BACHELOR
IN
ELECTRONICS, COMMUNICATION AND INFORMATION ENGINEERING

Year : I **Part : I**

Teaching Schedule								Examination Scheme						Total	Remark
								Theory			Practical				
									Final			Final			
S. N.	Course Code	Course Title	Credits	L	T	P	Total	Assessment Marks	Duration hours	Marks	Assesment Marks	Duaration hours	Marks		
1	SH 101	Engineering Mathematics I	3	3	2	-	5	40	3	60	-	-	-	100	
2	SH 102	Engineering Physics	4	4	1	2	7	40	3	60	25	-	-	125	
3	CT 101	Computer Programming	3	3	1	3	7	40	3	60	50	-	-	150	
4	ME 101	Engineering Drawing	2	2	-	4	6	20	3	30	50	-	-	100	
5	EX 101	Fundamental of Electrical and Electronics Engineering	3	3	1	3	7	40	3	60	50	-	-	150	
6	ME 106	Engineering Workshop	1	1	-	3	4	20	-	-	30	-	-	50	
		Total	**16**	**16**	**5**	**15**	**36**	**180**	-	**270**	**175**	-	-	**675**	

Year : I **Part : II**

Teaching Schedule								Examination Scheme						Total	Remark
								Theory			Practical				
									Final			Final			
S. N.	Course Code	Course Title	Credits	L	T	P	Total	Assessment Marks	Duration hours	Marks	Assesment Marks	Duaration hours	Marks		
1	SH 151	Engineering Mathematics II	3	3	2	-	5	40	3	60	-	-	-	100	
2	CT 151	Object Oriented Programming	3	3	1	3	7	40	3	60	50	-	-	150	
3	EX 151	Electronic Device and Circuits	3	3	1	3	7	40	3	60	50	-	-	150	
4	EX 152	Digital Logic	3	3	1	3	7	40	3	60	50	-	-	150	
5	EE 154	Electrical Circuits and Machines	4	4	1	1.5	6.5	40	3	60	25	-	-	125	
6	SH 153	Engineering Chemistry	3	3	1	3	7	40	3	60	25	-	-	125	
		Total	**19**	**19**	**7**	**13.5**	**39.5**	**240**	-	**360**	**200**	-	-	**800**	

ENGINEERING MATHEMATICS I

SH 101

Lecture : 3 **Year : I**
Tutorial : 2 **Part : I**
Practical : 0

Course Objectives:

To equip the students with the essential mathematical skills and techniques that are relevant to the engineering fields and enable them to solve engineering problems using mathematical methods.

1 Derivatives and its Applications (10 hours)

1.1 Review of derivative and differentiability, mean value theorems with interpretations
1.2 Indeterminate forms, types and their real life examples, L-Hospital's Rule
1.3 Power series of single valued functions
  1.3.1 Taylor's series
  1.3.2 Maclaurin's series
1.4 Asymptotes to Cartesian and Polar curves
1.5 Pedal equation to Cartesian and Polar curves
1.6 Curvature and radius of curvature for Cartesian curves

2 Antiderivatives and its Applications (11 hours)

2.1 Review of definite and indefinite integrals
2.2 Differentiation under integral sign
2.3 Improper integrals
2.4 Application of Beta and Gamma functions
2.5 Area, arc length, volume and surface of revolution in plane for Cartesian curves
2.6 Centroid and moment of inertia under area of curve

3 Ordinary Differential Equations and its Applications (10 hours)

3.1 Review of: Order, degree, solution of first order first degree differential equations by variable separation method and solution of homogeneous equations.
3.2 Linear differential equation and equations reducible to linear differential equation of first order Bernoulli's equation, modeling electric circuit
3.3 First order and higher degree differential equations; Clairaut's form

3.4 Linear second order differential equations with constant coefficient and variable coefficients reducible to constant coefficients, Cauchy's equations and modeling mass spring system
3.5 Application in physical sciences and engineering

4 Plane Analytic Geometry (4 hours)

4.1 Transformation of coordinates: Translation and Rotation
4.2 Equation of conic in Cartesian and polar form, identification of conics

5 Three dimensional geometry (10 hours)

5.1 The Straight line: symmetrical and general form
5.2 Coplanar lines
5.3 Shortest Distance
5.4 Sphere: General equation, plane section by planes, tangent planes
5.5 Introduction to right circular cone and right circular cylinder

Tutorials

There shall be related tutorials exercised in class and given as regular homework exercise. Tutorial can be as following for each specified chapters

1. Derivatives and its Applications
2. Antiderivatives and its Applications
3. Ordinary Differential Equations and its Applications
4. Plane Analytic Geometry
5. Three dimensional geometry

Reference

1. Jeffery A., (2001), Advanced Engineering Mathematics (1st ed.), Academic Press.
2. O'Neill, P.V., (2003), Advanced Engineering Mathematics (5th ed.), Thomson Learning.
3. Kreyszig , A. (1993), Advanced engineering Mathematics (7th ed.), John Wiley & Sons.
4. Sastry S.S. (2008), Engineering Mathematics Volume I and II (4th ed.). PHI India.
5. Wylie C. and Barrett L.(1995), Advanced Engineering Mathematics (6th ed.), McGraw-Hill College.
6. Thomas, T. and Finny, R. (1984), Calculus and Analytic Geometry (6th ed.), Addison-Wesley.

ENGINEERING PHYSICS
SH 102

Lecture : 4 | **Year : I**
Tutorial : 1 | **Part : I/II**
Practical : 2

Course Objectives:
To provide students a concept and sound knowledge of physics with the emphasis in present day applications to apply them in relevant fields. The background of physics corresponding to Proficiency Certificate Level is assumed.

1 Oscillation (6 hours)

1.1 Physical pendulum
  1.1.1 Bar pendulum
  1.1.2 Interchangeability of point of suspension and point of oscillation
  1.1.3 Minimum time period in case of physical pendulum
  1.1.4 Torsion pendulum
1.2 Damped and Forced Oscillation
  1.2.1 Damped harmonic oscillator
  1.2.2 Difference between free and damped oscillator
  1.2.3 Energy in damped oscillation
  1.2.4 Relaxation time
  1.2.5 Forced oscillation and resonance
  1.2.6 Sharpness of resonance
  1.2.7 Quality factor

2 Acoustics (3 hours)

2.1 Introduction
  2.1.1 Threshold of hearing and loudness
  2.1.2 Reverberation and reverberation time
  2.1.3 Absorption coefficient
  2.1.4 Sabine's Law
  2.1.5 Conditions for good acoustics
2.2 Ultrasound
  2.2.1 Production (piezoelectric) of ultrasound and its applications
  2.2.2 Test of structure and materials
  2.2.3 Medical uses

