

Roll No.

40004

**B. Tech. 2nd Sem. (Fire Technology &
Safety) Examination – May, 2026**

**INTRODUCTION TO ELECTROMAGNETIC THEORY
(IEMT)**

Paper : 25BSC-PHY-101-H

Time : Three Hours]

[Maximum Marks : 70

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Attempt any *seven* sub-questions : $7 \times 2 = 14$

- (a) Write properties of magnetic lines of forces.
- (b) Find out the value of divergence of a vector i.e.,
 $\vec{E} = x\hat{i} + xy\hat{j} + 4z^2\hat{k}$ at a point $(1, -1, -1)$.
- (c) What do mean by conservation of charge ?
- (d) Write Poisson and Laplace's equation.

40004-1850-(P-4)(Q-9)(26)

P. T. O.

- (e) What is the dimensional formula for the ratio of electric field intensity to magnetic field intensity i.e. E/B ?
- (f) Define the electric dipole moment and write its unit.
- (g) What do you mean by electric susceptibility and relative permittivity and write their relation?
- (h) Explain electromagnetic breaking.
- (i) What do you mean by transverse nature of electromagnetic waves?
- (j) Explain Lenz's Law.

UNIT - I

- 2. (a) What do you mean by electric dipole and electric dipole moment? Find out electric potential at axial and equatorial lines of the dipole. 7
- (b) State Gauss's law in electrostatics and find out electric field intensity due to infinity long straight wire carrying uniform linear charge. 7
- 3. (a) What do you mean by polar and nonpolar dielectrics? Define electric field intensity ($\vec{E}$), electric polarization vector ($\vec{P}$) and electric displacement vector ($\vec{D}$) and derive their relation i.e. $\vec{D} = \epsilon_0 \vec{E} + \vec{P}$. 7

40004-1850-(P-4)(Q-9)(26) (2)

- (b) Find boundary conditions of electric field intensity and potential. 7

UNIT - II

- 4. (a) Write the integral and differential form of Biot-Savart law and find out the magnetic field intensity at the center of the current-carrying circular wire. 7
- (b) Write short notes on properties of Diamagnetic, Paramagnetic and Ferromagnetic materials. 7
- 5. (a) What do you mean by Magnetic vector potential ($\vec{A}$). Show that $\nabla^2 \vec{A} = -\mu_0 \vec{J}$, where $\vec{J}$ is electric current density. 7
- (b) Derive differential form of all Maxwell equations and write their physical significance. 7

UNIT - III

- 6. (a) Discuss the limitation of Ampere's law and explain Maxwell's correction to it. 7
- (b) Discuss magnetic polarization. Define relative permeability (μ_r), and magnetic susceptibility (χ_m) and derive their relation i.e. $\mu_r = 1 + \chi_m$. 7
- 7. (a) State and prove the Poynting Theorem. 7

40004-1850-(P-4)(Q-9)(26) (3)

P. T. O.

- (b) Define electromagnetic induction. A rectangular coil of length 'L' (the side that cuts magnetic flux) moves with constant speed 'v' and enters a region of uniform magnetic field 'B'. The plane of the coil is perpendicular to magnetic field. Derive an expression for the motional (induced) emf while the coil is partly inside the field. 7

UNIT – IV

8. (a) Show that pressure exerted by electromagnetic wave incident normally on the highly reflective surface is twice the ratio of intensity and speed of the wave i.e., $P = 2I/C$. 7
- (b) Show that electromagnetic wave is transverse in nature. 7
9. (a) Derive the equation of electromagnetic wave in a non-conducting medium. 7
- (b) Write down important properties of electromagnetic waves. Show that electric and magnetic energy densities are equal in electromagnetic waves. 7

Roll No.

3001

B. Tech. 2nd Semester (ECE)

Examination – May - 2026

Introduction to Electromagnetic Theory

Paper : BSC-PHY-101-G

Time : Three hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selection *one* question from each unit. Question no. 1 is *compulsory*. All questions carry equal marks.

1. (a) State Gauss Law. $10 \times 1.5 = 15$
(b) Check whether the given vector Field $E=6x\hat{i}+(3x^2-3y^2)\hat{j}$ is an electrostatic field or magnetostatic field.
(c) Define Poynting vector.
(d) What will be the polarization in the sample of dielectric having polar molecules in the absence of external electric field ?

3001-550-(P-3)(Q-9)(26)

P. T. O.

- (e) Distinguish between polar and non-polar dielectrics.
- (f) What are diamagnetic and paramagnetic substances?
- (g) Define electric flux. Is electric flux a vector or scalar quantity?
- (h) Discuss behavior of dielectric materials in electric fields.
- (i) Discuss electromagnetic braking.
- (j) Write characteristics of electromagnetic waves.

UNIT - I

- 2. (a) Define Potential. Derive an expression for potential due to an electric dipole at any arbitrary point and hence show that electric potential due to an electric dipole varies inversely as square of the distance. 10
- (b) Deduce Poisson's and Laplace equations from differential form of Gauss law in electrostatics. 5
- 3. (a) Prove that curl of electrostatic field is zero and discuss the physical significance of curl. 8
- (b) Obtain expression for Gauss Law in the presence of dielectrics. 7

UNIT - II

- 4. Derive boundary conditions on B. 15
- 5. (a) Define Biot-Savart's Law. Obtain expression for magnetic field at a distance "s" from a long straight wire carrying steady current I. 10
- (b) Derive Ampere's Law for Magnetized materials. 5

UNIT - III

- 6. (a) State Faraday's Law of electromagnetic induction. Derive differential form of Faraday's Law. 7
- (b) Obtain expression for energy stored in magnetic field. 8
- 7. Derive Maxwell's equations in vacuum. 15

UNIT - IV

- 8. Derive wave equation for plane electromagnetic wave in vacuum and hence obtain expression for velocity of propagation of electromagnetic waves in vacuum. 15
- 9. (a) Show that electromagnetic waves are transverse in nature. 10
- (b) Derive expression for energy carried by electromagnetic waves. 5

Roll No.

40005

**B. Tech. 2nd Semester
(Electrical & Electronics Engg.)
Examination – May, 2026**

OSCILLATIONS, WAVE & OPTICS

Paper : 25BSC-PHY-102H

Time : Three Hours]

[Maximum Marks : 70

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Attempt any *seven* sub-questions : $7 \times 2 = 14$
- (i) What is Simple Harmonic Motion ? Mention any two basic characteristics of SHM.
 - (ii) Define damping force. What is the equation of motion for a damped harmonic oscillator ?
 - (iii) What do you mean by resonance and write resonance frequency of LCR circuit ?
 - (iv) Define a wave and give one example each of a transverse and a longitudinal wave.

