

Electrical Engineering

Paper-II

Time Allowed: Three Hours

Maximum Marks: 300

- Note:** 1. The figures in the margin indicate full marks for the questions.
2. Candidate should answer questions No. 1 and 5 which are compulsory and any **three** of the remaining questions, selecting at least **one** from each section.

SECTION – A

1. (a) What is steady state error? Draw a typical transient response output for an underdamped second order system and show the location of all the transient response specifications. 20
- (b) (i) How the 20-bit effective address is calculated in 8086 processors? 10
- (ii) Explain the advantages of PIC chips in microprocessor based systems. 10
- (c) What do you mean by A/D conversion? Explain any **one** of the following A/D techniques:
 - (i) Successive approximation. 10
 - (ii) Parallel / flash converter. 10
2. (a) A system characterised by the transfer function 20

$$\frac{Y(s)}{u(s)} = \frac{2}{s^3 + 6s^2 + 11s + 6}$$

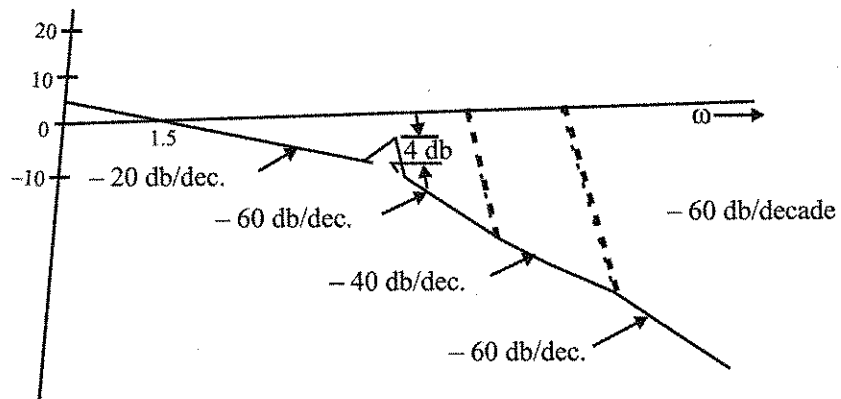
Find the state and output equation in matrix form and also test the controllability and observability of the system.

- (b) A unit step input is applied to a unity feedback control system having open loop transfer function 20

$$G(s) = \frac{K}{s(1+2sT)}$$

Determine the value of K and T to have $M_p = 20\%$ and resonant frequency $\omega_r = 6$ rad/sec. Calculate the resonant peak (M_r).

- (c) (i) Show that the steady state error increase by using the derivative feedback control. 10
- (ii) Explain Two position or ON-OFF control. 10
3. (a) Find the transfer function of the system from the data given on Bode diagram. 20

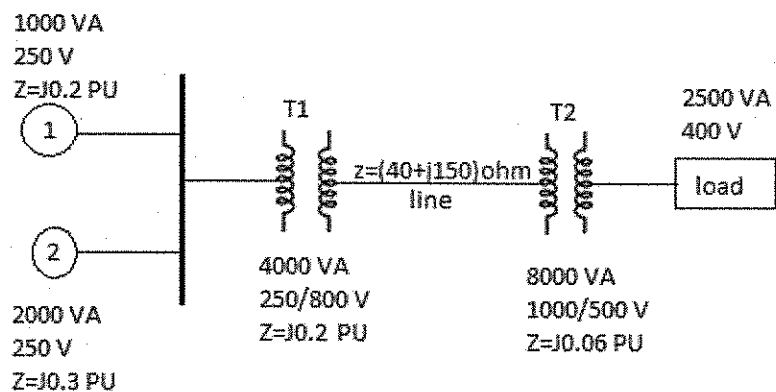


- (b) Specify the function of the address bus and the direction of the information flow on the address bus. 20
- (c) (i) What are the difficulties associated with solar power generation? Give its major applications. 10
- (ii) Explain the conversion of solar energy into electrical energy in a solar power plant. 10
4. (a) What is the difference between a CRT and CRO? Draw a neat block diagram of a general purpose CRO and explain function of each block. 20
- (b) Explain piezoelectric effect and give the name of piezoelectric materials and their applications. 20

- (c) Two photodiodes, each with an effective area of 10 cm^2 , are exposed to bichromatic radiation having power densities of 500 W/m^2 , in narrow bands one around 430 THz and the other around 600 THz . One diode has a band gap energy of 1 eV , the other has 2 eV . When diode is reverse biased (in the dark), the saturation current is 10 nA . The diodes operate at 300 K . Find the short-circuit photo currents. 20

SECTION - B

5. (a) With a suitable standard coil connected to a Q meter resonance is obtained with a frequency f_1 , with resonating capacitor set at C_1 , the indicated Q-factor is Q_1 . As unknown impedance is connected in series with the standard coil and resonance is re-established by resetting the resonating capacitor at C_2 , the corresponding Q-factor being Q_2 . Determine (i) The resistive and (ii) Reactive components of the unknown impedance when $C_1=208 \text{ pF}$, $Q_1=80$, $C_2=184 \text{ pF}$ and $Q_2=50$. The frequency is 165 kHz . 20
- (b) What are the different methods of measurement? Distinguish between the direct and indirect methods of measurement. Give examples to support your answer. 20
- (c) (i) Why selection of transducers is important? Give the points to be considered in determining transducer suitability for a specific measurement. 10
- (ii) What is the resolution of a 4.5 digit display? How would 15.84 V be displayed on a 10 V range and 0.5243 V on 1 V and 10 V ranges? 10
6. (a) What is per unit system? State merits and demerits of per unit system. Redraw the network shown in figure where the per unit impedances are represented in common 5000 VA base and 250 V . 20



- (b) (i) Derive the expression for active and reactive power of a two bus system. 10
- (ii) Calculate the most economical power factor when kW demand is constant. 10
- (c) Compare the advantages and disadvantages of using a synchronous condenser and a static capacitor for power factor improvement. 20
7. (a) A generating station has a maximum demand of 20 MW, a load factor of 60%, plant capacity factor of 48% and a plant use factor of 80%. Find out (i) The daily energy consumed (ii) The reserve capacity of the plant (iii) The maximum energy that could be produced daily, if the plant were running all the time and (iv) The maximum energy that could be produced daily, if the plant were fully loaded. 20
- (b) What is the principle of HVDC system operation? Discuss the technical and economical advantages of DC systems over AC systems. 20
- (c) Explain why series compensation leads to improvement in system stability. Compare the performances of series and shunt capacitors in power system. 20
8. (a) Why is it not possible to use the same antenna for reception for both lower and upper VHF channel? Describe any one type of multiband array commonly employed to cover all the channels in VHF band. 20
- (b) Draw circuit diagram of a keyed AGC system employing transistors and having a noise gate. Explain how the AGC voltage is developed and amplified. 20
- (c) (i) A cable TV system has 100 commercial channels, all of them alternating program with advertising. Is this more like TDM or like FDM? 10
- (ii) Data link layer almost always put the CRC in a trailer, rather than in a header. Why? 10