Total number of printed pages : 8

B. TECH.
CPES 5202

2nd Year Supplementary Exam., June – 2005

ANALOGUE ELECTRONICS CIRCUITS

Full Marks : 70

Time : 3 Hours

Answer question No. 1 which is compulsory and any four questions from the rest.

The figures in the right-hand margin indicate marks for the questions.

1. Answer the following : 2×10

   (a) How are the emitter-base junction and collector-base junction of a pnp transistor biased when the transistor is to work under

   (i) forward bias

   (ii) saturation.

P.T.O.

(b) Two BJTs with $\beta = 80$ and 120 form a Darlington pair.

(i) Show the Darlington connection

(ii) What is the β of the Darlington pair ?

(c) Three voltage amplifiers with gain and bandwidth ($A_1 = 100$, $BW_1 = 20$ kHz), ($A_2 = 10$ dB, $BW_2 = 20$ kHz) and ($A_3 = 120$, $BW_3 = 20$ kHz) are connected in cascade. Calculate :

(i) Overall gain in dB

(ii) Overall bandwidth.

(d) In squarewave testing of an audio amplifier a 5 kHz squarewave singnal was applied at the input of the amplifier. The output wave form seen on the screen of oscilloscope records 10% rise of amplitude in 3 μs and 90% rise in 20 μs. Determine the bandwidth of the amplifier.

(e) For sustained oscillation in a feedback oscillator which is true and why ?

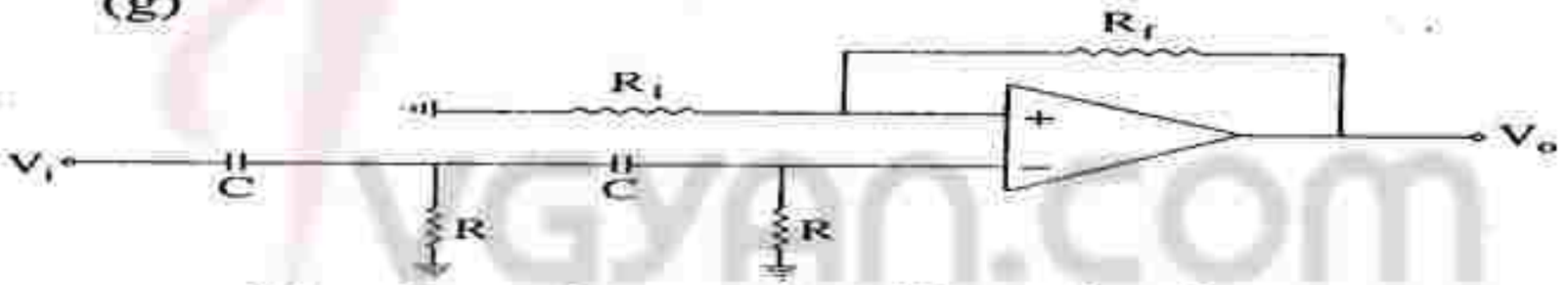
(i) $A\beta = 1$

(ii) $A\beta < 1$

(iii) $A\beta > 1$.

(f) The input voltages to the inverting and non-inverting terminals of an op-Amp are respectively $V_{i1} = 200\ \mu V$ and $V_{i2} = 140\ \mu V$. The differential gain $A_d = 6000$ and CMRR $= 10^5$. Determine the ouput voltage.

(g)



The above is an active filter circuit.

(i) Name the type and plot the gain vrs frequency response.

(ii) What is the slope at cut off frequency point ?

(h) Show that the small signal low frequency h-parameters h_{11}, h_{12}, h_{21} and h_{22} can be graphi-

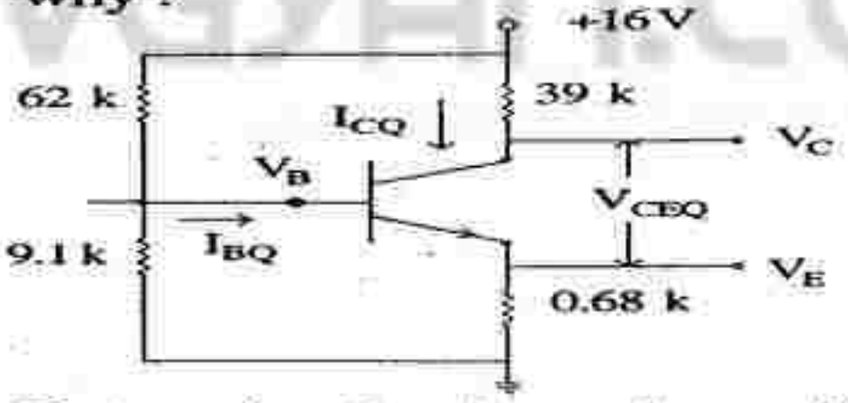
cally determined from the V-I characteristic of a transistor.

