Please check that this question paper contains 9 questions and 2 printed pages within first ten minutes.

[Total No. of Questions: 09]
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Program/Course: B.Tech.(Batch 2018 onward)
Semester: 1, 2
Name of Subject: Mathematics-I
Subject Code: BSC-103
Paper ID: 15927

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are **compulsory**.
2) **Part -C** has Two questions Q8 and Q9.Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part -A **[Marks:02 each]**

Q1.

a) Test the convergence or divergence of the improper integral $\int_0^\infty \frac{dx}{9+x^2}$.

b) Define Clairaut's equation and write its solution.

c) Evaluate $\lim_{x\to a}\frac{x^3-a^3}{x-a}$.

d) Find the rank of the matrix $\begin{bmatrix}1 & 4 & 5\\ 2 & 6 & 8\\ 3 & 7 & 22\end{bmatrix}$.

e) Test the convergence of the series $\sum_{n=1}^{\infty}\left(\frac{n}{n+1}\right)^{n^2}$.

f) Find the particular integral of $(D^3-3D^2+4)y=e^{2x}$.

Part -B **[Marks: 04 each]**

Q2. Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$.

Q3. Solve $p(p+y)=x(x+y)$.

Q4. Solve the following differential equation by method of variation of parameters:
$y''+4y=\tan 2x$.

Q5. Solve $2x-2y+z=1, x+2y+2z=2, 2x+y-2z=7$ by rank method.

Q6. Test the convergence of the series $\sum_{n=1}^{\infty}\frac{1}{(n+1)^2}$ using Cauchy integral test.

Q7. Expand $\tan x$ in powers of $\left(x-\frac{\pi}{4}\right)$ upto first four terms.

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Part -C [Marks: 12 each]

Q8.(a) Solve $x^2y'' - 4xy' + 8y = 4x^3 + 2\sin(\log x)$.

OR

(b) (i) Solve the following differential equation :

$$\frac{dy}{dx} + y = xy^3.$$

(ii) Solve the following differential equation :

$$(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0.$$

Q9.(a) Discuss the convergence of the series :

$$1 + \frac{2x}{2!} + \frac{3^2x^2}{3!} + \frac{4^3x^3}{4!} + \frac{5^4x^4}{5!} + \ldots\ldots\ldots\ldots\infty.$$

OR

(b) Diagonalize the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ and obtain its modal matrix.

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