SE (IT) III Applied Maths - III (CORDS) 31 May 2014

(OLD COURSE) QP Code : **MV-17880**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. 1 is **compulsory.**
(2) Attempt any **four** out of remaining **six** questions.
(3) Make **suitable** assumptions if **required** and **justify** the **same.**
(4) A **figure to right indicates** the **full** marks

1. (a) Find L $\{t\, e^{2t} \sin 3t\}$ 5

(b) Use adjoint method to find the inverse of 5

$$\begin{bmatrix} 2 & 3 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 3 \end{bmatrix}$$

(c) Find P, if $f(z) = r^2 \cos 2\theta + i r^2 \sin p\theta$ is analytic 5

(d) Find Fourier Series for $f(x) = |x|$ in $(-1, 1)$ 5

2. (a) Show that $u = \cos x \cosh y$ is harmonic function. Find its harmonic conjugate and corresponding analytic function. 8

(b) Show that the set of functions $\sin(2n+1)x$; $n = 0, 1, 2, \ldots\ldots$ is orthogonal over $[0, \pi/2]$. Hence construct orthonormal set of functions 6

(c) Show that every hermitian matrix can be uniquely expressed as P + iQ where P is real symmetric & Q is real skew - symmetric matrix. 6

3. (a) Find the Laplace transform of each of the following :- 8

(i) $\dfrac{e^{-t} \sin 2t}{t}$ (ii) $te^{3t} \cosh 2t \sin t \cos 3t$.

(b) Find half range sine series for the function 6

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

(c) Find non -singular matrices P & Q such that PAQ is normal form, Hence find the rank of matrix A. Where 6

$$A = \begin{bmatrix} 1 & 3 & 2 & 5 \\ 6 & 12 & 14 & 17 \\ 3 & 2 & 1 & 5 \end{bmatrix}$$

4. (a) Investigate for what values of λ & u the equations 8

$$x + 2y + 3z = 4$$
$$x + 3y + 4z = 5$$
$$x + 3y + \lambda z = \mu$$

have (i) no solution, (ii) a unique solution, (iii) an infinite no. of solution.

(b) Find inverse laplace transform of the following. 6

(i) $\dfrac{e^4\, e^{-3s}}{(s+4)^{5/2}}$ (ii) $\dfrac{s}{(s^2+4s+5)}$

(c) Expand the fourier series for the function $f(x) = x^2 - x$ in $(0, 2\pi)$ 6

5. (a) Using convolution theorem, find the inverse laplace tranform of 8

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

(b) Find analytic function whose imaginary part is given as $v = \tan^{-1}(y/x)$ 6

(c) Find fourier series for the function 6

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

6. (a) Using Laplace transform, Solve the following differential equation 8
$(D^2 - 3D + 2)\, y = 4\, e^{2t}$ wtih $y(0) = 3$ $y'(0) = 5$

(b) Find the fourier series for the function

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

(c) Determine l, m, n & find A^{-1} if A is orthogonal 6

$$A = \begin{bmatrix} 0 & 2m & n \\ l & m & -n \\ l & -m & n \end{bmatrix}$$

7. (a) Evaluate the following integral by Laplace tranform 8

$$\int_0^{\infty} e^{-2t} \sin^2 3t \, dt$$

(b) Using Residue theom, evaluate 6

$$\int_0^{2\pi} \frac{d\theta}{5 - 3\cos\theta}$$

(c) Reduce the following matrix to normal form & find it's rank **6**

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 6 & 2 & 7 & 3 \\ 4 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \end{bmatrix}$$