(i) Why is it that maximum power conversion efficiency increases to 50% when it is transformer conpled class A type power amplifier where as series-fed class type has it only 25% ?

(j) Why emitter-follower or source-follower amplifier is used as buffer between two amplifier stages ?

2. (a) Among the different DC biasing circuits namely Fixed bias, emitter stabilized bias, voltage divider bias and Bias with voltage feedback, which one ensure better stabilisation of operating point and why ? 4

(b)

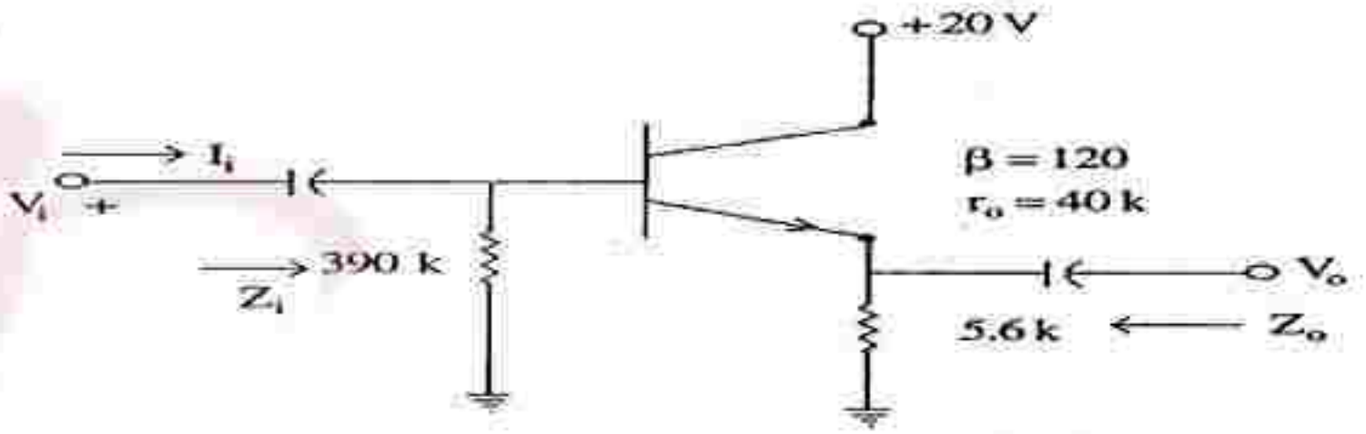


Silicon transistor
$\beta = 80$

Determine the d.c. values of I_{BQ}, I_{CQ}, V_{CEQ}, V_C, V_E and V_B. 8.5

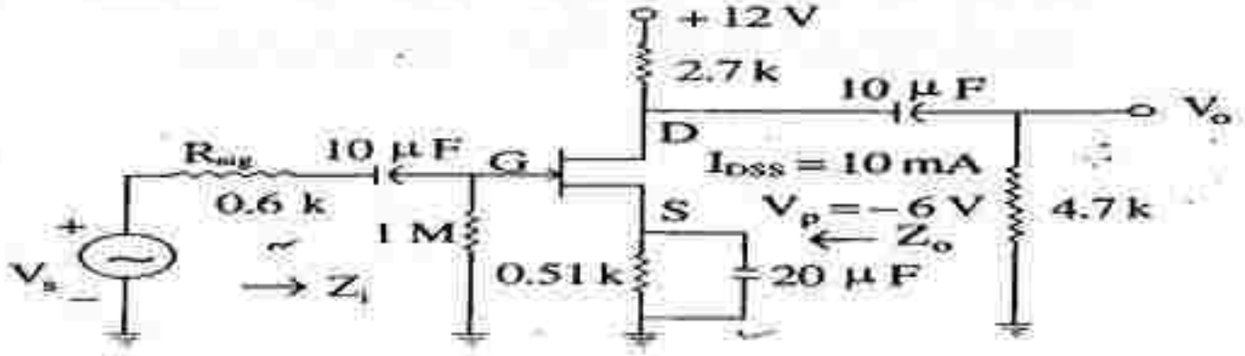
3. (a) Derive the small signal low-frequency a.c. equivalent circuit of a bi-polar transistor. Interpret h_{11}, h_{12}, h_{21} and h_{22}. 4

(b)



Draw the a.c. equivalent circuit. Determine Z_i, Z_o, A_v and A_I. 8.5

4. (a)



For the above JFET $I_{DSS} = 10$ mA and $V_p = -6$V.

(i) Draw the small signal equivalenct circuit.

(ii) Determine the no load voltage gain A_{VNL} and Z_i and Z_o.

(iii) Draw the 2-port model using parameters determined at (ii).

(iv) Determine the loaded voltage gain using (iii).