40005-550-(P-4)(Q-9)(26)

P. T. O.

- (v) Draw a labelled graph of a sinusoidal wave and define wavelength, amplitude, period and phase.
- (vi) What is standing wave ?
- (vii) What do you mean by coherent sources ?
- (viii) What are Huygens postulates of wave theory ?
- (ix) What is Total Internal Reflection ?
- (x) If a He-Ne laser emits light of wavelength 632.8 nm, calculate the energy of a single photon. (Given $h = 6.626 \times 10^{-34}$ J.s.)

UNIT - I

2. (a) Explain in detail the motion of a simple pendulum. Derive its equation of motion and obtain the time period for small oscillations. Discuss the effect of amplitude and length on the time period. Give at least two practical examples where this concept is applied. 10
- (b) A simple pendulum of length $L = 1.5$ m performs small oscillations. Take $g = 9.8$ m/s². Calculate its time period T and frequency f . 4
3. (a) Derive the differential equation for a forced harmonic oscillator subjected to an external periodic driving force $F(t) = F_0 \cos(\omega t)$. Obtain the complete solution of the equation and discuss the transient and steady-state parts of the motion. 10

40005-550-(P-4)(Q-9)(26)

(2)

- (b) A series LCR circuit has $L = 0.1$ H, $C = 50$ μ F, $R = 20$ Ω . Calculate : 4
 - (i) Resonance angular frequency ω_0 and resonance frequency f_0 .
 - (ii) Quality factor Q of the circuit (use the series-RLC formula).

UNIT - II

4. (a) Derive the one-dimensional wave equation for a transverse wave on a string. Explain how the speed of the wave on a stretched string depends on tension and linear mass density. 10
- (b) A stretched string has tension 100 N and linear mass density 0.04 kg/m. Find the speed of a transverse wave on the string. 4
5. (a) Derive the wave equation for longitudinal waves and apply it to the propagation of sound waves in air. Explain how the speed of sound depends on temperature, humidity and density of the medium. 10
- (b) A travelling harmonic wave is given by $y(x, t) = 0.02 \sin(40\pi t - 4\pi x)$ (SI units). Find : amplitude, frequency, wavelength and wave speed. 4

UNIT - III

6. (a) Describe Newton's Rings experiment with a neat labelled diagram. Derive the formula for the radius of dark and bright ring and explain how this experiment is used to find (i) wavelength of light and (ii) refractive index of a liquid. 10

40005-550-(P-4)(Q-9)(26)

(3)

P. T. O.

- (b) Define constructive and destructive interference and also write their conditions. 4
7. (a) Explain the phenomenon of interference in thin parallel films. Derive expressions for the condition of bright and dark fringes in reflection. 10
- (b) In Young double slit experiment, a monochromatic light of wavelength $\lambda = 500\text{nm}$ is incident on slits system of separation $d = 0.5\text{ mm}$. The screen is placed at distance of $D = 1.5\text{ m}$ from slits. A thin transparent sheet of thickness $(t) = 2.0 \times 10^{-4}\text{ m}$ introduced in front of one slit causes central fringe to shift by 200 fringes. Find refractive index μ of the sheet. 4

UNIT – IV

8. (a) Discuss the phenomena of stimulated absorption, spontaneous emission and stimulated emission, and derive the relations between Einstein's coefficients B_{12} , A_{21} and B_{21} . 10
- (b) State the important properties of laser radiation. 4
9. (a) Define optical fiber and angle of acceptance. Derive the expression of angle of acceptance. 10
- (b) List the important applications of laser. 4

Roll No.

3002

B. Tech. 2nd Semester (EE)

Examination – May - 2026

Waves and Optics & Quantum Mechanics

Paper : BSC-PHY-102-G

Time : Three hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, Selecting *one* question from each Section. Question no. 1 is *compulsory*. All questions carry equal marks.

1. (a) What do you mean by simple harmonic motion ?
When will the motion of a simple pendulum be simple harmonic ?
- (b) Draw diagram for experimental setup of Newton's ring experiment and explain why interference fringes are circular in shape ?

3002-200-(P-4)(Q-9)(26)

P. T. O.

- (c) Discuss the concept of monochromaticity as applied to lasers.
- (d) Define dispersive power of the grating. Derive relation for it.
- (e) Draw square-well potential and write down Schrodinger wave equation for a particle in square well potential.
- (f) Differentiate between intrinsic and extrinsic semiconductors. $2.5 \times 6 = 15$

SECTION - I

2. Discuss the theory of forced harmonic oscillator. How does sharpness of resonance depend on damping? Illustrate your answer with suitable diagram. 15
3. What are the electromagnetic waves? Derive Fresnel's equation in transverse electric (TE) mode and determine reflection and transmission coefficients in terms of angle of incidence. 15

SECTION - II

4. (a) Explain construction, working and theory of Michelson's interferometer. How it can be used to determine the wavelength of light used? 10

3002- (P-4)(Q-9)(26) (2)

- (b) State Rayleigh criterion of resolution. Derive an expression for the resolving power of transmission grating. 5

5. (a) Describe the principle, construction and working of Ruby laser. 10

- (b) Explain the terms : 5

(i) Population inversion

(ii) Metastable state

(iii) Optical pumping in laser.

SECTION - III

6. (a) Derive time-dependent Schrodinger wave equation in 3-D. 10

- (b) Give the physical significance of wave function Ψ . 5

7. (a) What is scanning tunneling microscope? Describe its construction, working and applications. 10

- (b) Write a note on field ionization. 5

3002- (P-4)(Q-9)(26) (3)

P. T. O.

SECTION - IV

8. Discuss the origin of energy bands in solids on the basis of Kronig-Penney model. 15

9. Write notes on :

(a) Carrier generation and recombination process. 8

(b) Drift and diffusion currents in semiconductors. 7

Roll No.

40007

**B. Tech. 2nd Semester (Civil Engg.)
Examination – May, 2026**

MECHANICS

Paper : 25BSC-PHY-104H

Time : Three Hours]

[Maximum Marks : 70

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Distinguish between inertial and non-inertial frames of reference.
- (b) What is meant by a central force ? Give *two* examples.
- (c) Find out if the force field $F(x, y) = yz \mathbf{i} + zx \mathbf{j} + xy \mathbf{k}$ is conservative or not. (where $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$ are unit vectors along x , y and z -axis, respectively)
- (d) Define a rigid body.

