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Question Paper Code : 95278

5 Year M.Sc. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

First Semester

Software Engineering

EMA 001 — TRIGNOMETRY, ALGEBRA AND CALCULUS

(Common to 5 Year M.Sc. Software Systems)

(Regulations 2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State DeMoivre's theorem.

2. Find the cube roots of unity.

3. State Cayley – Hamilton theorem.

4. The product of two eigen values of $A=\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is 16. Find the third eigen value.

5. State Euler's theorem on homogeneous functions.

6. Give the Maclaurin's series for a function of two variables.

7. Evaluate $\int_0^{\pi/2}\int_0^{\sin\theta} r\,dr\,d\theta$.

8. Change the order of integration in $\int_0^1\int_y^1 f(x,y)dy\,dx$.

9. Solve $\left(4D^2-4D+1\right)y=0$.

10. Transform the equation $(2x+3)^2 y''-2(2x+3)y'+2y=6x$ into a linear equation with constant coefficients.

PART B — (5 × 16 = 80 marks)

11. (a) (i) If $2\cos\theta = x + \frac{1}{x}$, prove that $\frac{x^{2n}+1}{x^{2n-1}+x} = \frac{\cos n\theta}{\cos(n-1)\theta}$. (8)

(ii) If $x^2 - 2x\cos\theta + 1 = 0$ show that $x^{2n} - 2x^n \cos n\theta + 1 = 0$. (8)

Or

(b) If $u = \log\tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$ prove that

(i) $\tan h\frac{u}{2} = \tan\frac{\theta}{2}$. (8)

(ii) $\theta = -i\log\tan\left(\frac{\pi}{4} + i\frac{u}{2}\right)$. (8)

12. (a) Verify Cayley-Hamilton theorem for the matrix $\begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$ and hence find A^{-1} and A^4. (16)

Or

(b) Reduce the quadratic form $6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 + 4x_1x_3 - 2x_2x_3$ to canonical form through an orthogonal transformation and also find its rank, index, nature and signature. (16)

13. (a) (i) If $u = \cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{-1}{2}\cot u$. (8)

(ii) Expand $e^x \sin y$ by Taylor's series in powers of x and y up to second degree terms. (8)

Or

(b) (i) In a triangle ABC, find the maximum value of $\cos A \cos B \cos C$. (8)

(ii) Find the volume of the greatest parallolepiped that can be inscribed in the ellipsoid whose equation is $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$. (8)

14. (a) Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$. (16)

Or

(b) Change the order of integration in $\int_0^a \int_{a-\sqrt{a^2-y^2}}^{a+\sqrt{a^2-y^2}} xy \, dx \, dy$ and then evaluate it. (16)

15. (a) Solve the simultaneous equation $\frac{dx}{dt} + 2x - 3y = 5t$, $\frac{dy}{dt} - 3x + 2y = 0$ given that $x(0) = 0$, $y(0) = -1$. (16)

Or

(b) Solve $\frac{d^2y}{dx^2} + y = x \sin x$ by the method of variation of parameters. (16)