12.5

5. (a) For R-C low pass and high pass filters derive the expressions for cut off frequencies. 4

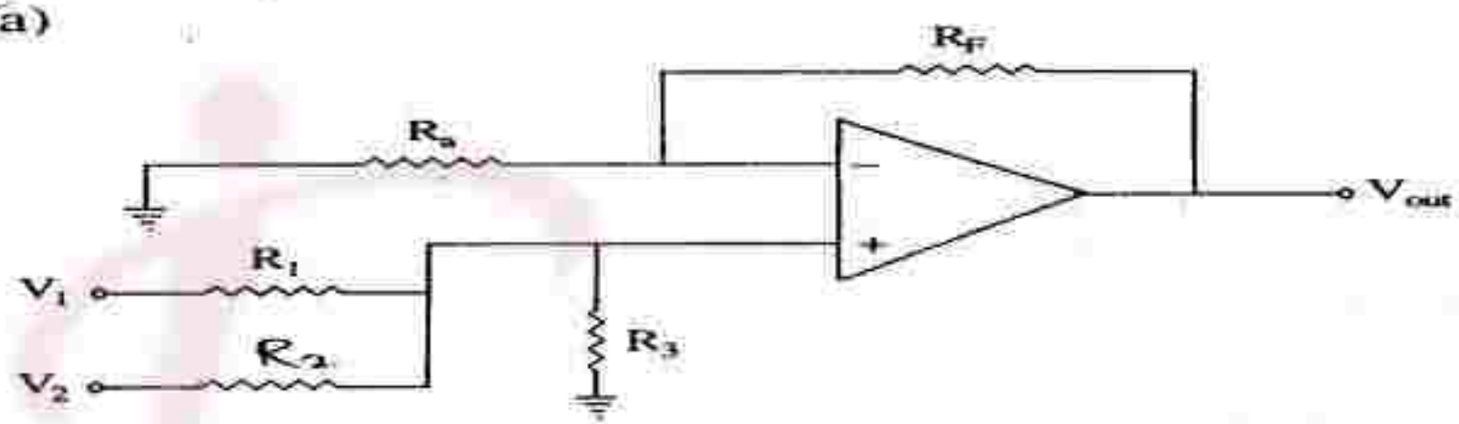
(b) For the amplifier circuit of Q. No. 4 determine the lower cut off frequencies. Plot the gain frequency response (Bode plot). 8.5

6. (a) Draw the four basic types of feedback amplifiers in block schematic form. which types ensure higher input impedance and lower output impedance ? 4

(b) For voltage-series type of feedback amplifier derive expressions for Z_{if}, Z_{of}, and A_{vf}. For

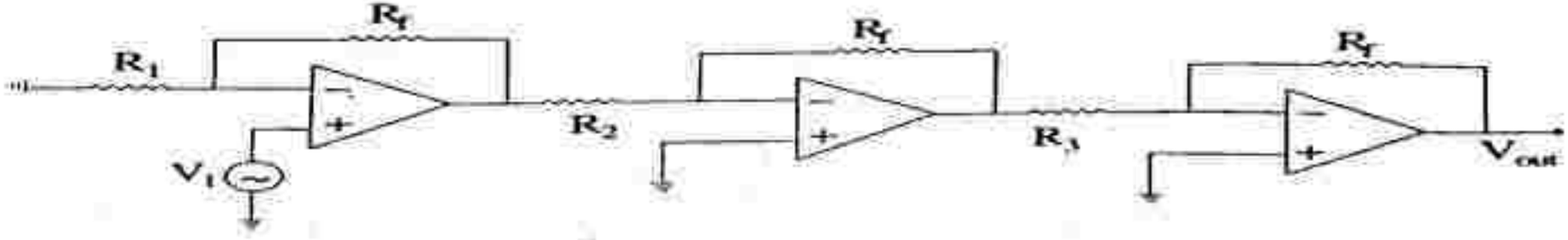
$A_v = -300$, $Z_i = 1.5$ k, $Z_o = 50$ k and feedback factor $\beta = -\frac{1}{15}$, calculate the value of Z_{if}, Z_{of} and A_{vf}. 8.5

7. (a)



Find an expression for V_{out}. 6.5

(b)



If $V_1 = 50\ \mu v$, $R_1 = 4.7$ k, $R_2 = 47$ k, $R_3 = 47$ k and $R_f = 470$ k, find the overall gain of the amplifier. 6

8. (a) Draw a circuit diagram of transformer compled class B push-pull power amplifier. Show that a perfect push-pull connection eliminates even harmonic distortions. 6

(b) For a class B power amplifier providing 22 V peak signal to an 8-ohm load and a power supply of 25 V, determine

(i) input power

(ii) output power

(iii) circuit efficiency.

6.5