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S.E. (Comp/IT) (II Semester) EXAMINATION, 2019

ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Three Hours

Maximum Marks : 60

- N.B. :—**
- (i) Neat diagrams must be drawn wherever necessary.
 - (ii) Figures to the right indicate full marks.
 - (iii) Use of electronic pocket calculator is allowed.
 - (iv) Assume suitable data, if necessary.

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

(i) $\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + 4y = e^{2x} \sin 4x + 2^{3x} + 6$

(ii) $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = x^4 + 3x + 1$

(iii) $\frac{d^2y}{dx^2} + 9y = \tan 3x$, by using the method of variation of parameters.

(b) Solve the integral equation : [4]

$$\int_0^{\infty} f(x) \cos \lambda x \, dx = \begin{cases} 2 - \lambda, & 0 \leq \lambda \leq 2 \\ 0, & \lambda > 2 \end{cases}$$

P.T.O.

Or

2. (a) An inductor of 0.25 henries, with negligible resistance, a capacitor of 0.04 farads are connected in series and having an alternating voltage $[12 \sin 6t]$. Find the current and charge at any time t . [4]

- (b) Solve any *one* of the following : [4]

(i) Obtain $z[4^k e^{-6k}]$, $k \geq 0$.

(ii) Obtain $z^{-1} \left[\frac{13z}{(5z+1)(4z+1)} \right]$.

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

$$f(k+2) - 7f(k+1) + 12f(k) = 0$$

where $f(0) = 0$, $f(1) = 3$, $k \geq 0$.

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, β_1 and β_2 . [4]

- (b) Fit a straight line of the form $Y = aX + b$ to the following data by the least square method : [4]

X	1	3	4	5	6	8
Y	-3	1	3	5	7	11

- (c) A riddle is given to three students whose probabilities of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. Find the probability that the riddle is solved. [4]

Or

4. (a) In a sample of 1,000 cases, the mean of a certain examination is 14 and standard deviation is 2.5. Assuming the distribution to be normal. Find the number of students scoring between 12 and 15. [4]

[Given : $Z_1 = 0.4$, $A_1 = 0.1554$, $Z_2 = 0.8$, $A_2 = 0.2881$]

- (b) During working hours, on an average 3 phone calls are coming into a company within an hour. Using Poisson distribution, find the probability that during a particular working hour, there will be at the most one phone call. [4]

- (c) For a bivariate data, the regression equation of Y on X is $8x - 10y = -66$ and the regression equation of X on Y is $40x - 18y = 214$. Find the mean values of X and Y. Also, find the correlation coefficient between X and Y. [4]

5. (a) Find the directional derivative of $\phi = xy^2 + yz^2 + zx^2$ at (1, 1, 1) along the line $2(x - 2) = y + 1 = z - 1$. [4]

- (b) Find constants a , b , c so that

$$\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$$

is irrotational. [4]

- (c) Find the workdone by the force

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

in taking a particle from (0, 0, 0) to (1, 2, 1). [5]

Or

6. (a) Show that (any one) : [4]

$$(i) \quad \nabla \cdot \left(\frac{\vec{a} \times \vec{r}}{r^n} \right) = 0 \quad (ii) \quad \nabla^2 \left[\nabla \cdot \left(\frac{\vec{r}}{r^2} \right) \right] = \frac{2}{r^4} .$$

- (b) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2$ at $(2, -1, 2)$ along the tangent to the curve

$$x = e^t \cos t, y = e^t \sin t, z = e^t \text{ at } t = 0. \quad [4]$$

- (c) Find the workdone by, $\vec{F} = 2xy^2\vec{i} + (2x^2y + y)\vec{j}$ in taking a particle from $(0, 0, 0)$ to $(2, 4, 0)$ along the parabola $y = x^2, z = 0$. [5]

7. (a) Determine the analytic function $f(z) = u + iv$ if $u = 2x - x^3 + 3xy^2$. [4]

- (b) Find the bilinear transformation that maps to points $z = -i, 0, i$ into the points $W = 1, 0, \infty$. [4]

- (c) Evaluate $\int_c \frac{z^3}{z^2 - 4} dz$, where c is the circle $|z| = 3$. [5]

Or

8. (a) Determine the analytic function $f(z) = u + iv$ if $u = 3x^2y + 2x^2 - y^3 - 2y^2$. [4]

- (b) Find image of the circle $|z - 2i| = 2$, under the mapping $w = \frac{1}{z}$. [4]

- (c) Evaluate $\int_c \frac{2z^2 + z}{z^2 - 1} dz$, where c is the circle $|z| = \frac{3}{2}$. [5]