

Code No: 51002

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  $\sum \left(\frac{n}{n+1}\right)^n \cdot x^n$
- b) Test the convergence and absolute convergence of the series [7+8]
- $$\frac{1}{2} - \frac{2}{5} + \frac{3}{10} - \frac{4}{17} \dots + \frac{(-1)^{n+1} n}{n^2 + 1} + \dots \text{to } \infty$$
- 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  $\rho_1, \rho_2$  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  $\frac{dy}{dx}(x^2y^3 + xy) = 1$ .
- 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  $(D^2 - 4D + 4)y = 8x^2e^{2x} \sin 2x$
- b) Apply the method of variation of parameters to solve  $\frac{d^3y}{dx^3} + y = \operatorname{cosec} x$ . [8+7]

- 7.a) Apply Convolution theorem to evaluate  $L^{-1}\left\{\frac{s^2}{(s^2+4)(s^2+25)}\right\}$ .
- 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  $\vec{F}=3xy\hat{i}-y^2\hat{j}$  then evaluate  $\int_C \vec{F}\cdot d\vec{r}$  where C is the curve  $y=2x^2$  in xy- plane from  $(0, 0)$  to  $(1, 2)$  [7+8]

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