(3 lectures)

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 utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, 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:Genetics

(4 lectures)

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: Biomolecules

(4 lectures)

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: Enzymes

(4 lectures)

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

Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyze reactions? 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: Information Transfer

(4 lectures)

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: Macromolecular analysis

(5 lectures)

Purpose: *How to analyse biological processes at the reductionist 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: Metabolism

(4 lectures)

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 ΔG and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $\text{CO}_2 + \text{H}_2\text{O}$ (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: Microbiology

(3 lectures)

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.

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 Calendar, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Course Outcomes:

After studying the course, the student will be able to:

Describe how biological observations of 18th Century that lead to major discoveries. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Classify enzymes and distinguish between different mechanisms of enzyme action. Identify DNA as a genetic material in the molecular basis of information transfer. Analyse biological processes at the reductionistic level Apply thermodynamic principles to biological systems. Identify and classify microorganisms.

ESC 201	Basic Electronic Engineering	3L:1T:0P	4 credits
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Objectives:

To provide an overview of electronic device components to Mechanical engineering students

Contents:

Module 1:

(10 lectures)

Semiconductor Devices and Applications: Introduction to P-N Junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Module 2:

(8 lectures)

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

Module 3:

(6 lectures)

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as table and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Module 4:

(10 lectures)

Digital Electronics Fundamentals: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using Kmap, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Module 5:

(8 lectures)

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Text /Reference Books:

1. Floyd ,” Electronic Devices” Pearson Education 9th edition, 2012.
2. R.P. Jain , “Modern Digital Electronics”, Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, “Communication Electronics: Principles and Applications”, Tata Mc Graw Hill, 3rd Edition, 2001

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates, flip flop as a building block of digital systems.
5. Learn the basics of Electronic communication system.

ESC 202	Engineering Mechanics	3L:0T:2P	4 credits
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Objectives:

The primary purpose of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

Contents:**Module 1: (7 lectures)**

Statics: Force System, Moment of a force about a point and an axis; Equivalent force and moment

Module 2: (6 lectures)

Equilibrium: Free body diagram; equations of equilibrium; problems in two and three dimension; plane frames and trusses.

Module 3: (8 lectures)

Friction: Laws of Coulomb friction, impending motion problems involving large and small contact surfaces; square threaded screw; principle of virtual work and stability.

Module 4: (6 lectures)

Dynamics: Kinematics and kinetics of particles dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables.

Module 5: (8 lectures)

Properties of areas: Center of mass; Moments of inertia; kinematics of rigid bodies; Chasle's Theorem, concept of fixed vector, velocity and acceleration of particles in different frames of references. General plane motion.

Module 6: (7 lectures)

Work & Energy and impulse and Momentum methods for particles and rigid bodies: Conservation of momentum, coefficient of restitution, moment of momentum equation.

Text /Reference Books:

1. Engineering Mechanics by Shames, Pearson's Education.
2. Mechanics for Engineers. Beer, F.P. and Johnston. Tata McGraw Hill. New Delhi
3. Engineering mechanics. Meriam Wiley pub.
4. Engineering Mechanics. Timoshenko. McGraw Hill Inc.

Practical:

1. Practical based on mechanical advantage of different machines.
2. Verification of triangle law & parallelogram law of forces
3. Verification of polygon law of forces
4. Determination of moment of inertia of a flywheel
5. Crank Lever apparatus
6. Verification of support reactions of a simply supported beam
7. Verification of condition of equilibrium of a system of forces
8. Verification of axial forces in the members of a truss
9. Verification of equilibrium of three dimensional forces.
10. Determination of coefficient of friction between two surfaces
11. Verification of centroid of different laminae
12. Verification of Newton's laws of motion

* **At least 6 experiments should be performed from above list.**

Course outcomes:

Students will be able to articulate and describe:

1. Relative motion. Inertial and non-inertial reference frames.
2. Parameters defining the motion of mechanical systems and their degrees of freedom.
3. Study of the interaction of forces between solids in mechanical systems.
4. Centre of mass and inertia tensor of mechanical systems.
5. Application of the vector theorems of mechanics and interpretation of their results.
6. Newton's laws of motion and conservation principles.

