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

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

    c. Find the radius of curvature of the curve $x^4 + y^4 = 2$ at the point $(1, 1)$.   (06 Marks)

OR

2 a. if $x = \tan(\log y)$, find the value of $(1+x^2)y_{n+2} + (2nx-1)y_{n+1} + (n)(n-1)Y_{n-1}$ (/trks)

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

    valuate&l: $\left(\dfrac{----}{x} \right)$.   (05 Marks)

    . State Euler's theorem and use it to find $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y}$ when $u - \tan^{-1}\dfrac{x_2 +}{x + y}$ (05 Marks)

OR

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

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

    c. $u = \dfrac{x_2 x_3}{x_1}$, $v = \dfrac{x_1 x_3}{x_2}$, $w = \dfrac{x_1 x_2}{x_3}$ find the value of Jacobian $J\left(\dfrac{u, v,}{x_1, x_2, x_1}\right)$ (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 $V = (xyz)i + (3x^2 y)j + (xz^2 - y^2 z)K$ at the point $(2, -1, 1)$.   (05 Marks)

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

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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 $\int \sin^n x \cos^a x \, dx$.   **(06 Marks)**

   b. Evaluate $\int^{2a} x\sqrt{2ax - x^2} \, dx$.   **(05 Marks)**

   c. Solve $(2x \log x - xy) dy + 2y \, dx = 0$.   **(05 Marks)**

OR

8   a. Obtain the reduction formula of $\int \cos^n x \, dx$.   **(06 Marks)**
    b. Obtain the Orthogonal trajectory of the family of curves $r^n \cos n\theta = a$. 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 $x_0 - y_0 - z_0 = 0$.
     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)**