3 Heat and Thermodynamics (8 hours)

- 3.1 Quantity of Heat
  - 3.1.1 Calorific value of Foods and Fuels
  - 3.1.2 Bomb Calorimeter
  - 3.1.3 Specific heat of solid: Dulong - Petit law, Einstein's law
- 3.2 Nature of Heat
  - 3.2.1 Degree of freedom
  - 3.2.2 Maxwell's law of equipartition of energy
  - 3.2.3 atomicity of gases
  - 3.2.4 Vander-Waal's equation of real gases
  - 3.2.5 Critical constants
- 3.3 Thermodynamics
  - 3.3.1 Laws of Thermodynamics
  - 3.3.2 Clapeyron latent heat equation
  - 3.3.3 Entropy and Third law of thermodynamics
  - 3.3.4 Negative energy
  - 3.3.5 Maxwell's thermodynamic relations
  - 3.3.6 Gibb's free energy and phase transitions
- 3.4 Heat and Mass Transfer
  - 3.4.1 Fourier's law of thermal conductivity
  - 3.4.2 Use of thermal conductivity in building sciences
  - 3.4.3 Thermal resistance
  - 3.4.4 Types of convection
  - 3.4.5 Law of diffusion
  - 3.4.6 Relation between Stefan's law and Newton's law of Cooling
  - 3.4.7 Pyrheliometer and Pyrometer

4 Optics (17 hours)

- 4.1 Geometrical optics
  - 4.1.1 Lens separation
  - 4.1.2 Chromatism in lens combination
- 4.2 Interference
  - 4.2.1 Interference in thin films (reflected and transmitted light)
  - 4.2.2 fringes produced by a wedge-shaped thin film
  - 4.2.3 Newton's rings (both reflected and transmitted case)
  - 4.2.4 Determination of wavelength of light and refractive index of liquid by using Newton's rings.
- 4.3 Diffraction
  - 4.3.1 Introduction: Fresnel and Fraunhoffer's diffraction
  - 4.3.2 Fraunhoffer's diffraction at single slit
  - 4.3.3 Intensity distribution in the diffraction pattern due to a single slit
  - 4.3.4 Multiple slits, diffraction grating
  - 4.3.5 X-ray diffraction, X-rays in material testing

4.4 Polarization
- 4.4.1 Introduction: double refraction, Nichol prism (construction and uses)
- 4.4.2 Retardation plate (quarter and half wave plates), plane, elliptical and circular polarized light (theoretical and mathematical explanation)
- 4.4.3 Optical activity, specific rotation

4.5 Laser
- 4.5.1 Introduction: Laser and ordinary light, properties of laser
- 4.5.2 Induced absorption, spontaneous and Stimulated emission, active medium, population inversion, metastable state
- 4.5.3 Pumping (types: optical, electrical, chemical and heating)
- 4.5.4 He-Ne laser, semiconductor Laser
- 4.5.5 Uses of laser

4.6 Fiber Optics
- 4.6.1 Introduction: Propagation of light wave
- 4.6.2 Types of optical fiber: step index and graded index
- 4.6.3 Fiber transmission – single and multimode, self focusing, acceptance angle and numerical aperture
- 4.6.4 Applications

5 Electrostatics (8 hours)

5.1 Electric Field
- 5.1.1 Electric field due to a electric dipole (along axial line and equatorial line)
- 5.1.2 Electric dipole in an external electric field
- 5.1.3 Electric field due to linear electric quadrupole (along axial line)
- 5.1.4 Electric field: a ring of charge, circular ring and disc of charge

5.2 Electric Potential
- 5.2.1 Potential due to electric dipole
- 5.2.2 Potential due to linear quadrupole
- 5.2.3 potential due to continuous charge distribution, potential due to ring of charge and disc of charge

5.3 Capacitors
- 5.3.1 Cylindrical Capacitor
- 5.3.2 Charging and discharging of capacitor
- 5.3.3 Capacitor with dielectrics: dielectrics and Gauss law
- 5.3.4 High intensity electrostatic fields: uses and hazards (xerography, inkjet, precipitation)

6 Electromagnetism (6 hours)

- 6.1 Electromagnetic induction
  - 6.1.1 Faraday's laws
  - 6.1.2 Induction and energy transformation
  - 6.1.3 Induced electric field
  - 6.1.4 Self-induction and mutual induction
  - 6.1.5 LR circuit
  - 6.1.6 Energy stored in a magnetic field and energy density
  - 6.1.7 Induced magnetic field: modified Ampere's law and displacement current
- 6.2 Eddy Current
  - 6.2.1 Introduction
  - 6.2.2 Applications: Induction cooker, Electric Guitar, Metal Detector and Eddy Current Breaking
  - 6.2.3 Cyclotron and Synchrotron

7 Electromagnetic waves (6 hours)

- 7.1 Maxwell's Equations
  - 7.1.1 Differential and integral forms
  - 7.1.2 Conversion of Maxwell's equations from integral form to differential form and differential form to integral form
  - 7.1.3 Maxwell's equations in different media
- 7.2 Applications
  - 7.2.1 Wave equations: non conducting and conducting medium and free space
  - 7.2.2 Plane solution of wave equations, amplitude of electromagnetic waves, speed of electromagnetic waves, ratio of electric and magnetic fields
  - 7.2.3 Continuity equation
  - 7.2.4 Energy transfer and Poynting vector, Radiation pressure

8 Photon and matter waves (6 hours)

- 8.1 Quantum Physics
  - 8.1.1 Inadequacy of classical mechanics and rise of quantum mechanics, Quantization of energy
  - 8.1.2 Group velocity and phase velocity, electrons and matter waves
  - 8.1.3 de-Broglie wavelength, its applications
  - 8.1.4 Heisenberg uncertainty principle and its applications
  - 8.1.5 Wave functions and its significance

8.2 Schrodinger wave equation
   8.2.1 Time dependent and independent equation
   8.2.2 Probability distribution
   8.2.3 One dimensional infinite potential well, particle in a box
   8.2.4 Barrier tunneling (reflection and transmission coefficient)

Laboratory

1. To determine the acceleration due to gravity and radius of gyration of the given metal bar using bar pendulum.
2. To determine the modulus of elasticity of the given material and moment of inertia of the circular disc about the wire as an axis passing through its center and perpendicular to its plane by using torsional Pendulum
3. To determine the coefficient of thermal conductivity of a bad conductor by Lee's method
4. To determine the mechanical equivalent of heat by given method
5. To determine the wavelength of the sodium light using Newton's rings
6. To determine the wavelength of sodium light using wedge-shaped method
7. To determine the wavelength of LASER light using diffraction grating and hence determine the particle size of lycopodium power
8. To determine the focal length of two lenses when they are separated by some finite distance
9. To determine the chromatic aberration of a convex lens between red and blue colors
10. To determine the capacitance of the given capacitor by the method of charging and discharging through resistor
11. To plot the graph between frequency and current in LCR series circuit and hence determine the quality factor of the circuit
12. To study the growth and decay of current in LR circuit then determine the self-inductance of the given inductor
13. To determine the dielectric constant of the given material

Reference

1. Halliday, Resnick, Walker, "Fundamentals of Physics', John Wiley & Sons. Lnc.
2. Pokharel, Bhattarai, and Paudel "Fundamentals of Engineering Physics", Benchmark Publication.
3. Brij Lal and Subrahmanyam, ''A text book of Optics", S. Chand Publisher.
4. Basudeva, A.S. 'Modern Engineering Physics", S. Chand Publisher.
5. Caur R. K. and Gupta, S. L., "Engineering Physics', Dhanpat Publisher.
6. Brij Lal and Subrahmanyam, 'Waves and Oscillation", S. Chand publisher.
7. Brij Lal and Subrahmanyam, 'Heat and Thermodynamics", S. Chand publisher
8. Avadhanulu, Kshirsaga and Arun Murthy, A text Book of Engineering Physics, S. Chand publisher.

