Reg. No. : ....

Name : ....

Third Semester B.Tech. Degree Examination, January 2015
(2008 Scheme)
08.301 : ENGINEERING MATHEMATICS – II (CMPUNERFTAHBS)

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.

P.T.O.

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 $I = \int_0^a \int_{x^2/a}^{2a-x} xy\,dy\,dx$ 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) $\frac{\pi^2}{12} = 1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots$

ii) $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots$

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 $F\left[x^n f(x)\right] = (-i)^n \frac{d^n}{ds^n} F(s)$.

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 $(D^2 + D'^2)z = e^{x+2y}$.
