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**Third Semester B.E. Degree Examination, Dec.2016/Jan.2017**  
**Engineering Mathematics – III**

Time: 3 hrs.

Max. Marks: 80

**Note: Answer any FIVE full questions, choosing one full question from each module.**

**Module-1**

- 1 a. Expand  $f(x) = x - x^2$  as a Fourier series in the interval  $(-\pi, \pi)$ . (08 Marks)  
 b. Obtain the half-range cosine series for the function  $f(x) = x(l - x)$  in the interval  $0 \leq x \leq l$ . (08 Marks)

**OR**

- 2 a. Obtain the Fourier series of  $f(x) = \frac{\pi - x}{2}$  in  $0 < x < 2\pi$ . Hence deduce that  

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$
 (06 Marks)  
 b. Find the half-range sine series for the function  

$$f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < 1/2 \\ x - \frac{3}{4} & \text{in } 1/2 < x < 1 \end{cases}$$
 (05 Marks)  
 c. Compute the constant term and the coefficient of the 1<sup>st</sup> sine and cosine terms in the Fourier series of  $y$  as given in the following table:

x:	0	1	2	3	4	5
y:	4	8	15	7	6	2

(05 Marks)

**Module-2**

- 3 a. If  $f(x) = \begin{cases} 1 - x^2; & |x| < 1 \\ 0; & |x| \geq 1 \end{cases}$ . Find the Fourier transform of  $f(x)$  and hence find the value of  

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} dx$$
 (06 Marks)  
 b. Find the Fourier sine and cosine transform of  

$$f(x) = \begin{cases} x, & 0 < x < 2 \\ 0, & \text{elsewhere} \end{cases}$$
 (05 Marks)  
 c. Solve using Z-transform  $y_{n+2} - 4y_n = 0$  given that  $y_0 = 0, y_1 = 2$ . (05 Marks)

**OR**

- 4 a. Obtain the inverse Fourier sine transform of  $F_s(\alpha) = \frac{e^{-a\alpha}}{\alpha}$ ,  $a > 0$ . (06 Marks)  
 b. Find the Z-transform of  $2n + \sin\left(\frac{n\pi}{4}\right) + 1$ . (05 Marks)  
 c. If  $U(z) = \frac{z}{z^2 + 7z + 10}$ , find the inverse Z-transform. (05 Marks)

**Module-3**

- 5 a. Obtain the coefficient of correlation for the following data:

x :	10	14	18	22	26	30
y :	18	12	24	6	30	36

(06 Marks)

- b. By the method of least square find the straight line that best fits the following data:

x :	1	2	3	4	5
y :	14	27	40	55	68

(05 Marks)

- c. Use Newton-Raphson method to find a root of the equation  $\tan x - x = 0$  near  $x = 4.5$ . Carry out two iterations.

(05 Marks)

**OR**

- 6 a. Find the regression line of y on x for the following data:

x :	1	3	4	6	8	9	11	14
y :	1	2	4	4	5	7	8	9

Estimate the value of y when  $x = 10$ .

(06 Marks)

- b. Fit a second degree parabola to the following data:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(05 Marks)

- c. Solve  $xe^x - 2 = 0$  using Regula - Falsi method.

(05 Marks)

**Module-4**

- 7 a. From the data given in the following table. Find the number of students who obtained less than 70 marks.

Marks :	0-19	20-39	40-59	60-79	80-99
Number of students :	41	62	65	50	17

(06 Marks)

- b. Find the equation of the polynomial which passes through the points (4, -43), (7, 83), (9, 327) and (12, 1053). Using Newton's divided difference interpolation.

(05 Marks)

- c. Compute the value of  $\int_{0.2}^{1.4} (\sin x - \log x + e^x) dx$  using Simpson's  $\frac{3}{8}$  rule taking six parts.

(05 Marks)

**OR**

- 8 a. Using Newton's backward interpolation formula find the interpolating polynomial for the function given by the following table:

x :	10	11	12	13
f(x) :	22	24	28	34

Hence find  $f(12.5)$ .

(06 Marks)

- b. The following table gives the premium payable at ages in years completed. Interpolate the premium payable at age 35 completed. Using Lagrange's formula.

Age completed :	25	30	40	60
Premium in Rs. :	50	55	70	95

(05 Marks)

- c. Evaluate  $\int_4^{5.2} \log_e x \, dx$  taking 6 equal strips by applying Waddles rule.

(05 Marks)

**Module-5**

- 9 a. Verify Green's theorem for  $\oint (xy + y^2)dx + x^2dy$  where  $c$  is the closed curve of the region bounded by  $y = x$  and  $y = xz$ . (06 Marks)
- b. Verify Stoke's theorem for  $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$  taken round the rectangle bounded by the lines  $x = \pm a$ ,  $y = 0$  and  $y = b$ . (05 Marks)
- c. A heavy cable hangs freely under gravity between two fixed points. Show that the shape of the cable is a catenary. (05 Marks)

**OR**

- 10 a. Use divergence theorem to evaluate  $\iiint_S \vec{F} \cdot \hat{n} \, ds$  over the entire surface of the region above Xoy plane bounded by the cone  $z^2 = x^2 + y^2$ , the plane  $z = 4$  where  $\vec{F} = 4xz\hat{i} + xyz^2\hat{j} + 3z\hat{k}$ . (06 Marks)
- b. Find the extremal of the functional  $\int_{x_1}^{x_2} [(y')^2 - y^2 + 2y \sec x] dx$ . (05 Marks)
- c. Prove that the shortest distance between two points in a plane is along the straight line joining them. (05 Marks)

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