40007-600-(P-4)(Q-9)(26)

P. T. O.

- (e) Differentiate between limiting friction and non-limiting friction with examples.
- (f) The spherical coordinate of a point $P(r, \theta, \phi)$ are $(10, 30^\circ, 45^\circ)$. Find its cartesian coordinates.
- (g) State the perpendicular axis theorem and mention its application. $7 \times 2 = 14$

UNIT - I

2. (a) What are the scalar and vector? Also, discuss the effect of rotation transformation on them. 10
- (b) Write a short note on Inertial and Non-inertial frames of reference. 4
3. Define Coriolis force and discuss its effect on a particle moving on the earth's surface at latitude λ and discuss Coriolis force's impact on the weather system. 14

UNIT - II

4. What are the central forces? Derive the energy equation and energy diagrams for a central attractive force. 14
5. What are the main differences between central and non-central forces? Show that a central force is always conservative. 14

40007-600-(P-4)(Q-9)(26) (2)

UNIT - III

6. Compute the moment of inertia about the diameter for each of the following objects, assuming they have the same mass and radius:

- (a) A solid sphere
- (b) A hollow sphere

Explain the physical reason for the difference in their moment of inertia values. 14

7. (a) Briefly explain kinetic energy of a rotating rigid body. 7
- (b) Determine the moment of inertia of a disc about an axis perpendicular to its plane and passing through its centre. Also calculate its moment of inertia about a diameter lying in the plane of the disc. 7

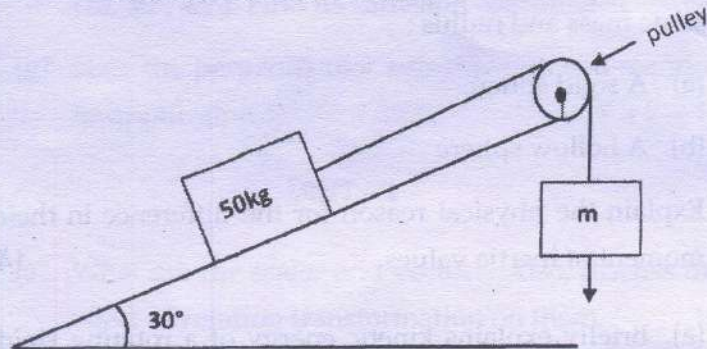
UNIT - IV

8. (a) Write a short note on Frictional forces? Discuss its type and the various factors affecting it in detail. 6
- (b) 50 kg block is on an inclined plane of 30° with the horizontal (as shown in fig. below). This block is attached with a mass m by an inextensible rope. If

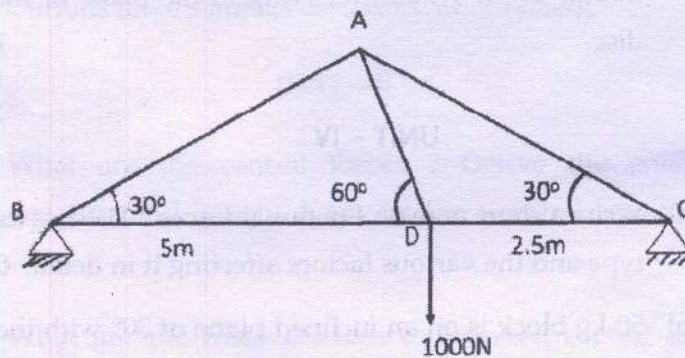
40007-600-(P-4)(Q-9)(26) (3)

P. T. O.

the coefficient of static friction between the block and the plane is 0.3. What is the range of m under which the block is in rest ? 8



9. Define trusses and explain perfect and non perfect trusses. Analyse the given truss of $BC = (BD + DC) = 5\text{m} + 2.5\text{m}$ spans. Loaded at D shown in the figure. Find the magnitude and nature of the force in all members. 14



Roll No.

3004

**B. Tech. 2nd Semester (Civil Engg.)
Examination – May, 2026**

MECHANICS

Paper : BSC-PHY-104-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) What is difference between free and forced oscillations ?
- (b) The spherical coordinate of a point $P(r, \theta, \phi)$ are $(10, 30^\circ, 45^\circ)$. Find its cartesian coordinates.
- (c) What do you mean by coriolis force ?
- (d) Define a rigid body.

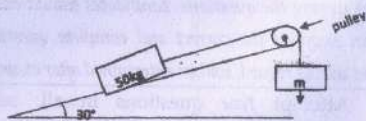
3004-255(P-4)(Q-9)(26)

P. T. O.

- (e) What are trusses ? Explain perfect and non-perfect trusses. 5 × 3 = 15

UNIT - I

2. Derive the expression for Newton's second law in spherical polar co-ordinate. 15
3. A 50 kg block is on an inclined plane of 30° with the horizontal (as shown in fig. below). This block is attached with a mass m by an inextensible rope. If the coefficient of static friction between the block and the plane is 0.3. What is the range of m under which the block is in rest ? 15



UNIT - II

4. Derive the five-term acceleration formula for the rotating coordinate system and explain the fictitious forces. 15
5. What do you understand by damped harmonic oscillations ? Derive its differential equation of motion and hence explain the term lightly damped, overdamped and critically damped oscillations. 15

3004- (P-4)(Q-9)(26) (2)

UNIT - III

6. Discuss the relation between angular momentum and angular velocity and define a moment of inertia tensor. 15
7. (a) What do you understand by a rigid body ? Explain the kinematics of rigid body rotating and translating in a plane. 8
- (b) State and prove the perpendicular axis theorem for a moment of inertia for a plane lamina. 7

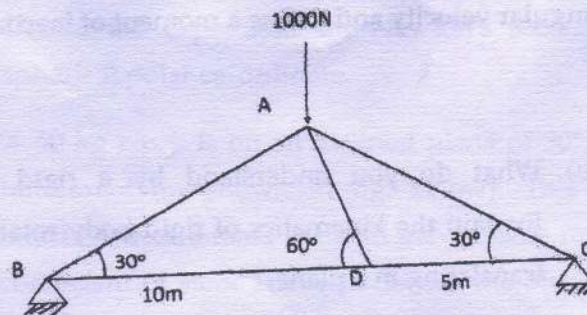
UNIT - IV

8. (a) What is the difference between limiting friction and non-limiting friction ? Derive the expression for the angle of friction and discuss its physical significance with examples. 7
- (b) What do you mean by equilibrium ? What are their types ? And what are conditions of equilibrium in three and two dimensions ? 8

3004- (P-4)(Q-9)(26) (3)

P. T. O.

9. Analyse the given truss of $BC = (BD + DC) = 10\text{ m} + 5\text{ m}$ span, loaded at A as shown in the figure. Find the magnitude and nature of the force in all members. 15



Roll No.

40009

**B. Tech. 2nd Semester
(Common For all Branches)
Examination – May, 2026**

CHEMISTRY

Paper : 25BSC-CH-101H

Time : Three Hours]

[Maximum Marks : 70

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question No. **1** is *compulsory*. All questions carry equal marks.

1. Compulsory Question :

7 × 2 = 14

- (a) Explain the term Auxochrome.
- (b) State Aufbau principle for filling of electrons.
- (c) Write short note on Frenkel defect.

40009-8200-(P-4)(Q-9)(26)

P. T. O.

- (d) Why tetramethyl silane (TMS) is chosen as reference for measuring Chemical Shift in NMR spectroscopy ?
- (e) Unit of Hardness.
- (f) Define the term Tautomerism.
- (g) Write short note on Saytzeff's Rule.

