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MATHEMATICS-1

(**CIVIL, EEE, MECH, ECE, CSE & IT**)

Time: 3 Hours. **Max. Marks: 70**

Note: 1. This question paper contains two parts A and B.
2. Part- A is Compulsory. Answer all Questions which carries 20 marks.
3. Part – B consists 5 units. Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART- A

(10*2 Marks=20Marks)

1. a) Find the values of b such that the rank of the matrix $\begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ b & 2 & 2 & 2 \\ 9 & 9 & b & 3 \end{bmatrix}$ is 3 — 2M

b) Define Echelon form of a matrix with a suitable example. — 2M

c) Determine A^8 for the matrix $= \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$. — 2M

d) Discuss about nature of the quadratic form. — 2M

e) Test for the convergence of the series $\sum_{n=1}^{\infty} \cos\left(\frac{1}{n}\right)$. — 2M

f) Define Absolute and conditional convergent. — 2M

g) Find the value of $\Gamma\left(-\frac{1}{2}\right)$. — 2M

h) State Rolle's theorem — 2M

i) If $u = x^2 - y^2, x = 2r - 3s + 4, y = -r + 8s - 5$. Find $\frac{\partial u}{\partial r}$ and $\frac{\partial u}{\partial s}$. — 2M

j) Find the stationary points of $u(x, y) = \sin x \sin y \sin (x + y)$ Where $0 < x,\ y < \pi$. — 2M

PART - B

(5*10 Marks=50Marks)

2 For what values of λ, the system of equations $x + y + z = 1,\ \ x + 2y + 4z = \lambda,\ x + 4y + 10z = \lambda^2$ have a solution and solve them completely in each case. — 10M

OR

3 Find the values of a and b for which the equations $x + ay + z = 3; x + 2y + 2z = b; x + 5y + 3z = 9$ are consistent. When will these equations have a unique solution? — 10M

4		Reduce the following quadratic form into a sum of squares by an orthogonal transformation $$8x^2+7y^2+3z^2-12xy-8yz+4zx$$	10M

OR

5		State and verify Cayley - Hamilton theorem and use it to find the inverse of the matrix $\begin{bmatrix}1 & 2 & 3\\2 & -1 & 4\\3 & 1 & -1\end{bmatrix}$.	10M

6	a)	Test for convergence of the series $1-\frac{x^2}{2!}+\frac{x^3}{3!}-\frac{x^4}{4!}+\cdots$	5M
	b)	Test the convergence of the series $x+\frac{2^2x^2}{2!}+\frac{3^3x^3}{3!}+\cdots$	5M

OR

7	a)	Test for convergence $\sum_2^{\infty}\frac{(-1)^{n+1}}{\sqrt{n(n+1)(n+2)}}$.	5M
	b)	Test the convergence of the series $1+\frac{x}{2}+\frac{2!\,x^2}{3^2}+\frac{3!\,x^3}{4^3}+\cdots$	5M

8		State and Verify Lagrange's mean value theorem for $f(x)=\begin{cases}x\sin\frac{1}{x} & (x\neq 0)\\ 0 & (x=0)\end{cases}$ in [-1. 1].	10M

OR

9	a)	Show that $h<e^h-1<he^h$ for $h\neq 0$.	5M
	b)	Expand $\log x$ in powers of $(x-1)$ and hence evaluate $\log 1.1$ correct to four decimal places.	5M

10	a)	If *z* is a homogenous function *x*, *y* of order *n* then prove that $x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}=nz$.	5M
	b)	If $u=\frac{1}{\sqrt{x^2+y^2+z^2}}, x^2+y^2+z^2\neq 0$ then evaluate $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}$.	5M

OR

11	a)	Find the volume of the greatest rectangular parallelepiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$..	5M
	b)	If $x=u(1-v); y=uv$ prove that $\frac{\partial(u,v)}{\partial(x,y)}\times\frac{\partial(x,y)}{\partial(u,v)}=1$.	5M

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