PCC-ME 201	Thermodynamics	3L:1T:0P	4 credits
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Objectives:

1. To learn about work and heat interactions, and balance of energy between system and its surroundings
2. Surroundings
3. To learn about application of 1st law to various energy conversion devices
4. To evaluate the changes in properties of substances in various processes
5. To understand the difference between high grade and low grade energies and 2nd law limitations on energy conversion

Contents:

Module 1:

(5 lectures)

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

Module 2:**(5 lectures)**

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

Module 3:**(8 lectures)**

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.

Module 4:**(5 lectures)**

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady law applications for system and control volume.

Module 5:**(5 lectures)**

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

Module 6:**(8 lectures)**

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of Entropy for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of entropy from steam tables-Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.

Module 7:**(4 lectures)**

Properties of dry and wet air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Yunus A. Cengel; Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill.
5. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Course Outcomes:

1. After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions
2. Students can evaluate changes in thermodynamic properties of substances
3. The students will be able to evaluate the performance of energy conversion devices
4. The students will be able to differentiate between high grade and low grade energies.

PCC-ME202	Machine Drawing	0L:0T:4P	2 Credits
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Objective:

The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Module 1: Introduction to full section, half section, revolved-section off-set section.	(2 Lectures)
Module 2: Nut Bolts, Riveted joints, Thread profiles, Screw jack.	(3 Lectures)
Module3: Bushed bearing, pedestal, bearing, foot step bearing.	(3 Lectures)
Module 4: Flanged coupling, flexible coupling, solid coupling.	(2 Lectures)
Module5: Engine parts - Stuffing box, Connecting rod, Atomizer, spark plug, etc.	(2 Lectures)
Module 6: Eccentric.	(2 Lectures)
Module 7: Cross Head.	(2 Lectures)
Module 8: Assembly of disassembled parts. disassembly of assembly parts.	(2 Lectures)

Text Books:

1. Dhawan, R.K., A Text Book of Machine Drawing, S. Chand & Company, 1996.
2. Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995.
3. Engineering Drawing Practice for Schools and Colleges SP: 46- 19
4. Engineering Drawing by ND Bhatt

Course Outcomes:

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

1. Identify the national and international standards pertaining to machine drawing.
2. Apply limits and tolerances to assemblies and choose appropriate fits.
3. Recognize machining and surface finish symbols.
4. Explain the functional and manufacturing datum.

103 EE

PCC-EE01	Electrical Circuit Analysis	3L:1T:0P	4 credits
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Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyse circuits in the sinusoidal steady-state (single-phase and three-phase).
- Analyse two port circuit behavior.

Module 1: Network Theorems (10 Hours)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

Module 2: Solution of First and Second order networks (8 Hours)

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Module 3: Sinusoidal steady state analysis (8 Hours)

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

Module 4: Electrical Circuit Analysis Using Laplace Transforms (8 Hours)

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

Module 5: Two Port Network and Network Functions (6 Hours)

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text / References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

PCC-EE02: Electrical Circuit Analysis (0:0:2 – 1 credit)

Hands-on experiments related to the course contents of EE01.

PCC-EE03	Analog Electronic Circuits	3L:0T:0P	3 credits
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Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyse various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

Module 1: Diode circuits (4 Hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Module 2: BJT circuits (8 Hours)

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Module 3: MOSFET circuits (8 Hours)

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Module 4: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 5: Linear applications of op-amp (8 Hours)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift).

Analog to Digital Conversion.

Module 6: Nonlinear applications of op-amp (6 Hours)

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Text/References:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley

& Sons, 2001.

PCC-EE04: Analog Electronic Circuits Laboratory (0:0:2 – 1 credit)

Hands-on experiments related to the course contents of EE03.

PCC-EE05	Electrical Machines-I	4L:0T:0P	4 credits
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Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concepts of magnetic circuits.
- Understand the operation of dc machines.
- Analyse the differences in operation of different dc machine configurations.
- Analyse single phase and three phase transformers circuits.

Module 1: Magnetic fields and magnetic circuits (6 Hours)

Review of magnetic circuits – MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil – through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Module 2: Electromagnetic force and torque (9 Hours)

B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

Module 3: Transformers (12 Hours)

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

Module 4: DC machines (8 Hours)

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Module 5: DC machine - motoring and generation (7 Hours)

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

Text / References

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

PCC-EE06: Electrical Machines Laboratory– I (0:0:2 – 1 credit)

Hands-on experiments related to the course contents of EE05.

