Code No: R19BS1101 **R19** SET - 1

I B. Tech I Semester Supplementary Examinations, November - 2020
MATHEMATICS-I
(Com. to CE, EEE, ME, ECE, CSE, Chem E, EIE, IT, Auto E, Min E, Pet E, Agri E)

Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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1. a) Test the convergence of the series $\sum \frac{n!}{n^n}$ (8M)
   b) Verify Cauchy's mean value theorem for f(x) = sinx , g(x) = cosx in [0,π/2] (7M)

Or

2. a) Test the convergence of the series $\sum \frac{(-1)^n}{n+1} x^{n+1}$ (8M)
   b) Verify Rolle's theorem for $f(x) = \frac{\sin x}{e^x}$ $in\ [0, \pi]$ (7M)

3. a) Solve the ODE $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ (8M)
   b) A bacterial culture, growing exponentially, increases from 100 to 400 gms in 10 hrs. How much was present after 3 hrs from the initial instant. (7M)

Or

4. a) Solve the ODE $\tan y \frac{dy}{dx} + \tan x = \cos y . \cos^3 x$ (8M)
   b) If the temperature of the air is 30^0C and substance cools from 100^0C to 70^0C in 15 minutes, find when the temperature will be 40^0C. (7M)

5. a) Solve the DE $(D^2 + 4)\, y = x \sin x$ (8M)
   b) A particle of mass 4 gm executing simple harmonic motion has velocities cm/sec and 6 cm/sec respectively. When it is at distance 3 cm and 4 cm from the centre of its path. Find its period and amplitude. Find also the force acting on the particle when it is a distance 1cm from the centre. (7M)

Or

6. a) Solve the DE $(D^2 + D)\, y = x^2 + 2x + 4$ (8M)
   b) Solve the DE $(D^2 - 2D)\, y = e^x \sin x$ by the method of variation of parameters (7M)

7. a) If $x^2 = au + bv, y^2 = au - bv$ prove that $\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial x}{\partial u}\right)_v = \frac{1}{2} = \left(\frac{\partial v}{\partial y}\right)_x \left(\frac{\partial y}{\partial v}\right)_u$ (8M)
   b) Evaluate the following using the relation $JJ^1 = 1$ (7M)

      if u = x +y+ z , u^2v = y + z , u^3w = z then find $J\left(\frac{u, v, w}{x, y, z}\right)$

Or
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8. a) Find the points on the surface $z^2 = xy + 1$ nearest to the origin. (8M)

   b) Expand $f(x,y) = x^y$ in powers of $(x-1)(y-1)$ using Taylor's series. (7M)

9. a) Evaluate $\int_0^{\pi/2}\int_0^{4a\sin\theta} \frac{r}{\sqrt{16-r^2}}\,dr\,d\theta$ (8M)

   b) Evaluate $\iiint_V (x+y+z)\,dx\,dy\,dz$ taken over the volume bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$ and $z = 0$, $z = 1$. (7M)

Or

10. a) Evaluate by change of order of integration $\int_3^5\int_0^{4/x} xy\,dx\,dy$ (8M)

    b) Evaluate $\int_0^a\int_0^x\int_0^y x^3\,y^2\,z\,\,dx\,dy\,dz.$ (7M)