JHARKHAND Rai University RANCHI

PRACTICE SET
End Semester Examination, December, 2025

Program: B.Tech (MiE/CSE)
Semester: I
Subject: Basic Electrical Engineering
Subject Code: 8ESC102 / 3ESC102

Course Outcome:
On the completion of the Course, the students will be able to:

Course Outcomes	Descriptions
CO1	Able to calculate rank of matrix, characteristic equation & characteristic roots & use the applicability of Caylay Hamilton Theorem to find inverse of matrix which is very important in many engineering application
CO2	Ability to understand calculus and its application in engineering
CO3	Gain knowledge about multiple differentiations which is helpful in Engineering & it is also useful in Research & Development
CO4	Gain knowledge about multiple Integration which is helpful in Engineering & it is also useful in Research & Development
CO 5	Appreciate knowledge of sequences and series and its application in real world problems.

Module – I
Marks: 01

1.If A =$\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$, then the determinant of A is **Understand (CO1) LOT**

(a) -2 (b) 2 (c) 10 (d) -10

2. The trace of a square matrix is: **Remember (CO1) LOT**

(a) The product of diagonal elements (b) The sum of diagonal elements

(c) The determinant of the matrix (d) The sum of all elements

3. If A is a 3×3 identity matrix, then A^{-1} is: **Understand (CO1) LOT**

(a) Zero matrix (b) Identity matrix (c) Negative of A (d) Undefined

4. A matrix is singular **if:** **Remember (CO1) LOT**

(a) It has all elements zero (b) It has no inverse (c) Its determinant $\neq 0$(d) It is symmetric

5. For a diagonal matrix, the eigenvalues are: Remember (CO1) LOT
(a) All equal (b) The diagonal elements (c) The sum of diagonal elements (d) Zero

6. The rank of a matrix is equal to: **Remember (CO1) LOT**
(a) Number of non-zero rows in echelon form (b) Number of rows
(c) Number of columns (d) The determinant value

7. If a matrix A is symmetric, then A^T=? **Remember (CO1) LOT**
(a) –A (b) A (c) A^{-1} (d) 0

8. **The characteristic equation of a 2×2 matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is** **Understand (CO1) LOT**
(a) $\lambda^2-(a+d)\lambda+(ad-bc)=0$ (b) $\lambda^2+(a+d)\lambda+(ad-bc)=0$ (c) $\lambda^2 -ad+bc=0$ (d) None

9. **If A has an eigenvalue λ, then the determinant of A equals:** **Remember (CO1) LOT**
(a) λ (b) Sum of eigenvalues (c) Product of eigenvalues (d) Trace of matrix

10. The determinant of a triangular matrix is: **Remember (CO1) LOT**
(a)Sum of diagonal elements (b) Product of diagonal elements (c) Always zero
(d) Undefined

Marks: 10

11. Find the Eigen value of the matrix $A^3 + 5A^2 – 6A + 2I$ if the matrix A = $\begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$.
Evaluate (CO1) HOT

12. Determine the condition for which the system x + y +z = 1; x + 2y – z = b; 5x + 7y + az = b^2
Admits (i) only one solution (ii) no solution (iii) many solution. Evaluate (CO1) HOT

13. Verify that the matrix A = $\begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ satisfies its own characteristic equation and hence find A^{-1}. Evaluate (CO1) HOT

Marks: 20

14. (i) Show that $\begin{bmatrix} 1 & -1 & 0 \\ -2 & 3 & -4 \\ -2 & 3 & -3 \end{bmatrix}$ is the inverse of $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ and hence evaluate system of the equation 3x – 3y + 4z = 5; 2x – 3y + 4z = 4; 0 – y + z = 0. Evaluate (CO1) HOT

(ii) Show that the matrix A = $\begin{bmatrix} 0 & 0 & 1 \\ 3 & 1 & 0 \\ -2 & 1 & -4 \end{bmatrix}$ satisfies its own characteristics equation. Hence find A^{-1}. Evaluate (CO1) HOT

15. Find eigen value and eigen vector of $\begin{bmatrix} 1 & 1 & -2 \\ -1 & 2 & 1 \\ 0 & 1 & -1 \end{bmatrix}$. Evaluate (CO1) HOT

Module – II

Marks: 01

16. Rolle's theorem is applicable to a function f(x) if: Remember (CO2) LOT
(a) f(x) is continuous on [a, b] (b) f(x) is differentiable on (a, b) (c) f(a)=f(b) (d) All of the above

17. The conclusion of Rolle's theorem is: Remember (CO2) LOT

(a) $f'(a)=f'(b)$ (b) $f'(c)=0$ for some $c \in (a, b)$ (c) $f(a)=f(b)$ (d) $f(c)=0$

18. The Mean Value Theorem (MVT) states that: Remember (CO2) LOT

(a) $f'(c)=0$ (b) $f'(c)=b-af(b)-f(a)$ for some $c \in (a, b)$ (c) $f(a)=f(b)$ (d) None of these