COMPUTER PROGRAMMING
CT 101

Lecture : 3 — **Year : I**
Tutorial : 1 — **Part : I**
Practical : 3

Course Objectives:
The primary goal of this course is to provide students with a solid foundation in the principles of programming and to impart practical skills in the C programming language. This course ensures that students comprehend the fundamental concepts of variables, data types, control structures, and functions within the context of C. Advanced topics such as pointers, structures, file handling and the Standard C Library are explored to broaden students' programming capabilities. Also, through project-based assessments and evaluations, students apply their knowledge to real-world scenarios, fostering creativity and project development skills.

1 Introduction to Computer Programming (3 hours)

- 1.1 Definition of a computer program and programming language
- 1.2 Types and Generations of Programming Languages
- 1.3 Problem-Solving using a Computer
  - 1.3.1 Problem Analysis
  - 1.3.2 Algorithm and Flowchart
  - 1.3.3 Programming
  - 1.3.4 Compilation, Linking and Execution
  - 1.3.5 Debugging and Testing
  - 1.3.6 Documentation

2 Overview of C Programming (3 hours)

- 2.1 Introduction to C programming
- 2.2 History and Importance of C
- 2.3 C Headers and Library Functions
- 2.4 Basic Structure of a C Program
- 2.5 Preprocessor Directives
- 2.6 Tokens in C (Character set, Keywords and Identifiers)
- 2.7 Type Casting (Implicit and Explicit)
- 2.8 Data Types, Variables and Constants
- 2.9 Compiler and IDE for C Programming

3 Operators and Expressions (4 hours)

- 3.1 Introduction to Operators and Expressions
- 3.2 Arithmetic, Relational and Logical Operators
- 3.3 Assignment, Increment and Decrement Operators
- 3.4 Conditional, Bitwise and Special Operators
- 3.5 Comma Operator, size of Operator
- 3.6 Evaluation and Type Conversion in Expressions
- 3.7 Operator Precedence and Associativity

4 Input and Output (3 hours)

- 4.1 Introduction to data I/O in C
- 4.2 Unformatted I/O
  - 4.2.1 Character I/O
  - 4.2.2 String I/O
- 4.3 Formatted I/O
  - 4.3.1 Control String (flags, field width, precision, and specifier)
  - 4.3.2 Formatted I/O (scanf(), printf())

5 Control Structures (8 hours)

- 5.1 Introduction to Simple and Compound Statement
- 5.2 Sequential Statement
- 5.3 Branching Statement
  - 5.3.1 Simple if Statement
  - 5.3.2 if-else Statement
  - 5.3.3 Nested if-else Statement
  - 5.3.4 else-if Ladder
  - 5.3.5 switch Statement
  - 5.3.6 go to statement
- 5.4 Looping Statement
  - 5.4.1 for loop
  - 5.4.2 while loop
  - 5.4.3 do while
  - 5.4.4 Nested loop
- 5.5 Loop Interruption
  - 5.5.1 break
  - 5.5.2 continue

6 Array and Pointer (7 hours)

- 6.1 Introduction to an Array
- 6.2 One-dimensional Array
- 6.3 Two-dimensional Array
- 6.4 Multidimensional Array
- 6.5 Introduction to String
- 6.6 String Handling Functions
- 6.7 Definition of a Pointer
- 6.8 Pointer Declaration
- 6.9 Pointer Arithmetic
- 6.10 Relationship between Pointer and Arrays

7 User-defined Functions (6 hours)

- 7.1 Introduction to Function
- 7.2 Advantages of Function
- 7.3 Elements of User-defined Function
  - 7.3.1 Function Definition
  - 7.3.2 Function Prototype
  - 7.3.3 Function Parameters
- 7.4 Storage Class
- 7.5 Scope Rules
- 7.6 Category of Functions
  - 7.6.1 Functions with no arguments and no return values
  - 7.6.2 Functions with arguments and no return values
  - 7.6.3 Functions with arguments and return values
  - 7.6.4 Functions with no arguments and return values
- 7.7 Recursive functions
- 7.8 Function Call by Values and Reference
- 7.9 Passing Array and String to Function

8 Structures (5 hours)

- 8.1 Defining a Structure
- 8.2 Declaring and Accessing Structure Elements
- 8.3 Initializing Structure
- 8.4 Array of Structure
- 8.5 Array as member to Structure
- 8.6 Pointer as member to Structure
- 8.7 Structure as a member to Structure
- 8.8 Passing and Returning Structures to/from Function

9 File management (4 hours)

- 9.1 Introduction
- 9.2 Binary and Text File in C
- 9.3 File Opening Modes
- 9.4 Defining, Opening and Closing File
- 9.5 Input-output operations on files
  - 9.5.1 Character I/O (fputc(), fgetc())
  - 9.5.2 String I/O (fgets(), fputs())
  - 9.5.3 Formatted I/O (fscanf(), fprintf())
  - 9.5.4 Record I/O (fwrite(), fread())
- 9.6 Overview of Random File Access
- 9.7 Error handling

10 Recent Trends in Programming (2 hours)

- 10.1 Introduction to Object Oriented Programming (OOP)
- 10.2 Definitions of Class, Method and Object in OOP
- 10.3 Difference between Procedure Oriented and OOP
- 10.4 Overview of other High Level Programming Languages

Laboratory

1. Lab 1: Introduction and Demonstrations of projects written in C
2. Lab 2: Formatted and Unformatted Input/output in C
3. Lab 3: Branching in Control Structure
4. Lab 4: Looping in Control Structure
5. Lab 5: Array in C
6. Lab 6: String in C
7. Lab 7: Pointers in C
8. Lab 8: User Defined functions in C
9. Lab 9: Structure in C
10. Lab 10: File handling in C
11. Group project on C maximum 4 students in a group at the end of the course.

Reference

1. Robert Lafore, “C Programming Using Turbo C++”, SAMS publication
2. E. Balagurusamy, “Programming in Ansi C”, McGraw Hill Education
3. Bryons S. Gotterfried, “Programming with C”, TMH ….

