

40001

B.Tech. 1st Semester
(Electrical & Electronics Engineering)
H Scheme Examination, December-2025
Mathematics-I (Calculus and Matrices)
Paper : 25BSC-MATH-101H

Time allowed : 3 Hours]

[Maximum marks : 70

Note : Question No. 1 is compulsory. Attempt one question from each unit.

1. (a) Evaluate $\lim_{x \rightarrow 0} \frac{\log x}{\cot x}$ 2

(b) Evaluate the following limit :

$$\lim_{\substack{x \rightarrow 1 \\ y \rightarrow 2}} \frac{2x^2y}{x^2+y^2+1} \quad 2$$

(c) Evaluate $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ for $z = \log(x^2 + y^2)$ 2

(d) Examine the following series for convergence : 2

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \infty$$

(e) Verify that the following matrix is orthogonal 2

$$A = \begin{bmatrix} 1/3 & 2/3 & 2/3 \\ 2/3 & 1/3 & -2/3 \\ 2/3 & -2/3 & 1/3 \end{bmatrix}$$

40001-P-3-Q-9 (25)

[P.T.O.]

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- (f) Define Eigen Values of a Matrix. 2
- (g) Find $B\left(\frac{7}{2}, \frac{3}{2}\right)$. 2

Unit-I

2. (a) Evaluate $\lim_{x \rightarrow 0} \left(\frac{x \cos x - \sin x}{x^2 \sin x} \right)$ 7
- (b) Expand $\sin x$ in powers of $\left(x - \frac{\pi}{2}\right)$. Hence find the value of $\sin 91^\circ$ correct to 4 decimal places. 7
3. (a) Find the Radius of Curvature at the point $\left(\frac{3a}{2}, \frac{3a}{2}\right)$ of the folium $x^3 + y^3 = 3axy$. 7
- (b) Evaluate the following : 7
- $$\int_0^9 x^{3/2} (9-x)^{1/2} dx$$

Unit-II

4. (a) Test the following Series for convergence : 7
- $$1 + \frac{2^2}{2!} + \frac{3^2}{3!} + \frac{4^2}{4!} + \dots$$
- (b) $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots + \infty$ 7

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5. (a) Examine the behaviour of the series; 7
- $$1 + \frac{x}{2} + \frac{x^2}{3^2} + \frac{x^3}{4^3} + \dots + (x > 0)$$
- (b) Test the following Series for conditional convergence; $\sum \frac{(-1)^{n-1}}{\sqrt{n}}$ 7

Unit-III

6. (a) If $z(x+y) = x^2 + y^2$; show that 7
- $$\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)^2 = 4 \left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$$
- (b) If $u = \tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$, prove that 7
- $$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u \text{ and}$$
- $$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = 2 \cos 3u \sin u$$
7. (a) If $z = f(x, y)$ and $x = e^u + e^{-v}$
 $y = e^{-u} - e^v$ Prove that 7
- $$\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y}$$
- (b) A rectangular Box open at the top is said to have volume of 32 cubic feet. Find the dimensions of the box requiring least material for its construction. 7

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[P.T.O.]

Unit-IV

8. (a) Determine Rank of Matrix 7

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$$

- (b) Using Gauss Jordan Method find the inverse of matrix 7

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

9. (a) Solve the following system of Linear Equations; 7

$$4x - 2y + 6z = 8$$

$$x + y - 3z = -1$$

$$15x - 3y + 9z = 21$$

- (b) Verify Cayley-Hamilton Theorem for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ 7

B.Tech (ME) 1st Semester (G-Scheme)

Examination, December-2025

MATH-I (CALCULUS AND MATRICES)

Paper-BSC-MATH-101-G

Time allowed : 3 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) Evaluate $\lim_{x \rightarrow 1} (1-x) \tan \frac{\pi x}{2}$.
- (b) Show that $\int_0^{\infty} \sqrt{x} e^{-x^3} dx$.
- (c) Using Maclaurin's theorem, expand $\cos x$ in power of x .
- (d) Show that the series $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} = \dots$ is convergent.
- (e) Find the Fourier coefficient a_n for $f(x) = x$ in the interval $0 > x < 2\pi$.

3007-P-4-Q-9 (25)

[P.T.O.]

- (f) Find the radius of convergence of the power series

$$\sum_{m=0}^{\infty} \frac{1}{2^m} (x-1)^{2m}$$

- (g) Verify that
- $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$
- for the function

$$u = \tan^{-1} \left(\frac{x}{y} \right)$$

- (h) Find the curl (
- \vec{F}
-), if
- $\vec{F} = (y+z)\hat{i} + (z+x)\hat{j} + (x+y)\hat{k}$
- .

- (i) Find the rank of the matrix
- $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \end{bmatrix}$
- .

