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Reg. No. : ....

Name : ....

Third Semester B.Tech. Degree Examination, September 2014
(2008 Scheme)
(Special Supplementary)
08.301 : ENGINEERING MATHEMATICS – II (CMPUNERFTAHB)

Time: 3 Hours Max. Marks : 100

PART – A

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

1. Using double integral, find the area bounded by the curves $x^2 + y^2 = a^2$ and $x^2 + y^2 = 2ax$.

2. Evaluate $\iint xy\,dx\,dy$ over the area between $y = x^2$ and $x + y = 2$.

3. Evaluate $\int_c \bar{F} \times d\bar{r}$ along the curve x = cost, y = 2 sint, z = cost, from t = 0 to $t = \pi/2$, where $\bar{F} = 2x\bar{i} + y\bar{j} + z\bar{k}$.

4. Write four assumptions involved in deriving one dimensional wave equation.

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

6. If F [f(x)] = F(s), prove that $F[f(ax)] = \frac{1}{|a|} F\left(s/a\right)$, where F[f(x)] is the Fourier transform of f(x).

7. Form a p.d.e. by eliminating arbitrary constants from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

P.T.O.

8. Solve $\sqrt{p} + \sqrt{q} = x + y$.

9. Solve $\frac{\partial^2 z}{\partial x^2} + 4\frac{\partial^2 z}{\partial y^2} = 0$ by method of separation of variables.

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

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 $\int_0^{\infty}\int_0^{x} x\, e^{-x^2/y}\, dx\, dy$.

b) Prove that $\int_c (r^n \bar{r}) \cdot d\bar{r} = 0$, where 'c' is a closed curve and $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$.

c) Evaluate $\int_c (x+y)\, dx + (2x-z)\, dy + (y+z)\, dz$ by Stoke's theorem, where 'c' is the boundary of the triangle with vertices (0, 0, 0), (2, 0, 0) and (0, 3, 0).

12. a) Find the area of a plate in the form of a quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

b) Use Green's theorem in the plane to evaluate $\int_c (2x - y^3)\, dx - xy dy$, where 'c' is the boundary of the region enclosed by the circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 9$.

c) Using divergence theorem, evaluate $\iint_s \bar{F} \cdot \bar{n}\, ds$ over the entire surface of the region above the xy – plane bounded by the cone $z^2 = x^2 + y^2$ and the plane $z = 4$, where $\bar{F} = 4xz\hat{i} + xyz^2\hat{j} + 3z\hat{k}$.

Module – II

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

    b) Find the Fourier transform of $e^{-x^2/2}$.

    c) Find a cosine series for the function $f(x) = \sin x$ in $0 \leq x \leq \pi$.

14. a) Obtain a Fourier Series for $f(x) = x - x^2$ in $-\pi < x < \pi$ and deduce that

    $$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} \ldots = \frac{\pi^2}{12}.$$

    b) Find the Fourier sine transform of $f(x) = e^{-ax}$; $a > 0$, and hence deduce that

    $$\int_0^\infty \frac{s}{s^2 + a^2} \sin sx \, ds = \frac{\pi}{2} e^{-ax}.$$

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

Module – III

15. a) Solve $(2z - y)\,p + (x + z)\,q + 2x + y = 0$.

    b) Solve $(D^2 + D^1 - 6D^{1^2})\,z = \cos(2x + 3y)$.

    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) Solve $(D^2 + 3DD^1 + 2D^{1^2})\,z = x^2y^2$.

    b) Solve $(y^2 + z^2)\,p - xyq + xz = 0$.

    c) The temperature at the ends $x = 0$ and $x = 100$ of a rod 100 cm in length are held at 0°C and 100°C respectively until steady state conditions prevail. Then at $t = 0$, the two ends are suddenly insulated. Find the resultant temperature distribution in the rod.