ENGINEERING DRAWING
ME 101

Lecture : 2 **Year : I**
Tutorial : 0 **Part : I**
Practical : 4

Course Objectives:

To develop basic projection concepts with reference to points, lines, planes and geometrical solids. Also, to develop sketching and drafting skills to facilitate communication.

1 Instrumental Drawing, Technical Lettering Practices and Techniques (1 hour)

1.1 Equipment, materials and drawing sheets (paper)
1.2 Description of drawing instruments, auxiliary equipment and drawing materials
1.3 Techniques of instrumental drawing
1.4 Pencil sharpening, securing paper, proper use of T- squares, triangles, scales dividers, compasses, erasing shields, French curves, inking pens
1.5 Line types and uses, thickness

2 Dimensioning (1 hour)

2.1 Fundamentals and techniques
2.2 Size and location dimensioning, SI conversions
2.3 Scales: Types and Representative factor
2.4 Use of scales, measurement units, reducing and enlarging drawings
2.5 Placement of dimensions: aligned and unidirectional, chain, parallel/baseline and combined type
2.6 Tolerance Dimensioning

3 Geometrical Construction (2 hours)

3.1 Plane geometrical construction: Proportional division of lines, Trisection of angles, smooth arc & line tangents
3.2 Methods for drawing regular polygons and standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and conical), ogee curve
3.3 Techniques to reproduce a given drawing (by construction)

4 Basic Descriptive Geometry (4 hours)

- 4.1 Introduction to Orthographic projection, Principal Planes, Four Quadrants or Angles
- 4.2 Projection of points on first, second, third and fourth quadrants
- 4.3 Projection of Lines: Parallel to one of the principal planes, Inclined to one of the principal plane and parallel to other, Inclined to both principal planes, Traces of a Line
- 4.4 Projection Planes: Perpendicular to both principal planes, Parallel to one of the principal planes and Inclined to one of the principal planes, perpendicular to other and Inclined to both principal planes
- 4.5 True length of lines: horizontal, inclined and oblique lines
- 4.6 Rules for parallel and perpendicular lines
- 4.7 Point view or end view of a line
- 4.8 Shortest distance from a point to a line
- 4.9 Edge View and True shape of an oblique plane
- 4.10 Angle between two intersecting lines
- 4.11 Intersection of a line and a plane, visible portion of line
- 4.12 Angle between a line and a plane
- 4.13 Dihedral angle between two planes
- 4.14 Shortest distance between two skew lines
- 4.15 Angle between two non- intersecting (skew) lines

5 Multi view (orthographic) projections (8 hours)

- 5.1 Orthographic Projections
  - 5.1.1 First and third angle projection
  - 5.1.2 Principal views: methods for obtaining orthographic views, Projection of lines, angles and plane surfaces, analysis in three views, projection of curved lines and surfaces, object orientation and selection of views for best representation, full and hidden lines
  - 5.1.3 Orthographic drawings: making an orthographic drawing, visualizing objects (pictorial view) from the given views
  - 5.1.4 Interpretation of adjacent areas, true-length lines, representation of holes, conventional practices
- 5.2 Sectional Views: Full, half, offset, broken (partial), rotated/aligned, revolved, removed (detail) sections, phantom of hidden section, specifying cutting planes for sections, conventions practices
- 5.3 Auxiliary views: Basic concept and use, drawing methods and types, symmetrical and unilateral auxiliary views, auxiliary sectional views

6 Developments and Intersections (7 hours)

- 6.1 Introduction and Projection of Solids with points transfer
- 6.2 Developments: general concepts and practical considerations, Triangulation method for approximate development of surfaces of a right/oblique; prism, cylinder, pyramid, cone, prism and cylinder cut by

oblique planes, frustum/truncated pyramid and cone, transition pieces for connecting different shapes and sphere

6.3 Intersections: lines of intersection of geometric surfaces, piercing point of a line and a geometric solid, intersection lines of two planes, intersections of – prism and prism, cylinder and prism, cylinder and cylinder, pyramid and prism, cone and prism, pyramid and cylinder, cone and cylinder.

7 Pictorial Drawings (7 hours)

- 7.1 Classifications: Advantages and Disadvantages
- 7.2 Isometric View
  - 7.2.1 Axonometric Projection
  - 7.2.2 Isometric Projection and Isometric Drawing (View)
  - 7.2.3 Isometric and Non-isometric Lines; Isometric and Non-isometric Surfaces
  - 7.2.4 Angles in Isometric Drawing
  - 7.2.5 Circles and Circular Arcs in Isometric and Non-isometric Surfaces (slopes)
  - 7.2.6 Irregular Curves in Isometric Drawing
  - 7.2.7 Isometric sectional Views
- 7.3 Oblique Drawing
  - 7.3.1 Procedure for making an Oblique drawing
  - 7.3.2 Rules for Placing Objects in Oblique drawing
  - 7.3.3 Angles, Circles and Circular Arcs in Oblique drawing
- 7.4 Perspective Projection
  - 7.4.1 Terms used in Perspective Projection
  - 7.4.2 Parallel and Angular Perspective
  - 7.4.3 Selection of Station Point
  - 7.4.4 Perspective projection of right prism and pyramid solid

Assignments

1. Geometrical Construction
2. Descriptive Geometry
3. Multi-view Projection I
4. Multi-view Projection II
5. Surface Development and Intersection
6. Isometric Drawing
7. Oblique Drawing and Perspective Projection

Laboratory

1. Drawing Sheet Layout, Freehand Lettering, Scale, Common Graphical Symbols, Sketching of parallel lines, circles, Dimensioning
2. Geometrical Construction (Sketch and Instrumental Drawing)
3. Descriptive Geometry I (Sketch and Instrumental Drawing)
4. Descriptive Geometry II (Sketch and Instrumental Drawing)
5. Multiview Drawings I (Sketch and Instrumental Drawing)

6. Multiview Drawings II (Sketch and Instrumental Drawing)
7. Multiview, Sectional Drawings and Dimensioning (Sketch and Instrumental Drawing)
8. Auxiliary View, Sectional Drawings and Dimensioning (Sketch and Instrumental Drawing)
9. Projection of Regular Geometrical Solids with point transfer (Sketch and Instrumental Drawing)
10. Surface Development of solids I (Sketch and Instrumental Drawing)
11. Surface Development of solids II (Sketch and Instrumental Drawing)
12. Intersection of solids (Sketch and Instrumental Drawing)
13. Isometric Drawing I (Sketch and Instrumental Drawing)
14. Isometric Drawing II (Sketch and Instrumental Drawing)
15. Oblique Drawing and Perspective Projection (Sketch and Instrumental Drawing)