- (j) Find the Eigen values of the matrix
- $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$

$$10 \times 2.5 = 25$$

Unit-I

2. (a) Find the equation of evolute of the parabola $y^2 = 4ax$. 6
- (b) Examine the extreme value of the function $x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$. 6.5
3. (a) Find the area of the surface formed by the revolution of $y^2 = 4ax$, about the x-axis, by the arc from the vertex to one end of latus rectum. 6

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- (b) Prove that
- $\int_0^1 \frac{x}{\sqrt{1-x^5}} dx = \frac{1}{5} \beta \left(\frac{2}{5}, \frac{1}{2} \right)$
- . 6.5

Unit-II

4. (a) Examine the convergence of the series

$$\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots \quad 6$$

- (b) Test the convergence of the series

$$1 + \frac{1}{2}, \frac{x^2}{4} + \frac{1.3.5}{2.4.6} \cdot \frac{x^4}{8} + \frac{1.3.5.7.9}{2.4.6.8.10} \cdot \frac{x^6}{12} + \dots \quad 6.5$$

5. (a) Obtain the Fourier series for the function
- $f(x) = |\cos x|$
- in the interval
- $(-\pi, \pi)$
- . 6

- (b) Find half range sine series for the function
- $f(x) = (x-1)^2$
- in
- $(-1, 1)$
- . 6.5

Unit-III

6. (a) Discuss the continuity of the function

$$f(x) = \begin{cases} x^2 - 4 & \text{when } x \neq 2 \\ \frac{x-2}{5} & \text{when } x = 2 \end{cases} \quad 6$$

- (b) If
- $u = f(r)$
- and
- $r = \sqrt{x^2 + y^2 + z^2}$
- , Show that :

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = f''(r) + \frac{2}{r} f'(r) \quad 6.5$$

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[P.T.O.]

7. (a) Find the $\text{div } \vec{F}$ and $\text{curl } \vec{F}$ where $\vec{F} = \text{grad}$
 $(x^2 + y^3 + z^3 - 3xyz)$. 6
- (b) Find the directional derivative of $\phi = ry^2 + yz^3$ at
 the point $(2, -1, 1)$ in the direction of the normal
 to the surface $x \log z - y^2 = -4$ at $(-1, 2, 1)$. 6.5

Unit-IV

8. (a) For what values of λ and μ the following system
 of equations:
 $3x + 3y + 5z = 9$; $7x + 3y - 2z = 8$; $2x + 3y + \lambda z = \mu$
 have (i) no solution (ii) a unique solution and
 (iii) an infinite number of solution. 6.5
- (b) Express the following matrix as a sum of
 symmetric and skew-symmetric matrix

$$\begin{bmatrix} 3 & -2 & 6 \\ 2 & 7 & -1 \\ 5 & 4 & 0 \end{bmatrix}$$

6

9. Find the Eigen values and corresponding Eigen vector

of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$

12.5

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B.Tech. (Artificial Intelligence) 1st Sem.
(H-Scheme) Examination, December-2025

MATHEMATICS-I

Calculus and Linear Algebra

Paper--25BSC-Math-103H

Time allowed : 3 hours]

[Maximum marks : 70

Note : Attempt five questions in total by selecting one question from each unit. Question No. 1 is compulsory.

1. (a) State Cauchy's mean value theorem. $7 \times 2 = 14$

(b) If $A + B = \begin{bmatrix} 1 & -1 \\ 3 & 0 \end{bmatrix}$, and $A - B = \begin{bmatrix} 3 & 1 \\ 1 & 4 \end{bmatrix}$ evaluate the product AB .

(c) Find the inverse of a matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$.

(d) Let V be a vector space of \mathbb{R}^3 Examine the whether the following is a subspace of V or not:
 $w = \{(x, y, z); 3x + y - z = 0, x, y, z \in \mathbb{R}\}$.

(e) Show that the composition of two linear transformation is again a linear transformation.

40002-P-4-Q-9(25)

[P.T.O.]

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- (f) Verify that the matrix $A = \begin{bmatrix} \frac{1}{3} & \frac{2}{3} & \frac{2}{3} \\ \frac{2}{3} & \frac{1}{3} & -\frac{2}{3} \\ \frac{2}{3} & -\frac{2}{3} & \frac{1}{3} \end{bmatrix}$ is orthogonal or not?
- (g) Define inner product space.

Unit-I

2. (a) Evaluate the limit $\lim_{x \rightarrow 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right)$ 7
- (b) Express $\tan^{-1} x$ in powers of $(x-1)$ up to four terms. 7
3. (a) (i) Find radius of curvature at any point on the ellipse : $x = a \cos \theta, y = b \sin \theta$ 7
- (ii) Compute $\int_0^1 \frac{dx}{\sqrt{1+x^4}}$.
- (b) Find the volume of the seel formed by the revolution of the cycloid $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$ about the tangent at the vertex. 7

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Unit-II

4. (a) If $E = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ and $F = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ calculate the product EF and FE and show that $E^2F + FE^2 = E$. 7

- (b) Reduce the matrix $A = \begin{bmatrix} 8 & 1 & 3 & 6 \\ 0 & 3 & 2 & 2 \\ -8 & -1 & -3 & 4 \end{bmatrix}$ into normal form and hence find its rank. 7

5. (a) Test for consistency and solve $2x - 3y + 7z = 5, 3x + y - 3z = 13, 2x + 19y - 47z = 32$. 7
- (b) Solve the following equation by Cramer's rule $x_1 + x_2 + x_3 = 1, x_1 + 2x_2 + 3x_3 = 6, x_1 + 3x_2 + 4x_3 = 6$. 7

Unit-III

6. (a) Show that the vectors $\{(2, -1, 0), (3, 5, 1), (1, 1, 2)\}$ form a basis of R^3 . 7
- (b) Determine whether the following mapping is a linear transformation or not?
- $T : R^3 \rightarrow R^3$ defined by $T(x, y, z) = (y, -x, -z)$ 7

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[P.T.O.]

