BSCT-101 1002

Odd Semester Examination 2018-19

B. TECH. (CSE) (SEMESTER-I)

(New Syllabus)

MATHEMATICS – I

Time: 03:00 Hours **Max Marks : 100**

Note: Student need to attempt all questions as per instructions given below. Each question carries equal marks.

1. This part **contains 6 questions** each of **5 marks**. Student need to Student need to **any four.**

(a) Express the matrix $A=\begin{bmatrix}1 & 5 & 7\\ -1 & -2 & -4\\ 8 & 2 & 13\end{bmatrix}$ as a sum of symmetric and a skew symmetric matrix.

(b) Verify the matrix $A=\frac{1}{3}\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -2\\ -2 & 2 & -1\end{bmatrix}$ is orthogonal also find its inverse.

(c) If $A=\begin{bmatrix}3 & -1 & 1\\ -1 & 5 & -1\\ 1 & -1 & 3\end{bmatrix}$ find Eigen values for A^T.

(d) Verify Rolle's theorem for $f(x)=e^x(\sin x-\cos x)$ $in\left[\frac{\pi}{4},\frac{5\pi}{4}\right]$.

(e) Evaluate $\lim_{x\to 0}\frac{xe^x-\log(1+x)}{x^2}$

(f) Evaluate $\int_0^\infty (x^2+4)e^{-2x^2}dx$.

2. This part **contains 6 questions** each of 5 marks. Student need to attempt **any four**.

(a) Prove that $\int_0^\infty \frac{x^{m-1}}{(a+bx)^{m+n}}dx = \frac{1}{a^n b^m}B(m,n)$

(b) Test the convergence of series $\frac{2!}{3}+\frac{3!}{3^2}+\frac{4!}{3^3}+\frac{5!}{3^4}+...$

(c) Find the Fourier series of $f(x)=x$ in the interval $(0, 2\pi)$.

(d) Apply Raabe's test to test the convergence of series whose n^{th} term is $u_n = \frac{2.5.8..............(3n-1)}{7.10.13...........(3n+4)}$.

(e) Evaluate divergence of $2x^2z\,\hat{i}-xy^2z\,\hat{j}+3yz^2\,\hat{k}$ at the point (1, 1, 1).

(f) If $u=e^{xyz}$, show that $\frac{\partial^3 u}{\partial x\partial y\partial z}=(1+3xyz+x^2y^2z^2)e^{xyz}$.

3. This part **contains 3 questions** each of 10 marks. Student need to attempt **any two**.

(a) Discuss the consistency of system and if consistent find the solution

$$4x-2y+6z=8$$
$$x+y-3z=-1$$
$$15x-3y+9z=21$$

(b) Find the characteristic roots of the matrix $A=\begin{bmatrix}1 & 4\\ 2 & 3\end{bmatrix}$ and verify Cayley-Hamilton theorem for this matrix also find A^{-1}.

(c) State Maclaurin's theorem with Lagrange's form of remainder for $f(x)=\cos x$.

4. This part **contains 3 questions** each of 10 marks. Student need to attempt **any two**.

(a) Find the area of the surface of revolution generated by revolving the curve $x = y^3$ from $y = 0 \text{ to } y = 2$.

(b) Find the evolute of the parabola $y^2 = 4ax$.

(c) Find the Fourier series for $f(x) = x^2$ in the interval $(0, 2\pi)$ and hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots$

5. This part **contains 3 questions** each of 10 marks. Student need to attempt **any two**.

(a) Find the half range cosine series of $f(x) = x(\pi - x)$ in the interval $(0, \pi)$ and hence deduce that

$$\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots$$

(b) Find the directional derivative of $\varphi = (x_2 + y^2 + z^2)^{-1/2}$ at the point $P(3, 1, 2)$ in the direction of vector $yz\hat{i} + xz\hat{j} + xy\hat{k}$.

(c) Using Lagrange's method find the maximum value of $f = x^2 y^3 z^4$ subject to condition $x + y + z = 5$.

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