

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 $-\pi < x < \pi$ and

hence deduce $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$ (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 $f(x) = \frac{\pi}{2} - x$ in $[0, 2\pi]$ and hence deduce that

$\frac{\pi^2}{4} = 1 - \frac{1}{3^2} + \frac{1}{5^2} - \frac{1}{7^2} + \dots$ (08 Marks)

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

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 $f(x) = \begin{cases} x & 0 < x < a \\ 0 & x > a \end{cases}$ and hence deduce

$\int_0^a \frac{\sin x - x \cos x}{x^2} dx = \frac{\pi}{4}$ (08 Marks)

- b. Find the fourier sine transform of $f(x) = \frac{1}{1+x^2}$ and hence evaluate $\int_0^\infty \frac{\sin ax}{x} dx$; $a > 0$ (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 $f(x)$ (08 Marks)
 b. Find the fourier cosine transform of $f(x)$ where

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

$f(x) = \begin{cases} -x & 1 < x < 2 \\ 0 & x > 2 \end{cases}$ (06 Marks)

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- c. Solve $Li_n 0 + 6u_i h + 9u_{i+1} =$ 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	2	3	4	5	6	7	8	9	10
y	1	2	3	4	5	6	7	8	9	10

(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, 3y) (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	
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

$$\tan \theta = \frac{1 - r^2}{r} \rightarrow \frac{cf, a, b}{4 - Cr^2}; \text{ explain significance of } r = 0 \text{ and } r = \pm 1. \quad (06 \text{ Marks})$$

- 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 $\int_0^2 \cos x dx$ by Simpson's $\frac{1}{3}$ rule by dividing 0, π into 6 equal parts. (06 Marks)

OR

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

	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 $\int_1^e \log_e x dx$ taking 6 equal parts by applying Weddle's rule. (06 Marks)

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Module-5

9 a. If $F = 3xyi - y^2j$, evaluate $\int_C F \cdot dr$ where 'C' is arc of parabola $y = 2x^2$ from (0, 0) to (1, 2)

(08 Marks)

b. Evaluate by Stokes theorem

$(\sin z dx - \cos x dy + \sin y dz)$, where C is the boundary of the rectangle $0 < x < \pi$;

$0 < y < 1, z = 3$

(06 Marks)

c. Prove that the necessary condition for the $I = \int_C f(x, y, y') dx$ to be extremum is

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

OR

10 a. Using Green's theorem evaluate $\int_C (3x^2 + 8y') dx + (4y - 6xy) dy$, 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 $\int_0^1 [(y')^2 - 4y \cos x] dx$. Given that $y(0) = 0, y(1) = 0$.

(06 Marks)

c. Prove that the shortest distance between two points in a plane is along a straight line joining them.

(06 Marks)