7. (a) State and prove Rank nullity theorem. 7
- (b) Find the matrix representing the transformation $T: \mathbb{R}^2 \rightarrow \mathbb{R}^3$ given by $T(x, y) = (3x - y, 2x + 4y, 5x - 6y)$ relative to standard basis of \mathbb{R}^2 and \mathbb{R}^3 . 7

Unit-IV

8. (a) For $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$, find the eigen values and basis for each eigen space.
 $T(x, y) = (x + 2y, 3x + 2y)$ 7
- (b) Show that the matrix $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ is not diagonalizable over the field \mathbb{C} . 7
9. (a) Define orthogonal complement W^\perp of a subspace W of an inner product space $V(F)$. Prove that W^\perp is also a subspace of $V(F)$. 7
- (b) Using Gram-Schmidt process, find an orthonormal basis of the subspace W of $V_3(\mathbb{C})$ spanned by $u_1 = (1, 0, i), u_2 = (2, 1, 1+i)$. 7

B.Tech (CSE) 1st Semester (G-Scheme)

Examination, December-2025

MATH-I (CALCULUS AND LINEAR ALGEBRA)

Paper-BSC-MATH-103-G

Time allowed : 3 hours]

[Maximum marks : 75

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

1. (a) State Lagrange's Mean Value Theorem.
(b) Prove symmetry of Beta Function.
(c) Evaluate $A.B$ and $B.A_1$ which is possible where
- $$A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 1 & 3 \end{bmatrix}.$$
- (d) Show that the set $S = \{1, 2\}$ which is a subset of vector space C over the field of real numbers generate C over R .
(e) Let $T_1 : U \rightarrow V$ and $T_2 : V \rightarrow W$ be two linear transformations. If $T_2 T_1'$ is one-one then show T_1 is one-one.
(f) Define Inner product space.

Unit-I

2. (a) Verify Rolle's theorem for $f(x) = (x^2 - 4x + 3)e^{2x}$ in $[1, 3]$.

- (b) Show that $\log(x+h) =$

$$\log x + \frac{h}{x} - \frac{h^2}{2x^2} + \dots + (-1)^{n-1} \frac{h^n}{n(x+\theta h)^n}$$

3. (a) Find the volume of solid formed by revolution about x-axis of the loop of curve $y^2 = \frac{x^2(a+x)}{(a-x)}$

- (b) Evaluate the value of $\gamma\left(\frac{1}{2}\right)$.

Unit-II

4. (a) If $A = \begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$ & $B = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$.

Show $AB \neq BA$.

- (b) For what value of r and s do the equations

$$x+2y+3z=6, \quad 2y+y+rz=s, \quad x+2y+3z=6 \text{ have}$$

(i) Unique solution (ii) no solution (iii) many solutions.

5. (a) Find the rank of matrix :

$$\begin{bmatrix} 5 & 6 & 7 & 8 \\ 11 & 12 & 13 & 14 \\ 6 & 7 & 8 & 9 \\ 16 & 17 & 18 & 19 \end{bmatrix}$$

- (b) If $A = \begin{bmatrix} 2 & 4 & 3 & 2 \\ 3 & 6 & 5 & 2 \\ 2 & 5 & 2 & -3 \\ 4 & 5 & 14 & 14 \end{bmatrix}$ find A^{-1} by Gauss-Jordan

method.

Unit-III

6. (a) Show that vectors $(1, 1, 2, 4)$, $(2, -1, -5, 2)$, $(1, -1, -4, 0)$ and $(2, 1, 1, 6)$ are linearly dependent.
- (b) If $S = \{v_1, v_2, \dots, v_n\}$ is a basis of $U(F)$, then show every element of U can be uniquely expressed as linear combination of v_1, v_2, \dots, v_n and conversely.
7. (a) Let $T: U \rightarrow v$ be a linear transformation, then prove $U/\ker(T) \cong T(U)$.

- (b) If $T_1 : U \rightarrow v$ and $T_2 : v \rightarrow W$ are two invertible linear transformations, then show ' $T_2 T_1$ ' is also invertible and $(T_2 T_1)^{-1} = T_1^{-1} T_2^{-1}$.

Unit-IV

8. (a) Find Eigen values, eigen vectors of matrix

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- (b) Show that the matrix $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ is not diagonalizable over the field C .

9. (a) In an inner product space, if $\|u + v\| = \|u\| + \|v\|$, then the vectors u, v are linearly dependent.
- (b) Prove that every finite dimensional inner product space has an orthonormal basis.

40006

B.Tech. 1st Semester
(Artificial Intelligence & Data Science) H Scheme
Examination, December-2025
Semiconductor Physics
Paper : 25BSC-PHY-103H

Time allowed : 3 Hours]

[Maximum marks : 70

Note: Attempt five questions in total. Question No. 1 is compulsory and contains 10 short-answer questions, out of which any seven are to be attempted. For the remaining four questions, attempt one question from each unit. All questions carry equal marks.

1. Attempt any seven sub-questions : $7 \times 2 = 14$
- (i) Write limitations of classical physics.
 - (ii) State de Broglie's hypothesis.
 - (iii) Define the Compton Effect.
 - (iv) Draw the E-k diagram for a one-dimensional periodic potential.
 - (v) Define Fermi energy. Also sketch the Fermi-Dirac distribution at different temperatures.