Reference

1. “Fundamentals of Engineering Drawing”, W. J. Luzadder, Prentice Hall.
2. “Engineering Drawing and Graphic Technology”, T. E. French, C. J. Vierck, and R. J. Foster, Mc Graw Hill Publshing Co.
3. “Technical Drawing”, F. E. Giescke, A. Mitchell, H. C. Spencer and J. T. Dygdone, Macmillan Publshing Co.
4. “Elementary Engineering Drawing”, N. D. Bhatt, Charotar Publshing House, India.
5. “A Text Book of Engineering Drawing”, P. S. Gill, S. K. Kataria and Sons, India
6. “A Text Book of Engineering Drawing”, R. K. Dhawan, S. Chand and Company Limited, India
7. “Engineering Drawing I” and “Engineering Drawing II”, M. C. Luintel, Heritage Publishers and Distributors Pvt. Ltd., Bhotahity, Kathmdu, Nepal

FUNDAMENTAL OF ELECTRICAL AND ELECTRONICS ENGINEERING

EX 101

Lecture : 3 **Year : I**
Tutorial : 1 **Part : I**
Practical : 3

Course Objectives:

Objective of the course is to understand the language of electronics, elements, and their functionality, to introduce the DC and AC circuit analysis and basic understanding of analog systems and their applications

1 Basic Circuits Concepts (6 hours)

1.1 Current and Potential

1.2 Passive components: Resistance, Inductance, Capacitance; series, parallel combinations; Kirchhoff's voltage and current laws for dc circuits.

1.3 Signal sources: voltage and current sources; non ideal sources; representation under assumption of linearity; controlled sources: VCVS, CCVS, VCCS, CCCS; concept of gain, transconductance, transimpedance.

1.4 Maximum power transfer, Superposition theorem, Thevenin's theorem, Norton's theorem

2 Average and RMS Values (4 hours)

2.1 Generation of AC voltage

2.2 Waveform and its characteristics

2.3 RMS and Average values of periodic waveforms

3 AC Circuit Analysis (12 hours)

3.1 Single Phase AC Circuit Analysis

- 3.1.1 Series, parallel and network circuits with sinusoidal excitations
- 3.1.2 The concept of complex impedance and admittance
- 3.1.3 Sinusoidal excitation of inductive and capacitive reactance and complex impedance
- 3.1.4 Concept of time phase differences between various sinusoidal quantities
- 3.1.5 Phasor concept and phasor representation of AC quantities
- 3.1.6 Transformed Impedances and network reduction
- 3.1.7 Real , reactive and apparent power Concepts

3.2 Three Phase AC Circuit
  3.2.1 Generation of three phase voltage
  3.2.2 Wye and Delta connection

4 Diodes (7 hours)

4.1 Semiconductor diode characteristics
4.2 Modeling the semiconductor diode
4.3 Diode circuits: clipper; clamper circuits
4.4 Zener diode, LED, Photodiode, Varactor diode, Tunnel diodes
4.5 DC power supply: rectifier – half wave, full wave (center tapped, bridge), Zener regulated power supply

5 Transistor (10 hours)

5.1 BJT configuration and biasing, small and large signal model
5.2 T and π model
5.3 Concept of differential amplifier using BJT
5.4 BJT as switch and logic circuits
5.5 Construction and working principle of JFET, MOSFET and CMOS
5.6 MOSFET as logic circuits

6 The Operational Amplifier and Oscillator (6 hours)

6.1 Basic model; virtual ground concept; inverting amplifier; non-inverting amplifier; integrator; differentiator, summing amplifier and their applications
6.2 Basic feedback theory; positive and negative feedback; concept of stability; oscillato**r**
6.3 Waveform generator using op-amp for Square wave, triangular wave, Phase Shift oscillator and Wien bridge oscillator for sinusoidal waveform

Laboratory

1. Familiarization with passive components, function generator and oscilloscope
2. Measurement of amplitude, frequency, time period using oscilloscop
3. Ohm’s law, series, parallel circuits and calculate average, RMS value
4. Verification of KCL, KVL and network theorems
5. Maximum power transfer/ capacitor charging and discharging
6. Diode characteristics, rectifiers, Zener diodes
7. Bipolar junction transistor characteristics and single stage amplifier
8. BJT, PMOS, NMOS and CMOS as switch
9. Inverting, non-inverting, summing and subtractor amplifier using Op-amp
10. Relaxation oscillator
11. Analog sensor and small projects

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ENGINEERING WORKSHOP
ME 106

Lecture : 1 **Year : I**
Tutorial : 0 **Part : I**
Practical : 3

Course Objectives:

After completing this course, the students will be able to practice workshop safety rules effectively with different hand tools and machine tools for producing metal and sheet metal components. Acquire knowledge and practice on casting, forging, welding, soldering, brazing and riveting.

1 Safety Measures in the Workshop (1 hour)

1.1 Causes of accident
1.2 Types of safety: General safety, personal safety, machine and equipment safety, job safety

2 Bench Work and Fittings (4 hours)

2.1 Fitting Tools: Types, uses of holding tools, sticking tools, cutting tools (files, chisels, hacksaw), scrapping tools (scrappers), drilling tools (drill bits), measuring, marking and testing tools (steel rule, calipers, divider, surface plate, scriber, surface gauge, punches, angle plate, try square, combination sets, vernier caliper, micrometer, bevel protractor, miscellaneous tools (wrenches, screw drivers and pliers)
2.2 Benchwork and fitting operation
2.3 Filling operations, chipping operations and sawing operation

3 Thread Cutting (1 hour)

3.1 Classification of threads
3.2 Thread cutting tools for hand threading
3.3 Threading taps: Types, uses and care
3.4 Threading dies: Types, uses and care
3.5 Thread cutting by hand: Cutting internal and external thread

4 Sheet Metal (2 hours)

4.1 Introduction, sheet metal tools, sheet metal operation

4.2 Rivet types, types of rivet joints, riveting tools and their uses, riveting procedure

5 Machine Tools (2 hours)

5.1 Lathes: Working principle, types of lathes, main parts of lathe, lathe operations (facing, centre drilling, turning, knurling, boring, chamfering, thread cutting, counter sinking, counter boring).

5.2 Drilling Machine: Types of drilling machine, types of drill bits, drilling operations (drilling, counter boring, reaming, tapping)

6 Forging and Casting (1.5 hours)

6.1 Introduction, forging tools, forging operations

6.2 Introduction, pattern making foundry tools, core making, sand casting process

7 Welding (2.5 hours)

7.1 Arc welding: Introduction, arc welding equipment and accessories, influencing factor in arc welding, methods of striking an arc (tap, scratch), electrodes, types of joint, welding positions, TIG, MIG welding

7.2 Gas welding: Oxyacetylene gas welding, oxyacetylene gas welding accessories, filler rods, fluxes, types of flames and uses

8 Brazing and Soldering (1 hour)

8.1 Introduction, brazing equipment and materials, brazing process, surface clearing, join design, support parts, brazing operations (heating, filler metal applications, flux application, clearing after brazing)

8.2 Introduction, flux, soft solder and soldering process

Laboratory

1. Fitting Practice: Demonstration, usage of different types of hand tools and measuring instruments.
2. Perform Filing, sawing, drilling and tapping operations on given Mild steel strip
3. Machining practice: Perform Lathe operations
4. Welding Practice: Perform Arc welding and Oxy-Acetylene gas welding operations
5. Sheet metal practice: Perform sheet metal operations
6. Soldering and brazing
7. Electrical installations

