Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4757]-1071

S.E. (Computer Engineering/Information Technology)
(Second Semester) EXAMINATION, 2015
ENGINEERING MATHEMATICS–III
(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt *four* 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-programmble calculator is allowed.

(*v*) Assume suitable data if necessary.

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

(*i*) $(D^2 + 9)y = x^3 - \cos 3x$

(*ii*) $(D^2 + 2D + 1)y = e^{-x} \log x$

(*iii*) $(2x+1)^2 \frac{d^2y}{dx^2} - 6(2x+1)\frac{dy}{dx} + 16y = 8(2x+1)^2$.

(*b*) Find Fourier sine transform of $f(x) = e^{-x} \cos x, \quad x > 0$. [4]

Or

2. (*a*) A resistance of 50 ohms, an inductor of 2 henries and a 0.005 farad capacitor are connected in series with e.m.f. of 40 volts and an open switch. Find the instanteneous charge and current after the switch is closed at $t = 0$, assuming that at that time charge on capacitor is 4 coulomb. [4]

P.T.O.

(*b*) Solve (any *one*) : [4]

(*i*) Find z-transform of $f(k) = \frac{\sin ak}{k}$, $k > 0$.

(*ii*) Find inverse z-transform of $\frac{3z^2 + 2z}{z^2 + 3z + 2}$, $1 < |z| < 2$.

(*c*) Solve difference equation : [4]

$$f(k + 2) - 3f(k + 1) + 2f(k) = 0, \; f(0) = 0, \; f(1) = 1.$$

3. (*a*) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. Obtain the first four central moments, mean, standard deviation and coefficient of skewness and kurtosis. [4]

(*b*) A manufacturer of electronic goods has 4% of his product defective. He sells the articles in packets of 300 and guarantees 90% good quality. Determine the probability that a particular packet will violate the guarantee. [4]

(*c*) Find the directional derivative of $xy^2 + yz^3$ at $(2, -1, 1)$ along the line $2(x - 2) = (y + 1) = (z - 1)$. [4]

Or

4. (*a*) In an intelligence test administered to 1000 students the average score was 42 and standard deviation 24. Find the number of students with score lying between 30 and 54.

(Given : For $z = 0.5$, area $= 0.1915$). [4]

(*b*) Prove (any *one*) : [4]

(*i*) $\nabla^2 \left(\frac{\bar{a} \cdot \bar{b}}{r} \right) = 0$

(*ii*) $\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r} \right) = \frac{\bar{a}}{r} + \frac{(\bar{a} \cdot \bar{r})\bar{r}}{r^3}$.

(*c*) Show that $\overline{F} = r^2\overline{r}$ is conservative. Obtain the scalar potential associated with it. [4]

5. (*a*) Evaluate : [4]

$$\int_C \overline{F} \cdot d\overline{r}$$

where $\overline{F} = (2x + y^2)\overline{i} + (3y - 4x)\overline{j}$ and
C is the parabolic arc $y = x^2$ joining (0, 0) and (1, 1).

(*b*) Using Stokes theorem, evaluate : [5]

$$\int_C (x + y)dx + (2x - z)dy + (y + z)dz$$

where C is the curve given by
$x^2 + y^2 + z^2 - 2ax - 2ay = 0, \ x + y = 2a.$

(*c*) Use divergence theorem to evaluate :

$$\iint_S (x\overline{i} - 2y^2\overline{j} + z^2\overline{k}) \cdot d\overline{s}$$

where s is the surface bounded by the region $x^2 + y^2 = 1$ and $z = 0$ and $z = 1$. [4]

Or

6. (*a*) Apply Green's theorem to evaluate :

$$\int_C (2x^2 - y^2)dx + (x^2 + y^2)dy$$

where C is the boundary of the area enclosed by the x-axis and the upper-half of the circle $x^2 + y^2 = 16$. [4]

(*b*) Using Stokes theorem, evaluate

$$\iint_S (\nabla \times \overline{F}) \cdot d\overline{s}$$

where $\overline{F} = 3y\overline{i} - xz\overline{j} + yz^2\overline{k}$ and 's' is the surface of the paraboloid $2z = x^2 + y^2$ bounded by $z = 2$. [5]

(*c*) Show that : [4]

$$\iiint_V \frac{2}{r}\,dv = \iint_S \frac{\bar{r}\,.\,\hat{n}}{r}\,ds\,.$$

7. (*a*) Find the imaginary part of the analytic function whose real part is $x^3 - 3xy^2 + 3x^2 - 3y^2$. [4]

(*b*) Evalaute :

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

where C is the circle : [4]

$$|z - 1| = 1.$$

(*c*) Find the bilinear transformation, which maps the points

$z = -1, 0, 1$

on to the points

$w = 0, i, 3i$

respectively. [5]

Or

8. (*a*) Show that analytic function $f(z)$ with constant amplitude is constant. [4]

(*b*) Evaluate the following integral using residue theorem :

$$\oint_C \frac{4 - 3z}{z(z - 1)(z - 2)}\,dz$$

where C is the circle :

$$|z| = \frac{3}{2}.$$ [4]

(*c*) Find the image of the straight line $y = 3x$ under the transformation

$$w = \frac{z - 1}{z + 1}.$$ [5]