Sr. No.....................................

May 2019

B.Tech (All Branches), I SEMESTER (Reappear)

Mathematics-I(HAS-103)

Time: 3 Hours

Max. Marks:60

Instructions:
1. It is compulsory to answer all the questions (2 marks each) of Part -A in short.
2. Answer any four questions from Part -B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

Q1 (a) Find the Rank of the matrix $\begin{bmatrix} 1 & 2 & 1 \\ -1 & 0 & 2 \\ 2 & 1 & -3 \end{bmatrix}$ (2)

(b) Prove that product of eigen values of a matrix A is equal to the determinent of A. (2)

(c) Using Maclaurin's Theorem ,expand $\log secx$. (2)

(d) If $\sin u = \frac{x^2y^2}{x+y}$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3\ tanu$ (2)

(e) If $z = \log(e^x + e^y)$, show that $rt - s^2 = 0$ (2)

(f) Evaluate $\int\int_R (x + y)dy\ dx$, R is the region bounded by x=0, x=2, y=x, y=x+2 (2)

(g) Change the order of Integration $\int_0^\infty \int_0^x e^{-xy} y\ dy\ dx$ (2)

(h) Evaluate $\int_0^\infty x^6 e^{-3x} dx$ (2)

(i) Test the series $\sum_{n=1}^{\infty} \frac{1}{n+10}$ for convergence or divergence. (2)

(j) Discuss the convergence of the series $\sum_{n=1}^{\infty} (-1)^n \frac{n}{n^2+1}$ (2)

PART -B

Q2 (a) Find the eigen values and eigen vectors of matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ (5)

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(b) Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$. Hence evaluate A^{-1} (5)

Q3 (a) Find all the asymptotes of the following curve (5)

$$(x-y)^2(x+2y-1) = 3x + y - 7$$

(b) Show that radius of curvature at the ends of the major axis of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is equal to the semi-latus rectum of the ellipse. (5)

Q4 (a) If $\theta = t^n e^{r^2/4t}$, what value of n will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 \frac{\partial \theta}{\partial r}\right) = \frac{\partial \theta}{\partial t}$? (5)

(b) If xyz=8, Find the values of x,y for which $u = \frac{5xyz}{x+2y+4z}$ is a maximum. (5)

Q5 (a) Transform the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ into polar coordinates. (5)

(b) A pyramid is bounded by the three co-ordinate planes and the plane x+2y+3z=6. Compute this integral by double integration. (5)

Q6 (a) Evaluate $\iiint x^2yz\,dxdydz$ throughout the volume bounded by the planes $x = 0, y = 0, z = 0, \frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ (5)

(b) Evaluate $\iint r\,sin\theta dr d\theta$ over the area of the cardiod $r = a(1 + cos\theta)$ above the initial line. (5)

Q7 (a) Discuss the convergence of the series : (5)

$$1 + \frac{x}{2} + \frac{2!}{3^2}x^2 + \frac{3!}{4^3}x^3 + \frac{4!}{5^4}x^4 + \cdots \ldots\ldots\ldots \infty$$

(b) Discuss the convergence of the series $x + \frac{2x^2}{2!} + \frac{3x^3}{3!} + \frac{4x^4}{4!} + \cdots \ldots\ldots\ldots \infty$ (5)

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