ELECTRONIC SCIENCE

Paper – III

SECTION – I

Note :   i)   Answer all questions.

ii)   Each question carries twenty marks.

iii)   Each answer should be given in 500 words.   2 × 20 = 40

1.   In what respects is a tunnel diode different from an ordinary diode ? Explain qualitatively through energy band diagram, how the phenomenon of tunnelling gives rise to the special features of the I-V characteristic in a tunnel diode.

OR

Discuss the different modes of 8253 IC chip with the help of timing diagrams and suitable examples.

2.   Explain with simple ray diagram how dispersion occurs in multimode step index fibre. Obtain the expression for time delay between the fastest and slowest rays and explain how this effects the transmission data rate with an example. Explain physically how one can achieve low dispersion in graded index fibre.   5 + 7 + 5 + 3

OR

Draw the energy band diagram of a metal semiconductor contact and using Poisson's equation at the junction, derive expressions for the junction potential, junction capacitance and the built-in potential. How can one use this theory to obtain the carrier concentration of a semiconductor ?

SECTION – II

Note :   i)   Answer all questions.

   ii)   Each question carries fifteen marks.

   iii)   Each answer should be given in 300 words.   3 × 15 = 45

3.   Draw the physical structure of a junction field effect transistor and derive expressions

for the pinch-off voltage and DC drain current.   3 + 4 + 8

4.   Write three programs in *C* language that compute and print the value of factorial for
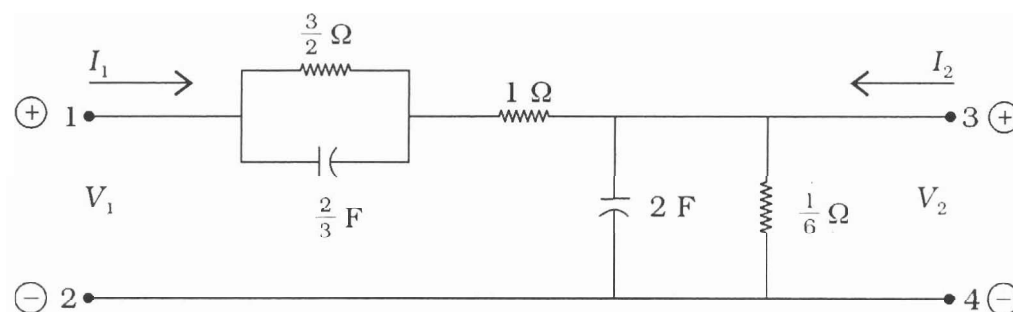
any given number using

i)   do-while loops

ii)   while loop and

iii)   factorial function to be called from the main block.   5 + 5 + 5

5.   For the given network, show that $Y_{12} = \dfrac{K(s+1)}{(s+2)(s+4)}$ and determine the value of *K*.

SECTION – III

Note :   i)   Answer all questions.

        ii)   Each question carries ten marks.

        iii)   Each answer should be given in 50 words. $9 \times 10 = 90$

6.   What do you mean by absorption, spontaneous emission and stimulated emission ? Why does laser show high degree of coherence ? What is the role of optical cavity resonator ?   2 + 2 + 2 + 4

7.   Distinguish between intermodal dispersion and intramodal dispersion with reference to multimode and single mode fibres. Why are the two wavelengths $1 \cdot 3 \, \mu m$ and $1 \cdot 55 \, \mu m$ important for propagation of signals in single mode fibre ?   6 + 4

8.   a)   What are the four different types of control systems ? Give examples of each

        b)   Describe, step by step, the procedure to draw Bode diagram.   4 + 6

9.   Using 2-to-1 multiplexer realize the following functions : 5×2

        i)   AND

        ii)   OR

        iii)   NOT

        iv)   EX-OR

        v)   NAND.

10. a)   What are the basic circuit building blocks required for a PCM generator ? What is

    the main advantage of this modulation technique ?

    b)   If the digit per code word is N and M is the number of quantization levels, then

    show that the signal to noise ratio (SNR) is

    SNR $= M^2 = 2^{2N}$ $2 + 2 + 6$

11. What is a race around condition ? How is this race around condition removed in a

    Master/Slave JK flip-flop ? Explain using a circuit designed with all NAND gate.

12. Explain group velocity and phase velocity as applied to waveguides. Show that the

    group velocity is given by $V_g = V_c \sqrt{1 - (\lambda/\lambda_0)^2}$

    where the symbols have their usual meaning.

13. Explain with the flow diagram, the different modes of programmed data transfer

    scheme highlighting their merits and demerits.

14. Distinguish between direct I/O and memory mapped I/O. Describe how a key code can

    be obtained in a 4 × 4 matrix keyboard using row scanning technique.

SECTION – IV

Note :   i)   Answer all questions.

ii) Each question carries five marks.

iii) Each answer should be given in 30 words.   5 × 5 = 25

Read the paragraph carefully and answer the following questions :

A reverse biased *p-i-n* diode works as a photodetector. Light falling on it creates excess electron-hole pairs. The electric field separates the carriers and current is produced in an external circuit.

15.   Obtain an expression for the maximum wavelength of light that can be detected.

16.   In which region of the diode, is the electric field present ?

17.   What happens to the excess carriers if the electric field is not present at all ?

18.   How is the photodetected current related to the power of the incident light ?

19.   Will there be any current if no light falls on the detector ? Briefly explain