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***B.Tech. Degree I & II Semester Examination in
Marine Engineering May 2016***

MRE 1102 ENGINEERING MATHEMATICS II

Time: 3 Hours

Maximum Marks: 100

(5 × 20 = 100)

I. (a) Find A^{-1} by Cayley Hamilton theorem where $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 2 & -1 \\ -2 & -3 & -1 \end{bmatrix}$. (10)

(b) Express $\begin{bmatrix} 2 & 3 & 1 \\ 4 & 2 & -1 \\ -1 & -1 & -2 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix. (10)

OR

II. (a) Find the analytic function whose real part is $e^{-x}(x \sin y - y \cos y)$. (6)

(b) Evaluate $\int_C \frac{dz}{(z-1)(z-3)}$ by Cauchy's Integral formula where C is the circle $|z|=4$. (7)

(c) Find the Laurent series expansion of $\frac{1}{z^2-5z+6}$ in the region $2 < |z| < 3$. (7)

III. (a) Solve $\frac{dy}{dx} + x \sin 2y = x^3 \cdot \cos^2 y$. (7)

(b) Form the differential equation of all straight lines in a plane. (6)

(c) Solve $(e^y + 1) \cos x dx + e^y \cdot \sin x \cdot dy = 0$ (7)

OR

IV. (a) Solve $\frac{d^2 y}{dx^2} - 9 \frac{dy}{dx} + 3y = e^{2x} + \sin 3x$. (10)

(b) Solve the simultaneous equations: (10)

$$\frac{dx}{dt} + y = \sin t, \quad \frac{dy}{dt} + x = \cos t.$$

V. (a) Obtain the Fourier series for the function (10)

$$f(x) = \begin{cases} \pi x & , 0 \leq x \leq 1 \\ \pi(2-x) & , 1 \leq x \leq 2 \end{cases}$$

(b) Express $f(x) = |x|$, $-\pi < x < \pi$ as Fourier series. (10)

OR

- VI. (a) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ and use it to evaluate (10)

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cdot \cos \frac{x}{2} \cdot dx.$$

- (b) Show that $\beta(p, q) = \int_0^{\infty} \frac{y^{q-1}}{(1+y)^{p+q}} dy = \int_0^1 \frac{x^{p-1} + x^{q-1}}{(1+x)^{p+q}} dx$. (10)

- VII. (a) Find the Laplace transform of $\frac{\cos at - \cos bt}{t}$. (6)

- (b) Derive the Laplace transform of periodic functions. (8)

- (c) Evaluate $\int_0^{\infty} \frac{e^{-t} \cdot \sin^2 t}{t} dt$. (6)

OR

- VIII. (a) Find the inverse Laplace transform of $\frac{s+8}{s^2+4s+5}$. (6)

- (b) Solve $y'' - 3y' + 2y = 4t + e^{3t}$; $y(0) = 1$, $y'(0) = -1$. (8)

- (c) Apply convolution theorem to evaluate $L^{-1} \left\{ \frac{s}{(s^2 + a^2)^2} \right\}$ (6)

- IX. (a) State and prove addition theorem of probability. (6)

- (b) Find the mean and variance of the following random variable. (7)

x	:	0	1	2	3	4	5
f(x)	:	k	2k	3k	4k	5k	6k

- (c) Calculate the correlation coefficient for the following data. (7)

x	:	10	15	20	25	30
y	:	12	18	21	15	6

OR

- X. (a) A bag contains two white and three black balls. Another one contains four white and five black balls. A bag is chosen at random and a ball is drawn from it. If it is white, find the probability that it comes from first bag. (10)

- (b) Define normal distribution. State the properties of it. (4)

- (c) If a random variable x has pdf (6)

$$f(x) = k(1-x-y); 0 < x < 1$$

$$0 < y < 1$$

Find the conditional expectation $f(x/y)$ and $f(y/x)$.