JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech I Year Examinations, December -2018
MATHEMATICS-I
(Common to CE, EEE, ME, ECE, CSE, CHEM, EIE, BME, IT, ETM, MMT, AE, BT,
AME, MIE, PTM, MSNT, AGE)

Time: 3 hours   Max. Marks: 75

Answer any five questions
All questions carry equal marks
- - -

1.a) Discuss the convergence of the series $\dfrac{x}{1.2}+\dfrac{x^2}{3.4}+\dfrac{x^3}{5.6}+\dfrac{x^4}{7.8}+\ldots\ldots$

  b) Define absolute and conditional convergence of a series.
Test the following series for absolute or conditional convergence

  i) $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}\dfrac{1}{n}$ and   ii) $\displaystyle\sum_{n=1}^{\infty}\dfrac{(-1)^n}{n^2}$.   [7+8]

2.a) Verify Rolle's theorem for $f(x)=\sin x$ in $\left[0,2\pi\right]$ and
Lagrange's theorem for $f(x)=x^3-4x$ in $[-1,1]$.

  b) Find the maximum and minimum values of the function
$f(x,y)=x^3+3xy^2-15x^2-15y^2+72x$.   [8+7]

3.a) Find the radius , centre and the equation of circle of curvature of the curve
$y^2=x^3$ at $(1,1)$.

  b) Trace the curve $y=x+\dfrac{1}{x}$.   [7+8]

4.a) Change the order of integration in $\displaystyle\int_0^1\int_{x^2}^{2-x}xy\,dy\,dx$ and hence evaluate the same.

  b) Find the volume of the tetrahedron bounded by the plane $\dfrac{x}{a}+\dfrac{y}{b}+\dfrac{z}{c}=1$ and the
coordinate planes.   [8+7]

5.a) Solve $y'+\dfrac{x}{3}\,y=\dfrac{x}{3y^2}$.

  b) If a substance cools from $370k$ to $330k$ in 10 minutes and if the temperature of the
surrounding air is $290k$, find the temperature of the substance after 40 minutes.   [7+8]

6.a) Solve $y'' - 2y' + y = xe^x \sin x$.

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

7.a) Find the Laplace transform of $f(t) = \dfrac{e^{-t} \sin^2 t}{t}$.

b) Using Laplace transforms, solve $y'' + y = 2e^t$, $y(0) = 0$, $y'(0) = 2$. [7+8]

8.a) Prove that i) $\nabla^2 r^n = n(n+1)r^{n-2}$ and ii) $\nabla^2 \left(\dfrac{1}{r}\right) = 0$.

b) Verify Stoke's theorem for $\vec{V} = \left(x^2 + y^2\right) \hat{i} - 2xy \, \hat{j}$ taken around the rectangle bounded by $x = a, x = -a, \ y = 0$ and $y = b$. [7+8]

---ooOoo---