EEE-301

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121306

Roll No.

B. Tech.

(SEM. III) (ODD SEM.) THEORY
EXAMINATION, 2014-15
BASIC SYSTEM ANALYSIS

Time : **3** Hours]   [Total Marks : **100**

Note :   Attempt all questions.

1.   Answer any TWO parts: **10x2=20**
        (a)   Determine whether the system y (t)=10x(t)+5 is
                (i)   Static or dynamic
                (ii)   Linear or non linear
                (iii)   Causal or noncausal
                (iv)   stable or unsatable.
        (b)   Synthesize the waveform as shown in Fig.1 in term of
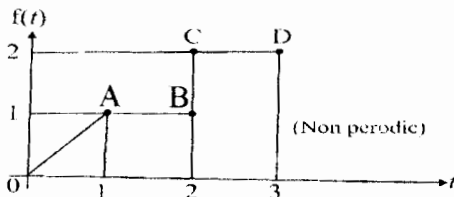   basic signals.

Fig. 1

(c) Draw the equivalent mechanical system of the given system. Hence write the set of equilibrium for it and obtain electrical analogous circuits using,
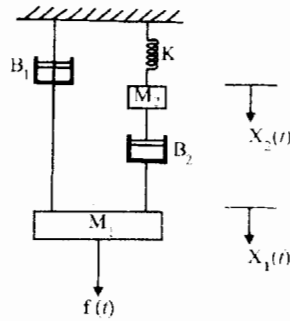(i)   F-V Analogy and (ii)   F-I Analogy

Fig. 2

2.   Answer any TWO parts: 10x2=20
(a) List the properties to be satisfied by a periodic function for which Fourier series exists. Discuss the procedure for evaluating coefficient of a trigonometric Fourier series.
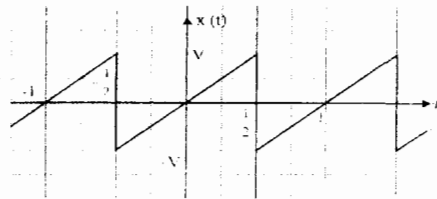b)   Using waveform symmetries obtain trigonometric Fourier series for the following sawtooth waveform.

Fig. 3

(c) Use duality to evaluate the inverse Fourier transform of the step function in frequency, $F'(j\omega) = u(\omega)$

3.   Answer any TWO parts: 10x2=20
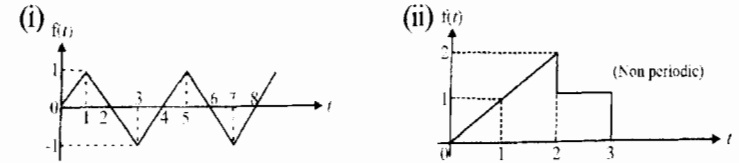(a) Find the Laplace transformation of voltage waveform Shown in fig. 4

Fig. 4

(b) Find the inverse Laplace Transformation of following

(i) $\dfrac{3s}{(s^2+1)(s^2+4)}$ (ii) $\dfrac{s^2}{(s^2+1)^2}$

(c) Consider the circuit shown in figure 3, where the switch S is switched on at t=0. Obtain the expression for the current. Also find the current through the capacitor at $t=0^+$. Assume the capacitor to be discharged initially.

4.   Answer any TWO parts: 10x2=20
(a) Define and explain the following terms,
(i)   State variables   (ii)   State vector
(iii)   State trajectory   (iv)   State
(v)   State Space.
(b) System matrix of a system is given by

$$A = \begin{bmatrix} -\dfrac{1}{2} & -\dfrac{5}{2} \\ \dfrac{1}{2} & -\dfrac{7}{5} \end{bmatrix}$$

Find the state transition matrix $\phi(t)$ of the system,

(c) obtain the state variable representation of the systems described by the following differential equations

(i) $\dddot{y}+4\ddot{y}+5\dot{y}+2y=u$

(ii) $\dfrac{d^3x}{dt^3}+3\dfrac{d^2x}{dt^2}+4\dfrac{dx}{dt}+4x=u_1(t)+3u_2(t)+4u_3(t)$

and the outputs,

$y_1=4\dfrac{dx}{dt}+3u_1$

$y_2=\dfrac{d^2x}{dt^2}+4u_2+u_3$

5. Answer any TWO parts: 10x2=20
   (a) Solve the following difference equation by means of the z-trnasform: f(k+2) - f(k) = 0; f(0) = 1, f(1) = 1
   (b) Determine the discrete time signal for which the z-transform of a function f(t) is given by:

   $f(z)=\log(1+az^{-1});|z|>|a|$.

   (c) find the inverse z-transform of

   $f(z)=\dfrac{36z^2-10z}{12z^2-7z+1};ROC:\dfrac{1}{4}<|z|<\dfrac{1}{3}$