40006-P-4-Q-9 (25)

[P.T.O.]

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- (vi) Differentiate drift current and diffusion current.
- (vii) Write a short note on LED.
- (viii) Define population inversion.
- (ix) 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.)
- (x) What do you mean by Black body?

Unit-I

2. (a) Derive the time-independent Schrodinger wave equation. 10
- (b) State the physical significance of the wave function and list its important properties. 4
3. (a) Obtain the allowed energy levels and the wave functions for a particle confined in a one-dimensional box. 10
- (b) An electron of mass 9.1×10^{-31} kg is confined in a one-dimensional box of length 2×10^{-10} m. Calculate its ground-state energy ($n = 1$). (Given $h = 6.626 \times 10^{-34}$ J.s.) 4

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Unit-II

4. (a) Describe Drude's classical theory of free electrons in metals and use it to explain Ohm's law. 10
- (b) Write short notes on direct and indirect band gaps. 4
5. Write a detailed note on the Kronig-Penney model for electrons in periodic potentials and explain the main conclusions. 14

Unit-III

6. (a) Derive expressions for charge-carrier concentration and the Fermi energy for n-type semiconductor. 10
- (b) Explain the working of a P-N junction diode under forward and reverse bias. 4
7. Write short notes on any two : $2 \times 7 = 14$
- (a) Solar cell
- (b) Light-emitting diode (LED)
- (c) Photoconductive cell

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[P.T.O.]

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} , B_{21} and A_{21} . 10
- (b) State the important properties of laser radiation. 4
9. (a) Discuss the construction, working and energy-level diagram of the He-Ne laser. 10
- (b) List the important applications of laser radiation. 4

3003

B.Tech (CSE) 1st Semester (G-Scheme)

Examination, December-2025

SEMI CONDUCTOR PHYSICS

Paper-BSC-PHY-103-G

Time allowed : 3 hours]

[Maximum marks : 75

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

1. (a) What do you mean by a photovoltaic effect ?
- (b) Distinguish Drift and diffusion current in a semiconductor ?
- (c) Determine the wavelength of LED fabricated by the GaAsP material with a bandgap of 2 eV.
- (d) Distinguish energy level and energy band.
- (e) Explain the principle behind hot-point probe method. 5×3=15

Unit-I

2. Discuss the motion of a free electron in one dimensional potential box and derive expressions for its energy eigen values and corresponding wave function. 15

Or

3003-P-3-Q-9 (25)

[P.T.O.]

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3. (a) What is occupation probability? Discuss Fermi-function for absolute zero temperature. Show that the probability of occupancy at Fermi energy is $\frac{1}{2}$ at any temperature. 10
- (b) Show that for a completely filled energy band in solid, the no of effective electron is Zero. 5

Unit-II

4. Derive an expression for the carrier concentration in extrinsic semiconductors. What would be the position of Fermi level? Explain. 15

Or

5. Explain the mechanism of depletion layer formation in the p-n junction diode and explain its V-I characteristic with an appropriate diagram. 15

Unit-III

6. What do you mean by the optical joint density of state? Obtain an expression for it. 15

Or

7. Define absorption, spontaneous emission, and stimulated emission in optical transitions and derive the relationship between them. Discuss Einstein's coefficients. 15

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Unit-IV

8. What are Quantum well, Quantum wire, and Quantum dots, and how are they fabricated and characterized? 15

Or

9. Discuss the four-probe method's experimental setup and working principle for resistivity measurement. 15

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B.Tech. 1st Semester (Common for All Branches)

(H-Scheme) Examination, December-2025

CHEMISTRY

Paper-25BSC-CH-101H

Time allowed : 3 hours]

[Maximum marks : 70

Note : Question No. 1 is compulsory. Students have to attempt five questions in all, by selecting one question from each Section. All questions carry equal marks.

1. (a) What is Magnetic Quantum number?
- (b) Explain the term Chromophore.
- (c) Write electronic configuration of Mn and Cr.
- (d) What is Emission Spectroscopy?
- (e) Unit of Hardness.
- (f) Define Pilling Bedworth rule
- (g) Give two examples of Reduction reaction.

7×2=14

Section-A

2. (a) What is Ionization Energy? On what factors it depends? How does it vary in group and period. 7
- (b) Discuss in detail the point defects in solid. 7

40009-P-3-Q-9(25)

[P.T.O.]

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3. (a) Discuss the Crystal field splitting in tetrahedral and octahedral complexes. 7
(b) Draw MO Energy level diagram of nitrogen molecule and discuss its bond order. 7

Section-B

4. (a) Write the synthesis of Aspirin. 5
(b) Draw various conformations of n-butane and compare their stability. 5
(c) Explain Optical Activity. 4
5. (a) Discuss R/S system of nomenclature in detail. 6
(b) What are Substitution Reactions? Classify them and explain the types. 8

Section-C

6. (a) What is Corrosion? Explain the factors that affect corrosion. 8
(b) What is softening of water? Explain the zeolite process of softening of hard water. 6
7. (a) Explain the various critical constants. 3
(b) Discuss equation of state of real gases. 5
(c) How will you measure hardness by EDTA method. 6

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Section-D

8. Write short note on:
(a) Applications of Ultraviolet Visible Spectroscopy. 6
(b) Magnetic Resonance Imaging. 4
(c) Shielding and deshielding of protons. 4
9. (a) Discuss Flame Photometry in detail. 8
(b) Explain Molecular vibrations in IR spectroscopy. 6

40009

**B.Tech (Common for all Branches) 1st Semester
(G-Scheme) Examination, December-2025**

CHEMISTRY-I

Paper-BSC-CH-101-G

Time allowed : 3 hours]

[Maximum marks : 75

Note : Question No. 1 is compulsory. Students have to attempt five questions in all, selecting one question from each section. All questions carry equal marks.