19. If $f(x)=x^2-4x+3$ on [1, 3], then $f'(c)=0$ at: Understand (CO2) LOT

(a) c=1 (b) c=2 (c) c=3 (d) c=0

20. If $f(x)=x^3-3x^2+2x$ on [0, 2], the value of c in Rolle's theorem is: Understand (CO2) LOT

(a) 0 (b) 1 (c) 2 (d) 3

21. Lim x→0 $(1-\cos x)/x^2$= Understand (CO2) LOT

(a) 0 (b) 1 (c) 1 / 2 (d) 2

22. lim x→0 $(e^x-1)/x$= Understand (CO2) LOT

(a) 0 (b) 1 (c) e (d) Undefined

23. limx→∞ 1/x = Understand (CO2) LOT

(a) 0 (b) ∞ (c) 1 (d) Undefined

24. limx→0 $(a^x-1)/x$= Understand (CO2) LOT

(a) 0 (b) 1 (c) lna (d) a

25. **If $f(x)=x^3$ on [–1, 1], then Rolle's theorem gives: Understand (CO2) LOT**

(a) c=0 (b) c = 1 /2 (c) c = -1 /2 (d) None

26. limx→0 tan2x/x= Understand (CO2) LOT

(a) 2 (b) 1 (c) 0 (d) ∞

Marks: 10

27. Determine a, b and c such that

$$\lim_{n\to 0} \frac{a\,e^x - b\cos x + c e^x}{x\sin x} = 2 \quad \text{Evaluate (CO2) HOT}$$

28. Find the relation between beta and gamma function. Or prove that $\beta(m,n) = \frac{\Gamma m.\Gamma n}{\Gamma m+n}$. Evaluate (CO2) HOT

29. Evaluate $\int_0^1 x^2(1-x^2)^{\frac{7}{2}}dx$ Evaluate (CO2) HOT

Marks: 20

30. Prove that if 0 < a < 1, 0 < b < 1; then $\frac{b-a}{\sqrt{1-a^2}} < sin^{-1}b - sin^{-1}a < \frac{b-a}{\sqrt{1-b^2}}$ hence deduce that $\frac{\pi}{6} - \frac{1}{2\sqrt{3}} < sin^{-1}\frac{1}{4} < \frac{\pi}{6} - \frac{1}{\sqrt{15}}$ Evaluate (CO2) HOT

31. Evaluate (i) $\lim_{x\to 0} \frac{x^{1/2}tanx}{(e^x-1)^{3/2}}$ (ii) $\lim_{\theta\to\alpha} \frac{1-\cos(\theta-\alpha)}{(sin\theta - sin\alpha)^2}$ Evaluate (CO2) HOT

Module – III

Marks: 01

32. A partial differential equation involves: Remember (CO3) LOT
(a) Only one independent variable (b) More than one independent variable
(c) Only algebraic functions (d) Only one dependent variable

33. The order of a partial differential equation is: Remember (CO3) LOT
(a) The degree of the equation (b) The highest derivative involved (c) The number of variables (d) The total number of terms

34. The equation $\partial^2z/\partial x^2+\partial^2z/\partial y^2=0$ is known as: Remember (CO3) LOT
(a) Heat equation (b) Wave equation (c) Laplace equation (d) Poisson equation

35. The equation $\partial^2u/\partial t^2=c^2\partial^2u/\partial x^2$ represents: Remember (CO3) LOT
(a) Laplace equation (b) Wave equation (c) Heat equation (d) Poisson equation

36. The equation $\partial u/\partial t=k\partial^2u/\partial x^2$ is called: Remember (CO3) LOT
(a) Wave equation (b) Heat equation (c) Laplace equation (d) None of these

37. For f(x, y, z, p, q) = 0 where $p = \partial z/\partial x$, $q = \partial z/\partial$ the equation is: Remember (CO3) LOT
(a) Ordinary differential equation (b) Partial differential equation
(c) Integral equation (d) Algebraic equation

38. A function f(x, y) has a maximum at (a, b) if: Remember (CO3) LOT
(a) $f_x=0, f_y=0$, and $f_{xx}\,f_{yy}-(f_{xy})^2 > 0$, $f_{xx} < 0$ (b) $f_x=0, f_y=0$, , and $f_{xx} > 0$
(c) $f_x=0, f_y=0$, and $f_{xx}f_{yy}-(f_{xy})^2 < 0$ (d) None of these

39. If $f_{xx}f_{yy}-(f_{xy})^2 < 0$, the point is: Remember (CO3) LOT
(a) Maximum (b) Minimum (c) Saddle point (d) None

40. The critical points of a function are obtained by: Remember (CO3) LOT
A) Solving f(x,y)=0 (b) Solving $f_x = 0$, and $f_y=0$ (c) Taking second derivative (d) None of these)

41. The function $f(x,y)=3x^2+2y^2+5$ has minimum value at: Understand (CO3) LOT
(a) (1,1) (b) (0,0) (c) (-1, 0) (d) None

Marks: 10

42. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$ then show that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = \frac{9}{(x+y+z)^2}$ Evaluate (CO3) HOT

