This question paper contains **4** printed pages]

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **6218**

Unique Paper Code : **222504** **D**

Name of the Paper : **Electronic Devices (PHHT-518)**

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

Semester : **V**

Duration : **3 Hours** Maximum Marks : **75**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *five* questions in all. *All* questions carry equal marks.

Question No. **1** is compulsory. Use of Scientific Calculator is allowed.

All symbols have their usual meaning.

(h = 6.63 × 10^{-34} Js, k_B = 1.38 × 10^{-23} J/K, q = 1.6 × 10^{-19} C, c = 3 × 10^8 m/s.)

1. Answer the following questions (any *five*) : 5×3=15

   (*a*) Calculate I_C and I_E for a transistor that has α = 0.98 and I_B = 100 μA.

   (*b*) The wavelength of light emitted by a certain LED is 60 nm. Find the energy gap in eV.

   (*c*) Determine peak point emitter voltage for a UJT transistor if V_{BB} = 20 V and η = 0.6.

P.T.O.

(*d*) What is the position of the Fermi level in an intrinsic semiconductor ? How does its position change when :

(*i*) donors and

(*ii*) acceptors

are added to the semiconductor ?

(*e*) Show that negative feedback helps in reduction of noise in amplifiers.

(*f*) Give a short note on photodiode.

(*g*) Differentiate between amplifier and oscillator. State Barkhausen Criterion for self-sustained oscillations.

2. (*a*) Explain the concept of potential energy barrier.

(*b*) Derive the Volt-Ampere (V-I) equation for a *p-n* junction diode.

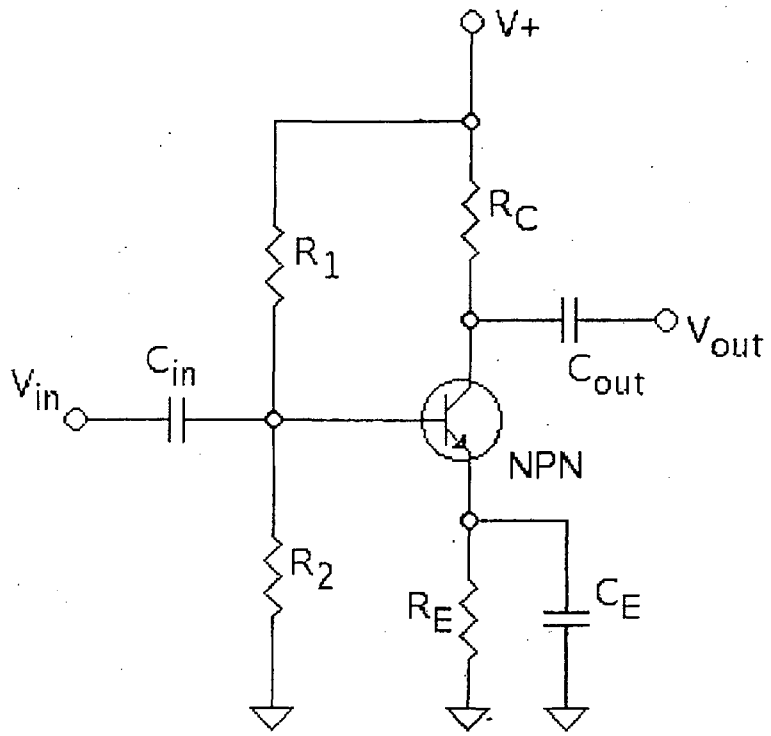
(*c*) For an abrupt Ge *p-n* junction doped with donor and acceptor concentrations of $N_d = 10^{23}$ m^{-3} and $N_a = 10^{22}$ m^{-3}, calculate the potential barrier if intrinsic carrier density $n_i = 10^{13}$ cm^{-3}. Assume $KT/q = 0.026$ V. 2,10,3

3. (*a*) Draw circuit diagram of a Full Wave rectifier. Calculate I_{dc}, I_{rms}, ripple factor, efficiency of rectification.