1. (a) What is Tautomerism ? Give an example.
(b) Explain the term Auxochrome.
(c) Give the unit of Hardness.
(d) Explain coupling constant in NMR Spectroscopy.
(e) Explain Oxidation reaction with example.
(f) Give the general electronic configuration of p and d-block elements. 2.5×6=15

Section-A

2. (a) Explain Crystal field splitting in tetrahedral and octahedral complexes. 7.5
(b) Draw MO energy level diagram of NO molecule and discuss its bond order and magnetic properties. 7.5

3006-P-3-Q-9 (25)

[P.T.O.]

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3. (a) Discuss Electronegativity. What are the factors affecting electronegativity and how does it vary in a group and period? 8
- (b) Explain the role of doping on band structures. 4
- (c) Write mathematical expression for Schrodinger wave equation. 3

Section-B

4. (a) Discuss the classification of isomerism. Explain structural isomers in detail. 7.5
- (b) Differentiate between Enantiomers and Diastereomers. 7.5
5. (a) Explain the synthesis of paracetamol. 7.5
- (b) Discuss the different types of organic reaction. Explain substitution reactions by giving suitable example. 7.5

Section-C

6. (a) Discuss in detail the EDTA method for hardwater determination. 7.5
- (b) Discuss the equation of state of real gases. 7.5

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7. (a) Explain the Lime-soda process for softening of hard water and discuss the role of lime and soda in the process. 7.5
- (b) Discuss Pitting and Galvanic Corrosion. 7.5

Section-D

8. (a) Discuss the principle of NMR Spectroscopy. 7.5
- (b) What is Flame photometry? Describe its principle and applications. 7.5
9. (a) Discuss the application of Infrared Spectroscopy. 5
- (b) Write short note on : 10
- (i) Beer's Lambert's law
- (ii) Magnetic Resonance imaging.

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**B. Tech. 1st Semester Common for all Branches
H-Scheme Examination, December-2025
PROGRAMMING FOR PROBLEM SOLVING**

Paper : 25-ESC-CSE-101-H

Time allowed : 3 hours]

[Maximum marks : 50

Note : All questions carry equal marks. Question 1 is compulsory. Attempt five questions in total by selecting one from each unit.

1. Write short notes on :
 - (a) Memory hierarchy
 - (b) Pseudocodes and flowcharts
 - (c) Header files
 - (d) Pointers

Unit-I

2. Describe the components of a computer system with block diagram. 10
3. Convert the numbers : 10
 - (a) $(BC7)_{16}$ to decimal & binary
 - (b) $(11011010)_2$ to octal & hexadecimal.
 - (c) $(764)_8$ to decimal & hexadecimal

Unit-II

4. What is an algorithm ? Write an algorithm to check if a number is exactly divisible by both 7 & 9 or not. 10

40010-P-2-Q-9(25)

[P.T.O.]

5. Discuss the various types of language translators in detail. 10

Unit-III

6. (a) Data types in 'C'. 2×5=10
(b) Linear search
7. WAP in 'C' to calculate sum of 'n' natural numbers using 'for' loop. 10

Unit-IV

8. Explain recursion & WAP in 'C' using recursion to calculate factorial of a number. 10
9. (a) Dynamic memory allocation 2×5=10
(b) Structures

**B.Tech 1st Semester (G-Scheme)
Examination, December-2025**

**(Common for all Branches except CSE, ECE, IT,
CS & IT and EEE)**

PROGRAMMING FOR PROBLEM SOLVING

Paper-ESE-CSE-102-G

Time allowed : 3 hours [Maximum marks : 75]

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

1. Write short note on following : 15
- Computer
 - Pseudo Code
 - Object Code
 - Conditional Statement
 - String
 - Call by reference

Unit-I

- Define Computer explain its applications. 15
- Explain the different types of operations on number system. 15

3012-P-2-Q-9 (25)

[P.T.O.]

Unit-II

4. Define Flowchart. Explain its benefits and limitations. 15
5. Describe the basic structure of 'C' Programm. 15

Unit-III

6. Describe the following decision making statements : 15
 - (a) Nested IF
 - (b) Switch-Case
7. Define Looping statement. Explain different types of looping statements. 15

Unit-IV

8. Define Arrays. Explain its declaration and types. 15
9. Give a complete description about Recursion. 15

40011

B. Tech. 1st Semester (Common for All Branches)

H-Scheme Examination, December-2025

BASIC OF ELECTRICAL & ELECTRONICS

ENGINEERING

Paper : 25ESC-EE-101H

Time allowed : 3 Hours]

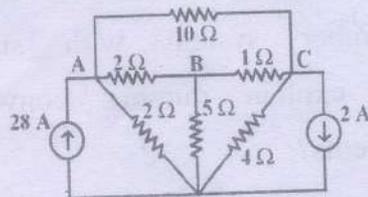
[Maximum marks : 50

Note : Question No. 1 is compulsory. Attempt one question from each section.

