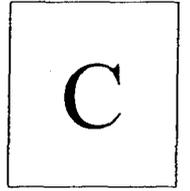


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**B. Tech. Degree I & II Semester Supplementary Examination in  
Marine Engineering May 2015**

**MRE 102 ENGINEERING MATHEMATICS II**

Time: 3 Hours

Maximum Marks: 100

(5×20=100)

- I. (a) Find the rank of  $A = \begin{bmatrix} 1 & 3 & 4 \\ 2 & -1 & 4 \\ -2 & 8 & 2 \end{bmatrix}$  by reducing to the Echelon form. (5)
- (b) Solve the equations (7)  
 $4x + 2y + z + 3\omega = 0$ ,  $6x + 3y + 4z + 7\omega = 0$ ,  $2x + y + \omega = 0$
- (c) Find the eigen values and eigen vectors of the matrix  $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$  (8)

OR

- II. (a) If  $W = \log Z$ , find  $\frac{d\omega}{dz}$  and determine where  $\omega$  is non-analytic. (5)
- (b) If  $F(\xi) = \int_C \frac{4z^2 + z + 5}{z - \xi} dz$  where C is the ellipse  $\frac{x^2}{4} + \frac{y^2}{9} = 1$ , find the (8)  
 values of  $F(3.5)$  and  $F''(-i)$
- (c) Find the Laurent's series expansion of  $f(z) = \frac{7z - 2}{(z + 1)z(z - 2)}$  in the (7)  
 region  $1 < |z + 1| < 3$ .
- III. (a) Solve the following (12)
- (i)  $\frac{dy}{dx} = e^{3x-2y} + x^2 e^{-2y}$
- (ii)  $(1 + y^2) dx = (\tan^{-1} y - x) dy$
- (b) Find the orthogonal trajectories of the family of confocal conics (8)  
 $\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$  where  $\lambda$  is the parameter.

OR

(P.T.O.)

IV. (a) Solve the following (2×6=12)

(i)  $(D^2 - 1)y = x \sin 3x + \cos x$

(ii)  $(D^4 + 2D^2 + 1)y = x^2 \cos x$

(b) Solve the simultaneous equations: (8)

$$\frac{dx}{dt} + 5x - 2y = t, \quad \frac{dy}{dt} + 2x + y = 0 \quad \text{being given } x = y = 0 \text{ when } t = 0.$$

V. (a) Find the fourier series expansion for  $f(x)$  if  $f(x) = -\pi, -\pi < x < 0$  (10)  
 $= x, 0 < x < \pi$

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

(b) Expand the function  $f(x) = x \sin x$  as a fourier series in the interval (10)

$-\pi \leq x \leq \pi$ . Deduce that  $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \frac{1}{7.9} + \dots = \frac{1}{4}(\pi - 2)$ .

**OR**

VI. (a) Prove that  $\beta(p, q) = \int_0^{\infty} \frac{y^{q-1}}{(1+y)^{p+q}} dy = \int_0^1 \frac{x^{p-1} + x^{q-1}}{(1+x)^{p+q}} dx$ . (8)

(b) Express the following integrals in terms of gamma functions (2×6=12)

(i)  $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$       (ii)  $\int_0^{\pi/2} \sqrt{\tan \theta} d\theta$

VII. (a) Find the Laplace transforms of (2×6=12)

(i)  $t e^{-t} \sin 3t$       (ii)  $\frac{1-e^t}{t}$

(b) Apply convolution theorem to evaluate (8)

$$L^{-1} \frac{s^2}{(s^2 + a^2)(s^2 + b^2)}$$

**OR**

VIII. (a) Use transform method to solve (8)

$$\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t \text{ with } x = 2, \frac{dx}{dt} = -1 \text{ at } t = 0.$$

(b) Find the transform of unit step function. (5)

(c) Find the Laplace transform of the function  $f(t) = \begin{cases} \sin \omega t, & 0 < t < \pi/\omega \\ 0, & \pi/\omega < t < 2\pi/\omega \end{cases}$  (7)

(Contd....3)

- IX. (a) Two persons A and B toss an unbiased coin alternately on the understanding that the first who gets the head wins. If A starts the game, find their respective chances of winning. (5)
- (b) (i) Is the function defined as follows a density function? (5×3=15)
- $$f(x) = e^{-x}, x \geq 0$$
- $$= 0, x < 0$$
- (ii) If so determine the probability that the variate having this density will fall in the interval (1,2)?
- (iii) Also find the cumulative probability function F(2).

**OR**

- X. (a) In 256 sets of 12 tosses of a coin, in how many cases one can expect 8 heads and 4 tails. (6)
- (b) If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals more than two will get a bad reaction. (6)
- (c) X is a normal variate with mean 30 and S.D.5. Find the probabilities that (8)
- (i)  $26 \leq X \leq 40$  (ii)  $X \geq 45$ .

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