

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) While a lead compensator reduces system bandwidth, a lag compensator on the other hand increases the system bandwidth.
 - (b) It is necessary to use preamplification and filtering before data processing.
 - (c) Tap changing transformers are used in power systems, especially to control reactive volt-amperes.
 - (d) For the correct reproduction of the picture on the screen of a television, it is desired that the scanning at the receiver and transmitter are synchronized.
2.
 - (a) What is the fundamental difference between a subroutine call and an interrupt request? Is it possible to employ a common memory stack for both? **20**
 - (b) For the network shown in Fig. 2 (b), obtain the complex bus bar voltage at bus 2 at the end of the first iteration. Use the Gauss-Seidel method. Line impedances are in pu. Given Bus 1 is slack bus with $V_1 = 1.0 \angle 0^\circ$. $P_2 + jQ_2 = -5.96 + j1.46$; $|V_3| = 1.2$ Assume $V_3^0 = 1.02 \angle 0^\circ$ and $V_2^0 = 1 \angle 0^\circ$
[Figure: Fig. 2 (b): three buses 1, 2, 3 in a row; line 1-2 impedance $0.04 + j 0.06$; line 2-3 impedance $0.02 + j 0.03$.] **20**
 - (c) Explain how a Buchholz relay protects a transformer. **20**
3.
 - (a) What is the proportion in which n-type and p-type Si both having conductivity of $10 \text{ ohm}^{-1} \text{ m}^{-1}$ be mixed so as to produce a fully compensated semiconductor at room temperature? Mobility of electrons and holes in Si are 0.14 and $0.05 \text{ m}^2 \text{V}^{-1} \text{s}^{-1}$ respectively at room temperature. **20**
 - (b) Explain the following in connection with power systems: Ferranti effects, infinite line, Peterson coil, load bus. **20**
 - (c) Calculate the maximum power by a solar cell at an intensity of 200 W/m^2 . Given $V_{max} = 0.14 \text{ V}$ and $I_{max} = -6 \text{ mA}$. Also calculate the cell efficiency if the area is 4 cm^2 . **20**
4. (a) While manufacturing IC, the Si wafer is oxidized time and again. What functions can an oxide layer perform during and after the manufacture? What role is played by dislocations which get generated during the growth of the single crystal and during processing of the wafer? **20**

- (b) Explain, what is meant by the term Blind Speed in MTI (Moving Target Indicator) radar. What is the method of overcoming the problems of blind speed in radar? **20**
- (c) What do you understand by the term Satellite Communication Package? Explain in brief the working of satellite repeaters in use. **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) In order to increase the distance between poles, carrying long distance transmission line, aluminum conductors should be strengthened by strain-hardening.
- (b) Routh-Hurwitz and continuous fraction stability criteria tell whether the system is stable or unstable. They do not tell anything about the relative stability of the system.
- (c) Using energy audit and energy management techniques, one avoid or postpone the installation of costly peaky generation.
- (d) In pulse compression radar, one gets a higher maximum range capability and a better range resolution.
6. (a) The conductivity of intrinsic Si at room temperature is $3.3 \times 10^{-4} \text{ ohm}^{-1} \text{ m}^{-1}$. A bridge is available which can measure 1 in 10^4 changes in resistance. With what accuracy can this Si be used to measure the temperature in the range from 0°C to 100°C ? The energy band gap in Si is 1.1 eV. The Boltzmann constant, $k=1.38 \times 10^{-23} \text{ J K}^{-1}$ and the electronic charge, $e=1.6 \times 10^{-19} \text{ C}$. **20**
- (b) Great a block diagram for a differential encoding and decoding system. Explain how it works by showing the encoding and decoding for the sequence 001111010001. Assume that the reference digit is a binary 1. Show that error proportion cannot occur. **20**
- (c) With reference to the colour television transmission and reception, explain (i) hue and saturation, and (ii) colour subscriber. **20**
7. (a) Discuss the effect of temperature on the relative dielectric constant of a material. **20**
- (b) The semi-major axis and the semi-minor axis of an elliptical satellite orbit are 25000 km and 20000 km respectively. Determine the apogee and perigee distances. **20**
- (c) Explain; how energy is lost at a sharp bend in a fibre. What do you understand by the term Dispersion, as applied to optical fibre? **20**
8. (a) (i) If the program counter is always one count ahead of the memory location from which the machine code is being fetched, how does the microprocessor change the sequence of program execution with a jump instruction? (ii) List the sequence of memory transfers required to process an indirect-addressing mode instruction, when the instruction is a control type (for example Jump Unconditionally). How many memory cycles are needed? **20**
- (b) Explain with the help of flow chart procedure for solution of exact coordination equations. **20**
- (c) Discuss the basic principles involved in distance protection and describe how it is applied to transformer feeders. **20**