SECTION - A

2. (a) What is Electron Affinity ? On what factors it depends ? How does it vary in group and period. 6
- (b) Write short note on Crystal field splitting in octahedral complexes. 4
- (c) Discuss pi-molecular orbital diagram of butadiene. 4
3. (a) Discuss Intrinsic and Extrinsic semiconductors in detail. 6
- (b) Draw MO energy level diagram of NO molecule and discuss its bond order and magnetic properties. 8

40009-8200-(P-4)(Q-9)(26) (2)

SECTION - B

4. (a) Write the synthesis of Paracetamol. 6
- (b) Differentiate between Enantiomers and Diastereomers. 8
5. (a) What is conformational analysis. Discuss various conformations of n-butane and compare their stability. 8
- (b) Write short notes on : 6
- (i) Oxidation Reaction
- (ii) Cyclisation Reaction

SECTION - C

6. (a) What is Hardness. Discuss its types. How will you measure hardness by EDTA method. 9
- (b) Discuss equation of state of real gases. 5
7. (a) Write short notes on : 6
- (i) Pitting Corrosion
- (ii) Galvanic Corrosion
- (b) Discuss in detail the Lime Soda process for softening of water. 8

40009-8200-(P-4)(Q-9)(26) (3)

P. T. O.

SECTION – D

8. Write short notes on :
- (a) Molecular vibrations in IR spectroscopy 6
 - (b) What is Chemical Shift. Explain the factors that influence chemical shift. 8
9. (a) Discuss Flame Photometry in detail. 6
- (b) Write short notes on :
- (i) Effect of conjugation in UV Spectroscopy 4
 - (ii) Magnetic Resonance Imaging 4

Roll No.

3006

**B. Tech. 2nd Semester
(Common for all Branches)
Examination – May, 2026**

CHEMISTRY-I

Paper : BSC-CH-101-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Define Electron Affinity. $6 \times 2.5 = 15$
(b) Explain the term Chromophore.
(c) Write electronic configuration of Cr and Cu.
(d) What is Emission Spectroscopy?

3006-1640-(P-3)(Q-9)(26)

P. T. O.

- (e) Give significance of Vander Waal's constants a and b .
 (f) Discuss Markonikov's Rule.

SECTION - A

2. (a) What is Ionization Energy ? What are the factors affecting Ionization Energy and how does it vary in group and period. 7
 (b) Discuss Pi-molecular orbital diagram of butadiene. 4
 (c) Write short note on role of doping of band structures. 4
 3. (a) Draw MO energy level diagram of nitrogen molecule and discuss its bond order and magnetic properties. 7.5
 (b) Explain Crystal field splitting in tetrahedral and octahedral complexes. 7.5

SECTION - B

4. (a) Explain Isomerism in Transition metal compounds with examples. 7.5
 (b) Draw various conformations of n-butane and compare their stability. 7.5
 5. (a) Give the synthesis of Aspirin. 6
 (b) What are Substitution Reactions ? Classify them and explain the types. 9

SECTION - C

6. (a) What is Corrosion ? Explain all the factors that affect corrosion. 8
 (b) What is softening of water ? Explain the zeolite process of softening of hard water. 7
 7. (a) Explain the various critical constants. 5
 (b) What is Hardness ? Discuss in detail the EDTA method for hard water determination. 10

SECTION - D

8. Write short note on :
 (a) Principle of Ultraviolet Visible Spectroscopy. 9
 (b) Magnetic Resonance Imaging 6
 9. (a) Discuss the principle working and applications of Flame Photometry. 8
 (b) Explain Molecular vibrations in IR spectroscopy. 7

Roll No.

40010

**B. Tech. 2nd Semester
(Common for all Branches)
Examination – May, 2026**

PROGRAMMING FOR PROBLEM SOLVING

Paper : 25ESC-CSE-101H

Time : Three hours]

[Maximum Marks : 50

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Write short notes on : $2.5 \times 4 = 10$
- (a) Operating system.
 - (b) Syntax & logical errors.
 - (c) Data types.
 - (d) Pointers.

40010-7,600-(P-3)(Q-9)(26)

P. T. O.

UNIT - I

2. Discuss the various types of memories used in a computer system. 10
3. Number conversion : $5 \times 2 = 10$
- (a) $(740)_{10}$ to binary, octal & hexadecimal.
- (b) $(11001101)_2$ to octal, decimal & hexadecimal.

UNIT - II

4. Draw a flowchart to find roots of a quadratic equation. 10
5. What are the differences between assembler, compiler & Interpreter ? 10

UNIT - III

6. (a) Binary search. 5
- (b) Multi-dimensional array. 5
7. WAP in 'C' that calculates factorial of a given number using 'for' loop. 10

40010-7,600-(P-3)(Q-9)(26) (2)

UNIT - IV

8. Explain recursion & WAP in 'C' to print fibonacci series upto 10 terms using recursion. 10
9. (a) Call by Value Vs. Call by Reference. 5
- (b) Structures. 5

40010-7,600-(P-3)(Q-9)(26) (3)

Roll No.

3011

B. Tech. 2nd Semester (CSE)
Examination – May, 2026
PROGRAMMING FOR PROBLEM SOLVING
Paper : ESC-CSE-101-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Write short notes on :

6 × 2.5

(a) Keywords

(b) Call by reference

(c) Do-while loop

3011-ESC(P-3)(Q-9)(26)

P. T. O.

- (d) Union
- (e) Type conversion
- (f) parameter passing in functions

UNIT – I

2. Discuss the idea of algorithm. How is it different from flowchart ? 15
3. (a) Header files $3 \times 5 = 15$
- (b) Storage classes
- (c) Derived data-types

UNIT – II

4. (a) Conditional operator. 5
- (b) WAP in 'C' to make a calculator using switch-case. 10
5. What is difference between for & while loop ? WAP to calculate factorial of a number using for loop. 15

UNIT – III

6. What are strings ? WAP to find whether an input string is palindrome or not. 15

7. Define recursion. WAP for Ackermann function using recursion. 15

UNIT – IV

8. (a) Structures. 7.5
- (b) Dynamic memory allocation. 7.5
9. Demonstrate how to write & read in a file using 'C' program. 15

Roll No.

40011

**B. Tech. 2nd Semester
(Common for all Branches)
Examination – May, 2026**

BASICS OF ELECTRICAL & ELECTRONIC ENGG.

