25. The series $\frac{2}{1}+\frac{2^2}{2}+\frac{2^3}{3}+.....\infty$ is, 1 2 5 2

(A) Neither convergent nor divergent
(B) Oscillating
(C) Divergent
(D) Convergent

PART – B (5 × 10 = 50 Marks)
Answer **ALL** Questions

Marks BL CO PO

26. a.i. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$. 5 3 1 1,2

ii. Find the inverse of the matrix $\begin{bmatrix} -1 & 0 & 3 \\ 8 & 1 & -7 \\ -3 & 0 & 8 \end{bmatrix}$ using Cayley Hamilton theorem. 5 3 1 1,2

(OR)

b. Reduce the quadratic form $3x_1^2-3x_2^2-5x_3^2-2x_1x_2-6x_2x_3-6x_3x_1$ to the canonical form by an orthogonal transformation. Also find its rank, index, signature and nature of quadratic form. 10 3 1 1,2

27. a.i. Find $\frac{du}{dx}$, *if* $u=\tan^{-1}\left(\frac{x}{y}\right)$, where $x^2+y^2=a^2$. 5 3 2 1,2

ii. The sum of three numbers is constant, prove that their product is a maximum when they are equal. 5 4 2 1,2

(OR)

b.i. Expand *sin(xy)* in powers of *(x–1)* and *(y–π/2)* upto second degree term. 5 3 2 1,2

ii. If $x=u-uv, y=uv-uvw, z=uvw$, prove that $\frac{\partial(x,y,z)}{\partial(u,v,w)}=u^2v$. 5 3 2 1,2

28. a. Solve $\left(x^2D^2+9xD+25\right)y=(\log x)^2$. 10 3 3 1,2

(OR)

b. Solve $y''+4y=4\tan 2x$ using the method of variation of parameters. 10 3 3 1,2

29. a. Find the equation of circle of curvature of the rectangular hyperbola *xy=12* at *(3,4)*. 10 3 4 1,2

(OR)

b.i. Find the evolute of the parabola $y^2=4ax$. 5 4 4 1,2

ii. Find the envelope of the family of straight line $x\cos\alpha+y\sin\alpha=a\sec\alpha$, 'α' being the parameter. 5 3 4 1,2

30. a.i. Test for convergence of the series whose n[th] term is $\frac{1}{\sqrt{n+1}-\sqrt{n}}$. 5 3 5 1,2

ii. Discuss the convergence of the series $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+....\infty$. 5 3 5 1,2

(OR)

b. Discuss the convergence of $\frac{1.x}{2.4}+\frac{1.3}{2.4.6}x^2+.....+\frac{1.3.5....(2n-1)}{2.4.6....(2n+2)}x^n+....\infty$. 10 4 5 1,2

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2022
First Semester

18MAB101T – CALCULUS AND LINEAR ALGEBRA
(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

Note:
(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40[th] minute.
(ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours Max. Marks: 75

PART – A (25 × 1 = 25 Marks)
Answer **ALL** Questions

Marks BL CO PO

1. The characteristics equation of a 3×3 matrix whose trace is 2, determinant is 8 and one of the eigen value is 2, is given by 1 2 1 2

(A) $\lambda^3+8\lambda^2+4\lambda+2=0$
(B) $\lambda^3-2\lambda^2+4\lambda-8=0$
(C) $\lambda^3-2\lambda^2+8\lambda-4=0$
(D) $\lambda^3-4\lambda^2+2\lambda-8=0$

2. The eigen values of $A=\begin{bmatrix} 1 & 2 \\ 5 & 4 \end{bmatrix}$ are, 1 2 1 1

(A) (1, 6)
(B) (–1, –6)
(C) (1,–6)
(D) (–1,6)

3. The matrix of the quadratic form $2x_1^2+x_2^2+4x_2x_3-2x_1x_3$ is 1 2 1 2

(A) $\begin{bmatrix} 2 & 0 & -1 \\ 0 & 1 & 2 \\ -1 & 2 & 0 \end{bmatrix}$
(B) $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 1 & 2 \\ 0 & 2 & 0 \end{bmatrix}$
(C) $\begin{bmatrix} 2 & 0 & -1 \\ 0 & 1 & 2 \\ -1 & 2 & 1 \end{bmatrix}$
(D) $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & -1 \\ 2 & -1 & 1 \end{bmatrix}$

4. If the matrix $A=\begin{bmatrix} 3 & 4 \\ 0 & -3 \end{bmatrix}$ then the eigen value of A^2 is 1 1 1 2

(A) *(3,3)*
(B) *(–3i, 3i)*
(C) *(9,9)*
(D) *(4,3)*

5. The rank of the quadratic form is 1 1 1 1

(A) Total number of square terms in canonical form
(B) Total number of positive square terms in canonical form
(C) Total number of negative square terms in canonical form
(D) Total number of positive over negative square terms in canonical form

