

Attempt the following questions:

Maximum Marks (90)

1- (a) Prove that:

$$\lim_{t \rightarrow \infty} f(t) = \lim_{s \rightarrow 0} sF(s) \quad \text{where} \quad F(s) = \mathcal{L}[f(t)]$$

(6 marks)

(b) Solve the following D.E.:

$$\ddot{y}(t) + 5\dot{y}(t) + 6y(t) = 0$$

$$\text{given that: } y(0) = 3, \dot{y}(0) = -2, \ddot{y}(0) = 7$$

Then, sketch  $y(t)$  against  $t$

(8 marks)

(c) Define the following terms:

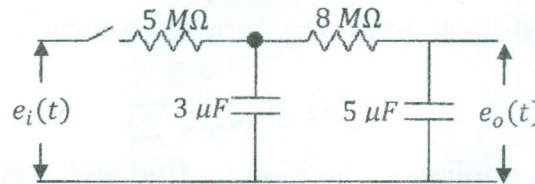
i- System type.

ii- Stable system.

iii- Maximum over-shoot.

(6 marks)

2- (a) Find the transfer function for the system shown in Fig. (1)



**N.B.:**

$$1 \text{ M}\Omega = 10^6 \Omega$$

$$1 \mu\text{F} = 10^{-6} \text{ F}$$

**Fig. (1)**

Then, determine the system order and the system type.

(12 marks)

(b) Define the following terms:

i- Open-loop transfer function.

ii- Natural undamped frequency.

iii- Settling time.

(6 marks)

3- (a) Define the following terms:

i- Steady-state error.

ii- Rise time.

iii- Peak time

(6 marks)

P.T.O.

