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B.E. IV - Semester Examination

BE-IV/9(SPL)

236276

CIVIL/MECH. ENGG.

Course No. : MTH-412

(Engg. Maths. - III)

Time Allowed- 3 Hours *Maximum Marks-100*

Note : Attempt **five** questions selecting atleast **two** questions from **each** section. All questions carry **equal** marks. Use of Calculator is **allowed.**

Section - I

1. Find the Laplace transform of

   i) $Cos2t\ cost$

   ii) $e^{-2t}(1+2t - \sin 2t)$

   iii) $t^2 \sinh 2t$

   iv) $\dfrac{Sin^3 t}{t}$ (5×4)

2. a) Find inverse laplace transform of

   i) $\dfrac{1}{(S-1)\sqrt{S}}$

4. ii) $\dfrac{S+13}{S^2 8S+97}$

b) Find $L\left[f(t)\right]$, where $f(t)$ is a Periodic function given by $f(t) = \begin{cases} t \ for\ 0<t<1 \ and\ f(t+2)= \\ 0 \ for\ 1<t<2 \qquad f(t)\forall t>0 \end{cases}$

c) Solve the following differential equation by laplace transform method

$$t\frac{d^2y}{dt^2}+\frac{dy}{dt}+ty=0, \text{ with } y(0)=a, y'(0)=0 \qquad \textbf{(6,7,7)}$$

3. a) Solve the following integral equations :

i) $y(t)=1+2\int_0^t y(t-u).Cos\,u\,du.$

b) Using fourier integral formula show that

$$\bar{e}^{ax}=\frac{2}{\pi}\int_0^\infty \frac{s\sin sx ds}{s^2+a^2}$$

c) Find Fourier Sine transform of

$$f(t)=\begin{cases} t\ , & for\ 0<t<1 \\ 2-t, & for\ 1<t<2 \\ 0, & for\ t>2 \end{cases}$$ **(7,7,6)**

4. a) Find the fourier transform of the function $f(t)$ defined by

$$f(t)=\begin{cases}1, \ for\ |t|<a\\ 0, \ \text{Otherwise}\end{cases}$$

and hence evaluate the integrals $\int_0^\infty \frac{1}{s}\ Sins\, a.Cos\, st ds.$

b) Find the inverse fourier Cosine transform of $\frac{Sin(as)}{S}$.

c) Find the fourier integral Representation of

$$f(t)=\begin{cases}S\text{int}, \ for\, t^2\le\pi^2\\ 0, \ \text{Otherwise}\end{cases}$$

(7,6,7)

Section - II

5. a) State and prove orthogonality of Bessel's functions.

b) Express $J_4(ax)$ in terms of $J_0(ax)$ *and* $J_1(ax)$, and show that

$$J_4(ax)=\left(\frac{48}{a^3x^3}-\frac{8}{ax}\right)J_1(ax)-\left(\frac{24}{a^2x^2}-1\right)J_0(ax)$$

(10,10)

6. a) Prove that $\int_0^r x\,J_1(ax)\,dx=\frac{r}{a}J_1(ar)$

b) Express the function $5x^3+3x^2+2x-1$ in terms of Legendre's polynomial.

c) Show that $\int_{-1}^{1} xP_n(x)P_{n-1}(x)\,dx = \frac{2n}{(2n-1)(2n+1)}$

(6,7,7)

7. a) Write tabular form of the Boolean function and then express in DNF and CNF : $[a \wedge b' \wedge c] \vee [a \vee b]' \vee c'$

b) Determine whether each of the Posets {1, 2, 3, 4, 5} and {1, 2, 4, 8, 16} is a lattice under the relation Divides **(10,10)**

8. a) If a lattice L is modular and if $a,b,c \in L$ with $a \geq b$, $a \wedge c = b \wedge c$ *and* $a \vee c = b \vee c$, then a = b

b) Draw the circuit representation of the function $(x' \vee y' \vee z) \wedge (x' \vee y \vee z) \wedge (x \vee y \vee z')$

c) Find the function that represent the circuit : **(7,7,6)**