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Total Number of Pages : 02

B.Tech
15BS1101

1st Semester Back Examination 2019-20

MATHEMATICS - I

BRANCH : AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH, MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE

Max Marks : 100

Time : 3 Hours

Q.CODE : HB708

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Only Short Answer Type Questions (Answer All-10) (2 x 10)

- Define rectilinear Asymptotes.
- Define homogeneous and non-homogeneous differential equation.
- What do you mean by integrating factor? How it helps to solve differential equations?
- Define curvature and center of Curvature.
- Define Cauchy's homogeneous linear Differential equation.
- Define a Unitary matrix and give examples.
- What is the rank of a matrix? Write its basic importance?
- Find the Legendre polynomial $P_1(x)$ and $P_2(x)$.
- How can you say a real square matrix is orthogonal?
- Explain the condition for which a system of linear equation will possess more than one solution.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Find the rank of the matrix $A = \begin{bmatrix} 4 & 2 & 3 \\ 8 & 4 & 6 \\ -2 & -1 & -1.5 \end{bmatrix}$
- Solve the equation $(1 + x^2) \frac{d^2y}{dx^2} + x \frac{dy}{dx} + 4y = 0$, by power series method.
- Reduce the equation $\sin y \frac{dy}{dx} = \cos x (2\cos y - \sin 2x)$ to a linear equation and hence solve it.
- Solve the differential equation: $xy \frac{dy}{dx} = 1 + x + y + xy$.
- Solve the differential equation: $y'' + 4y' + 4y = e^x \sin 2x$, where $y' = \frac{dy}{dx}$
- Solve the following differential equation $(2x + 3)^2 y'' - (2x + 3)y' - 12y = 6x$, where $y' = \frac{dy}{dx}$.
- Obtain the rectilinear asymptotes of the curve $(e^\theta - 1) = a(e^\theta + 1)$
- Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$
- Solve the differential equation, $\frac{dy}{dx} + x \sin 2y = x^3 \cos 2y$
- Solve the differential equation $y'' + y = \cot x$, by using variation of parameter method.
- Prove that the center of curvature at points of a cycloid lie on an equal cycloid.
- Solve: $\left(y \left(1 + \frac{1}{x}\right) + \cos y\right) dx + (x + \log x - x \sin y) dy = 0$.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Find the point of the curve $y = e^x$, at which the curvature is maximum and show that the tangent at the point forms with the axes of co-ordinates a triangle whose sides are in the ratio $1:\sqrt{2}:\sqrt{3}$. **(16)**

Q4 Similar matrices have equal spectra verify this for A and $B = P^{-1}AP$, Where **(16)**

$$A = \begin{bmatrix} 10 & -3 & 5 \\ 0 & 1 & 0 \\ -15 & 9 & -10 \end{bmatrix}, P = \begin{bmatrix} 2 & 0 & 3 \\ 0 & 1 & 0 \\ 3 & 0 & 5 \end{bmatrix}$$

Q5 a) Solve the differential equation by using method of undetermined coefficient: $(D^2 + 16)y = x + 16 \sin 4x$. **(16)**

b) Solve $(D^2 + 5D + 6)y = e^{2x} \sinh 2x$

Q6 State and prove Rodrigues formula and hence derive $P_4(x)$. **(16)**