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SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL NO : | | | | | | | | | | | | **Total no. of pages:[2]**

Total number of questions:06

ENGINEERING MATHEMATICS-II

Subject Code :BTAM-102A(Regular) | BTAM102

Paper ID : M118 (RG|RP)

2011 batch onwards

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**

PART A (10x 2marks)

Q. 1. Short-Answer Questions:

(a) Write Cauchy's homogeneous linear differential equation. How it can be reduced to linear differential equation with constant coefficient.

(b) Find the rank of matrix of following matrix by reducing it into normal form.

$$\begin{pmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{pmatrix}$$

(c) Solve $x^2 y dx - (x^3 + y^3) dy = 0$

(d) Solve $p = \sin(y - px)$

(e) Solve $(xy^2 + 2x^2y^3)dx + (x^2y - x^3y^2)dy = 0$

(f) For what values of k, do the equations $x + y + z = 1;\ 2x + y + 4z = k;\ 4x + y + 10z = k^2;$ have a solution other than $x = y = z = 0$.

(g) Test for the convergent of following series using Leibnitz test

$$1 - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} - \frac{1}{\sqrt{4}} \cdots \quad to\ \infty$$

(h) Test the convergence of the infinite series $\sum 1/\left(1+\frac{1}{n}\right)^{n^2}$

(i) Separate $i^{(1+i)}$ into real and imaginary parts. Also find its modulus and arguments.

(j) Using De-Moivre theorem, solve $x^4 + x^3 + x^2 + x + 1 = 0$

PART B (8×5)

CO1

Q. 2. a. Solve differential equation

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 4y = e^x \cos x$$

b. Solve the differential equation

$\frac{d^2y}{dx^2} + 4y = \tan 2x$, by method of variation of parameter

OR

CO2

Find non-singular matrices P and Q such that PAQ is in normal form

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

Q. 3. For an electric circuit (constant L, R, C), Charge q on a plate of condenser is given by CO1

$$L\frac{d^2q}{dt^2}+R\frac{dq}{dt}+\frac{q}{c}=E\sin\omega t,$$ where L, R and E are constants and the current $i=\frac{dq}{dt}$, the circuit is tuned to resonance so that $\omega^2=\frac{1}{LC}$.

If $R^2<\frac{4L}{C}$ and if $q=i=0$ at $t=0$, Show that

$$q=\frac{E}{\omega R}\left\{-\cos\omega t+e^{\frac{-Rt}{2L}}(\cos pt+\frac{R}{2Lp}sinpt)\right\}$$

$$i=\frac{E}{R}\left\{sin\omega t-\frac{1}{p\sqrt{LC}}e^{\frac{-Rt}{2L}}sinpt)\right\}$$ where $p^2=\frac{1}{LC}-\frac{R^2}{4L^2}$

OR

a. Solve CO1

$$x^2\frac{d^2y}{dx^2}+2x\frac{dy}{dx}-12y=x^3\log x$$

b. Solve $y=2px+p^2y$

Q. 4. a. Find Eigen values and Eigen vector of matrix CO2

$$\begin{pmatrix}3&-1&1\\-1&5&-1\\1&-1&3\end{pmatrix}$$

OR

Verify Cayley Hamilton Theorem for CO2

$$\begin{bmatrix}2&-1&1\\-1&2&-1\\1&-1&2\end{bmatrix},$$ Hence obtain A^{-1}

Q. 5. a. Discuss the convergence of infinite series CO3

$$\frac{x}{1.3}+\frac{x^2}{3.5}+\frac{x^3}{5.7}+\cdots\infty$$

b. Discuss the convergence of $\sum\frac{1}{1+n^2}$, by applying Cauchy Integeral test

OR

Discuss the convergence of infinite series CO3

$$\frac{1^2}{4^2}+\frac{1^2.5^2}{4^2.8^2}+\frac{1^2.5^2.9^2}{4^2.8^2.12^2}+\cdots\infty$$

Q. 6. Prove that CO4

$$(1+\sin\theta+i\cos\theta)^n+(1+\sin\theta-i\cos\theta)^n=2^{n+1}\cos^n\left(\frac{\pi}{4}-\frac{\theta}{2}\right)\cos\left(\frac{n\pi}{4}-\frac{n\theta}{2}\right)$$

OR

Sum the series CO4

$$\cos\alpha-\frac{\cos(\alpha+2\beta)}{3!}+\frac{\cos(\alpha+4\beta)}{5!}-\ldots\infty$$