PCC-EE07	Electromagnetic Fields	3L:1T:0P	4 credits
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Course Outcomes:

At the end of the course, students will demonstrate the ability

- To understand the basic laws of electromagnetism.
- To obtain the electric and magnetic fields for simple configurations under static conditions.
- To analyse time varying electric and magnetic fields.
- To understand Maxwell's equation in different forms and different media.
- To understand the propagation of EM waves.

This course shall have Lectures and Tutorials. Most of the students find difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.

Module 1: Review of Vector Calculus (6 hours)

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

Module 2: Static Electric Field (6 Hours)

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

Module 3: Conductors, Dielectrics and Capacitance (6 Hours)

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

Module 4: Static Magnetic Fields (6 Hours)

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Module 5: Magnetic Forces, Materials and Inductance (6 Hours)

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

Module 6: Time Varying Fields and Maxwell's Equations (6 Hours)

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.

Module 7: Electromagnetic Waves (6 Hours)

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Text / References:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G.W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W.J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W.J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E.G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

105 CSE

ESC 301	Analog Electronic Circuits	3L:0T:4P	5 Credits
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Objectives of the course:

1. To learn the fundamentals of analog electronic circuits.
2. To design, construct and debug the analog electronic circuits.
3. Principles of operation, terminal characteristics, and equivalent circuit models for diodes, transistors, and op-amps.
4. Differential amplifiers, frequency response of cascaded amplifiers and gain-bandwidth considerations.
5. Linear and nonlinear applications of op-amp.

Module 1

Lectures: 4 hrs.

Diode circuits: P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Module 2

Lectures: 8 hrs.

BJT circuits: Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.

Module 3

Lectures: 8 hrs.

MOSFET circuits: MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Module 4

Lectures: 8 hrs.

Differential, multi-stage and operational amplifiers: Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 5

Lectures: 8 hrs.

Linear applications of op-amp: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag

compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.

Module 6

Lectures: 4 hrs.

Nonlinear applications of op-amp: Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector, Monoshot.

Suggested Books:

1. A S Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

Course Outcomes

After the completion of course, students can able to able to:

1. Understand the characteristics of transistors.
2. Design and analyze various rectifier and amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of OP-AMP and design OP-AMP based circuits.

ESC 301P	Analog Electronic Circuits Lab
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Hands-on experiments related to the course contents of ESC 301.

PCC CS 301	Data Structure & Algorithms	3L:0T: 4P	5 credits
Pre-requisite	Programming for Problem Solving		

Objectives of the course:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Detailed contents:

Module 1 **Lecture 4 hrs.**

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Module 2 **Lecture 10 hrs.**

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each Type of Queues: Algorithms and their analysis.

Module 3 **Lecture 6 hrs.**

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Module 4 **Lecture 12 hrs.**

Searching, Sorting and Hashing: Linear Search and Binary Search Techniques and their complexity analysis. Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Module 5

Lecture 8 hrs.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Suggested reference books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
2. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.
3. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Course outcomes

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

PCC CS 301P	Data Structure & Algorithms Lab
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Hands-on experiments related to the course contents of PCC CS 301.

PCC CS 302	Object Oriented Programming using C++	3L:0T: 4P	5 credits
Pre-requisite	Programming for Problem Solving		

Objectives of the course:

1. To impart the basic concepts of Object Oriented Programming.
2. To understand concepts about Classes and Data Abstraction
3. To understand basic concepts about Inheritance.
4. To enable them to write algorithms for solving problems using object oriented approach.

Detailed contents:

Module 1 **Lecture: 3 hrs.**

Introduction to C++ : Object Oriented Technology, Advantages of OOP, Input- output in C++, Tokens, Keywords, Identifiers, Data Types C++, Derives data types. The void data type, Type Modifiers, Typecasting, Constant, Operator, Precedence of Operators, Strings.

Module 2 **Lecture: 6 hrs.**

Control Structures and Functions: Decision making statements like if-else, Nested if-else, goto, break, continue, switch case, Loop statement like for loop, nested for loop, while loop, do-while loop. Parts of Function, User- defined Functions, Value- Returning Functions, void Functions, Value Parameters, Function overloading, Virtual Functions.

Module 3 **Lecture: 12 hrs.**

Classes and Data Abstraction : Structure in C++, Class, Build- in Operations on Classes, Assignment Operator and Classes, Class Scope, Reference parameters and Class Objects (Variables), Member functions, Accessor and Mutator Functions, Constructors, default Constructor, Destructors.

Module 4

Lecture: 8 hrs.