Paper : 25ESC-EE-101-H

Time : Three hours]

[Maximum Marks : 50

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Explain :

2 × 5 = 10

- (a) Kirchhoff's law
- (b) Transistor
- (c) Transformer
- (d) Universal Gates
- (e) LED

40011-8200-(P-3)(Q-9)(26)

P. T. O.

UNIT - I

2. Explain Superposition Theorem with an example. 10
3. A wheatstone bridge ABCD is arranged as follows resistance between A-B, B-C, C-D, D-A and B-D are 10, 2, 8, 4 and $5\ \Omega$ respectively. A 100 V supply is connected between terminals A & C. Determine the current in branches AB & AD of the circuit and the total current taken from the supply. 10

UNIT - II

4. Explain the performance of the transformer on load along with an equivalent circuit and a neat phasor diagram for an inductive load. 10
5. Discuss the open circuit and short circuit test of a transformer in detail. 10

UNIT - III

6. (a) What is PN junction diode ? Explain VI characteristics in detail. 5
- (b) Explain the construction and working principle of MOSFET. 5
7. Explain the working principle of an nPn and PnP transistor in detail. Also explain $I_E = I_B + I_C$ in both the cases. 10

40011-8200-(P-3)(Q-9)(26) (2)

UNIT - IV

8. Explain the logic gates with truth table, symbols and switching representation : 10
- (a) AND
- (b) OR
- (c) NAND
- (d) NOR
- (e) XOR
9. (a) Simplify the following boolean expression : 5
- (i) $Y = A(\bar{A} + C)(\bar{A}B + C)(\bar{A}BC + \bar{C})$
- (ii) $Y = A\bar{B} + (\bar{A} + B)C$
- (b) Explain De-Morgan's theorem with the help of an example. 5

40011-8200-(P-3)(Q-9)(26) (3)

Roll No.

3010

**B. Tech. 2nd Semester
(Common for all Branches)
Examination – May, 2026**

BASIC ELECTRICAL ENGINEERING

Paper : ESC-EE-101-G

Time : Three Hours] [Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question No. 1 is *compulsory*.

1. (a) State and Explain KVL. $10 \times 2.5 = 25$
(b) Define Bilateral Networks.
(c) What are the methods of Power factor improvement in power system ?
(d) Discuss the assumptions of diagram of Ideal Transformer.
(e) Define Auto Transformer.

3010-1702-(P-3)(Q-9)(26)

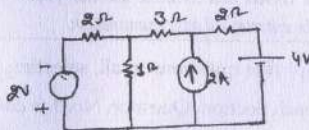
P. T. O.

- (f) Derive and explain the mathematical equation of slip in an Induction motor.
- (g) What is the function of commutator in DC machines?
- (h) What is controlling torque in measuring instruments?
- (i) State and explain Lenz's law.
- (j) Discuss the hysteresis losses in Electrical Machines in brief.

SECTION - A

2. State and Explain Superposition theorem. Solve the given circuit to find the value of current flowing through 1 ohm resistor by using Norton's theorem.

12.5



3. Outline the step-by-step procedure for applying the Nodal analysis to find the voltage across a specific resistor in any given Electrical network.

12.5

SECTION - B

4. Discuss the application Open circuit test in single phase transformer.

12.5

3010- (P-3)(Q-9)(26) (2)

5. Derive the mathematical equation for voltage regulation of single phase transformer at Inductive load.

12.5

SECTION - C

6. Explain how the double field revolving theory 1 phase induction motor.
7. Explain the construction and working principle of Synchronous motor.

12.5

12.5

SECTION - D

8. Explain the construction and working principle of moving Iron Voltmeter in detail.
9. What do you mean by earthing? Discuss the types of earthing in detail.

12.5

12.5

3010- (P-3)(Q-9)(26) (3)

Roll No.

40012

**B. Tech. 2nd Semester
(Common for all Branches)
Examination – May, 2026**

WORKSHOP TECHNOLOGY

Paper : 25ESC-ME-102H

Time : Three Hours]

[Maximum Marks : 35

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Define manufacturing. 7
- (b) What is Additive manufacturing ?
- (c) What is basic principle of hot and cold working ?
- (d) Define hot extrusion.
- (e) Write types of allowances associated with pattern.
- (f) Define resistance welding.

40012-8250-(P-3)(Q-9)(26)

P. T. O.

UNIT - I

2. Define Accident and its types. Explain causes and common sources of Accident. 7
3. Discuss the importance of industrial safety in manufacturing processes. Explain various methods of industrial safety. 7

UNIT - II

4. Describe sheet metal operations, including shearing, punching, blanking, piercing and bending. 7
5. Discuss in detail the types of timber, advantages of timber and defects in timber. 7

UNIT - III

6. Explain the basic steps in casting processes. Discuss the properties of moulding sand. 7
7. Define pattern. Discuss types of pattern with neat sketches. Explain any five casting defects and suggest their remedies. 7

UNIT - IV

8. Explain the principle of Arc Welding. Compare TIG (GTAW) and MIG (GMAW) welding. 7
9. Discuss the principle of Oxy-Acetylene gas welding. Also explain any five welding defects and suggest their remedies. 7

Roll No.

3013

**B. Tech. 2nd Semester
(Common for all branches)
Examination – May, 2026**

WORKSHOP TECHNOLOGY

Paper : ESC-ME-102-G

Time : Three hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

*Note : Attempt **five** questions in all, selecting **one** question from each Unit. Question No. 1 is **compulsory**.*

1. (a) Name *two* secondary process. $2.5 \times 10 = 25$
(b) Name the *two* joining process.
(c) How accidents avoided in a workshop ?
(d) Define hot working.
(e) What is punching ?

3013-[300-(P-3)(Q-9)(26)

P. T. O.

- (f) Draw any two-piece pattern.
- (g) Name the parts of shaper machine.
- (h) Name the gas used in gas welding.
- (i) What is blow hole ?
- (j) What is step turning ?

UNIT - I

- 2. Explain the various methods of preventing the accidents. 12.5
- 3. What is Plant Layout and discuss the various types of plant Layout ? 12.5

UNIT - II

- 4. Differentiate Hot & Cold Working Processes and also explain forging. 12.5
- 5. Discuss the making of metal tank for storing water using Sheet Metal Operations. 12.5

UNIT - III

- 6. Discuss the various parts of lathe machine. 12.5
- 7. Discuss the various types of pattern used in casting process. 12.5

UNIT - IV

- 8. Explain the resistance welding process and classify the various types welding processes. 12.5
- 9. Discuss the various Welding Defects and also discuss the remedies of same. 12.5

Roll No.

40013

**B. Tech. 2nd Semester (Common for all
Branches) Examination – May, 2026**

ENGLISH

Paper : 25HSMC-ENG-101-H

Time : Three Hours]

[Maximum Marks : 35

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. Answer the following questions briefly : $1 \times 7 = 7$

- (a) Correct the sentence "She is having two brothers".
- (b) Make a sentence on "Subject + Verb + Object + Infinitive".
- (c) Supply one word substitute for "a person who cannot read or write".
- (d) Change the voice in "Open the door".
- (e) Use the idiom 'once in a blue moon' in a sentence.

40013-7550-(P-4)(Q-9)(26)

P. T. O.

(f) What do you mean by 'IPA' ?