Reference

1. Khurmi, R. S., & Gupta, J. K. (2008). A Textbook of Workshop Technology. S. Chand Publishing.

2. Raghuwanshi, B. S. (1990). A Course in Workshop Technology, Volume II (machine tools). New Delhi: Dhanpat Rai & Company Ltd, 23(5), 309-316.
3. S. K. Hajra Choudhary, A. K. Hajra Choudhary (2005). Elements of Workshop Technology Vol. I and II: Manufacturing Processes. Media promoter & publishers Pvt. Ltd.
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COMPUTER ORGANIZATION AND ARCHITECTURE
ENEX 253

Lecture : 3 — **Year : II**
Tutorial : 1 — **Part : II**
Practical : 3/2

Course Objectives:

The objective of this course is to provide the organization, architecture and designing concept of computer system including processor architecture, computer arithmetic, memory system, I/O organization and multicore.

1 Introduction (6 hours)

- 1.1 Organization and architecture
- 1.2 Structure and function
- 1.3 The evolution of computer architecture (RISC, CISC, BERKELEY RISC I, overlapped register window)
- 1.4 Performance assessment
  - 1.4.1 Clock speed and instruction per second
  - 1.4.2 Instruction execution rate: CPI, MIPS Rate, MFLOPS rate, arithmetic mean, harmonic mean, speed metric, geometric mean, rate metric, Amdahl's law, speed up
- 1.5 Computer function
  - 1.5.1 Instruction fetch and execute
  - 1.5.2 Instruction cycle state diagram
- 1.6 Interconnection structure, bus interconnection, multilevel bus hierarchy, PCI

2 Central Processor Organization (6 hours)

- 2.1 Processor bus organization
- 2.2 ALU: Arithmetic circuit, logic circuit, one and multi-stage ALU, shifter
- 2.3 Instruction formats: CPU organization, zero and more address instruction formats
- 2.4 Addressing modes
- 2.5 Instruction set
  - 2.5.1 Data transfer instruction
  - 2.5.2 Data manipulation instruction: Arithmetic, logical and shift operations
  - 2.5.3 Program control instruction
- 2.6 Status bit conditions

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3 Control Unit (5 hours)

3.1 Definition, block diagram, control signals
3.2 Hardwired and microprogrammed CU
3.3 Microprogramming approach
  3.3.1 Control memory and its organization
  3.3.2 Computer organization
  3.3.3 Microprogram organization
  3.3.4 Address sequencing
  3.3.5 Mapping of microoperations
  3.3.6 Microinstruction formats
  3.3.7 Microprogramming examples
  3.3.8 Microprogram sequencer
  3.3.9 Field decoding

4 Memory System (8 hours)

4.1 Characteristics of memory system
4.2 Memory classification and hierarchy
4.3 RAM (SRAM and DRAM) and ROM organization: Circuit level implementation
4.4 Locality of reference
4.5 Cache memory principle
  4.5.1 Cache and main memory
  4.5.2 Cache / main memory structure
  4.5.3 Cache read operation
  4.5.4 Typical cache organization
  4.5.5 Elements of cache design (Cache address, cache size, mapping techniques, replacement algorithms, write policy, line size, number of caches)

5 Computer Arithmetic (8 hours)

5.1 Integer and floating-point representation
5.2 Integer arithmetic
  5.2.1 Addition and subtraction
  5.2.2 Multiplication
  5.2.3 Division
5.3 Floating-point arithmetic
  5.3.1 Addition and subtraction
  5.3.2 Multiplication
  5.3.3 Division

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6 Pipelining and Vector Processing **(4 hours)**

6.1 Pipelining concept
6.2 Types of pipelining: Instruction and arithmetic pipelining
6.3 The major hurdle and hazards of pipelining: Data, structure and control hazards
6.4 Vector computation
  6.4.1 Vector computation approach
  6.4.2 Implementation: Pipelined ALU, parallel ALU and parallel processors

7 Input Output (I/O) Organization **(4 hours)**

7.1 Peripheral device
7.2 I/O modules
7.3 I/O interface
7.4 Modes of transfer
  7.4.1 Programmed I/O
  7.4.2 Interrupt driven I/O
  7.4.3 DMA
7.5 I/O processor
7.6 Data communication processor

8 Multicore Computer **(4 hours)**

8.1 Multicore computer
8.2 Hardware performance issues
  8.2.1 Increase in parallelism
  8.2.2 Power consumption
8.3 Software performance issue: Software in multicore
8.4 Multicore organization

Tutorial **(15 hours)**

1. Numerical examples on performance assessment
2. Design of arithmetic circuit, logic circuit and ALU
3. Coding examples covering different instruction formats
4. Microprogramming examples in CU
5. Cache memory mapping: Hit and miss ratio
6. Numerical examples for various arithmetic algorithms

Practical **(22.5 hours)**

1. Programming / simulation for addition and subtraction algorithm
2. Programming / simulation for multiplication algorithm
3. Programming / simulation for division algorithm
4. Programming / simulation for cache mapping techniques
5. Programming / simulation for ALU
6. Programming / simulation for vector processing

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	6	8
2	6	8
3	5	8
4	8	10
5	8	10
6	4	5
7	4	5
8	4	6
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Stalling, W. (2018). Computer Organization and Architecture. Pearson Education INC.
2. Mano, M. M. (2008). Computer System Architecture. Pearson Education INC.
3. Hennessy, J. L. Patterson D. A., (2000). Computer Architecture - A Quantitative Approach. Harcourt Asia PTE Ltd.

ELECTROMAGNETICS
ENEX 254

Lecture : 3 Year :II
Tutorial : 1 Part : II
Practical : 3/2

Course Objectives:
The objective of this course is to provide students with a basic mathematical concepts related to electromagnetic time invariant and time variant fields including electromagnetic wave and their transmission on different media

1 Introduction **(4 hours)**
- 1.1 Scalar and vector fields
- 1.2 Operations on scalar and vector fields
- 1.3 Co-ordinate systems (Cartesian, cylindrical and spherical) and conversions

2 Electric Field **(15 hours)**
- 2.1 Coulomb's law
- 2.2 Electric field intensity
- 2.3 Electric flux density
- 2.4 Gauss's law and applications
- 2.5 Physical significance of divergence, divergence theorem
- 2.6 Electric potential, potential gradient
- 2.7 Energy density in electrostatic field
- 2.8 Electric properties of material medium
- 2.9 Free and bound charges, polarization, relative permittivity, electric dipole electric boundary conditions
- 2.10 Current, current density, conservation of charge, continuity equation, relaxation time
- 2.11 Boundary value problems, Laplace and Poisson equations and their solutions, uniqueness theorem