(*b*) With the help of energy band diagram, explain current *Vs.* voltage characteristics of a Tunnel diode in forward and reverse biasing conditions. 8,7

4. (*a*) Why the voltage divider bias circuit is preferred to Fixed bias circuit for a BJT ? Calculate stability factors S of voltage divider bias circuit.

(*b*) Determine the dc bias voltage and the current I_c for the voltage-divider configuration if V = 22 V, R_1 = 39 kΩ, R_2 = 3.9 kΩ, R_c = 10 kΩ, R_E = 1.5 kΩ, $C_{in} = C_{out}$ = 10 μF, C_E = 50 μF and β = 140. 8,7



5. (*a*) Draw the circuit diagram of RC coupled amplifier. Give its ac equivalent circuit in different frequency ranges. Derive its voltage gain in low frequency region.

(*b*) Calculate hybrid parameters of a CE single stage transistor amplifier :

(*i*) with a.c. output shorted having I_b = 20 μA, I_c = 1 mA, V_{be} = 22 mV and V_{ce} = 0 V

(*ii*) with a.c. input open circuited having I_b = 0 μA, I_c = 30 μA, V_{be} = 0.25 mV and V_{ce} = 1 V. 8,7

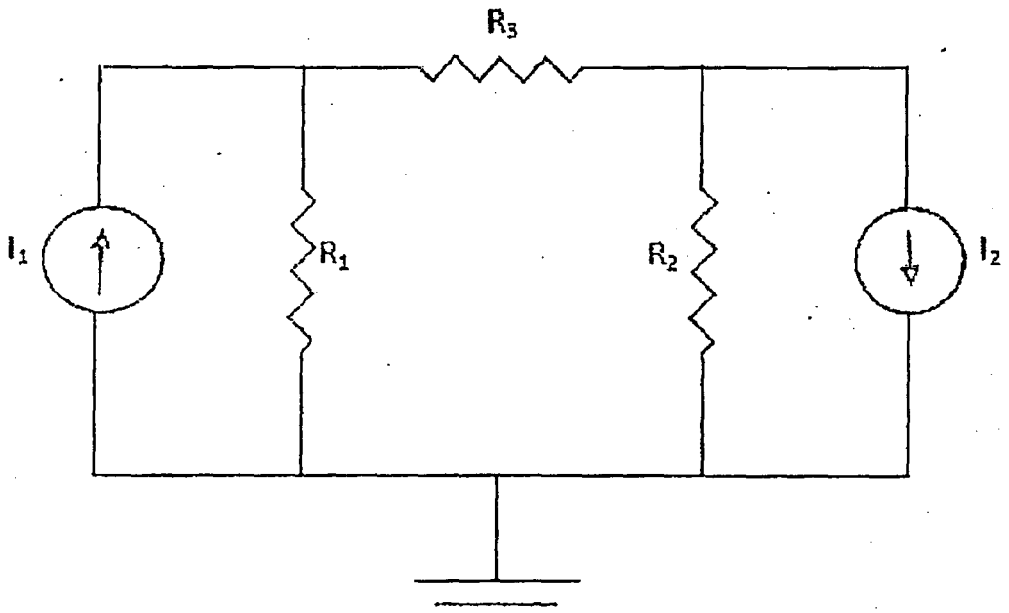
P.T.O.

6. (*a*) Explain the working of a transistor astable multivibrator. Obtain an expression for time period and draw the output waveform for both the transistors.

(*b*) Explain the working of a JFET. Draw and discuss the transfer and drain characteristics of an *n*-channel JFET. Also give its equivalent circuit. 7,8

7. (*a*) What is amplitude modulation ? Show that the amplitude modulated wave consists of carrier and two side bands.

(*b*) Determine the nodal voltages for the given network if $I_1 = 4$ A, $I_2 = 2$ A, $R_1 = 2\ \Omega$, $R_2 = 6\ \Omega$, $R_3 = 12\ \Omega$.



(*c*) Convert the following π to T network. 8,5,2