BT-MRE-I & II(S)-05.15-0568 Reg. No. [ | | | | | | | ]

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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 $\dfrac{d\omega}{dz}$ and determine where $\omega$ is non-analytic. (5)

(b) If $F(\xi)=\int_C \dfrac{4z^2+z+5}{z-\xi}\,dz$ where C is the ellipse $\dfrac{x^2}{4}+\dfrac{y^2}{9}=1$, find the values of $F(3.5)$ *and* $F''(-i)$ (8)

(c) Find the Laurent's series expansion of $f(z)=\dfrac{7z-2}{(z+1)z(z-2)}$ in the region $1<|z+1|<3$. (7)

III. (a) Solve the following (12)

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

(ii) $(1+y^2)\,dx=(\tan^{-1}y-x)\,dy$

(b) Find the orthogonal trajectories of the family of confocal conics (8)
$\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2+\lambda}=1$ where $\lambda$ is the parameter.

**OR**

**(P.T.O.)**

IV. (a) Solve the following (2×6=12)

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

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

(b) Solve the simultaneous equations: (8)

$\frac{dx}{dt}+5x-2y=t$, $\frac{dy}{dt}+2x+y=0$ being given $x=y=0$ 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 $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.......=\frac{\pi^2}{8}$

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

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

**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)

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

**OR**

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

$\frac{d^2x}{dt^2}-2\frac{dx}{dt}+x=e^t$ with $x=2,\ \frac{dx}{dt}=-1$ 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)

$$f(x) = e^{-x},\ x \geq 0$$
$$= 0,\quad x < 0$$

(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 (i) $26 \leq X \leq 40$ (ii) $X \geq 45$. (8)

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