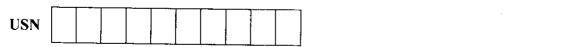
CBCS Scheme



First Semester B.E. Degree Examination, Dec.2015/Jan.2016 Engineering Mathematics - I

Time: 3 hrs.

Max. Marks: 80

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

Module-1

a. Find the nth derivative of $\frac{x^2}{2x^2 + 7x + 6}$.

(06 Marks)

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b. Find the angle between the curves $r^2 \sin 2\theta = 4$ and $r^2 = 16 \sin 2\theta$.

(05 Marks)

c. Find the radius of curvature of the curve represented by $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$.

(05 Marks)

OR

2 a. If $y = (x + \sqrt{x^2 - 1})^m$ then prove that $(x^2 - 1)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0$.

(06 Marks)

b. Find the pedal equation of $r^n = a(1 + \cos n \theta)$.

(05 Marks)

c. Find the radius of curvature of the curve $r^n = a^n \sin n\theta$.

(05 Marks)

Module-2

3 a. Expand sin x in powers of $(x - \frac{\pi}{2})$ upto fourth degree term.

(06 Marks)

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

(05 Marks)

c. If u = x + y + z, uv = y + z, uvw = z then find $\frac{\partial(x, y, z)}{\partial(u, v, w)}$.

(05 Marks)

OR

4 a. Find the Maclaurin's series expansion of sec x upto x^4 term.

(06 Marks)

b. If $V(x,y) = (1-2xy + y^2)^{-1/2}$ and $x \frac{\partial v}{\partial x} - y \frac{\partial v}{\partial y} = y^2 V^K$, then find K.

(05 Marks)

c. If $u = \sin^{-1} \left\{ \frac{x + 2y + 3z}{x^8 + y^8 + z^8} \right\}$ then find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$.

(05 Marks)

Module-3

- 5 a. A particle moves along the curve whose parametric equations are $x = t^3 + 1$, $y = t^2$, z = 2t + 5 where t is the time. Find the component of its velocity at t = 1 in the direction of I + J + 3K. Find also the component of its acceleration at t = 1 along the normal to I + J + 3K. (06 Marks)
 - b. Verify whether $\vec{A} = (2x + yz) I + (4y + zx) J (6z xy)K$ is irrotational or not. And find the scalar potential of \vec{A} . (05 Marks)
 - c. If \vec{A} is a vector point function and ϕ is a scalar point function then prove that $div(\phi \vec{A}) = \phi div \vec{A} + (grad \phi) \cdot \vec{A}$. (05 Marks)

- a. If $\vec{f} = x^2 I + y^2 J + z^2 K$ and $\vec{g} = yzI + zxJ + xyK$, then verify whether $\vec{f} \times \vec{g}$ is solenoidal
 - b. Find the directional derivative of $\phi = x^2 + y^2 + 2z^2$ at P(1, 2, 3) in the direction of line $\overrightarrow{PQ} = 4i - 2j + k.$ (05 Marks)
 - c. Prove that curl (grad ϕ) = \vec{O} . (05 Marks)

- a. Obtain the reduction formula for $\int \sin^n x \, dx$. Hence evaluate $\int_0^{x_2} \sin^n x \, dx$. (06 Marks)
 - b. Solve $(4xy + 3y^2 x) dx + x(x+2y)dy = 0$. (05 Marks)
 - c. Find the Orthogonal trajectories of the family $r^n = a^n \sin n\theta$, where a is the parameter. (05 Marks)

OR

- 8 a. Evaluate $\int_{0}^{\infty} \frac{x^{6} dx}{(4+x^{2})^{15/2}}$. (06 Marks)
 - b. Solve $x \frac{dy}{dy} + y = x^3 y^6$. (05 Marks)
 - c. A body is heated to 110°C and placed in air at 10°C. After one hour its temperature become 60°C. How much additional time is required for it to cool to 30°C? (05 Marks)

Module-5

a. Solve the following system of equations by Gauss – Jordan method:

x + y + z = 8; -x - y + 2z = -4; 3x + 5y - 7z = 14. (06 Marks) b. Verify the transformation $y_1 = 19x_1 - 9x_2 + 2x_3$; $y_2 = -4x_1 + 2x_2 - x_3$; $y_3 = -2x_1 + x_2$ is

- regular or not and find the inverse transformation if possible.
- Reduce the matrix to the diagonal form

$$A = \begin{pmatrix} 1 & 1 \\ 3 & -1 \end{pmatrix}.$$
 (05 Marks)

OR

- a. Solve the following system by Gauss Seidal method: (06 Marks) 20x + y - 2z = 17; 3x + 20y - z = -18; 2x - 3y + 20z = 25. Perform three iterations.
 - b. Determine the largest eigen value and the corresponding eigen vector of

$$A = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$$
 using Power method. (05 Marks)

Take $(1, 0, 0)^T$ as the initial eigen vector and perform four iterations.

c. Reduce the quadratic form:

$$8x^2 + 7y^2 + 3z^2 - 12xy + 4xz - 8yz into canonical form.$$
 (05 Marks)