(g) What is 'detachment' according to Swami Vivekanand ?

UNIT - I

2. Make sentences based on following verb patterns : 7

- (i) Subject + Modal + Verb + Object
- (ii) Subject + Verb + Object + Wh-clause
- (iii) Subject + Verb + Complement + Adverb
- (iv) Sub + Verb + Gerundical infinitive
- (v) Subject + Verb + Object + Object Complement
- (vi) Subject + Verb + Object + Adjective
- (vii) Subject + Verb + Object Complement

3. Correct the following sentences : 7

- (i) One of the students have failed.
- (ii) He is senior than me.
- (iii) She is married with a doctor
- (iv) Neither of the boys have come back
- (v) He suggested me to join his club
- (vi) The noise caused me wake up suddenly
- (vii) The news are very surprising

UNIT - II

4. Use the following *idioms* in your sentences so as to make the meanings of the idioms clear ; 7

- (i) By leaps and bounds
- (ii) Nail biting experience
- (iii) Fool's paradise
- (iv) Make both ends meet
- (v) Hard nut to crack
- (vi) Once for all
- (vii) In black and white

5. Supply one-word substitute and use in your sentences : 7

- (i) Someone who collects stamps
- (ii) Absence of law and order
- (iii) Fear of height
- (iv) One who lives alone
- (v) For that purpose
- (vi) After death
- (vii) Someone who advocates only men

UNIT - III

6. Write short notes on any *two* the following : 7

- (a) Diphthongs
- (b) Semi Vowels
- (c) Lateral

7. Supply *phonetic transcription* of the following words : 7

- (a) Doll
- (b) Fox
- (c) Camel
- (d) Lengthy
- (e) Master
- (f) Phonetic
- (g) Examine

OR

Draw a neat diagram of the Speech Mechanism with appropriate labels.

UNIT – IV

8. Discuss the central theme of Swami Vivekanand's essay
The Secret of Work. 7

OR

What according to you are the key traits of Dr. A. P. J. Abdul Kalam ? How does he inspire the youth ?

9. Suppose your department conducted an intensive workshop on "Professional Communication Skills" assessed through continuous evaluation. Draft an email to the Dean requesting its inclusion in semester grading and seek a meeting for discussion. 7

Roll No.

40014

**B. Tech. 2nd Semester
(Common for all Branches)
Examination – May, 2026**

UNIVERSAL HUMAN VALUES

Paper : 25HSMC-UHV-101-H

Time : Three Hours]

[Maximum Marks : 50

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Explain the meaning of Right Understanding in the context of holistic human development.
 $2.5 \times 4 = 10$
- (b) Describe the difference between the Self and the Body.
- (c) Explain why trust is called the foundational value in relationships.
- (d) Explain the meaning of existence as co-existence at all levels.

40014-8200-(P-3)(Q-9)(26)

P. T. O.

UNIT – I

2. Demonstrate how a right, understanding, healthy relationships, and physical facilities together lead to holistic development. 10
3. Apply the method of self-exploration to analyze your career goals. 10

UNIT – II

4. Examine the consequences of fulfilling only the needs of the Body while ignoring the needs of the Self. 10
5. Compare a harmonious person and a materialistic person in terms of health and happiness. 10

UNIT – III

6. Apply the concept of respect in resolving a conflict between two people. 10
7. Illustrate how self-regulation helps in protecting the environment. 10

40014-8200-(P-3)(Q-9)(26) (2)

UNIT – IV

8. Examine the impact of holistic perception of harmony on human behaviour. 10
 9. Analyze the role of value-based management in organizational success. 10
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40014-8200-(P-3)(Q-9)(26) (3)

Roll No.

40021

**B. Tech. 2nd Semester (Common For all
Branches) (Table-3)
Examination – May, 2026**

BASICS OF MECHANICAL ENGINEERING

Paper : 25ESC-ME-103-H

Time : Three Hours]

[Maximum Marks : 50

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

- 1.** Explain the following : 10
- (a) Principal parameters of Metal Cutting.
 - (b) Third Law of Thermodynamic.
 - (c) Coefficient of performance

40021-3350-(P-3)(Q-9)(26)

P. T. O.

(d) What is priming ? Why it is necessary ?

(e) Principle of friction clutches.

UNIT - I

2. Draw a neat diagram of Lathe and explain the principal parts and operation that can be performed on lathe machine. 10

3. (a) State the second law of thermodynamic with Kelvin Plank statement and Clausius statement. 5

(b) Explain the following : 5

(i) Internal Energy

(ii) Entropy

UNIT - II

4. (a) Explain the Psychrometric chart. 5

(b) Write short note on Human Comfort. 5

5. Define a centrifugal pump, with a neat and labelled diagram, explain the construction and working principle of a centrifugal pump. 10

40021-3350-(P-3)(Q-9)(26) (2)

UNIT - III

6. What are the requirements of a clutch ? Also explain the working of a single plate clutch with the help of a neat sketch. 10

7. Establish a relationship within E, C and K. 10

UNIT - IV

8. (a) Explain the basic components of a Numerical control system. 5

(b) What is the procedure of a Numerical Control ? 5

9. (a) How are the Numerical control systems classified ? 5

(b) Differentiate between the NC and CNC. 5

40021-3350-(P-3)(Q-9)(26) (3)

Roll No.

40027

**B.Tech. 2nd Sem. (Electrical & Electronics
Engg.) Examination – May, 2026**

**MATHEMATICS-III (Multivariable Calculus, Differential
Equations & Complex Analysis)**

Paper : 25BSC-MATH-102-H

Time : Three Hours]

[Maximum Marks : 70

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, by selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Define double integral and its application.
(b) Define analytic function with example.
(c) Define differential equation with example.
(d) Define Cauchy-Riemann equations in terms of Cartesian Coordinates.
(e) Solve :

$$\frac{d^2y}{dx^2} - \frac{3dy}{dx} + 2y = 0$$

40027-4750-(P-4)(Q-9)(26)

P. T. O.

- (f) Check whether given differential equation is exact or not ?

$$(x^2 + y^2 - a^2)xdx + (x^2 - y^2 - b^2)ydy = 0$$

- (g) State Cauchy Integral Formula. $2 \times 7 = 14$

UNIT - I

2. (a) Evaluate the following integral : 7

$$\int_1^2 \int_y^{y^2} dx dy$$

- (b) Show that the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16}{3}a^2$. 7

3. (a) Evaluate the integral : 7

$$\int_0^3 \int_0^2 \int_0^1 (x+y+z) dz dy dx$$

- (b) Find the volume of sphere $x^2 + y^2 + z^2 = a^2$ using Triple Integral. 7

UNIT - II

4. (a) Solve : 7

$$(x+1) \frac{dy}{dx} - y = e^{3x}(x+1)^2$$

- (b) Solve : 7

$$(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$$

40027-4750-(P-4)(Q-9)(26) (2)