1. Explain or define : 5×2=10
- (a) Voltage division rule
 - (b) Current division rule
 - (c) FET
 - (d) XOR gate
 - (e) Transformer

Section-A

2. Using the method of model analysis, determine the current in various resistors of the network shown in figure. 10



40011-P-3-Q-9 (25)

[P.T.O.]

(2)

40011

3. State and prove the venin theorem with the help of an example? 10

Section-B

4. Explain ideal and practical transformer with the phesor diagrams? 10
5. What are losses in transformer also write note in transformer tests? 10

Section-C

6. Explain operation of BJT also elaborate its different configuration? 10
7. Explain working of PN function diode with suitable diagrams. Discuss the formation of depletion region, energy band diagram, and behaviour of diode under forward and reverse bias. Also derive diode current equation and explain significance of each term? 10

Section-D

8. Explain the number systems used in digital electronics. Discuss binary, octal, decimal and hexadecimal number system with suitable examples. Also explain number conversion between there systems? 10

40011

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40011

9. What are logic gates? Explain the operation, truth tables, and symbols of basic logic gates (AND, OR, NOT) and universal gates (NAND, NOR). Also prove how NAND and NOR gates can be used to implement any Boolean function? 10

40011

**B.Tech (Common for all Branches) 1st Semester
(G-Scheme) Examination, December-2025**

BASIC ELECTRICAL ENGINEERING

Paper-ESC-EE-101-G

Time allowed : 3 hours]

[Maximum marks : 75

*Note : Question No. 1 is compulsory and carry 25 marks
and attempt four questions by selecting one question
from each section carry 12.5 marks each.*

1. (a) Differentiate between the active and Passive networks with example.
- (b) Draw the symbols of ideal voltage source and ideal, current source.
- (c) What is the necessity of Time Domain analysis ? Explain.
- (d) State apparent Power, True Power and Reactive Power with their units.
- (e) Why Transformer are measure in KVA ?
- (f) Describe the importance of Phasor Representation.
- (g) Define Krichoffs Law.
- (h) Explain the purpose of Earthing.

3010-P-4-Q-9 (25)

[P.T.O.]

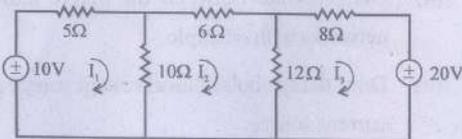
(2)

3010

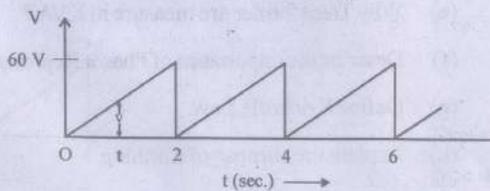
- (i) Differentiate between absolute instrument and secondary instrument.
- (j) Define Ohms Law. Also mention its limitations.

Section-A

2. (a) Differentiate Thevenin and Norton Theorem.
- (b) Find $I(1)$, $I(2)$, $I(3)$ in the network shown below using loop current Method :



3. (a) Define Series Resonance with properties.
- (b) Determine the average and effective values of the saw tooth waveform shown in figure.



3010

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Section-B

4. (a) Explain Power measurement by two wattmeter method with phasor diagram.
- (b) Explain Different losses occur in a transformer.
5. A 10kVA, 1-phase, 50Hz, 500/250V transformer gave following test results :
OC test (LV) side: 240V, 3.0A, 175W
SC test (HV) side: 25V, 20A, 250W
Calculate efficiency and regulation at full-load, 0.85 p.f lagging.

Section-C

6. (a) Explain Principle of operation of single-phase induction motors.
- (b) Describe different types of Induction motor.
7. (a) Explain working Principle of Synchronous motor.
- (b) Explain speed control methods of DC machine.

Section-D

8. (a) Explain construction and working of moving coil type wattmeter.

3010

[P.T.O.]

- (b) Explain MCB, MCCB, ELCB.
- 9. (a) Explain different types Cables.
- (b) Write short note on Battery Back-up.

40012

B. Tech. 1st Semester (Common for All Branches)

H- Scheme Examination, December-2025

WORKSHOP TECHNOLOGY

Paper : 25ESC-ME-102H

Time allowed : 3 Hours]

[Maximum marks : 35

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

1. (i) Define First Aid.
(ii) Give classification of metals.
(iii) Explain Punching and Blanking.
(iv) What is casting?
(v) Define pattern.
(vi) Define soldering.

Unit-I

2. Define Accident and its types. Discuss causes and common sources of Accident in an industrial environment.
3. Define plant layout. Explain the types of plant layout and discuss their advantages.

40012-P-2-Q-9 (25)

[P.T.O.]

Unit-II

4. Discuss the basic principle of Hot and Cold working. Explain hot rolling in detail.
5. Discuss in detail the types of timber, advantages of timber and defects in timber.

Unit-III

6. Explain the basic steps in casting processes. Discuss any five casting defects and suggest their remedies.
7. Why gating system is required for casting? Explain the different elements of gating system with neat sketch.

Unit-IV

8. Explain the principle of Arc Welding. Compare TIG (GTAW) and MIG (GMAW) welding.
9. Classify welding processes. Explain any five welding defects and suggest their remedies.

