CBCS SCHEME

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USN [redacted] MI

17MAT11

First Semester B.E. Degree Examination, June/July 2019
Engineering Mathematics – I

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the n^{th} derivative of $\sin 2x \sin 3x$. **(06 Marks)**

b. Find the angle between the two curves $r = \frac{a}{1+\cos\theta}$ and $r = \frac{b}{1-\cos\theta}$ **(07 Marks)**

c. Find the radius of curvature for the curve $x^3 + y^3 = 3xy$ at (3/2, 3/2). **(07 Marks)**

OR

2 a. If $y = \cos(m \log x)$ then prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (m^2+n^2)y_n = 0$. **(06 Marks)**

b. With usual notation prove that $\tan\phi = r\frac{d\theta}{dr}$ **(07 Marks)**

c. Find the pedal equation of the curve $r^m = a^m \cos m\theta$. **(07 Marks)**

Module-2

3 a. Find the Taylor's series of $\log(\cos x)$ in powers of $(x - \pi/3)$ upto fourth degrees terms. **(06 Marks)**

b. If $u = \tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$ by using Euler's theorem. **(07 Marks)**

c. if $u = \frac{yz}{x}, v = \frac{xz}{y}, w = \frac{xy}{z}$ then find $J = \frac{\partial(u,v,w)}{\partial(x,y,z)}$ (07 Marks)

OR

4 a. Evaluate $\lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{1/x^2}$ **(06 Marks)**

b. Using Maclaurin's series, prove that $\sqrt{1+\sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{3} + \frac{x^4}{4} \ldots$ **(07 Marks)**

c. If $u = f(2x-3y, 3y-4z, 4z-2x)$ then prove that $\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial u}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z} = 0$. **(07 Marks)**

Module-3

5 a. A particle moves along the cuvre $\vec{r} = (t^3 - 4t)\hat{i} + (t^2 + 4t)\hat{j} + (8t^2 - 3t^3)\hat{k}$. Find the components of velocity and acceleration in the direction of $\hat{i} - 3\hat{j} + 2\hat{k}$ at $t = 0$. **(06 Marks)**

b. Find the constant a and b such that $\vec{F} = (axy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (bxz^2 - y)\hat{k}$ is irrotational and find scalar potential function ϕ such that $\vec{F} = \nabla\phi$. **(07 Marks)**

c. Prove that $\text{curl}(\phi \vec{A}) = \phi\,\text{curl}\vec{A} + \text{grad}\phi \times \vec{A}$. (07 Marks)

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

6 a. Show that vector field F $\frac{x\hat{i}+y\hat{j}}{x^{-}+y^{-}}$ is both solenoidal and irrotational. **(06 Marks)**

b. If F = (x + y +1) + j-(x + y)i then prove that = curlF = 0 . **(07 Marks)**

c. Show that div(curl A) = 0 . **(07 Marks)**

Module-4

7 a. Obtain reduction formula for sin" x dx(n > 0). (06 Marks)

b. Solve the differential equation $\frac{dy}{dx}$ + y cot x = cos x (07 Marks)

c. Find the orthogonal trajectory of the curve r = a(1+ sin 0). (07 **Marks)**

OR

8 a. Evaluate I sin ^{7} 0 cos^{h} 0 de
0 (06 Marks)

b. Solve the differential equation : (2xy + y - tan y)dx + (x ^{2} - x tan` y + sec^{2} y)dy = 0 . **(07 Marks)**

c. If the temperature of air is 30°C and the substance cools from 100°C to 70°C in 15 mins. Find when the temperature will be 40°C_ **(07 Marks)**

Module-5

9 a. Find the rank of the matrix $\begin{vmatrix} 1 & 1 & I & 6 \\ 1 & -1 & 2 & s \\ 3 & 1 & 1 & 8 \\ 2 & -2 & 3 & 7 \end{vmatrix}$ by reducing to Echelon form. (06 Marks)

b. Find the largest eigen value and egien vector of the matrix $\begin{vmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{vmatrix}$ by taking initial vector as [1 1 1]^{i} by using Rayleigh's power method. Carry out five iteration. **(07 Marks)**

c. Reduce $8x^2 + 7y^2 + 3z^2$ - I 2xy + 4xz - 8yz into canonical form, using orthogona transformation_ **(07 Marks)**

OR

10 a. Solve the system of equations

10x+ y+ z = 12
x+ 10y+ z= 12
x+ y+ 10z= 12

by using Gauss-Seidel method. Carry out three iterations. (06 Marks)

b. Diagonalise the matrix A = $\begin{vmatrix} 5 & 4 \end{vmatrix}$ (07 Marks)

c. Show that the transformation

$x_i + 2x_2 + 5x_3$
Y2 = 2X1 4x2 + 1 1 x3
y3 = —X2 + 2X3

is regular. Write down inverse transformation. (07 Marks)