RpifigriE

USN

15MAT31

Ent*,

Third Semegfer B.E. Degree Examination, Dec.2018/Jan.2019

Engineering Mathematics - III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. An alternating current after passing through a rectifier has the form,

I= I, sin x for 0 < x < rc
0 for 7C < X < 27C

where I_0 is the maximum current and the period is= 2m. Express I as a Fourier series. (08 Marks)

b. Determine the constant term and the first cosine and sine terms of the Fourier series ex0ansion of from the followin data: (08 Marks)

x	0	45	90	135	180	225	270	315
y	2	1.5	1	0.5	0	0.5	1	1.5

OR

2 a. Obtain the Fourier series expansion of the function, f(x) in 7C, TO and hence deduce that,

$$\frac{1}{1^2} \pm \frac{1}{3^2} + \frac{1}{5^2} \ldots = \frac{7C^2}{8}$$ (06 Marks)

b. Find the Fourier series expansion of the function,

f(x) = 7CX in 0 x
742 – x) in 1 x 2 (05 Marks)

c. The following table gives the variations of periodic current over a period.

t(sec)	0	H		M IN	2T 3	5T 6	T
A(amplitude)	1.98	1.30	1.05	1.3	– 0.88	– 0.25	1.98

Show by harmonic analysis that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic. (05 Marks)

Module-2

3 a. Find the complex Fourier transform of the function f(x) = {1 for a; 0 for > a. Hence evaluate

$$\int_0 \frac{\sin X}{x} dx.$$ (06 Marks)

b. Find the Fourier sine transform of $\frac{e^{-ax}}{}$ (05 Marks)

c. Compute the inverse z-transforms of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$ (05 Marks)

Important Note

OR

4 a. Find the z-transform of e'n + sin n 4 (06 Marks)

b. Solve y_{0+2} + 6y,, + $9y_0$ = 2n with y_0 = y, = 0 using z-transform. (05 Marks)

C. Find the Fourier cosine transform of, f(x) = | 4x 0<x<1 ; 4— x 1 < x < 4. ; x > 4 (05 Marks)

Module-3

5 a. Find the Correlation coefficient and, equations of regression lines for the following data:

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

(06 Marks)

b. Fit a straight line to the following data:

x	0	1	2	3	
y	1	1.8	3.3	4.5	6.3

(05 Marks)

c. Find a real root of the equation xe^x = cos x correct to three decimal places that lies between 0.5 and 0.6 using Regula-falsi method. (05 Marks)

OR

6 a. The following regression equations were obtained from a correlation table.

y =0.516x+33.73

x = 0.516y+ 32.52

Find the value of (i) Correlation coefficient (ii) Mean of x's (iii) Mean of y's. (06 Marks)

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

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

(05 Marks)

c. Use Newton-Raphson's method to find a real root of x sin x + cos x = 0 near x = π carry out three iterations. (05 Marks)

Module-4

7 a. The following data gives the melting point of an alloy of lead and zinc, where t is the temperature in °C and P is the percentage of lead in the alloy:

P%	60	70	80	90
t	226	250	276	304

Find the melting point of the alloy containing 84% of lead, using Newton's interpolation formula. (06 Marks)

b. Apply Lagrange's interpolation formula to find a polynomial which passes through the points (0, — 20), (1, —12) , (3, —20) and (4, —24) (05 Marks)

c. Find the approximate value of $\int_0^2$ Vcosed0 by Simpson's $\frac{3}{8}$ rule by dividing it into 6 equal parts. (05 Marks)

OR

8 a. From the following table :

x°	10	20	30	40	50	60
cosx	0.9848	0.9397	0.8660	0.7660	0.6428	0.5

Calculate cos 25° using Newton's forward interpolation formula. (06 Marks)

b. Use Newton's divided difference formula and find f(6) from the following data:

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

(05 Marks)

c. Evaluate $\int_0^1 \frac{dx}{1+x}$ using Weddle's rule by taking equidistant ordinates. (05 Marks)

Module-5

9 a. Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ with the help of Green's theorem in a plane. (06 Marks)

b. Solve the variational problem $5\,{}_0 1(12xy + y^{12})dx = 0$ under the conditions y(0) = 3, y(1) = 6. (05 Marks)

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

OR

10 a. A cable hangs freely under gravity from the fixed points. Show that the shape of the curve is a catenary. (06 Marks)

b. Use Stoke's theorem to evaluate for $F = (x^2 + y^2)i - 2xyj$ taken around the rectangle bounded by the lines $x = \pm a$, $y = 0$, $y = b$. (05 Marks)

c. Evaluate ii(yzi + zxj + xyk).rids where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$ in the first octant. (05 Marks)