HCU-003-1273001 Seat No. _____

M. Sc. (ECI) (Sem. III) (CBCS) Examination

October / November – 2017

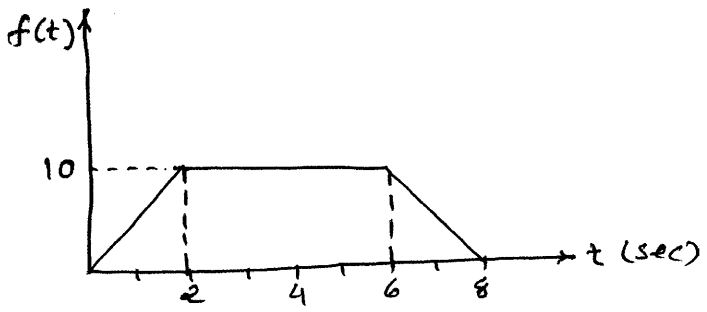
Paper - IX : Advance Circuit & Network Concepts

Faculty Code : 003
Subject Code : 1273001

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 Answer any seven from the following : **14**

(1) Use step function to write the expression for the following function :



(2) Find the Laplace transform of the function,

$$f(t) = 4t^3 + t^2 - 6t + 7$$

(3) Find Laplace transform of $\sin 3t$. Use derivative formula.

(4) Determine the partial fraction expansion for,

$$F(S) = \frac{S-5}{S(S+2)^2}$$

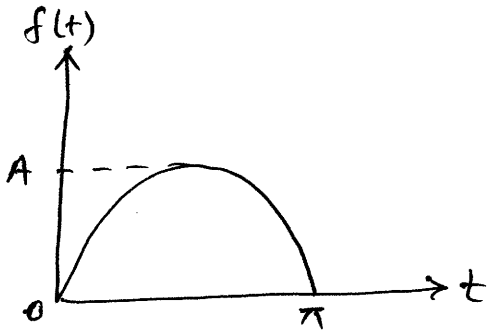
(5) Verify the initial value theorem for following function.

$$f(t) = 2 - e^{5t}$$

(6) Verify the final value theorem for the following function.

$$f(t) = 2 + e^{-3t}\cos 2t$$

(7) Write the expression for following waveform in terms of unit function. Then obtain the Laplace transform for the same.



(8) Determine the Laplace transform of $\frac{d^2y}{dt^2}$ if $y = t^2$.

(9) Determine partial fraction expansion for the following.

$$F(S) = \frac{S-1}{(S+9)^2(S+4)\left(S^2+3S+2\right)(S+7)^2}$$

(10) Determine the inverse Laplace of following.

$$F(S) = \frac{96(S+5)(S+12)}{S(S+8)(S+6)}$$

2 Answer any two from the following :

(a) Discuss the natural response of an RC circuit using S - domain analysis. **7**

(b) Discuss the response of a circuit where input generates Impulse source by switching a capacitor. **7**

(c) Discuss transform impedance of capacitor. **7**

3 Answer the following :

(a) Explain following statements for pole and zero concepts : **7**

(1) "The real parts of all zeros and poles must be negative or zero".

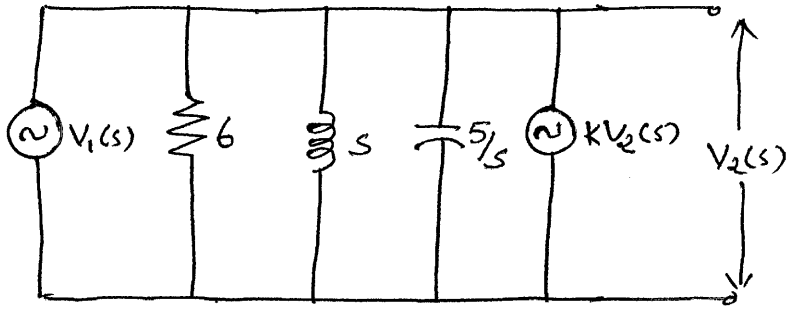
(2) "Poles and zeros lying on the $j\omega$ – axis must be simple".

(b) A network function has two real poles. Discuss its time response using pole zero concept. If the same function has two complex poles, discuss its time response. **7**

OR

3 Answer the following :

(a) Discuss the stability criterion for the following active network in *S*-domain. **7**



(b) Represent ABCD parameters in terms of Z-parameters and Y-parameters. **7**

4 Answer the following :

(a) For T-network filter prove the following : **7**

(1) $Z_{0T} = \sqrt{\frac{Z_1^2}{4} + Z_1 Z_2}$

(2) $Z_{0T} = \sqrt{Z_{0c} * Z_{sc}}$

(3) $\gamma = \ln\left[1 + \frac{Z_1}{2Z_2} + \sqrt{\left(\frac{Z_1}{2Z_2}\right)^2 + \frac{Z_1}{Z_2}}\right]$

(b) What are the limitations of constant *k* filter ? Discuss m-derived low pass filter. **7**

5 Answer any two from the following :

(a) Draw and explain full shunt equalizer. **7**

(b) Discuss the realization of immitance function of LC network given below for Foster-I and Cauer-I form **7**

$$Z(s) = \frac{4\left(s^2+1\right)\left(s^2+9\right)}{s\left(s^2+4\right)}$$

(c) Realize the following RC network impedance function for Foster-II and Cauer-II methods : **7**

$$Z(s) = \frac{(s+1)(s+4)}{s(s+2)}$$

(d) Explain the basics of synthesis of driving point impedance function of RL networks. Write the properties of RL driving point impedance function. Write about the plot of $Z(\sigma) \rightarrow \sigma$. **7**