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Total Number of Pages: 02

B.Tech
PAM1A001

1st Semester Regular / Back Examination 2017-18

APPLIED MATHEMATICS-I

BRANCH: AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, FAT, IEE, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, PE, PLASTIC, PT, TEXTILE

Time: 3 Hours

Max Marks: 100

Q.CODE: B733

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: *multiple type or dash fill up type* (2 x 10)

- a) The Asymptote of a nth degree curve cuts the curve into
a) n points (b) n(n-1) points (c) n(n-2) points (d) None ?
- b) The number of asymptotes of a curve of nth degree is
a) Atleast one (b) Atleast n (c) Atmost n (d) None
- c) The sum of order and degree of the differential equation
 $\frac{d^2}{dx^2}(y'' + 1) + 2y' = 0$ is
a) 2 (b) 3 (c) 4 (d) 5
- d) Let $A = [a_{ij}]$ be a 2017×2017 matrix such that $a_{ij} = \alpha$ for all i and j, then characteristics polynomial of A is
a) $x^{2015}(x - 2017\alpha)$ (b) $x^{2016}(x - 2017\alpha)$ (c) $x^2(x - 2017\alpha)$ (d) None
- e) Let $A^* = A^{-1}$; Where $A^* = (\bar{A})^T$ Then eigen values of A are
a) $\lambda = \pm 1$ (b) $\lambda = \pm i$ (c) $|\lambda| = 1$ (d) $\lambda = \pm 2$?
- f) If Trace(A)=3 and Trace(P)= 5, Then Trace($P^{-1}AP$); where P is an invertible matrix, Is equal to
a) 2 (b) 4 (c) 5 (d) 3
- g) The Radius of curvature of the curve $y = e^x$ at the point (0, 1) is
a) $2\sqrt{2}$ (b) $3\sqrt{2}$ (c) 0 (d) None
- h) Let $p_n(x)$ be the Legendre polynomial then $p'_n(1)$
a) 0 (b) 1 (c) $\frac{n(n-1)}{2}$ (d) $\frac{n(n+1)}{2}$
- i) Let $A = [a_{ij}]$ be a $n \times n$ matrix such that rank of $A = r$, then number of linearly independent solutions of the homogeneous system of equations $Ax = 0$ is
a) $n-1$ (b) $n-r$ (c) $n+r$ (d) $n-r+1$
- j) What is the integrating factor of $(2y dx + 3x dy) + 2xy(3ydx + 4x dy)$
a) x^2y (b) xy (c) xy^2 (d) None

Q2 Answer the following questions: *Short answer type* (2 x 10)

- a) Find the Algebraic and Geometric multiplicity of $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ with respect to the eigenvalue 1?
- b) Find the Radius of curvature for the pedal curve $p^2 = ar$
- c) Find the Radius of convergence of $\sum_1^\infty 5^n x^{n+2}$?
- d) Solve $(x^3 D^3 - 3x^2 D^2 + 6x D - 6)y = 0$?
- e) What is the integrating factor of $y' + p(x)y = q(x)y^n$; $n \neq 0, 1$?
- f) Write down the Lagrange sufficient conditions for a function of two variable to attain a minimum value ?
- g) Solve the ordinary differential equation $(D + 1)((D - 2)^3 y = 0$; $D = \frac{d}{dx}$

h) Find the asymptotes to the curve $x^4 + y^4 + x^2y + xy^2 = 0$ which are parallel to the axis ?

i) Define Similar Matrices.

j) Let $A = [a_{ij}]$ be a 3×3 matrix such that $\det(A - I) = 0$, Where I be a 3×3 identity matrix. If $\text{Trace}(A) = 13$, $\det(A) = 36$ Then find the sum of the square of the eigenvalues ?

Q3 a) Find all the asymptotes of the curve (10)

$$4x^4 - 13x^2y^2 + 9y^4 + 32yx^2 - 42y^3 - 20x^2 + 74y^2 + 16 = 0$$

b) Find the radius of curvature for the curve $r = a(1 - \cos \theta)$ (5)

Q4 a) Find the extrema of the function $f(x,y) = x^3y^2(1 - x - y)$ (10)

b) Expand $f(x, y) = (2x + y)^2$ about the point $(x, y) = (1, 1)$ by the Taylor series method. (5)

Q5 a) Using method of variation of parameter solve $x^2y'' + xy' - y = x^2e^x$? (10)

b) Find the second linear independent solution of $xy'' - (x + 1)y' + y = 0$ While one solution is e^x ? (5)

Q6 a) Find the series solution of $y'' + xy' + x^2y = 0$ about $x = 0$? (10)

b) Prove that $np_n(x) = xp_n'(x) - p_{n-1}'(x)$; where $p_n(x)$ is the Legendre polynomial. (5)

Q7 a) Show that $np_n(x) = (2n - 1)xp_{n-1}(x) - (n - 1)p_{n-2}(x)$; $n \geq 2$? (10)

b) Prove that $\int_{-1}^1 p_m(x)p_n(x)dx = 0$ if $m \neq n$? (5)

Q8 a) Find eigenvalue and eigenvector of $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 8 \end{bmatrix}$? (10)

b) Prove that product of two unitary matrix is unitary ? (5)

Q9 a) Solve $(1+y^2)dx = (\tan^{-1} y - x) dy$ (10)

b) Find the current at any time $t > 0$ in a circuit having in series a constant electromotive force 40 v, a resistor 10Ω and an inductor 0.2H given that initial current is zero. (5)