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Total no of pages :3
Total No. of Questions :09

B.Tech (Sem.2nd)

ENGINEERING. MATHEMATICS-II

Subject Code :BTAM-102

Paper ID : [A1111]

Time: 3 Hrs.

Max. Marks :60

Note:- (1) Section-A is compulsory. Attempt any five question from section B and Section-C
Selecting at east two from each section. Each question of section B and C Carry
eight marks.

SECTION-A

(2x10=20)

- Q1. (a) Test whether the set $\{(1,1,1),(1,1,0),(1,0,1)\}$ of vectors is Linearly independent or dependent.
- (b) Prove that the eigen values of unitary matrix are of unit modulus.
- (c) Define the logarithmic function of a complex variable and hence find the general value of $\log(-i)$.
- (d) Express $\sin^5 \theta \cos^2 \theta$ in a series of sines of multiples of θ .
- (e) Discuss the convergence/divergence of the series $\sum_{n=2}^{\infty} \frac{\cos n\pi}{n\sqrt{n}}$
- (f) Find the general solution of the equation $\frac{dy}{dx} = \sin(y-x \frac{dy}{dx})$.
- (g) Obtain the particular solution of the equation $\frac{d^2y}{dt^2} + 4y = \cos 2t$.
- (h) Define Hermetian and skew-hermetian matrix with one example of each.
- (i) For what value of "k" the differential equation $xy^3dx + kx^2y^2dy = 0$ is an exact equation.

- (j) State Integral test and use it to test the convergence/divergence of the series

$$\sum_{n=2}^{\infty} \frac{1}{n \log n}$$

SECTION-B

2x10=20

- Q2. (a) Solve the following simultaneous differential equation (5)

$$\frac{dx}{dt} + 3y + 4x = t, \quad \frac{dy}{dt} + 2x + 5y = e^t$$

- (b) Find the particular solution of the differential equation $y'' - 4y' + 3y = e^x \cos 2x$ by using operator method. (3)

- Q3. (a) Use method of variation of parameters to find the general solution of the differential equation $y'' + 3y' + 2y = 2e^x$. (4)

- (b) Find the complete solution of the differential equation (4)

$$(3x+2)^2 y'' + 3(3x+2)y' - 36y = 3x^2 + 4x + 1$$

- Q4. (a) An e.m.f $E_0 \sin pt$ is applied at $t=0$ to a circuit containing a capacitance C and inductance L . The current i satisfies the equation $L \frac{di}{dt} + \frac{1}{C} \int i dt = E_0 \sin pt$. If $p^2 = 1/LC$ and initially the current i and the charge q are zero. Find the current i any time t in the circuit (5)

- (b) Solve the equation $y = 2px - p^2$, Where $P = \frac{dy}{dx}$. (3)

- Q5. (a) Solve the differential equation $xy(1+xy^2) \frac{dy}{dx} = 1$ (4)

- (b) Find the solution of the differential equation $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$ (4)

SECTION-C

- Q6. (a) Use the rank method to test the consistency of the system of equations (4)

$x+2y-2z=1; 2x-3y+z=0; 5x+y-5z=1; 3x+14y-12z=5,$
if consistent, then solve it completely.

- (b) State Cayley-Hamilton theorem and use it to find the inverse of the matrix (4)

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

- Q7. (a) Test for what values of x the series (4)

$$\frac{1}{2} + \frac{2}{3}x + \left(\frac{3}{4}\right)^2 x^2 + \left(\frac{4}{5}\right)^3 x^3 + \dots \infty, (x > 0) \text{ Converges /diverges.}$$

- (b) Test for the convergence/diverge of the following series

(i) $\sum_{n=1}^{\infty} \sin \frac{1}{n}$ (ii) $\sum_{n=1}^{\infty} \frac{1.3.5 \dots (2n-1)}{4^n 2^n (n!)}$ (4)

- Q8. (a) Use Demoivre's theorem to prove that (4)

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

- (b) Separate $\sin^{-1}(e^{-i\theta})$ into real and imaginary parts, Where θ is a positive acute angle. (4)

- Q9. (a) Find the sum of the series (5)

$$1 - \frac{1}{2} \cos \theta + \frac{1.3}{2.4} \cos 2\theta - \frac{1.3.5}{2.4.6} \cos 3\theta + \dots, -\pi < \theta < \pi.$$

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

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