

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

| | |
|---------------------|--|
| Seat No. | |
|---------------------|--|

[4657]-571

S.E. (Computer Engineering/Information Technology)

(II Sem.) EXAMINATION, 2014

ENGINEERING MATHEMATICS—III

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Attempt 4 questions : Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of electronic non-programmable calculator is allowed.

(v) Assume suitable data whenever necessary.

1. (a) Solve any two : [8]

(i) $(D^2 + 6D + 9)y = x^{-3}e^{-3x}$

(ii) $(D^2 - 2D + 2)y = e^x \tan x$ (by variation of parameters method)

(iii) $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x).$

(b) Find the Fourier sine and cosine transforms of e^{-mx} , $m > 0$. [4]

P.T.O.

Or

2. (a) The currents x and y in the coupled circuits are given by :

$$(LD + 2R)x - Ry = E$$

$$(LD + 2R)y - Rx = 0.$$

Find the general values of x and y in terms of t . [4]

- (b) Find the inverse z -transform (any one) : [4]

(i) $F(z) = \frac{10z}{(z-1)(z-2)}$ (by inversion integral method)

(ii) $F(z) = \frac{z}{\left(z - \frac{1}{4}\right)\left(z - \frac{1}{5}\right)}, |z| > \frac{1}{4}.$

- (c) Solve the difference equation : [4]

$$f(K + 1) - f(K) = 1, K \geq 0, f(0) = 0.$$

3. (a) The first four moments about 44.5 of a distribution are -0.4 , 2.99 , -0.08 and 27.63 . Calculate moments about mean, coefficients of Skewness and Kurtosis. [4]

- (b) The incidence of a certain disease is such that on the average 20% of workers suffer from it. If 10 workers are selected at random, find the probability that : [4]

(i) exactly 2 workers suffer from disease.

(ii) not more than 2 workers suffer.

(c) Find the directional derivative of :

$$\phi = 4xz^3 - 3x^2y^2z$$

at (2, -1, 2) along a line equally inclined with coordinate axes. [4]

Or

4. (a) A random sample of 200 screws is drawn from a population which represents size of screws. If a sample is normally distributed with a mean 3.15 cm and S.D. 0.025 cm, find expected number of screws whose size falls between 3.12 cm and 3.2 cm. [4]

[Given : For $z = 1.2$, area = 0.3849; for $z = 2$, area = 0.4772]

(b) Show that (any one) : [4]

$$(i) \quad \nabla \cdot \left(\frac{\bar{a} \times \bar{r}}{r} \right) = 0$$

$$(ii) \quad \nabla^4 (r^2 \log r) = \frac{6}{r^2}.$$

(c) A fluid motion is given by :

$$\bar{v} = (y \sin z - \sin x) \hat{i} + (x \sin z + 2yz) \hat{j} + (xy \cos z + y^2) \hat{k}.$$

Is the motion irrotational ? If so, find the scalar velocity potential. [4]

5. (a) Find the work done by the force :

$$\bar{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$$

in taking a particle from (1, 1, 1) to (3, -5, 7). [4]

- (b) Use divergence theorem to evaluate :

$$\iiint_S (y^2z^2 i + z^2x^2 j + x^2y^2 k) \cdot d\bar{s}$$

where s is the upper half of the sphere $x^2 + y^2 + z^2 = 9$ above the xoy plane. [5]

- (c) Apply Stokes' theorem to evaluate :

$$\int_C (4y dx + 2z dy + 6y dz)$$

where C is the curve $x^2 + y^2 + z^2 = 6z, z = x + 3$. [4]

Or

6. (a) Find the work done in moving a particle from (0, 1, -1) to

$\left(\frac{\pi}{2}, -1, 2\right)$ in a force field : [4]

$$\bar{F} = (y^2 \cos x + z^3)i + (2y \sin x - 4)j + (3xz^2 + 2)k.$$

- (b) Evaluate :

$$\iiint_S [(x + y^2)i - 2xj + 2yzk] \cdot d\bar{s}$$

where s is the plane $2x + y + 2z - 6 = 0$ considered as one of the bounding planes of the tetrahedron $x = 0, y = 0, z = 0, 2x + y + 2z = 6$. [5]

(c) Verify Stokes' theorem for :

$$\bar{F} = -y^3i + x^3j$$

and the closed curve c is the boundary of the circle

$$x^2 + y^2 = 1. \quad [4]$$

7. (a) Find the condition under which :

$$u = ax^3 + bx^2y + cxy^2 + dy^3$$

is harmonic. [4]

(b) Evaluate :

$$\oint_C \frac{4z^2 + z}{z^2 - 1} dz,$$

where $C : |z - 1| = 3$. [5]

(c) Show that :

$$w = \frac{z - i}{1 - iz}$$

maps upper half of z -plane onto interior of unit circle in

w -plane. [4]

Or

8. (a) Find the harmonic conjugate of : [4]

$$u = r^3 \cos 3\theta + r \sin \theta.$$

(b) Evaluate :

$$\oint_C \frac{\sin 2z}{\left(z + \frac{\pi}{3}\right)^4} dz,$$

where $C : |z| = 2$. [5]

(c) Find the bilinear transformation which maps the points 1, 0, i of the z -plane onto the points ∞ , -2 , $-\frac{1}{2}(1 + i)$ of the w -plane. [4]

stupidstupid.com