Seat No.	

P-310

Total No. of Pages : 4

F.E. (Part - I) (Semester - I) (Revised) Examination, May - 2016
ENGINEERING MATHEMATICS - I
Sub. Code : 59177

Day and Date : Friday, 6-05-2016
Time : 10.30 a.m. to 1.30 p.m.

Total Marks : 100

Instructions :
1) **All the questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Use of non-programmable calculator is allowed.**

SECTION - I

Q1) Attempt "Any Three" of the following: **[15]**

a) Reduce following matrix to Echelon form and find its rank;

$$A = \begin{bmatrix} 2 & -2 & 0 & 6 \\ 4 & 2 & 0 & 2 \\ 1 & -1 & 0 & 3 \\ 1 & -2 & 1 & 2 \end{bmatrix}.$$

b) Test for consistency and hence solve the equations if possible

$2x+3y-4z=-2;\ x-y+3z=4;\ 3x+2y-z=-5.$

c) Find the values of λ and μ if the equations has infinite number of solutions

$3x-2y+z=\mu; 5x-8y+9z=3;\ 2x+y+\lambda z=-1$

d) Use matrix method to solve the equations

$x-y-2z=0; 3x+4y+z=0; 4x+3y-z=0;\ 5x+y-4z=0.$

P.T.O.

Q2) Attempt "Any Three" of the following: **[15]**

a) Examine for linear dependance or independence of vectors [2–1 3 2]; [1 3 4 2]; [3 –5 2 2]. If dependent find relation between them.

b) Find Eigen vector for least Eigen value of the matrix $A=\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$.

c) Use Caley - Hamilton's Theorem to find inverse of matrix $A=\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{bmatrix}$.

d) Find Eigen values of the matrix $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ and Eigen values of A^{-1}. (Adj. A) and (2A) matrices.

Q3) Attempt Any Four of the following: **[20]**

a) Simplify $\left[\dfrac{1+\sin(\pi/8)\ +\ i\cos(\pi/8)}{1+\sin(\pi/8)-i\cos(\pi/8)}\right]^8$.

b) Prove that $\cos^7\theta=\dfrac{1}{2^6}\left[\cos(7\theta)+7\cos(5\theta)+21\cos(3\theta)+35\cos\theta\right]$.

c) Solve the equation $x^9+8x^6+x^3+8=0$ and find all the roots of the equation.

d) Prove that $\cos h^{-1}\left(\sqrt{1+x^2}\right)=\tan h^{-1}\left(\dfrac{x}{\sqrt{1+x^2}}\right)$.

e) If $7\cos hx + 8\sin hx = 1$ then find the real value of x.

SECTION - II

Q4) Attempt ANY THREE from the following **[15]**

a) Expand sec x by Maclaurians theorem in powers of x up to x^4.

b) Expand $\sin^{-1} x$ in ascending powers of x.

c) Evaluate $\lim_{x \to 0} \left[\frac{\tan x}{x} \right]^{1/x^2}$.

d) Using Taylors theorem to express $(x-2)^4 - 3(x-2)^3 + 4(x-2)^2 + 5$ in powers of x.

Q5) Attempt ANY FOUR from the following **[20]**

a) If $u = \log\left(x^3 + y^3 - x^2y - xy^2\right)$; Prove that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y}\right)^2 u = \frac{-4}{(x+y)^2}$.

b) If $u = \tan^{-1}\left(\frac{x^2 + y^2}{x - y}\right)$ then prove that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -2\sin^3 u \cos u.$$

c) If $x = u(1-v)$, $y = uv$ then show that JJ' = 1.

d) A power dissipated in a resistor is given by $P = \frac{E^2}{R}$. Using calculus, find the approximate percentage error in P where E is increased by 3% and R is decreased by 2%.

e) Find the stationary value of $x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$.

Q6) Attempt ANY THREE from the following **[15]**

a) Apply Gauss elimination method to solve $x+y+z=6,\ 3x+3y+4z=20,$ $2x+y+3z=13$.

b) Solve by Gauss Seidal method (only three iterations)

$13x+5y-3z+u=18,\quad 2x+12y+z-4u=13,\quad 3x-4y+10z+u=29$
$2x+y-3z+9u=31.$

c) Solve by Jacobi's iteration method $20x+y-2z=17,\ 3x+20y-z=-18,$ $2x-3y+20z=25$ upto fifth iteration.

d) Find the largest Eigen value of the matrix $\begin{bmatrix} 2 & 3 & 2 \\ 4 & 3 & 5 \\ 3 & 2 & 9 \end{bmatrix}$ using powers method

by taking $X=\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$, up to fifth iteration.

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