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17MAT31

Third Semester B.E. Degree Examination, Aug./Sept. 2020
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. Find the Fourier series to represent the periodic function $f(x) = x - x^2$ from $x = -\pi$ to $x = \pi$. **(08 Marks)**

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

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

Expand A as a Fourier series upto first harmonic. Obtain the amplitude of the first harmonic. **(06 Marks)**

c. Find the half range cosine series for the function $f(x) = (x-1)^2$ in $0 < x < 1$. **(06 Marks)**

OR

2 a. Find the Fourier series of $f(x) = 2x - x^2$ in (0, 3). **(08 Marks)**

b. Obtain the constant term and the coefficients of the first sine and cosine terms in the Fourier series expansion of y as given in the following table: **(06 Marks)**

x:	0	1	2	3	4	5	6
y:	9	18	24	28	26	20	9

c. Obtain the half-range sine series for the function,

$$f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x < \pi \end{cases}$$ **(06 Marks)**

Module-2

3 a. Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, & |x| \le a \\ 0, & |x| > a \end{cases}$. Hence deduce that

$$\int_0^\infty \frac{(\sin x - x\cos x)}{x^3}\cos\frac{x}{2}\,dx = \frac{3\pi}{16}.$$ **(08 Marks)**

b. Find the Z-transform of,
(i) $\cos n\theta$ and (ii) $\cosh n\theta$ **(06 Marks)**

c. Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = 0 = y_1$, using z-transforms technique. **(06 Marks)**

OR

4 a. Find the Fourier cosine transform of e^{-ax}. Hence evaluate $\int_0^\infty \frac{\cos\lambda x}{x^2+a^2}dx$ **(08 Marks)**

b. Find the Z-transform of,
(i) $(n+1)^2$ (ii) $\sin(3n+5)$ **(06 Marks)**

c. Find the inverse Z-transform of $\frac{2z^2+3z}{(z+2)(z-4)}$. **(06 Marks)**

Module-3

5 a. Find the two regression lines and hence the correlation coefficient between x and y from the data. **(08 Marks)**

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	28	36	41	49	40	50

b. Fit a second degree parabola to the following data: **(06 Marks)**

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

c. Using Newton-Raphson method find the root of $x\sin x+\cos x=0$ near $x=\pi$ corrected to 4 decimal places. **(06 Marks)**

OR

6 a. Two variables x and y have the regression lines $3x+2y=26$ and $6x+y=31$. Find the mean values of x and y and the correlation coefficient between them. **(08 Marks)**

b. Fit a curve of the form, $y=ae^{bx}$ to the following data: **(06 Marks)**

x:	5	15	20	30	35	40
y:	10	14	25	40	50	62

c. Using Regula-Falsi method find the root of $xe^x=\cos x$ in the interval (0, 1) carrying out four iterations. **(06 Marks)**

Module-4

7 a. Using Newton's forward and backward interpolation formulae, find f(1) and (10) from the following table: **(08 Marks)**

x	3	4	5	6	7	8	9
f(x)	4.8	8.4	14.5	23.6	36.2	52.8	73.9

b. Given that $f(5)=150$, $f(7)=392$, $f(11)=1452$, $f(13)=2366$, $f(17)=5202$. Using Newton's divided difference formulae find f(9). **(06 Marks)**

c. Using Simpson's $\frac{1}{3}^{rd}$ rule evaluate $\int_0^{0.6} e^{-x^2}dx$ by taking seven ordinates. **(06 Marks)**

OR

8 a. Using Newton's Backward difference interpolation formula find f(105) from, **(08 Marks)**

x	80	85	90	95	100
f(x)	5026	5674	6362	7088	7854

b. If $f(1)=-3$, $f(3)=9$, $f(4)=30$, $f(6)=132$ find Lagrange's interpolation polynomial that takes the same value as f(x) at the given point. **(06 Marks)**

c. Evaluate $\int_4^{5.2}\log_e x\,dx$ by Simpson's $\frac{3}{8}^{th}$ rule with $h=0.1$. **(06 Marks)**

Module-5

9 a. Verify Green's theorem for $\oint_C (xy + y^2)dx + x^2 dy$ where C is bounded by $y = x$ and $y = x^2$. **(08 Marks)**

b. Using Gauss divergence theorem evaluate $\iint_S \vec{F} \cdot \hat{n}\, ds$,

where $\vec{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$ over the rectangular parallel piped $0 \le x \le a$, $0 \le y \le b$ and $0 \le z \le c$. **(06 Marks)**

c. With usual notations derive Euler's equation, $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(06 Marks)**

OR

10 a. If $\vec{F} = (5xy - 6x^2)\hat{i} + (2y - 4x)\hat{i}$, evaluate $\oint_C \vec{F} . d\vec{r}$ along the curve C in the xy-plane, $y = x^3$ from (1, 1) to (2, 8). **(08 Marks)**

b. Find the extremals of the functional with y(0) = 0 and y(1) = 1. **(06 Marks)**

c. Show that Geodesics on a plane arc straight lines. **(06 Marks)**

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