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Reg. No. : ....

Name : ....

Third Semester B.Tech. Degree Examination, September 2016
(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. Using triple integral, find the volume common to the cylinders $x^2 + y^2 = a^2$ and $y^2 + z^2 = a^2$.

2. Evaluate $\iint (x^2y + xy^2)\,dxdy$ over the region between the line y = x and the parabola $y = x^2$.

3. Find the work done in moving a particle in the force field $\bar{F} = 3x^2\,\bar{i} + (2xz - y)\,\bar{j} + z\bar{k}$ along the curve defined by $x^2 = 4y$, $3x^3 = 8z$ from x = 0 to x = 2.

4. In steady state conditions, derive the solution of one-dimensional heat equation.

5. Obtain a Fourier sine series for the function $f(x) = e^{-x}$ in $0 < x < \pi$.

6. If F[f(x)] = F(s), prove that $F[f(x - a)] = e^{isa} F(s)$, where F[f(x)] is the Fourier transform of f(x).

7. Form a p.d.e. by eliminating arbitrary functions from z = yf(x) + xg(y).

8. Find the singular solution of $z = px + qy - p^2q$.

9. Solve $3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$, where $u(x, 0) = 4e^{-x}$, by method of separation of variables.

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

P.T.O.

PART – B

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

Module – I

11. a) Change the order of integration and hence evaluate $\int_0^1 \int_x^{2-x} \frac{x}{y}\, dxdy$.

b) Prove that $\iint_S \text{curl}\bar{F} \cdot \bar{n}\, ds = 0$, for any closed surface S and a vector function $\bar{F}$.

c) Evaluate $\int_C (2x - y^3)dx - xydy$ by using Green's theorem, where 'C' is the boundary of the region enclosed by $x^2 + y^2 = 1$ and $x^2 + y^2 = 9$.

12. a) Find the area enclosed by the curves $y = 3x^2 - x - 3$ and $y = -2x^2 + 4x + 7$.

b) Apply Stoke's theorem to evaluate $\int_C (x + y)dx + (2x - z)dy + (y + z)dz$, where 'C' is the boundary of the triangle with vertices (0, 0, 0), (2, 0, 0) and (0, 3, 0).

c) Using divergence theorem, evaluate $\iint_S \bar{F} \cdot \bar{n}\, ds$, where $\bar{F} = ax\bar{i} + by\bar{j} + cz\bar{k}$ and 'S' is the surface of the sphere $x^2 + y^2 + z^2 = 1$.

Module – II

13. a) Obtain a Fourier series for the function

$$f(x) = \pi x,\ 0 \le x \le 1$$
$$= \pi(x - 2),\ 1 \le x \le 2.$$

b) Find the Fourier transform of $f(x) = xe^{-x};\ 0 < x < \infty$.

c) Obtain a Fourier sine series for the function $f(x) = x \sin x$ in $0 < x < \pi$.

14. a) Find the Fourier cosine transform of $f(x) = e^{-4x}$ and hence deduce that

$$\int_0^\infty \frac{\cos 2x}{x^2 + 16} dx = \frac{\pi}{8} e^{-8}.$$

b) Obtain a Fourier series for the function $f(x) = (2x - x^2)$ in $-2 < x < 2$.

c) Obtain a Fourier cosine series for $f(x) = \begin{cases} \cos x, 0 < x < \pi/2 \\ 0, \pi/2 < x < \pi \end{cases}$

Module – III

15. a) Solve $(z^2 - 2yz - y^2)p + (xy + zx)q = xy - zx$.

b) $(D^2 + DD' - 6D'^2)z = y \cos x$.

c) The points of trisection of a stretched string are pulled aside through a distance 'h' on opposite sides of the position of equilibrium and the string is released from rest. Derive an expression for the string at any subsequent time.

16. a) Solve $p^2 + x^2y^2q^2 = x^2z^2$.

b) A metal bar 50 cms long whose surface is insulated is at temperature 60°C. At $t = 0$, a temperature of 30°C is applied at one end and a temperature of 80°C to the other end and these temperatures are maintained. Determine the temperature of the bar at any time assuming the diffusivity $K = 0.15$ cgs units.