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**B.Tech. Degree I & II Semester Supplementary Examination in
Marine Engineering April 2021**

MRE 1102 ENGINEERING MATHEMATICS II

Time: 3 Hours

Maximum Marks: 100

(5 × 20 = 100)

I. (a) Find the Eigen values and Eigen vectors of $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. (10)

(b) Test for consistency and solve: (10)

$$5x + 3y + 7z = 4, \quad 3x + 26y + 2z = 9, \quad 7x + 2y + 10z = 5.$$

OR

II. State and prove the necessary and sufficient condition for a function to be analytic. (20)

III. (a) Solve $xy(1+xy^2)\frac{dy}{dx} = 1$. (7)

(b) Obtain the differential equation of all circles of radius a and centre (h, k) . (7)

(c) Find the orthogonal trajectory of cardioids $r = a(1 - \cos\theta)$. (6)

OR

IV. (a) Solve $(D-2)^2 y = 8(e^{2x} + \sin(2x) + x^2)$. (10)

(b) By the method of variation of parameters solve $\frac{d^2 y}{dx^2} + 4y = \tan 2x$. (10)

V. (a) Obtain the Fourier series for the function $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases}$. Hence (10)

deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$.

(b) Express $f(x) = x$ as a half range sine series for $0 < x < 2$. (10)

OR

VI. (a) Show that $\beta(m, n) = \frac{\sqrt{mn}}{(m+n)}$. (10)

(b) Obtain a half range cosine series for $f(x) = \begin{cases} kx, & 0 \leq x \leq \frac{l}{2} \\ k(l-x), & \frac{l}{2} \leq x \leq l \end{cases}$. Deduce (10)

the sum of the series $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$.

(P.T.O.)

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- VII. (a) Find the Laplace transform of: (10)
- (i) $e^{-3t}(2\cos(5t) - 3\sin(5t))$
- (ii) $t^2 \sin(at)$

- (b) Derive the Laplace transform of periodic functions. (10)

OR

- VIII. (a) Find the inverse Laplace transform of (10)
- (i) $\frac{5s+3}{(s-1)(s^2+2s+5)}$

(ii) $\frac{4s+5}{(s-1)^2(s+2)}$

- (b) Use transform method to solve $\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t$ with $x=2, \frac{dx}{dt} = -1$ at $t=0$. (10)

- IX. (a) A problem in mechanics is given to three students A, B, C whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ respectively. What is the probability that the problem will be solved? (10)

- (b) The pdf of a variate X is: (10)

X	0	1	2	3	4	5	6
$P(X)$	k	$3k$	$5k$	$7k$	$9k$	$11k$	$13k$

Find $P(X < 4), P(3 < X \leq 4)$.

OR

- X. (a) In sampling a large number of parts manufactured by a machine, the mean number of defectives in a sample of 20 is 2. Out of 1000 such samples how many would be expected to contain at least 3 defective parts. (10)

- (b) X is a normal variate with mean 30 and standard deviation 5. Find the probability that: (10)

(i) $26 \leq X \leq 40$

(ii) $X \geq 45$

(iii) $|X - 30| > 5$