3 Magnetic Field **(9 hours)**
- 3.1 Biot-Savart's law
- 3.2 Magnetic field intensity
- 3.3 Ampere's circuital law and its application
- 3.4 Magnetic flux density
- 3.5 Physical significance of curl, Stoke's theorem
- 3.6 Scalar and magnetic vector potential
- 3.7 Magnetic properties of material medium

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3.8 Magnetic force, magnetic torque, magnetic moment, magnetic dipole, magnetization
3.9 Magnetic boundary condition

4 Time Varying Fields **(4 hours)**

4.1 Faraday's law, transformer EMF, motional EMF
4.2 Displacement current
4.3 Maxwell's equations in integral and point forms

5 Plane Waves **(9 hours)**

5.1 Wave propagation in lossless and lossy dielectric
5.2 Plane waves in free space, lossless dielectric, good conductor
5.3 Power and poynting theorem average power density
5.4 Reflection of plane wave at normal incidence
5.5 Standing wave and SWR
5.6 Input intrinsic impedance

6 Transmission Lines **(4 hours)**

6.1 Transmission line equations (Taking analogy from wave equations)
6.2 Lossless, lossy and distortionless transmission lines
6.3 Input impedance, reflection coefficient, standing wave ratio

Tutorial **(15 hours)**

1. Conversion of coordinate systems (Cartesian to cylindrical /spherical and vice versa, cylindrical to spherical and vice versa)
2. Electric field intensity and flux density (Coulomb's law, Gauss law, divergence, electric potential and energy density)
3. Boundary condition, electric dipole, and boundary value problems
4. Magnetic fields (Biot-Savart law, Ampere circuit law, Stoke's theorem, magnetic force and torque)
5. Time varying fields (Transformer/motional EMF, displacement current)
6. Wave propagation equations in lossy and lossless medium (Poynting theorem, standing wave ratio and intrinsic impedance)
7. Transmission line (Lossless, lossy and distortionless)

Practical **(22.5 hours)**

1. Teledeltos (Electro-conductive) paper mapping of electrostatic fields
2. Determination of dielectric constant, display of a magnetic hysteresis loop
3. Studies of wave propagation on a lumped parameter transmission line
4. Microwave sources, detectors, transmission lines
5. Standing wave patterns on transmission lines, reflections, power patterns on transmission lines, reflections, power measurement
6. Familiarizations of electric and magnetic field measurements using simulation tool

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	4	5
2	15	20
3	9	12
4	4	6
5	9	12
6	4	5
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Hayt, W. H. (2001). Engineering Electromagnetics. McGraw-Hill Book Company.
2. Kraus, J. D. (1973). Electromagnetics. McGraw-Hill Book Company.
3. Rao, N. N. (1990). Elements of Engineering Electromagnetics. Prentice Hall.
4. Devid K. Cheng, (1989). Field and Wave Electromagnetics. Addison-Wesley.
5. Sadiku, M. N. O. (2010). Elements of Electromagnetics. Oxford University Press.

INSTRUMENTATION
ENEX 252

Lecture : 4 | Year : II
Tutorial : 1 | Part : II
Practical : 3/2

Course Objectives:
The objective of this course is to provide comprehensive understanding on methods and instrument for a wide range of measurement problems used in instrumentation system. It also covers application of transducers in the microprocessor, microcontroller and their interfacing to design instrumentation system.

1 Introduction (2 hours)

1.1 Analog and digital instrument: Definition, block diagram, characteristics
1.2 Microprocessor-based systems: Open vs closed loop, benefits, features and applications in instrumentation design
1.3 Microcomputer on instrumentation design

2 Theory of Measurement (6 hours)

2.1 Static performance parameters: Accuracy, precision, sensitivity, resolution and linearity
2.2 Dynamic performance parameters: Response time, frequency response and bandwidth
2.3 Error in measurement
2.4 Statistical analysis of error in measurement
2.5 Measurement of resistance (Low, medium and high)
2.6 DC / AC bridge (Wheatstone bridge, Maxwell's bridge, Schering bridge)

3 Transducer (8 hours)

3.1 Transducer, workflow of a transducer in typical system, transducer classification
3.2 Sensor and its working principle (Resistive, capacitive and piezoelectric), generation of sensor, classification of sensor (Analog sensor, digital sensor)
3.3 Types of sensors (Electrical sensor, chemical sensor, biological sensor, acoustic sensor, optical sensor and other motion sensor), characteristic of sensors
3.4 Actuator, classification of actuators (Hydraulic, pneumatic, electric and mechanical), characteristic of actuator

4 Interfacing of Instrumentation System (14 hours)

4.1 Microprocessor and microcontroller and their selection criteria, and applications

4.2 The PPI 8255 and interfacing of peripherals (LED, 7 segment, dip switch, 8-bit ADC, 8/10-bit DAC using mode 0 and mode1) with 8085 microprocessor

4.3 Microcontrollers (Atmega328, STM32): Architecture, pin configuration, and their application

4.4 Sensor/Actuator interfacing with Atmega328P (Arduino): Analog and digital sensors, implementation of communication protocols, interrupt based interfacing

5 Connectivity Technology in Instrumentation System (6 hours)

5.1 Wired and wireless communication system

5.2 Wired connectivity: UART, I2C, SPI, CAN

5.3 Wireless sensor network and its technology

5.4 RF modem, Bluetooth, WI-FI, NFC, ZIGBEE and LORA

5.5 Thermal management: Heat dissipation technique, heat sink

5.6 Data acquisition system (Data loggers, data archiving and storage), cloud based data acquisition system

6 Circuit Design (4 hours)

6.1 Converting requirement into design, reliability and fault tolerance

6.2 High-speed design: Bandwidth, decoupling, crosstalk, impedance matching

6.3 PCB design: Component placement, trace routing, signal integrity, and ground loops

6.4 Noise and noise coupling mechanism, noise prevention, filtering, ferrite beads, decoupling capacitors, and ESD & its prevention

7 Software for Instrumentation Application (6 hours)

7.1 Overview of software engineering

7.2 Types of software

7.3 Software development life cycle (SDLC), software process models (Waterfall model, prototype model, incremental model, agile model)

7.4 Software reliability vs hardware reliability

7.5 Software bugs, software testing, different levels of testing

8 Electrical Equipment (6 hours)

8.1 Voltmeter and ammeter: Types and working principle

8.2 Energy meter: Types and working principle

8.3 Frequency meter: Types and working principle

8.4 Wattmeter: Types and working principle

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9 Latest Trends (3 hours)

9.1 Internet of things (IoT): Simple architecture, characteristics, advantages
9.2 Smart sensors
9.3 Important of cloud computing in instrumentation system
9.4 Instrumentation in industry 4.0/5.0

10 Application of Modern Instrumentation System (5 hours)

10.1 Instrumentation for power station including all electrical and non-electrical parameters
10.2 Instrumentation for wire and cable manufacturing and bottling plant
10.3 Instrumentations for a beverage manufacturing and bottling plant
10.4 Instrumentations required for a biomedical application such as a medical clinic or hospital
10.5 Instrumentation system design using a processor (Microprocessor, microcontroller or others)

Tutorial (15 hours)

1. Understanding the fundamentals of Op-amps is essential since they are central to analog instrumentation.
2. Learn how to filter, amplify, and modify analog signals for signal conditioning
3. How ADCs and DACs work and how to select the right one for your application
4. Interfacing of ADC on any application of your interest
5. Application for the protocol UART, I2C, SPI in Adriano
6. Design a simple temperature sensing system using a thermistor or thermocouple, op-amp, and analog display.
7. Explain the generation of PWM signals in ATmega328P for controlling things like motor speed or LED brightness.

