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**Question Paper Code : 65002**

5 Year M.Sc. DEGREE EXAMINATION, MAY/JUNE 2013.

First Semester

Software Engineering

XCS 112/10677 SW 102 – TRIGNOMETRY, ALGEBRA AND CALCULUS

(Common to 5 year M.Sc. Information Technology and 5 year M.Sc. Computer Technology)

(Regulation 2003/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Demoivre's theorem.
2. Define  $\sin hx$  and  $\cos h^{-1}x$ .
3. Find the rank of the matrix  $\begin{pmatrix} 1 & 2 & 4 \\ 2 & 4 & 8 \end{pmatrix}$ .
4. What are the applications of Cayley-Hamilton theorem?
5. If  $U = xy$  and  $x = e^t$ ,  $y = e^{-t}$ , find  $\frac{du}{dt}$ .
6. Find the Jacobian of the transformations  $x = r \cos \theta$  and  $y = r \sin \theta$ .
7. Prove that  $\int_0^a f(x) dx = \int_0^a f(a-x) dx$ .
8. Write down the formula to find the length of the arc of the curve  $y = f(x)$  between  $x = a$  and  $x = b$ .
9. Find the particular Integral for  $(D^2 + a^2)y = \sin ax$ .
10. Give the general form of Legendre's linear equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Prove that

$$(1 + \cos \theta + i \sin \theta)^n + (1 + \cos \theta - i \sin \theta)^n = 2^{n+1} \cdot \cos^n \left( \frac{\theta}{2} \right) \cdot \cos \left( \frac{n\theta}{2} \right).$$

- (ii) If  $\sin \theta = \tan hx$ , prove that  $\tan \theta = \sin hx$ .

Or

- (b) (i) Express  $\frac{\sin 7\theta}{\sin \theta}$  in terms of powers of  $\sin \theta$ .

- (ii) Separate into the real and imaginary parts of  $\tan^{-1}(x + iy)$ .

12. (a) (i) Test for consistency and hence solve :

$$x + y + z = 6, \quad x + 2y - 2z + 3 = 0, \quad 2x + 3y + z = 11.$$

- (ii) Find the eigen values and the eigen vectors of  $\begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$ .

Or

- (b) Reduce the following quadratic form into canonical form :

$$3x_1^2 + 5x_2^2 + 3x_3^2 - 2x_1x_2 - 2x_2x_3 + 2x_3x_1.$$

13. (a) (i) If  $Z(x + y) = x^2 + y^2$ , prove that  $\left( \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right)^2 = 4 \left( 1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} \right)$ .

- (ii) Obtain the Taylor's series of  $x^3 + y^3 + xy^2$  in powers of  $x - 1$  and  $y - 2$ .

Or

- (b) (i) If  $U = \tan^{-1} \left( \frac{x^3 + y^3}{x + y} \right)$ , find the value of  $x \cdot \frac{\partial u}{\partial x} + y \cdot \frac{\partial u}{\partial y}$ .

- (ii) Find the maxima and minima of  $x^3y^2(1 - x - y)$ .

14. (a) (i) Find a reduction formula for  $\int \sin^n x \, dx$ .

- (ii) Find the area of the loop of  $ay^2 = x^2(a - x)$ .

Or

(b) (i) Evaluate :  $\int_0^1 \frac{\log(1+x)}{1+x^2} dx$ .

(ii) Find the volume of a sphere of radius "a" units.

15. (a) (i) Solve :  $\frac{d^2y}{dx^2} + 7 \frac{dy}{dx} + 12y = x^2$ .

(ii) Solve :  $\frac{dx}{dt} - y = t, \frac{dy}{dt} + x = \sin 3t$ .

Or

(b) (i) Solve :  $(D^2 - 6D + 9)y = e^{-x} \cdot \cos 2x$ .

(ii) Solve :  $x^2y'' - 4xy' + 6y = \log x$ .

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