Overloading, Templates and Inheritance: Operator Overloading, Function Overloading, Function Templates, Class Templates. Single and Multiple Inheritance, virtual Base class, Abstract Class, Pointer and Inheritance, Overloading Member Function.

Module 5

Lecture: 11 hrs.

Pointers, Arrays and Exception Handling: Void Pointers, Pointer to Class, Pointer to Object, Void Pointer, Arrays. The keywords try, throw and catch. Creating own Exception Classes, Exception Handling Techniques (Terminate the Program, Fix the Error and Continue, Log the Error and Continue), Stack Unwinding.

Suggested books:

1. Thinking in C++, Volume 1 & 2 by Bruce Eckel, Chuck Allison, Pearson Education
2. Mastering C++, 1/e by Venugopal, Tata McGraw Hill.
3. Object Oriented Programming with C++, 3/e by E. Balaguruswamy, Tata McGraw Hill.
4. Starting Out with Object Oriented Programming in C++, by Tony Gaddis, Wiley India.

Suggested Reference Books:

1. The C++ Programming language 3/e by Bjarne Stroustrup, Pearson Education.
2. C++, How to Programme, 4e, by Deitel, Pearson Education.
3. Big C++ by Cay Horstmann, Wiley India.
4. C++ Primer, 3e by Stanley B. Lippmann, JoseeLajoie, Pearson Education.
5. C++ and Object Oriented Programming Paradigm, 2e by Debasish Jana, PHI.
6. Programming with C++, 2/e by Ravichandran, Tata McGraw Hill.
7. C++ Programming Black Book by Steven Holzner, Dreamtech Press.

Course outcomes

After the completion of course, students can able to able to:

1. Understand the concepts of Class, Object, Inheritance and Polymorphism.
 2. Apply overload operators in C++
 3. Understand the difference between function overloading and function overriding
 4. Incorporate exception handling in object-oriented programs
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5. Able to use template classes.
6. Able to write object-oriented programs of moderate complexity in C++

PCC CS 302P	Object Oriented Programming using C++ Lab
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Hands-on experiments related to the course contents of PCC CS 302.

BSC 301	Mathematics-III (Differential Calculus)	2L:0T: 0P	2 credits
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Detailed contents:

Module 1 **Lecture: 6 hrs.**

Successive Differentiation, Leibnitz’s Theorem. Limit, Continuity and Differentiability of function for one variable.

Module 2 **Lecture: 8 hrs.**

Limit, Continuity and Differentiability of function for several variables. Partial Derivatives, Euler’s Theorem for Homogeneous functions, Total derivatives, Change of Variables. Maxima and Minima of Several Variables. Methods of Lagrange Multipliers. Taylor’s and Maclaurin’s Theorem with remainders of several variables.

Module 3 **Lecture: 8 hrs.**

Vector Calculus: Gradient, Divergence and Curl of a Vector and their Physical Interpretations, Vector Identities. Directional Derivatives. Line, Surface and Volume integrals, Application of Green’s, Stokes and Gauss Divergence Theorem (Without Proof).

Module 4 **Lecture: 6 hrs.**

First Order Ordinary Differential Equations: Exact, Linear and Bernoulli's Equations, Euler's Equations, Equations not of First Degree: Equations Solvable for P, Equations Solvable for Y, Equations Solvable for X and Clairaut's Type.

Module 5 **Lecture: 8 hrs.**

Ordinary Differential Equations of Higher Orders: Second Order Linear Differential Equations with Variable Coefficients, Method of Variation of Parameters, Cauchy-Euler Equation; Power Series Solutions; Legendre Polynomials, Bessel Functions of the First Kind and their properties.

Module 6 **Lecture: 6 hrs.**

Partial Differential Equations – First Order: First Order Partial Differential Equations, Solutions of First Order Linear and Non-Linear PDEs.

HSMC 301	Technical Writing	3L:0T: 0P	3 credits
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Objectives of the course:

1. To understand the variety of structure of technical documents
2. To convey clearly, cogently and correctly, through written media, the technical aspects of a practice to audiences.
3. To recognize and use of the verbal and technical elements necessary for the successful practice of scientific and technical communication
4. To work collaboratively and individually to research, to analyze, and to write about, public debates regarding the conduct of science and technology

Detail contents

Module 1 **Lecture 10 hrs.**

Introduction: Fundamentals of Technical Writing: Need for Clear and Concise Technical Writing, Attributes of Technical Writing, Types of Technical Writing, Benefits of Technical Writing, Technical, Managerial and General Readers, Expressing versus Impressing, Correct use of Noun, Pronoun, Verb, Adjective, Adverbs, Tense and Punctuation.

