2020

(Held in 2021)

PHYSICS

(Major)

Paper : 5.4

(Electronics)

Full Marks : 42

Time : 2 hours

The figures in the margin indicate full marks for the questions

GROUP—A

(*Marks* : 21)

1. Answer the following questions briefly : 1×2=2

(a) Write the full form of CMRR.

(b) Name the type of feedback necessary to increase stability and bandwidth of an amplifier.

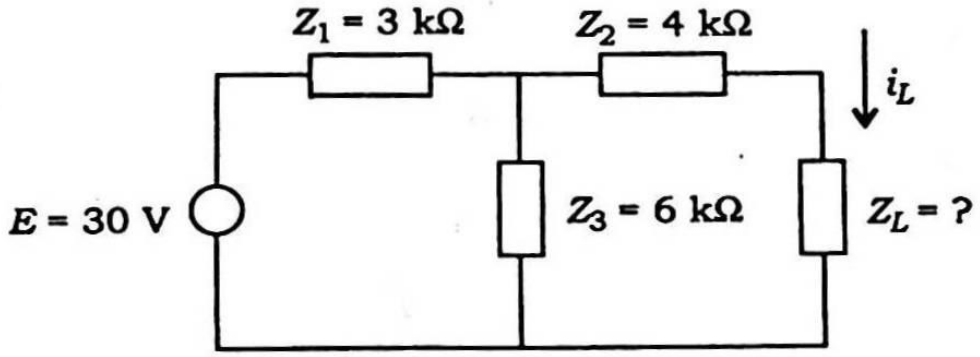
2. Write short answer to the following questions : 2×2=4

(a) State the reasons for which voltage gain of RC-coupled transistor amplifier continuously decreases in the high frequency range.

(b) State Barkhausen's criterion for sustained oscillation.

3. Answer any *three* of the following questions : 5×3=15

(a) Convert the following circuit into Thevenin's equivalent circuit and find the Thevenin's equivalent impedance and voltage. Find the value of load impedance Z_L when load current (i_L) is 2 mA : 2+2+1=5



(b) Draw the circuit diagram of a half-wave diode rectifier. Derive the expressions for d.c. for average and RMS value of current from the output waveform and hence find its efficiency. 1+1+1+2=5

(c) Convert the decimal numbers $37 \cdot 75_{10}$ and $15 \cdot 25_{10}$ into its binary equivalent and find the binary sum. Also find difference of these binary numbers by converting the smaller number into negative number. 3+2=5

(d) What are the variables related to input and output of a transistor when it is considered as a two-port four-terminal device? Establish the relations of *h*-parameters with these variables for small signal input a.c. signal with a suitable block diagram. Draw the *h*-parameter a.c. equivalent circuit. 1+3+1=5

(e) A negative feedback amplifier has open loop gain –99. Calculate gain before and after feedback if feedback ratio (β) is 0·05. State the advantages of negative feedback. 3+2=5

GROUP—B

(*Marks* : 21)

4. Answer any *three* of the following questions : 7×3=21

(a) Draw the circuit diagram of RC-coupled transistor amplifier. Explain the factors affecting the voltage gain of single-stage RC-coupled amplifier in the low frequency range with its equivalent circuit. Define lower half power frequency. 2+4+1=7

(b) Draw the circuit diagram of the Wien bridge oscillator and discuss how condition of oscillation is achieved. What is the frequency of oscillation of this type of oscillator? 2+3+2=7

(c) Explain the operation of an OP-AMP as integrator with a suitable diagram. An OP-AMP is used as integrator with $R = 2\ M\Omega$ and $C = 0 \cdot 5\ \mu F$. If input voltage is $0 \cdot 4t$ volts, calculate output voltage at time $t = 10$ sec. 4+3=7

(d) State De Morgan's theorem. State why NAND and NOR gates are called universal gates. Show with logic symbol how will you realize *(i)* NOT gate, *(ii)* OR gate and *(iii)* AND gate using NAND gates. What is bubbled AND gate?

2+1+3+1=7

(e) What is SSB transmission? Describe with a block diagram a method of generating single sideband. Show that the maximum power in SSB wave is 25% of unmodulated carrier power when modulation index $m = 1$. 1+4+2=7

(f) Draw the circuit diagram of a Master-Slave JK flip-flop. Explain how race-around condition is avoided by it. Draw the logic symbolic diagram to convert JK flip-flop into D and T flip-flop. 2+3+1+1=7

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