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Reg. No. : ....

Name : ....

Third Semester B.Tech. Degree Examination, November 2013
(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 $\iint x^2 dydx$ over the region bounded by $y = x$ and $y = x^2$.

2. Find the area bounded by $y = x$ and $y = 4x - x^2$.

3. If a force $\vec{F} = 2x^2y\,i + 3xyj$ displaces a particle in the xy plane from (0, 0) to (1, 4) along the line joining the points, find the work done.

4. Find the cosine series for $f(x) = \begin{cases} 1, & 0 \le x \le a/2 \\ -1 & \frac{a}{2} \le x < a \end{cases}$

5. Find the sine series for $f(x) = \cos x$ in $0 < x < \pi$.

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

7. Find the partial differential equation of

   $4(1 + a^2)z = (x + ay + b)^2$.

8. Solve $p^2y\,(1 + x^2) = qx^2$.

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

10. Write the assumptions involved in deriving one-dimensional heat equation.

P.T.O.

PART – B

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

Module – I

11. a) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dydx$ by changing the order of integration.

b) Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$.

c) Use Green's theorem in a plane to evaluate $\int_c (2x - y)dx + (x + y)dy$ where C is the boundary of the circle $x^2 + y^2 = a^2$ in the xy – plane.

12. a) Evaluate $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x \, dzdxdy$.

b) Evaluate $\iint_s \vec{F}.\hat{n}\, ds$ Using divergence theorem, where $\vec{F} = axi + byj + czk$ and S is the surface of the sphere $x^2 + y^2 + z^2 = 1$.

c) Apply Stoke's theorem to evaluate $\int (x + y)dx + (2x - 2)dy + (y + z)dz$ where C is the boundary of the triangle with vertices (2,0,0), (0,3,0) and (0,0,6).

Module – II

13. a) Obtain the Fourier series of $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, -\pi \le x \le 0 \\ 1 - \frac{2x}{\pi}, 0 \le x \le \pi \end{cases}$

b) Obtain the Fourier series of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in $0 \le x \le 2\pi$

c) Find the Fourier transform of

$$f(x) = \begin{cases} 1 \text{ if } |x| < a \\ 0 \text{ if } |x| \ge a, \ a > 0 \end{cases}$$

14. a) Obtain the Fourier series of $f(x) = \begin{cases} x, & 0 \le x \le \pi \\ 2\pi - x, & \pi \le x \le 2\pi \end{cases}$

b) Find the sine series of x sin x in $0 < x < \pi$.

c) Find the Fourier cosine transform of e^{-x^2}.

Module – III

15. a) Solve $p^2q^2 + x^2y^2 = x^2q^2(x^2 + y^2)$.

b) Solve the problem of the vibrating string for the following boundary conditions :

i) $y(0, t) = y(20, t) = 0$

ii) $y(x, 0) = 0$

iii) $\frac{\partial y}{\partial t}(x,0) = \begin{cases} x & \text{in } 0 \le x \le 10 \\ 20 - x & \text{in } 10 < x \le 20 \end{cases}$.

16. a) Solve $x^2(y - z)p + y^2(z - x)\, q = z^2(x - y)$.

b) Solve $(r - 6s + 9t) = 12x^2 + 36xy$.

c) Solve $\frac{\partial u}{\partial x} - 2\frac{\partial u}{\partial t} = u$, given that $u = 4e^{-3x}$ when $t = 0$.