USN | | | | | | | | | 15MAT 11

First Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics - I

Time: 3 hrs. **Max. Marks: 80**

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. If $y = e^x \cos^3 x$, find y_n. (06 Marks)

b. Find the angle between the curves

$r = \dfrac{a}{1+\cos\theta}$ and $r = \dfrac{b}{1-\cos\theta}$. (05 Marks)

c. Find the radius of curvature of the curve $x^4 + y^4 = 2$ at the point (1, 1). (05 Marks)

OR

2 a. if x = tan(log y), find the value of $(1+x^2)y_{n+1} + (2nx-1)y_n + n(n-1)y_{n-1}$ (06 Marks)

b. Find the Pedal equation of $\dfrac{2a}{r} = 1+\cos\theta$. (05 Marks)

c. Find the radius of curvature of the curve r. = an Ake. (05 Marks)

Module-2

3 a. Explain log(cos x) about the point $x = \dfrac{\pi}{3}$ upto 3rd degree terms using Taylor's series. (06 Marks)

b. Evaluate: t(x). (05 Marks)

c. State Euler's theorem and use it to find $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y}$ when $u = \tan^{-1}\dfrac{x^2+y^2}{x+y}$ (05 Marks)

OR

4 a. Expand $\dfrac{e^x}{1+e^x}$ using Maclaurin's series upto and including 3rd degree terms. (06 Marks)

b. Find $\dfrac{du}{dt}$ when $u = x^3y^2 + x^2y^3$ with $x = at^2$, $y = 2at$. Use Partial derivatives. (05 Marks)

c. If $u = \dfrac{x_2x_3}{x_1}$, $v = \dfrac{x_1x_3}{x_2}$, $w = \dfrac{x_1x_2}{x_3}$, find the value of Jacobian $J\left(\dfrac{u, v, w}{x_1, x_2, x_3}\right)$ (05 Marks)

Module-3

5 a. A particle moves on the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$, where t is the time find the components of velocity and acceleration at time t = 1 in the direction of i – 3j + 2k. (06 Marks)

b. Find the divergence and curl of the vector $V = (xyz)i + (3x^2y)j + (xz^2 - y^2z)K$ at the point (2, -1, 1). (05 Marks)

c. A vector field is given by $A = (x^2 + xy^2)\,i + (y^2 + x^2y)j$, show that the field is irrotational and find the scalar potential.

OR

6 a. Find grad (I) when if = $3x^2y — y^3z^2$ at the point (1, -2, **-1).** **(06 Marks)**

b. Find a for which f— (x + 3y)i + (y - 2z)j + (x + az)k is solenoidal. **(05 Marks)**

c. Prove that Div(curl V) = 0. **(05 Marks)**

Module-4

7 a. Obtain the reduction formula of !sin' x cos ^{n}x dx. **(06 Marks)**

b. Evaluate $\int^{2a}$ xV2ax x^2 dx. **(05 Marks)**

c. Solve (2x log x — xy) dy + 2y dx = 0. **(05 Marks)**

OR

8 a. Obtain the reduction formula off cos' x dx. **(06 Marks)**

b. Obtain the Orthogonal trajectory of the family of curves r" cos n 0 = a.. Hence solve it. **(05 Marks)**

c. A body originally at 80°C cools down at 60°C in 20 minutes, the temperature of the air being 40°C. What will be the temperature of the body after 40 minutes from the original?(05 **Marks)**

9 a. Find the rank of the matrix

$$A= \begin{vmatrix} 2 & 3 & —1 & —1 \\ 1 & —1 & — & \\ 3 & 1 & 3 & —2 \\ 6 & 3 & 0 & —7 \end{vmatrix}$$ **(06 Marks)**

. Solve by Gauss — Jordan method the system of linear equations
2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16. **(05 Marks)**

. Find the largest eigen value and the corresponding Eigen vector by power method given that

$$A — \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}.$$ (Use $[1\ 0\ 0]^T$ as the initial vector). (Apply 4 iterations). **(05 Marks)**

OR

10 a. Use Gauss — Seidel method to solve the equations **(06 Marks)**

20x + y — 2x = 17
3x + 20y — z = 18
2x — 3y + 20z = 25. Carry out 2 iterations with xo — yo — zo -- 0.

b. Reduce the matrix A = $\begin{bmatrix} -1 & 2 & —2 \\ 1 & 2 & 1 \\ —1 & —1 & 0 \end{bmatrix}$ to the diagonal form. **(05 Marks)**

c. Reduce the quadratic form $3x^2 + 5y^2 + 3z^2$ — 2yz + 2zx — 2xy to the canonical form. **(05 Marks)**