3013

B. Tech. 1st Semester

(Common for All Branches) (G-Scheme)

Examination, December-2025

WORKSHOP TECHNOLOGY

Paper : ESC-ME-102-G

Time allowed : 3 Hours]

[Maximum marks : 75

Note : Question No. 1 is compulsory, having ten parts and each part is of 2.5 mark total of 25 marks and remaining questions are of 12.5 marks. Attempt one question from each section.

1. (a) Name Any Two Machining Process. 25
(b) What is surface finishing process?
(c) What are important material first aid box should have?
(d) Define cold working.
(e) What is piercing?
(f) Draw sweep pattern.
(g) Name the parts of lathe machine.
(h) Write the definition of welding.
(i) What is a shift defect in casting?
(j) What is facing?

3013-P-2-Q-8 (25)

[P.T.O.]

Unit-I

2. What is accident? Explain the various methods of preventing the accidents. 12.5
3. What is Plant Layout and also discuss the various types of plant layout with its relative merits and demerits? 12.5

Unit-II

4. Explain Extrusion, and also explain various types of Extrusion. 12.5
5. Explain the various Sheet Metal Operations. 12.5

Unit-III

6. What is casting and discuss the various steps in casting process in details? 12.5
7. Discuss the construction of lathe and also write down the lathe operations. 12.5

Unit-IV

8. Explain the welding process and classify the various types Welding Processes. 12.5
9. Discuss the difference between Soldering & Brazing. 12.5

9. Imagine your class has completed a full course on English for Competitive Exams through the Swayam Portal and your class wants the university to consider it for inclusion in your semester results instead of holding a conventional examination. Draft an email to the Controller of Examination and request appointment for discussion.

40014

B. Tech. 1st Semester (Common for All Branches)
(H-Scheme) Examination, December-2025
English

25HSMC-ENG-101H

Time allowed : 3 hours] [Maximum marks : 35

Note : Attempt five questions in total selecting at least one question from each unit. Question No. 1 is compulsory.

1. Answer the following questions briefly :
- Correct the sentence "I returned back yesterday".
 - Make a sentence on "Subject+Gerund".
 - Supply one word substitute for "happening after death".
 - Change the voice in "Thank you".
 - Use the idiom 'break the ice' in a sentence.
 - What are 'nasal consonants'?
 - What is 'detachment' according to Swami Vivekanand?

Unit-I

2. Make sentences based on following verb patterns :
- Sub+Verb+Noun Phrase
 - Sub+Verb+Noun Complement
 - Noun Phrase+Verb+Direct Object
 - Sub+Verb+Adjective
 - Sub+Verb+Gerundical infinitive
 - Sub+Verb+Infinitive
 - Gerund+Helping Verb+Object Complement

40014-P-4-Q-9(25)

[P.T.O.]

3. Correct the following sentences :
- They let the students to leave early
 - I found the child cry silently in a corner
 - The doctor is sleeping for two hours
 - Neither of the boys have come back
 - He suggested me to join his club
 - The noise caused me wake up suddenly
 - She kept me to wait outside

Unit-II

4. Use the following *idioms* in your sentences so as to make the meaning of the idioms clear :
- Bread and butter
 - Cut ice
 - Fool's paradise
 - Hot water
 - Hard nut to crack
 - Once for all
 - Pull the plug
5. Supply One-word Substitutes and use in your sentences:
- Someone who collects coins
 - Absence of law and order
 - One who looks at the positive side of things
 - Mass murder for no reason
 - For that purpose
 - The place maintained for birds
 - Someone who advocates only men

40014

Unit-III

6. Write short notes on any two the following :
- Diphthongs
 - Semi Vowels
 - Lateral
7. Supply phonetic transcription of the following words :
- Dust
 - Fourteen
 - Doll
 - Length
 - Masterpiece
 - Phonetic
 - Examination

or

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

Unit-IV

8. Elaborate the idea of "Working like a master, not a slave" as contained in Swami Vivekananda's essay 'The Secret of Work'.

or

Record your impressions the views of Dr. APJ Abdul Kalam his essay "Patriotism beyond Religion and Politics".

40014

[P.T.O.]

**B.Tech (Common for all Branches) 1st Semester
(G-Scheme) Examination, December-2025**

ENGLISH

Paper-HSMC-ENG-101-G

Time allowed : 3 hours]

[Maximum marks : 75

Note : Attempt five questions in total. Question No. 1 is compulsory. Select one question from each unit.

1. Answer the following questions briefly : $2.5 \times 6 = 15$
- (a) What is true liberation in 'The Secret of Work' ?
 - (b) What is Speech Mechanism ?
 - (c) Differentiate between 'wide' and 'vide'.
 - (d) Make words using the prefixes-in,-ex, -pre, -mal, -uni
 - (e) Describe Spring Balance.
 - (f) What are friction consonants ?

(2)

3014

Unit-I

2. (a) Make sentences based on following verb patterns : $5 \times 3 = 15$
- (i) Sub + Verb + Indirect Object + Direct Object
 - (ii) Sub + Verb + Noun Complement
 - (iii) Noun Phrase + Helping Verb + Adjective + Noun
 - (iv) Subject + Verb + Subject Complement
 - (v) Sub + Verb + Infinitive
- (b) Correct the following sentences :
- (i) Each of the boys have done homework.
 - (ii) Sandals and towels are essential gear for beach.
 - (iii) Either Ram or Shyam pay the employees.
 - (iv) He returned back yesterday.
 - (v) I am couldn't but laughing.

