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Total No. of Questions: 09

B.Tech. (2011 Onwards) (Sem. – 2)

ENGINEERING MATHEMATICS – II

M Code: 54092

Subject Code: BTAM-102

Paper ID: [A1111]

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

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select at least TWO questions from each SECTION - B & C.**

SECTION A

1. a) Find the general value of $\log i^i$.

   b) Solve the the differential equation $p = \sin(y - xp)$, where p has its usual meaning.

   c) Test whether the differential equation $(5x^3 + 12x^2 + 6y^2)dx + 6xydy = 0$ is exact or not? Give reasons. If not. Find its integrating factor which will make it exact.

   d) Show that e^z is a periodic function. Find its fundamental period.

   e) Test whether the set of vectors {(1,0,0), (1,1,1), (1,2,3)}is linearly independent or dependent.

   f) Examine the convergence / divergence of the series $\sum_{n=1}^{\infty} \frac{1}{n} \sin \frac{1}{n}$

   g) Test the absolute convergence of the series $\sum_{n=1}^{\infty} \frac{\cos n\pi}{n\sqrt{n}}$

   h) If λ is an eigen value or a matrix A then prove that λ^{-1} is an eigen value of A^{-1}.

   i) For what values of 'k' the system of equation

   $$x + y + z = 6;\ x + 2y + 3z = l0;\ x + 2y + kz = \lambda,$$

   has uniue solution.

   j) If $x^2 - 2x\cos\theta + 1 = 0$, then show that $x^{2n} - 2x^n \cos n\theta + 1 = 0$

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SECTION B

2. a) Solve the differential equation:

$$y - 2px = \tan^{-1}(x\,p^2)$$

b). Use method of variation of parameters to find the general solution of the differential equation: $y'' - 2y' + y = e^x \log x$

3. a) Find the solution of the differential equation:

$$xy(1+xy^2)dy = dx$$

b) Find the particular solution of the differential equation:

$$x^2 y'' + xy' + y = \log x \sin(\log x).$$

by using operator method.

4. a) Solve the simultaneous linear differential equation:

$$\frac{dx}{dt} + 2y + sint = 0,\ \frac{dy}{dt} - 2x - \cos t = 0$$

b) Find the particular solution of the differential equation:

$$y''' - 7y'' + 10y' = e^{2x} \sin x$$

5. An L-C-R circuit, the charge q on a plate of the condensor is given by the equation: $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = E\sin pt,\ where\ \frac{dq}{dt} = i$ The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. If $q = i = 0$ when $t = 0$, show that for small values of R/L, the current in the circuit at time t is given by (Et /2L) sinpt.

SECTION C

6. a) Find the eigen values and the corresponding eigen vectors of the matrix:

$$\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$$

b) Test the conditional convergence of the series. $\sum_{n=1}^{\infty} \frac{(-1)^{n-1} n}{n^2 + 1}$

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7. a) Test the consistency of the system of equations:

   $x + 2y - z = 1$; $3x - 2y + 2z = 2$; $7x - 2y + 3z = 5$,

   and if consistent then solve it completely.

   b) Reduce the matrix $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & -1 \end{bmatrix}$ to normal form and hence find its rank.

8. a) Test for what values of 'x' for which the series

   $$\frac{1}{1.2}x + \frac{1}{3.4}x^2 + \frac{1}{5.6}x^3 + \frac{1}{7.8}x^4 + \cdots \infty$$

   Converges / diverges.

   b) Examine the convergence / diverge of the series:

   $$\frac{\sqrt{2}-1}{3^3-1} + \frac{\sqrt{3}-1}{4^3-1} + \frac{\sqrt{4}-1}{5^3-1} + \cdots \infty$$

9. a) If α, β, γ are the roots of the equation $x^3 + px^2 + qx + p = 0$, then prove that $\tan^{-1}\alpha + \tan^{-1}\beta + \tan^{-1}\gamma = n\pi$ radians except in one particular case. Mention this case.

   b) If $\sin^{-1}(u + iv) = \alpha + i\beta$, then prove that $\sin^2\alpha$ and $\cosh^2\beta$ are the roots of the equation $x^2 - x(1 + u^2 + v^2) + u^2 = 0$

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