

ELECTRICAL ENGINEERING (Paper II)

Time Allowed : Three Hours

Maximum Marks : 300

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two Sections.

Candidate has to attempt FIVE questions in all.

Question Nos. 1 and 5 are compulsory and out of the remaining, any THREE are to be attempted choosing at least ONE question from each Section.

The number of marks carried by a question/part is indicated against it.

Wherever any assumptions are made for answering a question, they must be clearly indicated.

Word limit in questions, wherever specified, should be adhered to.

SECTION 'A'

1. Select any three of the following statements read them carefully and identify the correct and the incorrect ones. Justify your answer using not more than 200 words in each case **20×3=60**
- (a) The magnitude of a transfer function whose poles are only in the left half of 's' plane and whose zeros are mirror images of the poles about the 'jw' axis increases with increase in frequency.
- (b) For measurement of 3 ϕ power using two wattmeters one of the wattmeters reads negative when the power factor angle is more than 60°
- (c) In a large interconnected power system, consider three buses having short circuit capacities 1600 MVA (1), 1200 MVA (2) and 1000 MVA (3) respectively, the voltages of all the buses are 1 p.u. If a 3 ϕ fault takes place on bus 2, the change in bus voltage is described as $\Delta V_1 > \Delta V_2 > \Delta V_3$.
- (d) A satellite earth station must have as many receive chains as there are carriers transmitted to it.
2. (a) A system is represented by state equation $\dot{X} = AX$. If for $X(0) = \begin{bmatrix} 1 \\ -3/2 \end{bmatrix}$ the response is $X(t) = \begin{bmatrix} e^{-2t} \\ -3/2 e^{-2t} \end{bmatrix}$
And for $X(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$
 $X(t) = \begin{bmatrix} e^{-t} \\ -e^{-t} \end{bmatrix}$
Determine the state transition matrix. **20**
- (b) Station 'A' transmits 50 MW power to station 'B' through a tie-line. Maximum steady state capacity of the line is 100 MW. Determine the allowable sudden load that can be switched on without loss of stability. Derive any formulae used. **20**
- (c) Explain clearly the construction of a p-n junction and its use to convert sun-light directly into electricity. What distinguishes a solar cell from a conventional p-n junction diode? **20**
3. (a) Discuss briefly the microprocessor architecture with special reference to the following components- (i) Data bus, (ii) Address bus and (iii) Control bus. **20**
- (b) Explain briefly various abnormal operating conditions in a large alternator against which protection is necessary. Explain clearly with neat diagram the protection of alternator against failure of excitation. **20**
- (c) What is wave power? Describe some of the devices used for converting wave power into electrical power. Discuss briefly its feasibility with reference to Indian sub-continent. **20**

4. (a) Differentiate between para-magnetic, diamagnetic and ferro-magnetic materials. Discuss various factors which affect permeability and hysteresis loss 20
- (b) Explain how television is capable of displaying complete moving pictures, despite the fact that at any instant of time, only a tiny portion of the picture tube screen is active. 20
- (c) How do the functions of a communication satellite compare with those of a microwave link repeater? What is the most significant difference in their functions? 20

SECTION 'B'

5. Select any three of the following statements, read them carefully and identify the correct and the incorrect ones. Justify your answer using not more than 200 words in each case **20×3=60**
- (a) The steady - state errors for unit step input to type-0, type-1 and type-2, unity feedback systems are finite non-zero, zero and infinite respectively.
- (b) “Tan δ ” of an insulating material is an indication of its health
- (c) For the same rupturing capacity the actual current to be interrupted by an HRC fuse is much greater than that of any circuit breaker.
- (d) PCM is considered very well, but other modulation systems are also used
6. (a) Explain with suitable diagrams, how one single phase wattmeter can be used to measure 3ϕ active and reactive power. Discuss the limitation of this method. 20
- (b) Find the signal-to-quantization noise ratio in a binary PCM system, if the number of quantization levels is 64: 20
- (c) In a TV receiving system the pre-amplifier (mounted on the aerial) has a gain of 20 dB and a noise factor of 6 dB and the cable between the pre-amplifier and the receiver has an attenuation factor of 3 dB. While the RF and IF stages of the receiver have a total gain of 90 dB and a noise figures of 3 dB (RF stage) and 13 dB (IF stage) Determine the system overall noise figure. 20
7. (a) Show that the feedback reduces the effect of parameter variation on the performance of the control system, but adversely affects the gain of the systems Also discuss briefly the effect of feedback on the transient performance of the control system. 20
- (b) Derive a simple expression for the orbital period of a satellite in terms of the mechanical constants of the satellite and the earth. 20
- (c) A multimode fiber has a core refractive index 1.5 and the relative refractive index difference is 3 per cent and the operating wavelength is 0.8 μ m. Calculate the critical radius of curvature at which large bending losses occur. 20
8. (a) First manually place 00s in the accumulator and all general purpose registers. Then write a programme which will (i) place the hex number FE in the accumulator. (ii) copy the contents of the accumulator ‘A’ into register ‘B’ (iii) copy the contents of the accumulator ‘A’ into register ‘C’ (iv) stop. Show the programme in 8085 mnemonics. 20
- (b) Derive swing equation and discuss its application in the study of power system stability. 20
- (c) Discuss one scheme each of (i) constant speed constant frequency (CSCF) (ii) variable speed constant frequency (VSCF) of a wind-electrical energy conversion system. 20