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B. Tech. (Sem. - 2nd)
ENGINEERING MATHEMATICS - II
SUBJECT CODE : AM – 102 (2004 – 10 Batch)
Paper ID : [A0119]

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Five** questions from Section – B & C.
- 3) Select at least **Two** questions from Section –B & C.

Section - A

Q1)

(2 Marks Each)

- a) Find the rank of matrix $\begin{bmatrix} 1 & 2 & -1 \\ 3 & 1 & 0 \\ 2 & -1 & 1 \end{bmatrix}$
- b) Write down the matrix of the quadratic form $3x^2 + 7y^2 - 8z^2 - 4yz + 3xz$
- c) Solve the differential equation $p = \log(px - y)$
- d) Solve the differential equation $(1 + y^2) dx = (\tan^{-1} y - x) dy$
- e) At the end of three successive seconds the distances of point moving with simple Harmonic motion from its mean position are y_1, y_2, y_3 respectively. Show that time of a complete oscillation is $\frac{2\pi}{\cos^{-1}\left(\frac{y_1+y_3}{2y_2}\right)}$
- f) Show that Gradient $(r^n) = nr^{n-2}\vec{r}$ where $r = |\vec{r}|$, $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$.
- g) Give geometrical interpretation of gradient of a scalar field.
- h) Show that $r^n\vec{r}$ is irrotational where $r = |\vec{r}|$, $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$
- i) If the probability of a bad reaction from a certain infection is 0.001. Determine the probability that out of 2000 individuals more than two will get a bad reaction.
- j) State F-test.

Section - B

(8 Marks Each)

- Q2)** (a) Show that equations $3x + 4y + 5z = a$, $4x + 5y + 6z = b$, $5x + 6y + 7z = c$ do not have a solution unless $a + c = 2b$.

- (b) Find a matrix p which transforms the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ in to a diagonal form.

- Q3)** (a) Solve $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$.

- (b) Solve $x^2\left(\frac{dy}{dx}\right)^2 + 3xy\frac{dy}{dx} + 2y^2 = 0$

- Q4)** (a) Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x \cos x$.
(b) Solve by method of variation of parameter the differential equation
$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$$

- Q5)** (a) The differential equation for a circuit in which self inductance and capacitance neutralize each other is $L \frac{d^2i}{dt^2} + \frac{i}{c} = 0$. Find the current i as a function of t , given that I is maximum current and $i = 0$ when $t = 0$.
(b) A body weighing 4.9 kg is hung from a spring. A pull of 10 kg will stretch the spring to 5 cm. The body is pulled down 6cm below the equilibrium position and then released. Find the displacement of body from its equilibrium position at time.

Section – C

(8 Marks Each)

- Q6)** Prove that

(a) $\text{div}(\phi \vec{A}) = \phi(\text{div} \vec{A}) + (\text{grad } \phi) \cdot \vec{A}$, where \vec{A} is a vector function & ϕ is a scalar function.

(b) Compute the line integral $\int_C y^2 dx - x^2 dy$ about the triangle whose vertices are (1, 0) (0, 1) and (-1, 0).

- Q7)** (a) Verify Green's theorem for $\int_C (x^2 + 2y) dx + (y^2 + x^3 y) dy$ where C is square with vertices P(0, 0) Q(1, 0) R(1, 1) S(0, 1).

(b) Evaluate $\oint_C \vec{F} \cdot d\vec{r}$ by stoke's theorem where $\vec{F} = y\hat{i} + xz^3\hat{j} - zy^3\hat{k}$, C is circle $x^2 + y^2 = 4, Z = \frac{3}{2}$.

- Q8)** (a) In a examination given by 500 candidates, average and standard deviation of marks obtained (normally distributed) are 40% and 10% find approximately

(i) How many will pass if 50% is fixed as minimum.

(ii) What should be minimum if 350 candidates are to pass.

(b) Fit a linear curve to the data $\{(x, y) : (1, 14), (2, 27), (3, 40), (4, 55), (5, 68)\}$

- Q9)** (a) The 9 items of a sample have the following values 45, 50, 47, 52, 48, 47, 49, 53, 51. Does the mean of these values differ significantly from the assumed mean 47.5.

(b) The following table gives the number of accidents. That take place in an industry during various days of the week. Test if accidents are uniformly distributed over the week.

Day :	Mon	Tue	Wed	Thu	Fri	Sat
No of accidents :	14	18	12	11	15	14