43. Examine the function $u = x^3y^2(12 - 3x - 4y)$ for extreme values. Evaluate (CO3) HOT

44. Show that the rectangular solid of maximum value that can be inscribed in a sphere is a cube. Evaluate (CO3) HOT

Marks: 20

45. (i) Find the maximum value of the $f = x^2y^3z^4$ subject to the condition x + y + z = 5. Evaluate (CO3) HOT

(ii) If $u = x^2 + y^2 + z^2 - 2xyz = 1$ show that $\frac{dx}{\sqrt{1-x^2}} + \frac{dy}{\sqrt{1-y^2}} + \frac{dz}{\sqrt{1-z^2}} = 0$

46. Find the extreme values of $u = x^3 + y^3 - 63(x + y) + 12xy$ Evaluate (CO3) HOT

Module – IV
Marks: 01

47. The double integral $\iint_R 1\, dx\, dy$ represents: Remember (CO 4) LOT
(a) Volume under a surface (b) Area of the region RRR (c) Length of a curve (d) None

48. The order of integration in $\int_0^2 \int_0^x f(x,y)dydx$ is:
(a) dy dx (b) dx dy (c) dx only (d) None

49. The region bounded by y=0, x=1, and $y = x^2$ is: Understand (CO 4) LOT
(a) Rectangular region (b) Triangular region (c) Parabolic region (d) Circular region

50. Changing the order of integration involves: Remember (CO 4) LOT
(a) Changing limits only (b) Changing both limits and order (c) Changing the integrand (d) None

51. Evaluate $\iint_R xy\, dx\, dy$, R: $0 \le x \le 1, 0 \le y \le 2$ Understand (CO 4) LOT
(a) 1 (b) 2 (c) ½ (d) None of these

52. For the region bounded by x=0, y=0, x+y=1, $\iint_R x\, dx\, dy$= ? Understand (CO 4) LOT

(a) 1/6 (b) 1/3 C) ½ (d) None of these

53. The limits of integration for the region bounded by y = x and y = x^2 are: Understand (CO 4) LOT

(a) x=0 to x= 1 (b) x=−1 to x= 1 (c) y=0 to y = 1 (d) x=1 to x = 2

54. The value of $\iint_R e^{x+y}\,dx\,dy$, R:0 ≤x ≤1, 0 ≤y ≤1 Understand (CO 4) LOT

(a) e^2-1 (b) e−1 (c) $(e-1)^2$ (d) None

55. Evaluate $\iint_R x^2\,dx\,dy$, R:0 ≤x ≤2,0 ≤y ≤1 **Understand (CO 4) LOT**

(Aa) 4/3 (b) 2 (c) 8/3 (d) 4

56. When limits of integration are interchanged, the sign of the integral: Remember (CO 4) LOT

(a) Always changes (b) Never changes (c) Changes only in single integrals (d) May or may not change

Marks: 10

57. Evaluate $\int_0^{\infty}\int_0^{\infty}\frac{e^{-x^3}}{\sqrt{x}}y^4e^{-y^6}dxdy$ Evaluate (CO 4) HOT

58. Evaluate $\int\int e^{ax+by}dxdy$, over the triangle bounded by x = 0, y = o, ax + by = 1. Evaluate (CO 4) HOT

59. Evaluate $\int\int(x^2+y^2)dxdy$ over the ellipse $2x^2 + y^2 = 1$ Evaluate (CO 4) HOT

60. Evaluate $\int\int ydxdy$ over the region enclosed by the parabola $x^2 = y$ and the line y = x + 2. Evaluate (CO 4) HOT

61. Find the value $\int_0^2\int_1^z\int_0^{yz}xyzdxdydz$. Evaluate (CO 4) HOT

Marks: 20

62. (i) Evaluate $\int_1^e\int_1^{logy}\int_1^{e^x}logzdxdydz$ Evaluate (CO 4) HOT

(ii) Find the area bounded by the parabola $y^2 = 4x$ and the line 2x – 3y + 4 = 0. Evaluate (CO 4) HOT

63. (i) Find the area bounded between the parabola $x^2 = 4ay$ and $x^2 = 0 - 4a(y - 2a)$. Evaluate (CO 4) HOT

(ii) Find the area of the loop of the curve $x(x^2 + y^2) = a(x^2 - y^2)$. Evaluate (CO 4) HOT

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Summary Sheet

CO Wise

CO	Q. No.	Marks
CO1	1 to 15	80
CO2	16 to 31	81
CO3	32 to 46	80
CO4	47 to 63	90
		331

Unit Wise

Unit	Q. No.	Marks
Unit 1	1 to 15	80
Unit 2	16 to 31	81
Unit 3	32 to 46	80
Unit 4	47 to 63	90
	Total =	**331**

Blooms Taxonomy Level (BTL) Wise

BTL	Q. No.	Marks
LOT	1 to 10, 16 to 26, 32 to 41, 47 t0 56	41
HOT	11 to 15, 27 to 31,42 to 46,57 to 63	290
	Total =	**331**

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<u>Disclaimer</u>: - This is a Practice Set. The Question in End term examination will differ from the Practice set. This Practice set is meant for practice only.