This question paper contains 4 printed pages. *Your Roll No. .....*

Sl. No. of Ques. Paper : **8423** **C**

Unique Paper Code : **222504**

Name of Paper : **PHHT-518 : Electronic Devices**

Name of Course : **B.Sc. (Hons) Physics Part III**

Semester : **V**

Duration : 3 hours *Maximum Marks* : 75

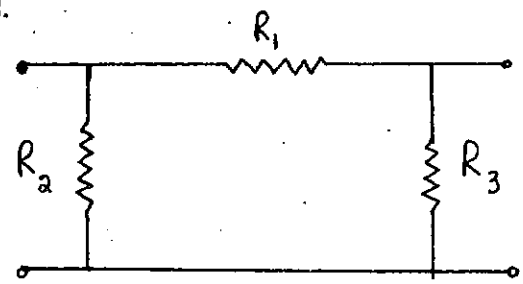
Attempt five questions in all. All questions carry equal marks. Question No. 1 is compulsory. Attempt at least one question from each Section.

Use of scientific calculator is allowed.

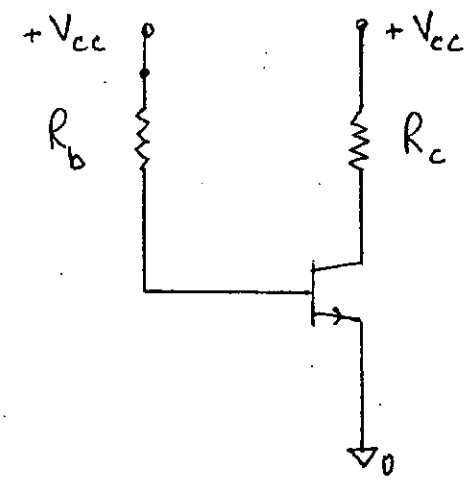
(All symbols have their usual meaning.
$h=6\cdot63\times10^{-34}$ Js, $k_B=1\cdot38\times10^{-23}$ J/K, $q=1\cdot6\times10^{-19}$ C, $c=3\times10^8$ m/s)

1. Answer any *five* of the following: $3\times5=15$

(a) Convert the given network into its T equivalent circuit. Given $R_1=R_2=R_3=8\ \Omega$.



(b) Find the voltage at the collector in the circuit shown below.



P. T. O.

Given : $R_b=240\,k\Omega$, $R_c=2{\cdot}2\,k\Omega$, $V_{CC}=12\,V$, $V_{BE}=0{\cdot}7\ V$ and $\beta=100$

(c) Show the position of the Fermi level in intrinsic, P-type and N-type semiconductor with suitable diagrams.

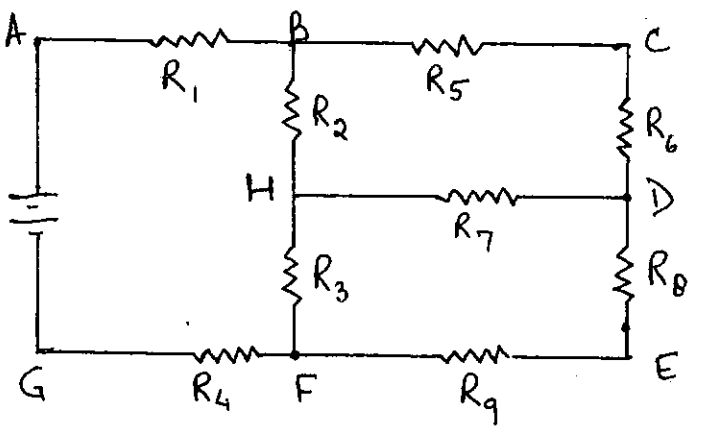
(d) Draw the output characteristics of an N-channel FET in the common source configuration.

(e) Draw the circuit diagram of a transistorized monostable multivibrator.

(f) Distinguish between Pulse Width and Pulse Amplitude Modulation.

(g) How does the junction capacitance of a reverse biased PN-junction diode vary with applied voltage? Which device makes use of this property?

