



Reg. No. :

Name :



Third Semester B.Tech. Degree Examination, September 2016
(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. 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 $\iint (x^2y + xy^2) dx dy$ 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 $\vec{F} = 3x^2\vec{i} + (2xz - y)\vec{j} + z\vec{k}$ 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 $\int_0^1 \int_x^{2-x} \frac{x}{y} dx dy$.
- b) Prove that $\iiint_S \text{curl} \bar{F} \cdot \bar{n} ds = 0$, for any closed surface S and a vector function \bar{F} .
- c) Evaluate $\int_C (2x - y^3) dx - xy dy$ 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 $\iiint_S \bar{F} \cdot \bar{n} ds$, 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
 $f(x) = \pi x, 0 \leq x \leq 1$
 $= \pi(x - 2), 1 \leq x \leq 2$.
- 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.

