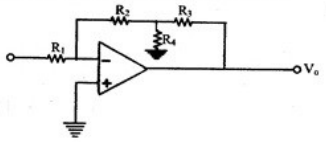
7. (*a*) Draw the circuit of differential amplifier. Find the output voltage. **(6)**

(*b*) Find the V_o of the following circuit :



(7)

(*c*) What is CMRR ? For a given op-amp CMRR = 10^4 and differential mode gain $A_d = 10^5$. What is the common mode gain A_C ? **(7)**

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B. TECH. Ist - Year

SECOND SEMESTER EXAMINATION, 2007-2008

TEC-201 BASIC ELECTRONICS

Time : 3 *Hours* *Maximum Marks : 100*

Note: Question No. 1 compulsory. Attempt any *Five* questions including Question No. 1. *All* questions carry equal marks.

1. Answer any 10 parts :

(*a*) Identify the components that constitute DC load in a BJT bias circuit.
(*b*) Write the expression for voltage gain in Differential amplifier.
(*c*) How can the output amplitude of phase shift oscillator be stabilized ?
(*d*) What is the need for cascade amplifier ?
(*e*) What is meant by ripple rejection ratio in voltage regulator ?
(*f*) Explain the difference between diffusion and transition capacitance.
(*g*) Explain the difference between BJT and FET.
(*h*) Sketch the output characteristics of CE transistor. Indicate the active, cut-off and saturation region.
(*i*) What is pinch-off voltage ?
(*j*) Sketch the circuit diagram of a Darlington pair.
(*k*) What is the effect of temperature on zener and avalanche breakdown ?
(*l*) Explain the difference between intrinsic and extrinsic semiconductors ?
(*m*) What is Thermal Runway ?
(*n*) Calculate the closed loop gain for negative feedback amplifier when $A_v = 100000$ and $\beta = 1/100$. **(20)**

2. (*a*) Define α and β of a transistor and derive the relationship between them. **(6)**

(*b*) Derive an expression for the dynamic resistance of a diode in forward bias and hence interpret graphically its variation with (*i*) Current (*ii*) Temperature . **(6)**

(*c*) Explain the formation of potential barrier in a *p-n* junction. Why is silicon preferred to germanium in the manufacturing of semiconductor device ?

Calculate the junction potential for a step graded Germanium p-n junction. It has $N_D = 103\ N_A$ and N_A corresponds to one atom, per 10^8 Germanium atoms. Assume $n_i = 2{\cdot}5 \times 10^{13}/cm^3$ and atom density of Ge = $4{\cdot}4 \times 10^{22}$ atoms $/cm^3$. **(8)**

3. (*a*) Describe the Hall effect. Find the magnitude of a Hall voltage V_H in *n* type germanium semiconductor having majority carrier concentration $N_D = 10^{17}/cm^3$, d = 3 mm, $E_x = 5$ V/cm, $B_Z = 0{\cdot}1$ wb/m^2, $\mu_n = 3800\ cm^2/v\text{-}s$. **(6)**

(*b*) What is meant by Fermi level in semiconductors. Prove that the Fermi level in intrinsic semiconductor lies in the middle of energy band gap. **(6)**

(*c*) What is law of mass action ? A sample of silicon at I = 300 K is doped with boron at a concentration of $2{\cdot}5 \times 10^{13}/cm^3$. What type of material it is ? Find the concentration of holes and electrons. Assume m = $1{\cdot}5 \times 10^{10}/cm^3$. **(8)**

4. (*a*) What are hybrid parameters ? Derive the h-parameters for a two port network. **(7)**

(*b*) An operational amplifier is to have a voltage gain of 50. Determine the required values of the external resistors R_1 and R_F if

(*i*) A non-inverting amplifier,

(*ii*) An inverting amplifier is required. **(7)**

(*c*) Realize the all other gates using NAND gate only. **(6)**

5. (*a*) Sketch a *npn* transistor CE amplifier circuit that uses fixed bias. Include a capacitor coupled signal source and load resistor. Explain the circuit operation. **(10)**

(*b*) Draw the circuit of the transformer coupled class – A amplifier. Get the expression for the efficiency of class A-amplifier. List the applications. **(10)**

6. (*a*) Convert the following numbers :-

(*i*) $(110110.000101)_2 = (\ldots\ldots\ldots)_8$

(*ii*) $(1BE)_8 = (\ldots\ldots)_{16} = (\ldots\ldots\ldots)_2$

(*iii*) Solve without changing the base :

$$(432)_5 - (124)_5$$ **(5)**

(*b*) Simplify the following expression using K-map method :

$$f(wxyz) = \Sigma\, m(1,4,8,12,13,15) + d\,(3,14)$$ **(5)**

(*c*) Define the following terms :

(*i*) Break-down voltage

(*ii*) Ripple factor

(*iii*) Pinch-off voltage

(*iv*) Drift and diffusion **(10)**