5. (a) Solve : 7

$$\frac{d^3y}{dx^3} + \frac{2d^2y}{dx^2} + \frac{dy}{dx} = e^{-x} + \cos 2x$$

- (b) Using method of variation of parameters, solve : 7

$$\frac{d^2y}{dx^2} + y = \tan x$$

UNIT - III

6. (a) Find the real and imaginary parts of $e^{(5+3i)^2}$. 7

- (b) Find the general value of $\log(6+8i)$. 7

7. (a) Determine an analytic function whose real part is $u = y + e^x \cos y$. 7

- (b) Find the bilinear transformation which maps the point $-1, i, 1$ of the z -plane onto $1, i, -1$ of w -plane respectively. 7

UNIT - IV

8. (a) Evaluate $\int_0^{2+i} (\bar{z})^2 dz$ along the line $y = \frac{x}{2}$. 7

- (b) Evaluate, using Cauchy Integral formula : 7

$$\oint_C \frac{\sin \pi z^2 - \cos \pi z^2}{(z-1)(z-2)} dz; |z| = 3$$

40027-4750-(P-4)(Q-9)(26) (3)

P. T. O.

9. Show that :

14

$$\int_0^{2\pi} \frac{\cos 2\theta}{1 - 2a \cos \theta + a^2} d\theta = \frac{2\pi a^2}{1 - a^2} (a^2 < 1)$$

Roll No.

3015

**B. Tech. 2nd Semester (ME)
Examination – May, 2026**

**MATH-II (Multivariable Calculus, Differential Equations
and Complex Analysis)**

Paper : BSC-Math-102-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Define stokes theorems.
(b) Solve $y = px + p^3$
(c) Define Conformal mapping.

3015-360(P-4)(Q-9)(26)

P. T. O.

- (d) Define isolated singularity.
- (e) State Taylor's theorem.
- (f) State Maximum-Modulus theorem.

UNIT - I

2. (a) Evaluate $\iint_R xy(x^2 + y^2)^{\frac{n}{2}} dx dy$, by changing to polar coordinates, over the positive quadrant of $x^2 + y^2 = 4$.
- (b) Find the C. G. of the area in the positive quadrant of the curve $x^{2/3} + y^{2/3} = a^{2/3}$.
3. (a) Evaluate $\iiint_R (x^2 + y^2 + z^2) dx dy dz$ where R is the region bounded by $x=0, y=0, z=0$ and $x+y+z=a, (a>0)$.
- (b) Use Divergence theorem to Evaluate $\iint_S \vec{F} \cdot d\vec{S}$ where $\vec{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ and S is the surface bounded by region $x^2 + y^2 = 4, z=0$ and $z=3$.

UNIT - II

4. (a) Solve : $(y^2 + 2yx^2) dx = (xy - 2x^3) dy$
- (b) Solve : $(D^2 - 1)y = \bar{e}^x \sin(\bar{e}^x) + \cos(\bar{e}^x)$ by method of variation of parameters.
5. (a) Solve $(1+x^2) \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = 0$.
- (b) Show that $4J_n''(x) = J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)$, where $J_n(x)$ is Bessel function of first kind.

UNIT - III

6. (a) Show that the real and imaginary parts of function $f(z) = \log z$ satisfy the C-R equations when $z \neq 0$.
- (b) Prove that $u = x^2 - y^2$ and $v = \frac{y}{x^2 + y^2}$ are harmonic functions of (x, y) , but are not harmonic conjugate.

7. (a) If $f(z)$ is analytic then prove it is conformal mapping.

(b) Show that $u = \frac{1}{2} \log(x^2 + y^2)$ is harmonic and find its harmonic conjugate and the analytic function.

UNIT - IV

8. (a) Evaluate $\int_c \frac{4-3z}{z(z-1)(z-2)} dz$ using Cauchy

integral formula where c is the circle $|z| = \frac{3}{2}$.

(b) Find Taylor series expansion of a complex variable

$$f(z) = \frac{1}{(z-1)(z-3)} \text{ about point } z = 4.$$

9. (a) Write all possible Laurent series for the function $f(z) = z(z+2)^{-3}$ about pole $z = -2$.

(b) Using contour integration, evaluate the integral :

$$\int_0^\pi \frac{1+2\cos\theta}{5+4\cos\theta} d\theta$$

Roll No.

40028

**B. Tech. 2nd Sem. (Artificial Intelligence)
Examination – May, 2026**

MATHEMATICS-II (PROBABILITY AND STATISTICS)

Paper : 25BSC-MATH-104-H

Time : Three Hours]

[Maximum Marks : 70

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks

1. (a) Define probability space. $2 \times 7 = 14$
- (b) Define additive law of probability.
- (c) Define discrete random variable with example.

40028-10750-(P-7)(Q-9)(26)

P. T. O.

- (d) Explain measure of central tendency and mention its types.
- (e) Define regression with example.
- (f) Explain properties of normal distribution.
- (g) For $n = 6$ (no. of trials), p (probability) $= \frac{1}{4}$, what is the value of mean and variance of binomial distribution?

UNIT - I

2. (a) Two urns contain 4 white, 6 blue balls and 4 white, 5 blue balls, respectively. One of the bags is selected at random and a ball is drawn from it. If the ball drawn is white; find the probability that it is drawn from the first urn. 7
- (b) A random variable X has the following probability distribution value of X : 7

x :	0	1	2	3	4	5	6	7	8
$p(x)$:	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

- (i) Determine the value of a
- (ii) Find $P(X < 3)$, $P(2 \leq X < 5)$

40028-10750-(P-7)(Q-9)(26) (2)

3. (a) State and prove Chebheshev's inequality. 7
- (b) If the probability of a bad reaction from a certain injection is 0.001. Determine the chance that out of 2000, individuals more than 2 will get a bad reaction? 7

UNIT - II

4. (a) Let X and Y be two random variables, then for : 7

$$f(x,y) = \begin{cases} k(3x+y) & 0 < x < 2, 0 < y < 5 \\ 0 & \text{elsewhere} \end{cases}$$

be a joint density function, find the value of k .