6. If *u=x, v=y* then $\frac{\partial(x,y)}{\partial(u,v)}=$ 1 2 2 2

(A) 0 (B) 1
(C) 2 (D) 3

7. If $u = x + y + z$ *then* $u_x + u_y + u_z$ is 1 2 2 2
(A) 1 (B) 2
(C) 3 (D) 4

8. Every extreme point is a _________ 1 1 2 1
(A) Saddle point (B) Regular point
(C) Center point (D) Stationary point

9. $f(x,y) = f(0,0) + \left[xf_x(0,0) + yf_y(0,0)\right] + \left[\frac{x^2}{2!}f_{xx}(0,0) + xyf_{xy}(0,0) + \frac{y^2}{2!}f_{yy}(0,0)\right] + ...$ 1 1 2 1
is known as
(A) Maclaurin's series (B) Laurent's series
(C) Binomial series (D) Exponential series

10. $\frac{\partial(u,v)}{\partial(x,y)} \times \frac{\partial(x,y)}{\partial(r,\theta)} =$ 1 1 2 1
(A) $\frac{\partial(x,y)}{\partial(u,v)}$ (B) $\frac{\partial(u,v)}{\partial(r,\theta)}$
(C) $\frac{\partial(u,v)}{\partial(x,y)}$ (D) $\frac{\partial(r,\theta)}{\partial(u,v)}$

11. The solution of $(D+3)^2 y = 0$ is 1 2 3 2
(A) $c_1e^{3x} + c_2e^{-3x}$ (B) $(c_1 + c_2x)e^{-3x}$
(C) $c_1 \cos 3x + c_2 \sin 3x$ (D) $c_1e^{2x} - c_2e^{-2x}$

12. The complementary function of the differential equation $\left(x^2D^2 + xD + 1\right)y = 0$ is 1 2 3 2
(A) $c_1e^x + c_2e^{-x}$ (B) $(c_1 + c_2x)e^{-x}$
(C) $c_1 \cos x + c_2 \sin x$ (D) $c_1 \cos \log x + c_2 \sin \log x$

13. In method of variation of parameters the Wronskian, 'W' is given by, 1 1 3 1
(A) $f_1f_2' - f_2f_1'$ (B) $f_1f_2' + f_2f_1'$
(C) $f_2f_1' - f_1f_2'$ (D) $f_1' + f_2'$

14. The particular integral of $y'' + 2y' + y = e^x$ is 1 2 3 2
(A) $\frac{xe^x}{3}$ (B) $\frac{e^x}{4}$
(C) e^x (D) $\frac{e^x}{2}$

15. The complementary function of $\left(D^2 + 2D + 5\right)y = e^{-x} \tan x$ is 1 1 3 1

(A) $(c_1 + c_2x)e^{-x}$ (B) $c_1 \cos 2x + c_2 \sin 2x$
(C) $c_1e^x + c_2e^{-x}$ (D) $c_1e^{-x} \cos 2x + c_2e^{-x} \sin 2x$

16. The reciprocal of the curvature of the curve at any point P is, 1 1 4 1
(A) Radius of curvature (B) Circle of curvature
(C) Centre of curvature (D) Chord of curvature

17. The locus of point of intersection of the consecutive members of the family of curve is known as ______of the curve. 1 1 4 1
(A) Evolute (B) Involute
(C) Circle (D) Envelope

18. Evolute of the cycloid is 1 1 4 1
(A) Asteroid (B) Cardioid
(C) Cycloid (D) Parabola

19. The radius of curvature of the curve $y = 4 \sin x$ *at* $x = \frac{\pi}{2}$ is, 1 2 4 2
(A) 1/2 (B) 1/4
(C) –1/2 (D) –1/4

20. The value of $\mu\left(3\frac{1}{2}\right)$ is, 1 2 4 2
(A) $\frac{15}{8}\sqrt{\pi}$ (B) $\frac{105}{16}\sqrt{\pi}$
(C) $\frac{115}{8}\sqrt{\pi}$ (D) $2\sqrt{\pi}$

21. If the nth partial sum 'S_n' neither tends to finite limit nor to ±∞, as n→∞ then the series $\sum u_n$ is 1 1 5 1
(A) Convergent (B) Divergent
(C) Oscillatory (D) Alternating

22. The series $\sum \frac{1}{n^p}$ is divergent if 1 2 5 1
(A) p≥1 (B) p≤1
(C) p=1 (D) p=0

23. The alternating series $\sum_{n=1}^{\infty} (-1)^{n-1} u_n$ converges, if 1 1 5 2
(A) $\lim_{n\to\infty} u_n = 0$ *and* $\{u_n\}$ is monotonic increasing sequence
(B) $\lim_{n\to\infty} u_n = 0$ *and* $\{u_n\}$ is monotonic decreasing sequence
(C) $\lim_{n\to\infty} u_n \neq 0$ *and* $\{u_n\}$ is monotonic increasing sequences
(D) $\lim_{n\to\infty} u_n \neq 0$ *and* $\{u_n\}$ is monotonic decreasing sequence

24. The series $\sum u_n$ is absolutely convergent, if 1 1 5 1
(A) $\sum |u_n|$ is convergent (B) $\sum |u_n|$ is divergent
(C) $\sum u_n$ is convergent (D) $\sum u_n$ is divergent