B.Tech. Degree I & II Semester Examination in Marine Engineering May 2013

MRE 102 ENGINEERING MATHEMATICS II

Time : 3 Hours   Maximum Marks :100

(5 x 20 =100)

I. (a) Define Hermitian and Skew – Hermitian matrices. Give an example of 3rd order in each case.

  (b) Reduce the quadratic form
$Q = x_1^2 - 2x_2^2 - 2x_1 \, x_2 + 20x_2 x_3 - 4x_1 x_3$ to the Cannonical form. Also specify the nature of the quadratic form.

OR

II. (a) Expand $f(z) = \dfrac{1}{(z-1)(z-2)}$ in the region $|z| < |$.

  (b) Show that $f(z) = \sqrt{(xy)}$ is not analytic at the origin, even though Cauchy – Reiman equations are satisfied at that point.

III. Solve (i) $\dfrac{dy}{dx} = xy + x + y + 1$

  (ii) $\dfrac{dy}{dx} = \sin(x+y) + \cos(x+y)$

  (iii) $\left(1+y^2\right)dx = \left(\tan^{-1}(y) - x\right)dy$

OR

IV. Solve (i) $\dfrac{dy}{dx} = e^{3x-2y} + x^2 e^{-2y}$

  (ii) $\left(D^2 - 40 + 4\right)y = 8x^2 e^{2x} \sin 2x$

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

V. (a) Obtain a half range cosine series for
$f(x) = \begin{cases} kx, & 0 \le x \le \ell/2 \\ k(\ell - x), & \ell/2 \le x \le \ell \end{cases}$

  (b) Express $f(x) = \begin{cases} 1, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$

  as a Fourier sine integral and hence evaluate $\displaystyle\int_0^\infty \dfrac{1 - \cos(\lambda\pi)}{\lambda} \sin \lambda x \, d\lambda$

OR

VI.   (a)   Find the Fourier series for $f(x)$, if $f(x) = \begin{cases} -\pi & -\pi < x < 0 \\ x & 0 < x < \pi \end{cases}$

          Hence evaluate $\dfrac{1}{1^2} + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \ldots\ldots\ldots$

    (b)   Show that $\beta(p,q) = \int\limits_0^1 \dfrac{x^{p-1} + x^{q-1}}{(1+x)^{p+q}}\, dx$.

VII.   (a)   State convolution theorem. Use it to evaluate $L^{-1}\left[\dfrac{s}{\left(s^2 + a^2\right)^2} \right]$.

    (b)   Solve by method of Laplace transforms: $\dfrac{d^2 x}{dt^2} + 9x = \cos 2t$ if $x(0) = 1$, $x(\pi/2) = -1$.

<div align="center">OR</div>

VIII.   (a)   Find $L^{-1}\left[\dfrac{s^2}{\left(s^2 + a^2\right)\left(s^2 + b^2\right)} \right]$ using convolution theorem.

    (b)   Define unit step function and find its Laplace transform.

IX.   (a)   The time elapsed in minutes, between the placement of an order of pizza and its delivery is random with the density function

$$f(x) = \begin{cases} 1/15 & \text{if } 25 < x < 40 \\ 0 & , \quad \text{otherwise} \end{cases}$$

          Determine the mean and standard deviation of the time it takes for the pizza shop to deliver pizza.

    (b)   Find the mean and variance of Poisson distribution.

<div align="center">OR</div>

X.   (a)   Let $p(x,y,z) = k\left(x^2 + y^2 + yz\right)$, $x = 0, 1, 2$ $y = 2,3$ $z = 3, 4$

          For what value of k is $p(x,\, y,\, z)$ a joint probability mass function?

    (b)   Suppose that a Scottish Soldier's chest size is normally distributed with mean 39.8 and standard deviation 2.05 inches, respectively. What is the probability that out of 20 randomly selected Scottish Soldier's five have a chest size of atleast 40 inches?

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