



Reg. No. :

Name :

Third Semester B.Tech. Degree Examination, January 2015
(2008 Scheme)

08.301 : ENGINEERING MATHEMATICS – II (CMPUNERFTAHS)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.



1. Evaluate $\int_0^4 \int_0^{x^2} e^{y/x} dy dx$.

2. Find the area in the first quadrant bounded by the x-axis and the curves $x^2 + y^2 = 10$, $y^2 = 9x$.

3. Find the workdone by the force $\vec{F} = x\hat{i} + 2y\hat{j}$ when it moves a particle on the curve $2y = x^2$ from $(0, 0)$ to $(2, 2)$.

4. Find the half range sine series of $f(x) = x$ in $(0, 2)$.

5. Expand $f(x) = x^2$, $-\pi < x < \pi$ in a Fourier series.

6. Obtain the Fourier sine transform of $\frac{1}{x}$.

7. Find the p.d.e. of all spheres whose centres lie on the z-axis.

8. Solve $xp - y^2q^2 = 1$.

9. Find the particular integral of $\nabla^2 u = -xy$.

10. If the solution of one-dimensional heat flow equation depends on Fourier cosine series, what would have been the nature of the end conditions.



PART – B

Answer **one** question from **each** Module. **Each** question carries **20** marks.

Module – I

11. a) Change the order of integration in the integral $I = \int_0^a \int_{x^2/a}^{2a-x} xy^2 dy dx$ and evaluate it.
- b) Find the volume enclosed by the paraboloid $x^2 + y^2 = 4z$ and $z = 4$.
- c) Verify Green's theorem in a plane with respect to $\int_C (x^2 dx - xy dy)$ where C is the boundary of the square formed by $x = 0, y = 0, x = a, y = a$.
12. a) Evaluate $\iint (x^2 + y^2) dx dy$ throughout the area enclosed by the curves $y = 4x, x + y = 3, y = 0$ and $y = 2$.
- b) Evaluate $\oint (e^x dx + 2y dy - dz)$ where C is the curve $x^2 + y^2 = 4, z = 2$.
- c) Using divergence theorem show that $\int_S \nabla r^2 \cdot d\vec{s} = 6V$, where S is any closed surface enclosing a volume V.

Module – II

13. a) Find the Fourier series of $f(x) = x + x^2, -\pi < x < \pi$. Given that $f(x)$ is periodic with period 2π using the series deduce that
- i) $\frac{\pi^2}{12} = 1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$
- ii) $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots$
- b) Obtain the Fourier cosine transform of $f(x) = \sin x$ in $0 < x < \pi$.
- c) What are Dirichlet's conditions for a Fourier series ?



14. a) Show that $e^{\frac{-x^2}{2}}$ is self reciprocal.
- b) Prove that $F[x^n f(x)] = (-i)^n \frac{d^n}{ds^n} F(s)$.
- c) Write the Fourier sine series of K in $(0, \pi)$.

Module – III

15. a) Solve $\left(\frac{y-z}{yz}\right)p + \frac{z-x}{zx}q = \frac{x-y}{xy}$.
- b) Solve $p^2x^2 + q^2y^2 = z^2$.
- c) A string of length ' l ' is fastened at both ends. The midpoint of the string is taken to a height ' b ' and then released from rest in that position. Find the displacement of the string.
16. a) Derive one-dimensional heat equation.
- b) A bar 10 cm long with insulated sides has its ends A and B maintained at temperatures 50°C and 100°C respectively until steady-state conditions prevail. The temperatures at A is suddenly raised to 90°C and at the same time that at B is lowered to 60°C . Find the temperature distribution in the bar at time t .
- c) Solve $(D^2 + D'^2)z = e^x + 2y$.
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