CBCS SCHEME

USN

17MAT31

Third Semester B.E. Degree Examination, June/July 2019
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Obtain the fourier series of the function $f(x) = x - x^2$ in $-\pi \le x \le \pi$ and hence deduce $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots\ldots$ **(08 Marks)**

b. Obtain the Half Range Fourier cosine series for the $f(x) = \sin x$ in $[0, \pi]$. **(06 Marks)**

c. Obtain the constant term and the coefficients of first sine and cosine terms in the fourier expansion of y given

x :	0	1	2	3	4	5
y :	9	18	24	28	26	20

(06 Marks)

OR

2 a. Obtain the fourier series of $f(x) = \frac{\pi - x}{2}$ in $[0, 2\pi]$ and hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots$ **(08 Marks)**

b. Find the fourier half range cosine series of the function $f(x) = 2x - x^2$ in $[0, 3]$. **(06 Marks)**

c. Express y as a fourier series upto first harmonic given

x :	0	30	60	90	120	150	180	210	240	270	300	330
y :	1.8	1.1	0.30	0.16	1.5	1.3	2.16	1.25	1.3	1.52	1.76	2.0

(06 Marks)

Module-2

3 a. Find the fourier transform of $f(x) = \begin{cases} a^2 - x^2 ; |x| \le a \\ 0 \quad ; |x| > a \end{cases}$ and hence deduce $\int_0^{\infty} \frac{\sin x - x\cos x}{x^3} dx = \frac{\pi}{4}$ **(08 Marks)**

b. Find the fourier sine transform of $e^{-|x|}$ and hence evaluate $\int_0^{\infty} \frac{x \sin ax}{1+x^2} dx \; ; a > 0$ **(06 Marks)**

c. Obtain the z-transform of $\cos n\theta$ and $\sin n\theta$. **(06 Marks)**

OR

4 a. Find the fourier transform of $f(x) = xe^{-|x|}$. **(08 Marks)**

b. Find the fourier cosine transform of f(x) where

$$f(x) = \begin{cases} x \; ; & 0 < x < 1 \\ 2 - x ; & 1 < x < 2 \\ 0 \; ; & x > 2 \end{cases}$$

(06 Marks)

c. Solve $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ with $u_0 = u_1 = 0$ using z-transform. **(06 Marks)**

Module-3

5 a. Fit a straight line $y = ax + b$ for the following data by the method of least squares.

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

(08 Marks)

b. Calculate the coefficient of correlation for the data:

x :	92	89	87	86	83	77	70	63	53	50
y :	86	83	91	77	68	85	54	82	37	57

(06 Marks)

c. Compute the real root of $x\log_{10}x - 1.2 = 0$ by the method of false position. Carry out 3 iterations in (2, 3). **(06 Marks)**

OR

6 a. Fit a second degree parabola to the following data $y = a + bx + cx^2$.

x :	1	1.5	2	2.5	3	3.5	4
y :	1.1	1.3	1.6	2	2.7	3.4	4.1

(08 Marks)

b. If θ is the angle between two regression lines, show that

$\tan\theta = \left(\frac{1-r^2}{r}\right)\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}$; explain significance of $r = 0$ and $r = \pm 1$. **(06 Marks)**

c. Using Newton Raphson method, find the real root of the equation $3x = \cos x + 1$ near $x_0 = 0.5$. Carry out 3 iterations. **(06 Marks)**

Module-4

7 a. From the following table, estimate the number of students who obtained marks between 40 and 45.

Marks :	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of students	31	42	51	35	31

(08 Marks)

b. Use Newton's dividend formula to find f(9) for the data:

x :	5	7	11	13	17
f(x) :	150	392	1452	2366	5202

(06 Marks)

c. Find the approximate value of $\int_0^{\pi/2}\sqrt{\cos\theta}\,d\theta$ by Simpson's $\frac{1}{3}^{rd}$ rule by dividing $\left[0, \frac{\pi}{2}\right]$ into 6 equal parts. **(06 Marks)**

OR

8 a. The area A of a circle of diameter d is given for the following values:

d :	80	85	90	95	100
a :	5026	5674	6362	7088	7854

Calculate the area of circle of diameter 105 by Newton's backward formula. **(08 Marks)**

b. Using Lagrange's interpolation formula to find the polynomial which passes through the points (0, –12), (1, 0), (3, 6), (4, 12). **(06 Marks)**

c. Evaluate $\int_4^{5.2}\log_e x\,dx$ taking 6 equal parts by applying Weddle's rule. **(06 Marks)**

Module-5

9 a. If $\vec{F} = 3xy\,\hat{i} - y^2\,\hat{j}$, evaluate $\int_C \vec{F}.d\vec{r}$ where 'C' is arc of parabola $y = 2x^2$ from (0, 0) to (1, 2) **(08 Marks)**

b. Evaluate by Stokes theorem
$\oint_C (\sin z\,dx - \cos x\,dy + \sin y\,dz)$, where C is the boundary of the rectangle $0 \le x \le \pi$;
$0 \le y \le 1,\ z = 3$ **(06 Marks)**

c. Prove that the necessary condition for the $I = \int_{x_1}^{x_2} f(x, y, y')\,dx$ to be extremum is

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$ **(06 Marks)**

OR

10 a. Using Green's theorem evaluate $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region bounded by the lines $x = 0,\ y = 0,\ x + y = 1$. **(08 Marks)**

b. Find the external value of $\int_0^{\pi/2} \left[(y')^2 - y^2 + 4y\cos x\right]dx$. Given that $y(0) = 0,\ y\left(\frac{\pi}{2}\right) = 0$. **(06 Marks)**

c. Prove that the shortest distance between two points in a plane is along a straight line joining them. **(06 Marks)**

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