Practical (22.5 hours)

1. Measurement and accuracy testing: Analog and digital meters
2. Use of LabVIEW, Proteus, MATLAB or others for modeling instrumentation systems
3. Use of resistive, capacitive & inductive transducers / sensors / actuators
4. Review of assembly programming and simple I/O interfacing with 8085 and 8255
5. Interfacing of LEDs, seven segment display and motors
6. Interfacing of ADC and DAC

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Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	2	4
2	6	5
3	8	6
4	14	12
5	6	6
6	4	4
7	6	6
8	6	6
9	3	5
10	5	6
Total	**60**	**60**

* There may be minor deviation in marks distribution.

References

1. Hall, D. V., (1999). Microprocessor and Interfacing, Programming and Hardware. Tata McGraw Hill
2. Goankar, R. S., (2000). Microprocessor Architecture, Programming and Application with 8085. Prentice Hall
3. Fowler, K. R., (1996). Electronic Instrument Design: Architecting for the Life Cycle. Oxford University Press, Inc.
4. Sawhney, A. K., (1998). A Course in Electronic Measurement and Instrumentation. Dhanpat Rai and Sons.
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6. DE Silva C. W., Sensors and Actuators: Control System Instrumentation. CRC Press Taylor and French Group Boca Raton London New York.
7. Misra, S., Roy, C. and Mukherjee, A., (2020). Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

SIGNALS AND SYSTEMS
ENEX 255

Lecture	**: 3**	**Year : II**
Tutorial	**: 1**	**Part : II**
Practical	**: 3/2**	

Course Objectives:

The objective of this course is to provide students with a fundamental understanding of how signals are represented, analyzed, and processed in various systems. Students will grasp essential concepts such as signal classification, time and frequency domain analysis, convolution and Fourier analysis. By the end of the course, students should be proficient in solving problems related to signal processing and system analysis, enabling them to design and optimize systems effectively.

1 Signal and its Types (7 hours)

1.1 Introduction to signal and signal processing
1.2 Classification of signal based on dimension
1.3 Classification of one-dimensional signal (CT and DT) and properties
1.4 Fundamental signals: Delta function, unit step, ramp, rectangular pulse, signum function
1.5 Relationship between unit step and delta function
1.6 Signal classification based on causality
1.7 Classification of signals based on periodicity (CT and DT)
1.8 Transformation of the independent variable
1.9 Energy and power signals
1.10 Even and odd signals
1.11 System, types of systems: Linear and non-linear, causal and non-causal, time-invariant and time-variant

2 Fourier Series (9 hours)

2.1 Introduction to Fourier series
2.2 Fourier series representation of continuous time periodic signal
2.3 Properties of continuous time Fourier series: Linearity, time shifting, time scaling, time reversal, convolution, multiplication, frequency shifting, conjugate symmetry, Parseval's relation
2.4 Fourier series representation of discrete time periodic signal
2.5 Properties of discrete time Fourier series: Linearity, time shifting, time scaling, time reversal, convolution, modulation, conjugate symmetry, Parseval's relation
2.6 Applications of Fourier series

3 Fourier Transform (9 hours)

3.1 Introduction to Fourier transform
3.2 Continuous time Fourier transform
3.3 Properties of continuous time Fourier transform: Linearity, time shifting, frequency shifting, time scaling, time reversal, convolution, multiplication, duality, conjugation, Parseval's relation
3.4 Discrete time Fourier transform
3.5 Properties of discrete time Fourier transform: Linearity, time shifting, frequency shifting, time reversal, convolution, modulation, conjugation, Parseval's relation
3.6 Fourier transform for periodic signals
3.7 Applications of Fourier transform

4 Linear Time Invariant (LTI) System (7 hours)

4.1 Linear time invariant (LTI) system
4.2 Convolution integral properties of LTI system
4.3 Representation of discrete-time signals in terms of impulses
4.4 Convolution sum
4.5 Representation of continuous-time signals in terms of impulses
4.6 Convolution integral
4.7 Practical applications of convolution

5 Sampling (6 hours)

5.1 Introduction to sampling
5.2 Sampling theorem
5.3 Practical consideration of sampling and impulse-train sampling
5.4 Signal reconstruction from sampled version
5.5 Aliasing
5.6 Band limited signals

6 Frequency Response of Continuous and Discrete Time Systems (7 hours)

6.1 Frequency response of continuous time systems
6.2 Transfer function of continuous time system
6.3 Impulse response of ideal low-pass, band-pass and high-pass filter
6.4 Response of ideal low pass filter to a step function input
6.5 Frequency and Impulse response of RC filter
6.6 Frequency response of discrete time systems: Transfer function
6.7 Impulse response of low-pass, band-pass and high-pass filter

Tutorial (15 hours)

1. Numerical related to signal construction and periodicity
2. Numerical related to extraction of even and odd part of both continuous and discrete time signals

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3. Numerical to calculate the energy and power of both continuous and discrete time signals
4. Numerical related to Fourier series and its properties
5. Numerical related to Fourier transform and its properties
6. Numerical exercise to compute convolution sum and convolution integral
7. Numerical related to sampling and aliasing and signal reconstruction

Practical **(22.5 hours)**

1. Generation of continuous time sinusoidal signal, continuous time unit step signal, discrete time unit step signal, continuous time ramp signal, continuous time sinc function, discrete time sinusoidal signal, discrete time unit step signal, discrete time unit impulse signal, continuous time exponential signals, discrete time exponential signals, continuous time complex exponentials and discrete time complex exponentials
2. Convolution: Square wave with odd symmetry
3. Magnitude and phase of rational signal
4. Fourier series
5. Fourier transform

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	7	10
2	9	12
3	9	12
4	7	10
5	6	7
6	7	9
Total	**45**	**60**

* There may be minor deviation in marks distribution.

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1. Oppenheim, A.V., Willsky, A.S., Nawab, S.H. (2013). Signals and Systems. Pearson education second edition.
2. Oppenheim, A., Schafer, R. W. (2013). Discrete-Time Signal Processing: Pearson New International Edition. United Kingdom: Pearson Education.
3. Ingle, V. K., Proakis, J. G. (2000). Digital signal processing using MATLAB. United Kingdom: Brooks/Cole.
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