

B.Tech I Year I Semester (R15) Supplementary Examinations June 2017

MATHEMATICS - I

(Common to CE, EEE, CSE, ECE, ME, EIE and IT)

Time: 3 hours

Max. Marks: 70

PART - A

(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- Find the solution of the differential equation.
 $\frac{dy}{dx} + \frac{y}{x} = x^2$ under the condition $y = 1$ when $x = 1$.
 - Find the particular integral of $(D^2 + a^2)y = \cos ax$.
 - Solve $y'' + 6y' + 9y = 0$, $y(0) = -4$ and $y'(0) = 14$
 - Transform the Cauchy's homogeneous equation $(x^2D^2 + xD + 4)y = \log x \cdot \cos(2\log x)$ into a linear equation with constant coefficients.
 - If $u = x \cos y$, $v = y \sin x$, then find $\frac{\partial(u,v)}{\partial(x,y)}$.
 - If $f(x, y) = xy + (x - y)$, then find the stationary points.
 - Evaluate $\int_0^3 \int_0^2 (4 - y)^2 dy dx$.
 - Evaluate $\int_{-1}^1 \int_{-2}^2 \int_{-3}^3 dx dy dz$.
 - If $\vec{F} = x(y + z)\vec{i} + y(z + x)\vec{j} + z(x + y)\vec{k}$ then find $\text{div} \vec{F}$.
 - State Green's theorem in a plane.

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

- Solve $\left(1 + e^{\frac{x}{y}}\right) dx + e^{x/y} \left(1 - \frac{x}{y}\right) dy = 0$.
 - Solve $x^3 \sec^2 y \frac{dy}{dx} + 3x^2 \tan y = \cos x$.
- OR**

 - If the air is maintained at 15°C and the temperature of the body drops from 70°C to 40°C in 10 minutes. What will be its temperature after 30 minutes.
 - A circuit has in series an electromotive force given by $E = 100 \sin(40t) V$ a resistor of 10Ω and an inductor of $0.5 H$. If the initial current is 0, find the current at time $t > 0$.

UNIT - II

- Solve $(D^2 - 2D)y = e^x \sin x$ by the method of variation of parameters.
 - Solve $3x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = x$.

OR

- A particle is executing S.H.M with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the centre of force and are on the same side of it.

Contd. in page 2

UNIT - III

- 6 (a) Find the Taylor's series expansion of $\sin 2x$ about $x = \frac{\pi}{4}$.
 (b) Verify $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ for the function $u = \tan^{-1} \frac{x}{y}$.

OR

- 7 (a) Find the minimum value of $x^2 + y^2 + z^2$ given that $xyz = a^3$.
 (b) Find the point on the plane $x + 2y + 3z = 4$ that is closest to the origin.

UNIT - IV

- 8 (a) Evaluate $\iint (x^2 + y^2) dx dy$ over the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
 (b) Evaluate the double integral $\int_0^a \int_0^{\sqrt{a^2 - b^2}} (x^2 + y^2) dy dx$.

OR

- 9 (a) Find the area of the loop of the curve $r = a(1 + \cos\theta)$.
 (b) Evaluate $\iiint_R (x + y + z) dz dy dx$ where R is the region bounded by the planes $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$.

UNIT - V

- 10 (a) If \vec{A} is irrotational vector, evaluate $\text{div}(\vec{A} \times \vec{r})$ where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$.
 (b) Evaluate the line integral $\int_C [(x^2 + xy)dx + (x^2 + y^2)dy]$ where C is the square formed by the lines $x = \pm 1$ and $y = \pm 1$.

OR

- 11 Verify Green's theorem for $\int_C [(xy + y^2)dx + x^2 dy]$ where C is bounded by $y = x$ and $y = x^2$.