Module 2

Lecture 10 hrs.

Performing Technical Studies: Types of Technical Studies, General Methodology- Proposing a Project, Gathering Background Information, Designing Test Plans, Performing Experiments, Reporting Results.

Writing Strategy: Analysis of Readers, Scope of Writing, Purpose and Objective. **Document Options:** Document Hierarchy, Report Types and Selection. **Criteria for Good Technical Writing:** Technical Content, Presentation, Language Skills. **Writing Style:** Elements of Style, Examples of Writing Styles, Recommended Style, Learn to Prepare Effective Illustrations

Module 3

Lecture 10 hrs.

Formal Reports: The Outline and Introduction (Outline, Title, Front Matter, Writing the Introduction), Writing the Body (Writing a Procedure, Describing Machines/Processes, Writing Test Results, Writing the Discussion Section), Closure (Conclusions, Recommendations, References, Abstract, Back Matter, Report Distribution, Saving Reports). **Informal Reports:** Elements of an Informal Report, Investigation Reports, Service Work, Action Letters and Proposals. Typical Memo Reports.

Module 4

Lecture 10 hrs.

Review and Editing: Types of Review and Edit, Review and Editing Methodology, Examples of Reviews. **Oral Presentations:** Types of Oral Presentations, Preparation, Visual Aids, Impediments to Technical Writing, Maintaining Writing Skills, Measuring Report Results.

Suggested books:

1. "Engineers' Guide to Technical Writing", Kenneth G. Budinski, ASM International.
2. "Handbook for Technical Writing", James H. Shelton, NTC Contemporary Press
3. "The Technical Writer's Handbook: Writing With Style and Clarity", Matt Young, University Science Books

Suggested reference books:

1. "A Guide to Technical Writing", T. A. Rickard, Franklin Classics.
2. "Technical Writing", S. Jayprakash, Himalaya Publishing House Pvt. Ltd.
3. "Technical Writing", O. N. Pandey.

Course outcomes

1. Student should be able to demonstrate improved competence in Standard Written English, including grammar, sentence and paragraph structure, coherence, and document design (including the use of the visual), and use this knowledge to revise texts.
2. Student should identify and practice the stages required to produce competent, professional writing through planning, drafting, revising, and editing.
3. It determine and implement the appropriate methods for each technical writing task.
4. Students learn to practice the ethical use of sources and the conventions of citation appropriate to each genre.

106_IT

PCC-IT301	Discrete Mathematics	3L:1T:0P	4 Credits
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Objectives of the course

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Module 1:

Lecture 6

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Module 2:

Lecture 8

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

Module 3:**Lecture 8**

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module 4:**Lecture 8**

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Module 5:**Lecture 10**

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Coloring, Coloring maps and Planar Graphs, Coloring Vertices, Coloring Edges, List Coloring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw –Hill
2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw –Hill.

Suggested reference books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMGEdition, Tata McGraw-Hill
 2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marclipson,
 3. Discrete Mathematics, Tata McGraw -Hill
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Course Outcomes

1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives.
 2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference.
 3. For a given a mathematical problem, classify its algebraic structure
 4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
 5. Develop the given problem as graph networks and solve with techniques of graph theory.
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PCC-CS301: Data Structure & Algorithm

PCC-IT302	Data Structure & Algorithms	3L:0T: 4P	5 credits
Pre-requisite	Programming for Problem Solving		

Objectives of the course:

5. To impart the basic concepts of data structures and algorithms.
6. To understand concepts about searching and sorting techniques
7. To understand basic concepts about stacks, queues, lists trees and graphs.
8. To enable them to write algorithms for solving problems with the help of fundamental data structures

Detailed contents:

Module 1:

Lecture 4

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Module 2:

Lecture 10

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each Type of Queues: Algorithms and their analysis.

