Code No: 51002 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, May/June - 2019
MATHEMATICS-I
(Common to CE, EEE, ME, ECE, CSE, CHEM, EIE, BME, IT, AE, BT, AME, MIE, MSNT)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Discuss the nature of the convergence of the series $\sum\left(\frac{n}{n+1}\right)^n . x^n$

b) Test the convergence and absolute convergence of the series [7+8]

$$\frac{1}{2}-\frac{2}{5}+\frac{3}{10}-\frac{4}{17}....+\frac{(-1)^{n+1}n}{n^2+1}+.....to\ \infty$$

2.a) Define functional dependency of functions. Determine whether the following functions are functionally dependent or not. If functionally dependent find the relation among them.

$$u=x+y-z; v=x-y+z; w=x^2+y^2+z^2-2xz$$

b) Divide 24 into three parts such that the continued product of the first, square of the second and cube of the third may be maximum. [8+7]

3.a) Trace the curve $r=a\cos 2\theta.$

b) If ρ_1, ρ_2 be the radii of curvature at the extremities of any chord through the pole of the cardioid $r=a(1+\cos\theta)$. Show that $\rho_1^2+\rho_2^2=\frac{16a^2}{9}$. [7+8]

4.a) Evaluate the double integral $\int_0^a\int_0^{\sqrt{a^2-x^2}} y\sqrt{x^2+y^2}\,dx\,dy$ by transforming into polar coordinates.

b) Find the volume of the portion of the sphere $x^2+y^2+z^2=4$ lying inside the cylinder $x^2+y^2=2x.$ [7+8]

5.a) Solve the differential equation $\frac{dy}{dx}\left(x^2y^3+xy\right)=1.$

b) Bacteria in a culture grow exponentially so that the initial number has doubled in 3 hours. How many times the initial number will be present after 9 hours? [7+8]

6.a) Solve $\left(D^2-4D+4\right)y=8x^2e^{2x}\sin 2x.$

b) Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2}+y=\cos ec\ x.$ [8+7]

7.a) Apply Convolution theorem to evaluate $L^{-1}\left\{\frac{s^2}{\left(s^2+4\right)\left(s^2+25\right)}\right\}$.

b) Solve the differential equation $\frac{d^2x}{dt^2}+9x=\sin t$ using Laplace transform given that $x(0)=1, x\left(\frac{\pi}{2}\right)=1$. [7+8]

8.a) Find the directional derivative of $2xy+z^2$ at $(1,-1,3)$ in the direction of the vector $\hat{i}+2\hat{j}+3\hat{k}$.

b) If $\bar{F}=3xyi-y^2j$ then evaluate $\int_C \bar{F}.\overline{dr}$ where C is the curve $y=2x^2$ in xy- plane from $(0,0)$ to $(1,2)$. [7+8]

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