2E3201

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2E3201

B. Tech. II - Sem. (Main / Back) Exam., - 2023

2FY2 – 01 Engineering Mathematics - II

Time: 3 Hours **Maximum Marks: 70**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

PART – A [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1 Determine the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 1 & 6 & 5 \end{bmatrix}$

Q.2 State the Cayley-Hamilton Theorem.

Q.3 Write the Integrating Factor (I.F.) of the following differential equation - $(x + 2y^3)\, dy = y dx$.

Q.4 Write the condition of exactness of the differential equation $Mdx + Ndy = 0$.

Q.5 Solve – $(D^3 - 3D^2 + 4)\, y = 0,\ D \equiv d/dx$

Q.6 Write the Legendre differential equation.

Q.7 Find the partial differential equation from $Z = ax + by + ab$.

Q.8 Write the Lagrange form.

Q.9 Classify the partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

Q.10 Write the one dimensional heat equation.

PART – B [5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 Reduce the matrix in its normal form and hence find its rank -

$$A = \begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$$

Q.2 For what values of k, the equations $x + y + z = 1$, $2x + y + 4z = k$, $4x + y + 10z = k^2$ have a solution, and solve in each case.

Q.3 Solve – $y = 2px - p^2$

Q.4 Solve – $(D^2 + 2D + 1)\, y = e^x + x^2 - \sin x$

Q.5 Solve the differential equation by method of change of dependent variable – $\frac{d^2y}{dx^2} - 2\tan x \frac{dy}{dx} + 5y = e^x \sec x$

Q.6 Solve the following –

$x^2 (y-z)\, p + y^2 (z-x)\, q = z^2 (x-y)$

Q.7 Describe the method of separation of variables.

PART – C

[3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$

Hence, find A^{-1}

Q.2 Solve the following differential equation –

$(x^4y^4 + x^2y^2 + xy)\, y\, dx + (x^4y^4 - x^2y^2 + xy)\, x\, dy = 0$

Q.3 Solve by the method of variation of parameter –

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

Q.4 Solve by Charpit's method –

$px + qy = pq$

Q.5 Solve the Laplace equation – $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ by the method of separation of variable.

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B. Tech. II - Sem. (New Scheme) (Main) Exam., (Academic Session 2021- 2022)

All Branch

2FY1 – 01 Engineering Mathematics – II

Common to all Branches

Time: 2 Hours **Maximum Marks: 70**

Instructions to Candidates:

Part – A: *Short answer questions (up to 25 words) 5 × 3 marks = 15 marks. Candidates have to answer **five** questions out of **ten**.*

Part – B: *Analytical/Problem solving questions 3 × 5 marks = 15 marks. Candidates have to answer **three** questions out of **seven**.*

Part – C: *Descriptive/Analytical/Problem Solving questions 2 ×20 marks = 40 marks. Candidates have to answer **two** questions out of **five**.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

Q.1 Evaluate -

$$\Gamma\left(\frac{-9}{2}\right)$$

Q.2 Evaluate -

$$\int_0^{\pi}\int_0^{a\sin\theta} r\,d\theta\,dr$$

Q.3 Evaluate -

$$\int_0^{\infty} x^3 e^{-2x^2} dx$$

Q.4 Determine the constant b such that

$\vec{A} = (bx^2y + yz)i + (xy^2 - xz^2)j + (2xyz - 2x^2yz - 2x^2y^2)k$ is solenoidal vector.

Q.5 Find a unit vector normal to the surface $x^2y+2xz = 4$ at the point (2, -2, 3).

Q.6 State Gauss divergence theorem.

Q.7 Define right circular cone.

Q.8 Find the equation of the sphere through the circle $x^2 + y^2 + z^2 = 9$, $x + y - 2z + 4 = 0$ and the origin.

Q.9 Find the eigenvalues of the matrix $\begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$.

Q.10 Are the following vectors linearly independent.

$X_1 = (1,1,1,3)$, $X_2 = (1,2,3,4)$, $X_3 = (2,3,4,9)$

PART – B

Q.1 Evaluate by changing the order of integration:

$$\int_0^1 \int_{e^x}^{e} \frac{1}{\log y} \, dx \, dy$$

Q.2 Prove that –

$$\int_0^1 \frac{dx}{\sqrt{1-x^3}} = \frac{[\Gamma(1/3)]^3}{2^{1/3}\sqrt{3}\pi}$$

Q.3 If $\vec{r} = xi + yj + zk$ and $r = |\vec{r}|$, then find (a) div $(r^n \vec{r})$ (b) Curl $(r^n \vec{r})$.

Q.4 Use Green's theorem to evaluate the integral $\int_c [-y^3 dx + x^3 dy]$ where C is the circle $x^2 + y^2 = 1$.

Q.5 Find the equation of right circular cone generated by rotation of the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ about the line $\frac{x}{-1} = \frac{y}{1} = \frac{z}{2}$.

Q.6 Determine the rank of matrix.

$$\begin{bmatrix} -1 & 2 & 3 & -2 \\ 2 & -5 & 1 & 2 \\ 3 & -8 & 5 & 2 \\ 5 & -12 & -1 & 0 \end{bmatrix}$$

Q.7 For what values of λ and μ does the system of equation $2x + 3y + 5z = 9$, $7x + 3y - 2z = 8$ and $2x + 3y + \lambda z = \mu$ has

(i) No Solution

(ii) Unique solution

(iii) Infinite number of solutions

PART – C

Q.1 Find the volume and surface area of the solid generated by the revolution of the astroid $x = a\cos^3 t$, $y = a\sin^3 t$ about the x-axis.

Q.2 If $\vec{F} = xi - yj + (z^2-1)k$ find $\iint_s \vec{F}.\hat{n}ds$, where S is the closed surface bounded by the planes $z = 0$, $z = 1$ and the cylinder $x^2 + y^2 = 4$.

Q.3 Find the equation of the right circular cylinder described on the circle through the point (1,0,0), (0,1,0) and (0,0,1) as the guiding curve.

Q.4 Verify Cayley - Hamilton theorem for the matrix -

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$$

Hence, find A^{-1}.

Q.5 Find the constant λ so that $\vec{F}$ is a conservative vector field, where

$\vec{F} = (\lambda xy - z^3)i + (\lambda-2)x^2j + (1-\lambda)xz^2k$.

Find the work done in moving particle from $(1, 2, -3)$ to $(1, -4, 2)$
