2015

M.Sc. Part–I Examination

PHYSICS

PAPER—IV

Full Marks : 75

Time : 3 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Use separate Answerscripts for Gr. A & Gr. B.

Group—A

[Marks—40]
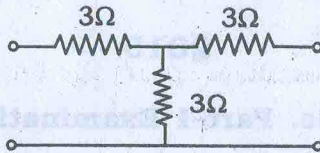
Attempt Q. No. *1, 2, 3* and any *two* from the rest.

1. Answer any *five* questions :   5×2

   (a) Convert the following T-network into its equivalent π form—

(b) Draw the circuit diagram of a simple diode detector and what should be the special characteristics of this diode?

(c) Comment on duct propagation.

(d) What do you mean by ionosphere? How is it formed?

(e) What do you mean by photoelectric transducer? Give some examples.

(f) What is the need of modulation? Explain.

(g) Why TV signals cannot be transmitted over long distances using terriestrial mode of transmission?

(h) Explain the operation of a duplexer. Where is it used?

2. Answer any *two* questions :   2×3

(a) What is a thermistor? Explain whether an intrinsic or extrinsic semiconductor is suitable for the fabrication of a thermistor?

(b) What is superheterodyne principle? What are its advantages?

(c) An amplifier has a voltage gain of −100. The feedback ratio is −0·04. Find (i) the voltage gain with feedback and (ii) the amount of feedback in dB.
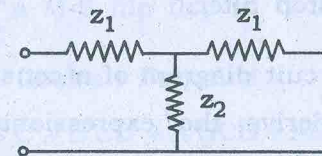
3. Answer any *one* question :   1×4

(a) Explain how the distance of a fixed target can be found by using two frequency CW radar.

(b) A symmetrical T section has the following open circuit (OC) and short circuit (SC) impedances :

$Z_{OC} = 800$ ohms, $Z_{SC} = 600$ ohms

Determine the T section parameters to represent the two post network in the following form :

4. (a) What do you mean by amplitude modulation? Write down the expression for an amplitude modulated

signal, modulated by a single frequency sinusoidal modulating signal. How many frequency components are there in the modulated signal and what are there values? Hence find out the bandwidth of the AM signal.

$$1 + \frac{1}{2} + 1 + \frac{1}{2}$$

(b) State the basic principle of producing DSB-TC AM signal and hence draw the circuit diagram of a practical AM modulator.   3+1

(c) A sinusoidal carrer voltage wave is amplitude modulated by a sinusoidal voltage of 20 KHz with 40% modulation. Determine the frequency and amplitude of the two side bands if the carrier frequency is 15 MHz and the amptitude is 20V.   3

5. (a) Draw the frequency response characteristics of an ideal band stop filter.   1

(b) Draw the circuit diagram of a constant-k band stop fitter and derive the expressions for its cut-off frequencies. Derive the expressions for the attenuation constant and phase constant in the pass band and attenuation bands. Also graphically represent their

variations as a function of frequency in the pass band and Attenuation band.   1+3+4+1

6. (a) State and explain Foster's reactance theorem. Explain also the two corrollaries of Foster's reactance theorem.

    6

(b) With a neat circuit diagram explain an FM detector.

    4

Group—B

[Marks—35]

Attempt Q. No. *1, 2* and any *two* from the rest.

1. Answer any *three* questions :   3×2

(a) Convert a M-S filp flop in D & T type flip flop.

(b) Simplify Boolean Function

$$F = A'B'C' + B'CD' + A'BCD + AB'C'$$

(c) Express the following logic equation in the SOP form:

$$Y = (A + BC)(B + \bar{C}A)$$

(d) Realize the above logic equation given in 1(c) by Nand gates only.

(e) What are positive and negative logic in binary signal ?

2. Answer any *three* bits : 3×3

(a) What is aliasing effect in sampling process and how it can be removed ?

(b) Design a M-S flip flop and describes its circuit operation.

(c) Design a full adder circuit.

(d) How ALE signal is demultiplexed from data bus.

(e) It is desired to clear the accumulator of 8085A. Explain the possible instructions for this purpose.

3. (a) Use a 555 timer to build an astable multivibrator. Give the necessary circuit diagram.

(b) Theoretically derive the expression for the period of the output wave form.

(c) Give an expression of the duty cycle. 4+4+2

4. (a) Explain different addressing modes of 8085 microprocessor with suitable example.

(b) Calculate address line required for 16K memory chip.

(c) What are low and high level languages. 6+2+2

5. (a) Design a 8 bit synchronous counter using state table.

(b) Describe time division and freq. division multiplexing. 6+4