Module 3:

Lecture 6

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Module 4:

Lecture 12

Searching, Sorting and Hashing: Linear Search and Binary Search Techniques and their complexity analysis Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Module 5:

Lecture 8

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVLTree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Suggested books:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Suggested reference books:

4. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
5. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

Course outcomes

6. For a given algorithm student will be able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
 7. For a given Search problem (Linear Search and Binary Search) student will be able to implement it.
 8. For a given problem of Stacks, Queues and linked list student will be able to implement it and analyze the same to determine the time and computation complexity.
 9. Student will be able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in terms of Space and Time complexity.
 10. Student will be able to implement Graph search and traversal algorithms and determine the time and computation complexity.
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PCC-IT303	Object Oriented Programming using C++	3L:0T: 4P	5 credits
Pre-requisite	Programming for Problem Solving		

Objectives of the course:

5. To impart the basic concepts of Object Oriented Programming.
6. To understand concepts about Classes and Data Abstraction
7. To understand basic concepts about Inheritance.
8. To enable them to write algorithms for solving problems using object oriented approach.

Detailed contents:

Module 1:

Lecture: 3

Introduction to C++ : Object Oriented Technology, Advantages of OOP, Input-output in C++, Tokens, Keywords, Identifiers, Data Types C++, Derives data types. The void data type, Type Modifiers, Typecasting, Constant, Operator, Precedence of Operators, Strings.

Module 2:

Lecture: 6

Control Structures and Functions: Decision making statements like if-else, Nested if-else, goto, break, continue, switch case, Loop statement like for loop, nested for loop, while loop, do-while loop. Parts of Function, User- defined Functions, Value- Returning Functions, void Functions, Value Parameters, Function overloading, Virtual Functions.

Module 3:

Lecture: 15

Classes and Data Abstraction : Structure in C++, Class, Build- in Operations on Classes, Assignment Operator and Classes, Class Scope, Reference parameters and Class Objects (Variables), Member functions, Accessor and Mutator Functions, Constructors, default Constructor, Destructors.

Module 4:

Lecture: 10

Overloading, Templates and Inheritance: Operator Overloading, Function Overloading, Function Templates, Class Templates. Single and Multiple Inheritance, virtual Base class, Abstract Class, Pointer and Inheritance, Overloading Member Function.

Module 5:

Lecture: 11

Pointers, Arrays and Exception Handling: Void Pointers, Pointer to Class, Pointer to Object, Void Pointer, Arrays. The keywords try, throw and catch. Creating own Exception Classes, Exception Handling Techniques (Terminate the Program, Fix the Error and Continue, Log the Error and Continue), Stack Unwinding.

Suggested books:

5. Thinking in C++, Volume 1 & 2 by Bruce Eckel, Chuck Allison, Pearson Education
6. Mastering C++, 1/e by Venugopal, Tata McGraw Hill.
7. Object Oriented Programming with C++, 3/e by E. Balaguruswamy, Tata McGraw Hill.
8. Starting Out with Object Oriented Programming in C++, by Tony Gaddis, Wiley India.

Suggested Reference Books:

8. The C++ Programming language 3/e by Bjarne Stroustrup, Pearson Education.
9. C++, How to Programme, 4e, by Deitel, Pearson Education.
10. Big C++ by Cay Horstmann, Wiley India.
11. C++ Primer, 3e by Stanley B. Lippmann, JoseeLajoie, Pearson Education.
12. C++ and Object Oriented Programming Paradigm, 2e by Debasish Jana, PHI.
13. Programming with C++, 2/e by Ravichandran, Tata McGraw Hill.
14. C++ Programming Black Book by Steven Holzner, Dreamtech Press.

Course outcomes

A student who successfully fulfills the course requirements will have demonstrated:

7. An understanding of the concepts of inheritance and polymorphism.
8. An ability to overload operators in C++
9. An understanding of the difference between function overloading and function overriding
10. An ability to incorporate exception handling in object-oriented programs
11. An ability to use template classes.
12. An ability to write object-oriented programs of moderate complexity in C++

BSC202	Mathematics III (PDE, Probability & Statistics)	3L:1T:0P	4 credits
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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 lectures)**

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 lectures)**

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.

lectures)

(12

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:

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

ESC 201	Basic Electronic Engineering	3L:1T:0P	4 credits
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Objectives:

To provide an overview of electronic device components to Mechanical engineering students

Contents

Module 1

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

(10 lectures)

Module 2

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

lectures)

Module 3

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as table and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator. (6

lectures)

Module 4

Digital Electronics Fundamentals: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using Kmap, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications. (10

lectures)

Module 5

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

(8

lectures)

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor devices and their applications.
 2. Design an application using Operational amplifier.
 3. Understand the working of timing circuits and oscillators.
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4. Understand logic gates, flip flop as a building block of digital systems.
5. Learn the basics of Electronic communication system.