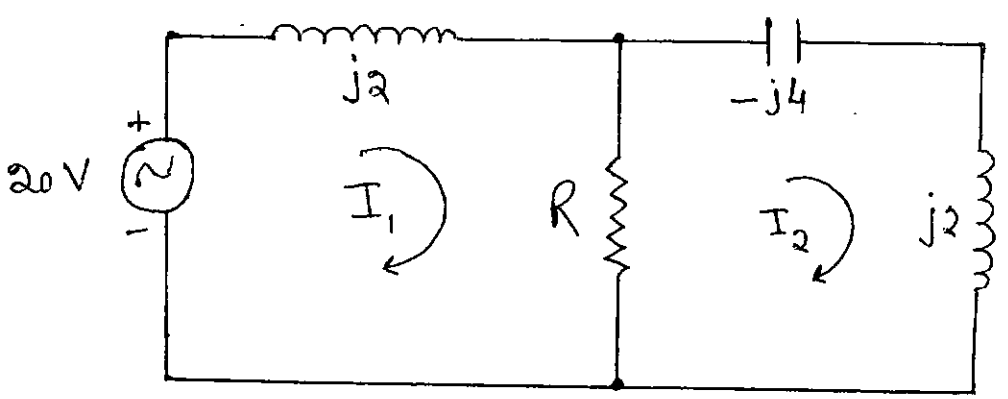
(h) Determine the number of (*i*) circuit elements, (*ii*) principal nodes and (*iii*) meshes, in the circuit shown below.



SECTION A

2. (a) Draw the circuit of an Anderson's Bridge, and derive the balance conditions. 11

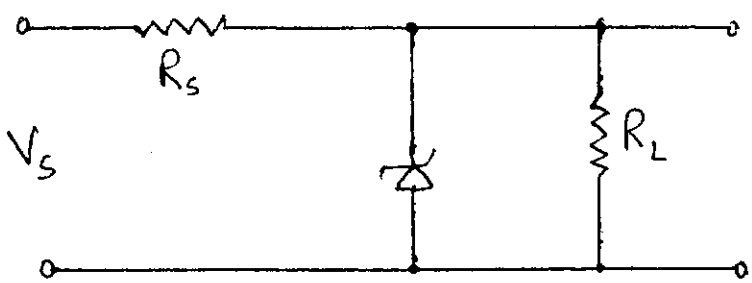
(b) Find the currents I_1 and I_2 in the given circuit, if R=8 Ω. 4



3. (a) Derive an expression for the width of the depletion region across an abrupt PN junction, under unbiased condition. 11

(b) The reverse saturation current at 300 K of a PN junction Si diode is 1 nA. Find the voltage to be applied to obtain a forward current of 0·5 μA. 4

4. (a) Draw the circuit diagram of a centre-tapped full wave rectifier. Sketch the input and output waveforms, and explain the circuit operation. Derive the expressions for average current, rms current and rectification efficiency. 11



(b) For the given zener voltage regulator circuit find the range over which the supply voltage V_s can be varied, without the loss of regulation. The zener diode of 5 V and 0·5 W has a minimum current of 5 mA. Given : R_L=1 kΩ, R_S=100 Ω. 4

5. (a) Sketch the biasing arrangement of the two junctions in the active region of a BJT in common base configuration. Show the effect of the bias voltage on depletion regions and barrier voltages on each junction. Show the movement of charge carriers through BJT, and prove

$$I_C=\alpha I_\beta+(1+\beta)I_{CBO}.$$ 9

(b) If in a transistor the emitter current I_E=1·2 mA, and β=60, find :

α, I_B and I_C 6

SECTION B

6. (a) Draw a circuit diagram showing voltage divider bias of an npn transistor in a CE amplifier. Explain how the emitter resistor improves the thermal stability of the circuit. Define and obtain an expression for the stability factor S. Also identify, and explain the working of, the bypass and coupling capacitors. 11

(b) An amplifier has voltage gain 100. It has a negative feedback ratio of 0·05. Find:

(i) The voltage gain with negative feedback.

(ii) The feedback voltage when the input voltage is 50 mV. 4

7. (a) Draw the circuit of a CE single stage transistor amplifier. Draw the corresponding ac equivalent circuit using *h*-parameters. Calculate the voltage gain, current gain, input impedance and output impedance of the amplifier. 11

(b) Draw the frequency response curve of an RC coupled amplifier. Define cut-off frequencies and show them on the diagram. Which circuit elements are responsible for the change in gain in (i) low frequency range and (ii) high frequency range? 4

8. (a) Draw the circuit of a Hartley oscillator and explain its working. Derive the expression for the frequency of oscillations, and the condition for sustained oscillations. 11

(b) Determine the value of capacitors to be used in an astable multivibrator to generate a train of pulse 1 μsec wide at a repetition rate of 100 KHz. Given: $R_1=R_2=10\,k\Omega$. 4

9. (a) Why is modulation necessary in communication system? Draw the circuit of an amplitude modulator and explain its working. Find an expression for the total power in AM wave in terms of the unmodulated carrier power and the modulation index. 11

(b) Draw the characteristic curves of UJT. Explain how a UJT can be used as a relaxation oscillator. 4