3014

(3)

3014

(c) Do as directed :

- (i) He prefers cigar _____ cigaratte (insert preposition)
 - (ii) He is poor. He is honest (make compound)
 - (iii) Honesty is _____ MLA (insert article)
 - (iv) There's _____ who likes to be poor (neither/none)
 - (v) With who do you live ? (correct pronoun)
3. Use the following pairs in your sentences so as to make the meanings of the individual words clear : $3 \times 5 = 15$
- (a) Momentary, Momentous
 - (b) Elder, Older
 - (c) Noted, Noticed
 - (d) Literary, Literal
 - (e) Loose, Lose

3014

[P.T.O.]

(4)

3014

Unit-II

4. (a) Supply One-word Substitutes : $7.5 \times 2 = 15$
- (i) A place for keeping birds
 - (ii) Fear of books
 - (iii) Government by officials
 - (iv) Study of human being
 - (v) Soldiers on foot
- (b) Supply meanings of the following foreign words and make sentences : $7.5 \times 2 = 15$
- (i) Alumni
 - (ii) Bon Voyage
 - (iii) En route
 - (iv) De jure
 - (v) Ex-officio
5. (a) Make sentences with the following idioms :
- (i) Dark horse,

3014

(5)

3014

- (ii) Break the ice
 - (iii) Run into
 - (iv) Turn down
 - (v) Watch out $7.5 \times 2 = 15$
- (b) Change into passive voice :
- (i) I am hitting this rod
 - (ii) Thank me
 - (iii) Who is removed my chair ?
 - (iv) She has asked for apples
 - (v) The caravan shall destroy our crops

Unit-III

6. Write short notes on any *two* : $15 \times 1 = 15$
- (a) Phonemes
 - (b) Friction Consonants
 - (c) Semi vowels

or

3014

[P.T.O.]

(6)

3014

Draw a neat diagram of Speech Mechanism and mark all speech organs

7. Define Affricates, Bilabials and Labio dentals. List all of them. $15 \times 1 = 15$

Unit-IV

8. Discuss the main idea of Khushwant Singh's essay '*Mother Teresa*'.

or

Develop a paragraph on '*Digital Economy*'.

9. Write an essay on Swami Vivekananda's idea of work and its nature. $15 \times 1 = 15$

or

Write an application to the Director of your institution/college seeking permission and requesting logistical arrangements for an educational trip of your batch.

or

3014

(7)

3014

Record your impressions of Bertrand Russel's views on Intellectual Rubbish.

3014

40014

B. Tech. 1st Semester (Common for All Branches)

H-Scheme Examination, December-2025

UNIVERSAL HUMAN VALUES

Paper : 25HSMC-UHV-101H

Time allowed : 3 Hours]

[Maximum marks : 50

Note : Attempt five questions in all. Question No. 1 is compulsory. Attempt four more question from the sections A, B, C & D by selecting at least one question from each section.

1. (a) Explain the meaning of holistic development of a human being.
- (b) Interpret the role of the self in giving direction to the Body.
- (c) Describe the meaning of harmony in the family.
- (d) Explain the concept of existence as co-existence. 4×2.5=10

Section-A

2. Define value education and explain its objectives. 10
3. Apply the concept of continuous happiness in personal life planning. 10

40014-P-2-Q-9-(25)

[P.T.O.]

Section-B

- 4. Explain the meaning of the statement: "The Body is an instrument of the Self." 10
- 5. Examine the effectiveness of a value-based lifestyle in ensuring health and harmony. 10

Section-C

- 6. Interpret the importance of respect in interpersonal relationships. Explain how lack of respect leads to conflict. 10
- 7. Apply the concept of interconnectedness to environmental protection. 10

Section-D

- 8. Explain why ethical conduct is universal and consistent. 10
- 9. Differentiate between profit-maximization and value-based management. 10

Section-A

- 2. Define value education and explain its objectives. 10
- 3. Apply the concept of continuous happiness in personal life planning. 10

40021

B. Tech.1st Semester (Common for All Branches)
(Table-3) H- Scheme Examination, December-2025

BASICS OF MECHANICAL ENGINEERING

Paper : 25ESC-ME-103-H (40021)

Time allowed : 3 Hours]

[Maximum marks : 50

Note: The students have to attempt **five** questions in total,

Question No.1 is being compulsory and selecting one from each unit.

1. Explain the following; 10
- (a) Principle of Turning.
 - (b) Zeroth Law of Thermodynamic.
 - (c) Rating of Refrigeration machines
 - (d) Impulse and reaction Turbine
 - (e) Principle of friction clutches.
 - (f) Young's Modulus of Elasticity.

UNIT-I

2. Draw a neat diagram of milling machine and explain the principal parts and operation performed on a milling machine. 10
3. (a) Explain First Law of Thermodynamics along with its limitations. 5
- (b) Explain the following: 5
- i. Enthalpy.
 - ii. Entropy.

40021-P-2-Q-9 (25)

[P.T.O.]

UNIT-II

4. Describe the simple vapour compression refrigeration cycle. Also discuss the essential components of a vapour compression refrigeration system and explain its working with neat sketch. 10
5. Draw a schematic diagram of Kaplan Turbine and explain its construction and working. 10

UNIT-III

6. Derive an expression for the length of flat belt between two pulleys for open belt drive. 10
7. Explain clearly the different types of stresses and strains. 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