- (b) The average daily sales of 500 branch offices was Rs. 150 and the standard deviation Rs. 15. Assuming the distribution to be normal. Indicate how many branches have sales between : 7

(i) $120 < X < 145$

(ii) $140 < X < 165$

40028-10750-(P-7)(Q-9)(26) (3)

P. T. O.

5. (a) Telephone calls arrive at switchboard following an exponential distribution with parameter $\lambda = 14$ per hour if we are at the switchboard, what is the probability that the waiting time for a call is : 7

(i) at least 10 minutes

(ii) not more than 20 minutes

- (b) State and prove the result of distribution of sums of bivariate probability distribution. 7

UNIT - III

6. (a) Calculate Mean, Median and Mode for the following data : 7

Groups	5-7	7-9	9-11	11-13	13-15	15-17	17-19
Frequency	4	7	11	5	3	2	1

- (b) Find coefficient of skewness for the following distribution : 7

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of Students	8	12	20	30	15	10

7. (a) Calculate correlation coefficient from the following data : 7

Adv. Exp. (Rs. Lakh)	X :	10	12	15	23	20
Sales (Rs. Crore)	Y :	14	17	23	25	21

- (b) From the following data, obtain the two regression equations : 7

Sales (Rs. Lakh)	91	97	108	121	67	124	51	73	111	57
Purchase (Rs. Crore)	71	75	69	97	70	91	39	61	80	47

UNIT - IV

8. (a) The average income of persons was Rs. 210 with a S. D. of Rs. 10 in sample of 100 people of a city. For another sample of 150 persons, the average income was Rs. 220 with standard deviation of Rs. 12. The standard deviation of incomes of the people of city was Rs. 11. Test whether there is any significant difference between the average income of the localities. 7
- (b) The 9 items of a sample have the following values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these values differ significantly from the assume mean 47.5 7
9. (a) A certain stimulus administered to each of 12 patients resulted in the following increase of blood pressure; 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will in general be accompanied by an increase in blood pressure. 7

- (b) The following table shows the distribution of digits in numbers chosen at random from a telephone directory : 7

Digits	0	1	2	3	4	5	6	7	8	9
Frequency	1026	1107	997	966	1075	933	1107	972	964	853

Test whether the digits may be taken to occur equally frequently in directory.

Roll No.

3016

**B. Tech. 2nd Semester (CSE)
Examination – May, 2026**

MATHEMATICS - II (Probability and Statistics)

Paper : BSC-MATH-104-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks. .

1. (a) A and B are two independent witnesses (i.e. there is no collision between them) in a case. The probability that A will speak the truth is x and the probability that B will speak the truth is y . A and B agree in a certain statement. Find the probability that this statement is true.

3016-1950-(P-7)(Q-9)(26)

P. T. O.

- (b) If a random variable X follow a Poisson distribution such that :

$P(X = 2) = 9 P(X = 4) + 90 P(X = 6)$, find mean and variance of X .

- (c) A power supply unit for a computer component is assumed to follow an exponential distribution with a mean life of 1200 hours. What is the probability that the component will :

- (i) fail in the first 300 hours ?
(ii) survive more than 1500 hours ?

- (d) Joint distribution of X and Y is given by $f(x, y) = 4xye^{-(x^2+y^2)}$, $x \geq 0, y \geq 0$. Test whether X and Y independent.

- (e) For 100 items, it is given that the regression equations of Y on X and X on Y is $8x - 10y + 66 = 0$ and $40x - 18y = 214$ respectively. Compute arithmetic means of X and Y .

- (f) It is previously being recorded that the average depth of ocean at a particular region is 67.4 fathoms. Is there reason to believe that at 0.01 level of significance if the reading at 40 random locations in that particular region showed a mean of 69.3 with standard deviation of 5.4 fathoms.

$$2.5 \times 6 = 15$$

UNIT- I

2. (a) For a discrete probability distribution : 8

x	0	1	2	3	4	5	6	7
f	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

Determine :

- (i) k
(ii) mean of distribution
(iii) variance of distribution
(iv) smallest value of x such that $P(X \leq x) > 1/2$

- (b) In sampling a large number of parts manufactured by machine, the mean number of defectives in a sample of 20 is 2. Out of 1000 such samples, how many would be expected to contain at least 3 defective parts. 7

3. (a) If $X_1, X_2, \dots, X_k$ are k independent Poisson variates with parameters $\lambda_1, \lambda_2, \dots, \lambda_k$ respectively, prove that the conditional distribution $P(X_1 \cap X_2 \cap \dots \cap X_k / X)$, where $X = X_1 + X_2 + \dots + X_k$ is fixed, is multinomial. 7

- (b) State and prove Chebyshev's inequality. 8

UNIT- II

4. (a) If $f(x) = ke^{-|x|}$ is a distribution function where $-\infty < x < \infty$. 8

- (i) Find the value of k .
- (ii) variance of the random variable.
- (iii) probability $P(0 \leq X \leq 4)$

- (b) In a normal distribution, 30.5% of the items are below 42 and 6.5% of the items are above 70. Find mean and variance of the distribution. 7

5. (a) If X and Y are two random variables having joint density function : 8

$$f(x, y) = \frac{1}{8}(6 - x - y); 0 < x < 2; 2 < y < 4$$

$$= 0, \quad \text{otherwise}$$

Find :

- (i) $P(X < 1 \cap Y < 3)$.
- (ii) $P(X + Y < 3)$.
- (iii) $P(X < 1 | Y < 3)$.
- (iv) Marginal distribution function of X and Y .

- (b) In a bulb factory, three machine A, B and C manufacture 60%, 25% and 15% of the total production respectively. Of their respective outputs 1%, 2%, and 1% are defective. A bulb is drawn at random from the total product and it is found to be defective. Find the probability that it was manufactured by machine C. 7

UNIT- III

6. (a) Calculate the mode from following frequency distribution : 7

Size of items	8	9	10	11	12	13	14	15
No. of items	5	6	8	7	9	8	9	6

- (b) The first four moments of a distribution about the value 5 of the variable are 2, 20, 40 and 50. Obtain moments about mean. Also comment upon the skewness and kurtosis of the distribution. 8

7. (a) From the following table, calculate the rank correlation coefficient : 7

X	48	33	40	9	16	16	65	24	16	57
Y	13	13	24	6	15	4	20	9	6	19

(b) If $4x - 2y = 3$ and $2x - 3y = 5$ are two lines of regression. Find : 8

- (i) regression coefficient b_{yx} and b_{xy} .
- (ii) correlation coefficient between x and y .
- (iii) estimate y when $x = 3$.

UNIT- IV

8. (a) A sample of heights of 6400 soldiers has a mean of 67.85 inches and a S.D. of 2.56 inches. While another sample of heights of 1600 sailors has a mean of 68.55 inches with S.D. of 2.52 inches. Do the data indicate that the sailors are on average taller than soldiers ? ($Z_{0.05} = 1.645$) 8

(b) A random sample of 27 pairs of observations from a normal population gives a correlation Coefficient of 0.42. Is it likely that the variables in population are uncorrelated ? ($t_{0.05} = 2.06$) 7

9. (a) The theory predicts the proportion of beans in the four groups, G_1, G_2, G_3, G_4 should be in the ratio 9 : 3 : 3 : 1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory ? (χ^2 at 5% = 7.815) 7

(b) From the following table regarding the colour of eyes of fathers and sons test if the colour of son's eye is associated with that of the father. 8

(χ^2 at 5%, d.f. 1 = 3.841)

Eye colour of son

	Light	Not Light
Eye colour of father		
Light	471	51
Not Light	148	230

Eye colour of father