Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech**
15BS1101

1st Semester Back Examination 2017-18
MATHEMATICS-I
BRANCH: AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE, ELECTRICAL, ETC, FAT, IEE, IT, MANUTECH, MECH, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE
Time: 3 Hours
Max Marks: 100
Q.CODE: B755

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 to the curve $x^2y + xy^2 = 0$ parallel to x-axis is
(a)y =1 (b)y = 0 (c) x = 0 (d) none?

b) Let $J_n(x)$ be the Bessel function then the value of $J_n(0)$ is _____

c) The degree of $(1 + y'')^{\frac{3}{2}} = (xy' + 5)$ is _____

d) Let A = $[a_{IJ}]$ be a 3× 3 matrix such that a_{ij} = 1 for all I and j, then characteristics polynomial of A is _____

e) The eigenvalues of idempotent matrix are _____

f) If Trace(A)=3 Then the value of the Trace(A^T) is _____

g) The Radius of curvature of the curve y = $x^3 + e^{2x}$ at the point (1 , 1) is _____

h) Let $p_n(x)$ be the Legendre polynomial then the value of $p_n(-1)$ is ____

i) The vector (1, 2,0),(1,1,1),(2,2,2) and (0,0,0) are
(a)linearly independent (b)linearly dependent (c) both a and b (d)none ?

j) The integrating factor of y (1+xy) dx + x(1- xy)dy is _____

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

a) Find the Algebraic and Geometric multiplicity of A= $\begin{bmatrix} 2 & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$ with respect to the eigenvalue 0?

b) Find the Radius of curvature for the pedal curve $p^3 = 2ar$

c) Find the Radius of convergence of $\sum_1^\infty \frac{n}{(n+1)!} x^n$?

d) Solve $(x^3D^3 - 3x^2D^2 + 6xD - 6)y = 0$?

e) What is the integrating factor of $y' + y = xy^3$?

f) Solve $(D^4 + 1)\, y = 0$?

g) Solve the ordinary differential equation $(D^2 + 1)((D-5)^3 y = 0; D = \frac{d}{dx}$

h) Find the asymptotes to the curve $2x^4y + 3y^4x + x^2y + xy^2 = 0$ which are parallel to the axis?

i) Define rank of a matrix and what is the rank of a sum of the identity matrix and null matrix of order 3 X 3?

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 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)**
$3x^3 + 2x^2y - 7xy^2 + 2y^3 - 14xy + 7y^2 + 4x + 5 = 0$?

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

Q4 **a)** Prove that $J_{-o.5}(x) = \sqrt{\frac{2}{\pi x}}\cos x$, $j_n(x)$ be the Bessel's functions? **(10)**

b) Evaluate the value of $(\frac{9}{2})$? **(5)**

Q5 **a)** Solve $(D^2 + 4)y = 2\tan x$; x>0 , D=$\frac{d}{dx}$? **(10)**

b) Find the second linear independent solution of $y'' - \frac{2}{x^2}y = 0$ **(5)**
While one solution is x^2 ?

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

b) State and Prove the Rodrigue's formula ? **(5)**

Q7 **a)** Show that (n+1)$p_{n+1}(x) = (2n + 1)xp_n(x) - np_{n-1}(x)$;n≥ 1 ? **(10)**

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

Q8 **a)** Find eigenvalue and eigenvector of A= $\begin{bmatrix} 3 & 0 & 0 \\ 2 & 6 & 0 \\ 4 & 2 & 12 \end{bmatrix}$? **(10)**

b) Prove that inverse of unitary matrix is unitary ? **(5)**

Q9 **a)** Solve $(2xy^4e^y + 2xy^3 + y)\,dx + (x^2y^4e^y - x^2y^2 - 3x)\,dy = 0$ **(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)**