Text /Reference Books:

1. Floyd ,” Electronic Devices” Pearson Education 9th edition, 2012.
2. R.P. Jain , “Modern Digital Electronics”, Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, “Communication Electronics: Principles and Applications”, Tata Mc Graw Hill, 3rd Edition, 2001

ESC 202	Engineering Mechanics	3L:0T:2P	4 credits
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Objectives:

The primary purpose of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

Contents:

Module 1

Statics: Force System, Moment of a force about a point and an axis; Equivalent force and moment. (7 lectures)

Module 2

Equilibrium: Free body diagram; equations of equilibrium; problems in two and three dimension; plane frames and trusses. (6 lectures)

Module 3

Friction: Laws of Coulomb friction, impending motion problems involving large and small contact surfaces; square threaded screw; principle of virtual work and stability (8 lectures)

Module 4

Dynamics: Kinematics and kinetics of particles dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables. (6 lectures)

Module 5

Properties of areas: Center of mass; Moments of inertia; kinematics of rigid bodies; Chasle's Theorem, concept of fixed vector, velocity and acceleration of particles in different frames of references. General plane motion. (8 lectures)

Module 6

Work & Energy and impulse and Momentum methods for particles and rigid bodies: Conservation of momentum, coefficient of restitution, moment of momentum equation. (7 lectures)

Course outcomes:

Students will be able to articulate and describe:

7. Relative motion. Inertial and non-inertial reference frames.
8. Parameters defining the motion of mechanical systems and their degrees of freedom.
9. Study of the interaction of forces between solids in mechanical systems.
10. Centre of mass and inertia tensor of mechanical systems.
11. Application of the vector theorems of mechanics and interpretation of their results.
12. Newton's laws of motion and conservation principles.

Text /Reference Books:

1. Engineering Mechanics by Shames, Pearson's Education .
2. Mechanics for Engineers. Beer, F.P. and Johnston. TataMcGraw Hill. New Delhi
3. Engineering mechanics. Meriam Wiley pub.
4. Engineering Mechanics. Timoshenko. McGraw Hill Inc.

Practical:

13. Verification of triangle law & parallelogram law of forces
14. Verification of polygon law of forces
15. Crank Lever apparatus
16. Verification of support reactions of a simply supported beam
17. Verification of condition of equilibrium of a system of forces
18. Verification of axial forces in the members of a truss
19. Verification of equilibrium of three dimensional forces.
20. Determination of coefficient of friction between two surfaces
21. Verification of centroid of different laminae
22. Determination of moment of inertia of a flywheel
23. Verification of Newton's laws of motion
24. Verification of motion parameters using conservation of energy.

*** At least 8 experiments should be performed from above list.**

ESC 201	Basic Electronic Engineering	3L:1T:0P	4 credits
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Objectives:

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Contents

Module 1

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Module 2

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator. **(8 lectures)**

Module 3

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as table and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator. **(6 lectures)**

Module 4

Digital Electronics Fundamentals: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using Kmap, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications. **(10 lectures)**

Module 5

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

(8

lectures)

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates, flip flop as a building block of digital systems.
5. Learn the basics of Electronic communication system.

Text /Reference Books:

1. Floyd ,” Electronic Devices” Pearson Education 9th edition, 2012.
 2. R.P. Jain , “Modern Digital Electronics”, Tata Mc Graw Hill, 3rd Edition, 2007.
 3. Frenzel, “Communication Electronics: Principles and Applications”, Tata Mc Graw Hill, 3rd
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Edition, 2001

PCC-LT201	Introduction to Leather Technology	3L: 0T:0 P	3 Credits
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Module: 1 (05 Hours)

Live stock population, animal mortality and availability of hides and skins in India.

Module: 2 (12 Hours)

Statistical analysis of leather Industries, Leather, Leather products (National & International Scenario).

Module: 3 (05 Hours)

Chemical constituents of hides and skins.

Module: 4 (15 Hours)

General principles involved in raw hide and skin preservation, assortment and their processing, pre tanning, tanning and post tanning operations.

Module: 5 (05 Hours)

Defects in leather, Microscopy & Bacteriology

Suggested books:

1. Introduction to the Principles of Leather Manufacture. By – S. S. Dutta, 4th Edition, ILTA, Kolkata
 2. Theory & Practice of Leather Manufacture. By – K. T. Sarkar, Macmillan India Press, Chennai.
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