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Total Number of Pages: 02

B.Tech  
PAM1A0011<sup>st</sup> 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 n<sup>th</sup> 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 n<sup>th</sup> 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  $2017 \times 2017$  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  $A^* = (\overline{A})^T$  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  $(2y dx + 3x dy) + 2xy(3y dx + 4x dy)$   
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  $3 \times 3$  matrix such that  $\det(A - I) = 0$ , Where  $I$  be a  $3 \times 3$  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  $xy'' - (x + 1)y' + y = 0$  (5)  
 While one solution is  $e^x$  ?
- 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  $10\Omega$  and an inductor 0.2H given that initial current is zero. (5)