

I B. Tech I Semester Supplementary Examinations, July/August - 2021**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**

1. a) Test the convergence of the series $\sum \frac{3^n n!}{n^n}$ (8M)

b) Show that for any $x > 0$, $1 + x < e^x < 1 + xe^x$ (7M)

Or

2. a) Test the convergence of the series $\sum \frac{(-1)^n}{n} x^n$ (8M)

b) Obtain Taylor's series expansion of $\sin x$ in powers of $(x - \pi/2)$ (7M)

3. a) Solve the ODE $y(2x^2y + e^x)dx = (e^x + y^3)dy$ (8M)

b) The initial value problem governing the current i flowing in series R, L circuit (7M)
when voltage $v(t) = t$ is applied is given by $Ri + L \frac{di}{dt} = t$, $t \geq 0$. Find the
current $i(t)$ at time t .

Or

4. a) Solve the ODE $x^3 \sec^2 y \frac{dy}{dx} + 3x^2 \tan y = \cos x$ (8M)

b) Show that the family of curves $\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$ is self-orthogonal, where λ (7M)
is a parameter.

5. a) Solve the DE $(D^2 + 2D + 1)y = x \cos x$ (8M)

b) The differential equation for a circuit in which self inductance and capacitance (7M)
neutralize is $L \frac{d^2q}{dt^2} + \frac{q}{c} = 0$. Find the charge and current, given that I is
maximum and charge q is zero at $t = 0$.

Or

6. a) Solve the DE $\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + y = \cos x \cos 2x$ (8M)

b) Solve the DE $(D^2 + 1)y = \sec^2 x$ by the method of variation of parameters. (7M)

7. a) find the maximum values of the following function using Lagrange's multiplier method if $u = x^2 y^3 z^4$ subject to $\phi(x, y, z) = 2x + 3y + 4z - a = 0$ (8M)
- b) Find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ using Euler's theorem for $u = \frac{x^2 + y^2}{\sqrt{x} + \sqrt{y}}$ (7M)

Or

8. a) Find $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$ using Euler's theorem for $u = \tan^{-1} \left(\frac{y^2}{x} \right)$ (8M)
- b) Find the extreme values of $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$ (7M)

9. a) Evaluate $\int_0^{\pi/2} \int_0^{a \sin \theta} \int_0^{(a^2 - r^2)/a} r \, dr \, d\theta \, dz$ (8M)
- b) Evaluate $\int_0^2 \int_0^{\sqrt{2x-x^2}} (x^2 + y^2) \, dx \, dy$ by changing in to polar co-ordinates. (7M)

Or

10. a) Evaluate by change of order of integration $\int_0^a \int_x^a (x^2 + y^2) \, dx \, dy$ (8M)
- b) Evaluate $\iiint_V xyz \, dx \, dy \, dz$ where v is bounded by the co-ordinate planes and the plane $x + y + z = 1$. (7M)