CBCS SCHEME

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Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
Engineering Mathematics - III

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Find the Fourier series for the function,
$f(x) = x(2\pi - x)$ over the interval $(0, 2\pi)$ and deduce $\frac{\pi^2}{12} = \sum \frac{(-1)^{n+1}}{n^2}$. **(08 Marks)**

b. Obtain the constant term and first two coefficients in the Fourier Cosine series for y using the following table :

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

(08 Marks)

OR

2 a. The following table gives the variation of periodic current over the period T:

t(sec) :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A (amp) :	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic. **(06 Marks)**

b. Find the Fourier series of the function,
$$f(x) = \pi x \quad 0 \le x \le 1$$
$$= \pi(2 - x) \quad 1 \le x \le 2$$
(05 Marks)

c. Express $f(x) = x$ as a half range cosine series in $0 < x < 2$. **(05 Marks)**

Module-2

3 a. Find the Fourier transform of $f(x) = 1 - |x|, \ |x| \le 1$; $= 0, \ |x| > 1$ and deduce $\int_0^\infty \frac{\sin^2 x}{x^2} dx = \frac{\pi}{2}$. **(06 Marks)**

b. Find the Fourier Cosine transform of,
$$f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 < x < 2 \\ 0 & x > 2 \end{cases}$$
(05 Marks)

c. Find z-transform of the following :
(i) $(n+1)^2$
(ii) $\sin(3n+5)$ **(05 Marks)**

OR

4 a. Obtain Fourier sine transform of $\frac{e^{-ax}}{x}$. **(06 Marks)**

b. Find the z-transform of $u_n = 2^n + 3^n n^2 + 6$ **(05 Marks)**

c. Solve the difference equation, $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using z-transform. **(05 Marks)**

Module-3

5 a. Find the coefficient of correlation and equations of lines of regression for the following values of x and y.

x:	1	2	3	4	5
y:	2	5	3	8	7

(06 Marks)

b. Using Newton Raphson method, find the real root of equation $x\log_{10} x - 1.2$. Correct to three decimal places. **(05 Marks)**

c. Fit a linear law of the form, $P = mW + C$ for the following data :

W:	50	70	100	120
P:	12	15	21	25

(05 Marks)

OR

6 a. Fit a second degree parabolic for the data below,

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

(06 Marks)

b. Find the real root of equation $xe^x - \cos x$ that lies between 0.4 and 0.6 by Regular falsi method correct upto three decimal places. **(05 Marks)**

c. The two regression equations of the variables x and y are $x = 19.63 - 0.87y$ and $y = 11.64 - 0.50x$. Find (i) Means of x's (ii) Means of y's (iii) Correlation coefficient between x and y. **(05 Marks)**

Module-4

7 a. Given f(0) = 1, f(1) = 3, f(2) = 7, f(3) = 13. Find f(0.1) using Newton's interpolation formula. **(06 Marks)**

b. Interpolate the value of y at x = 5 using Lagrange's method from the following data :

x:	1	2	3	4	7
y:	2	4	8	16	28

(05 Marks)

c. Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ using Simpson's $\frac{3}{8}^{th}$ rule taking step length h = 1. **(05 Marks)**

OR

8 a. Construct a polynomial for the data below, by using Newton's divided difference formula :

x:	2	4	5	6	8	10
y:	10	96	196	350	868	1746

(06 Marks)

b. Evaluate $\int_4^{5.2} \log_e x\, dx$, using Weddle's rule taking seven ordinates. **(05 Marks)**

c. Find the polynomial f(x) by using Lagrange's interpolation formula for the data :

x:	0	3	4
y:	1	10	21

(05 Marks)

Module-5

9 a. Evaluate $\int \vec{f}\cdot \vec{ds}$, given that vector function, $\vec{f} = (3x - 2y)i + (y + 2z)j - x^2k$, the curve being $x = z^2$, $z = y^2$ from (0, 0, 0) to (1, 1, 1) **(06 Marks)**

b. Derive Euler's equation in the form,

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0.$$ **(05 Marks)**

c. State Divergence theorem and hence evaluate $\int_R \text{div}\, F\, dV$ for

$\vec{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ taken over the rectangular parallelepiped $0 \le x \le a$, $0 \le y \le b$, $0 \le z \le c$. **(05 Marks)**

OR

10 a. Find the curve on which the function, $\int_0^{\frac{\pi}{2}} \left[y^2 - y'^2 - y\sin x\right]dx$ under the conditions $y(0) = y\left(\frac{\pi}{2}\right) = 0$ can be extremized. **(06 Marks)**

b. Evaluate $\oint (x^2 - 2xy)dx + (x^2y + 3)dy$ around the boundary of the region defined by $y^2 = 8x$ and x = 2, using Green's theorem. **(05 Marks)**

c. Prove that the shortest distance between two points in a plane is a straight line. **(05 Marks)**

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