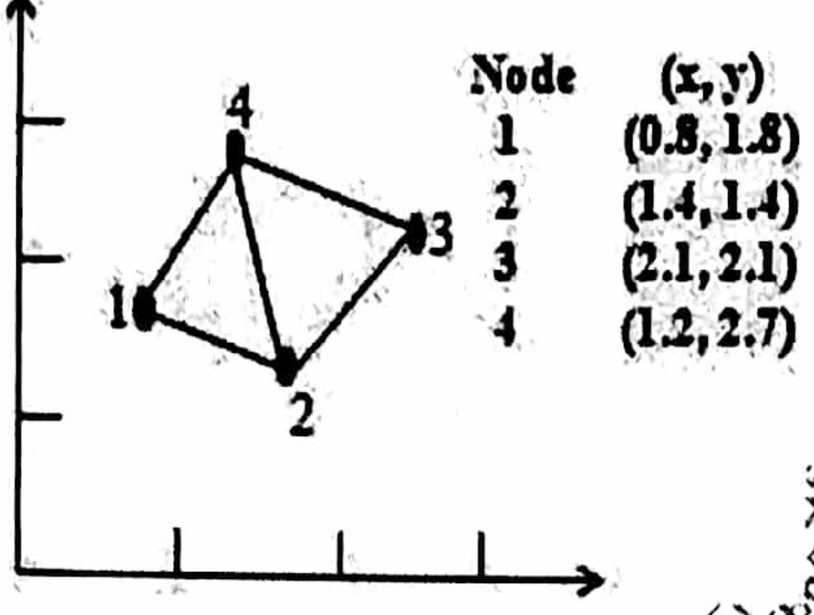
Q4. **(a)** Obtain reflection coefficient and transmission coefficient for perpendicularly polarized wave incident on a dielectric-dielectric boundary with oblique incidence. Define the Brewster angle for this case.

(b) Consider the two element mesh shown in the fig below. Using the finite element method, determine the potentials within the mesh.



Node	(x, y)
1	(0.8, 1.8)
2	(1.4, 1.4)
3	(2.1, 2.1)
4	(1.2, 2.7)

Q5. **(a)** What is the loss tangent of a material? How does it classify materials?

(b) Derive Helmholtz equations.

(c) A point charge $Q_1 = 10\mu C$ is located at $P_1(1, 2, 3)$ in free space, while $Q_2 = -5\mu C$ is at $P_2(1, 2, 1)$.

(a) Find the vector force exerted on Q_2 by Q_1.

(b) Find the coordinates of P_3 at which a point charge Q_3 experiences no force.

Q6. **(a)** A 5nC point charge is located at A(2, -1, -3) in free space. Find E, at the origin. [0

(b) Define skin depth. Most microwave ovens operate at 2.45GHz. Assume $\sigma = 1.1 \times 10^7$ mho/m and $\mu_r = 600$ for the stainless steel interior. Find the depth of penetration. [0

(c) Explain Ducting. State the conditions under which a duct is formed. [0

(d) With respect to the application of Electromagnetic Waves, explain the working of an Electromagnetic Pump. [0

| IV | Extc / EDC - II

17/5/2018

Q.P. Code: 40107

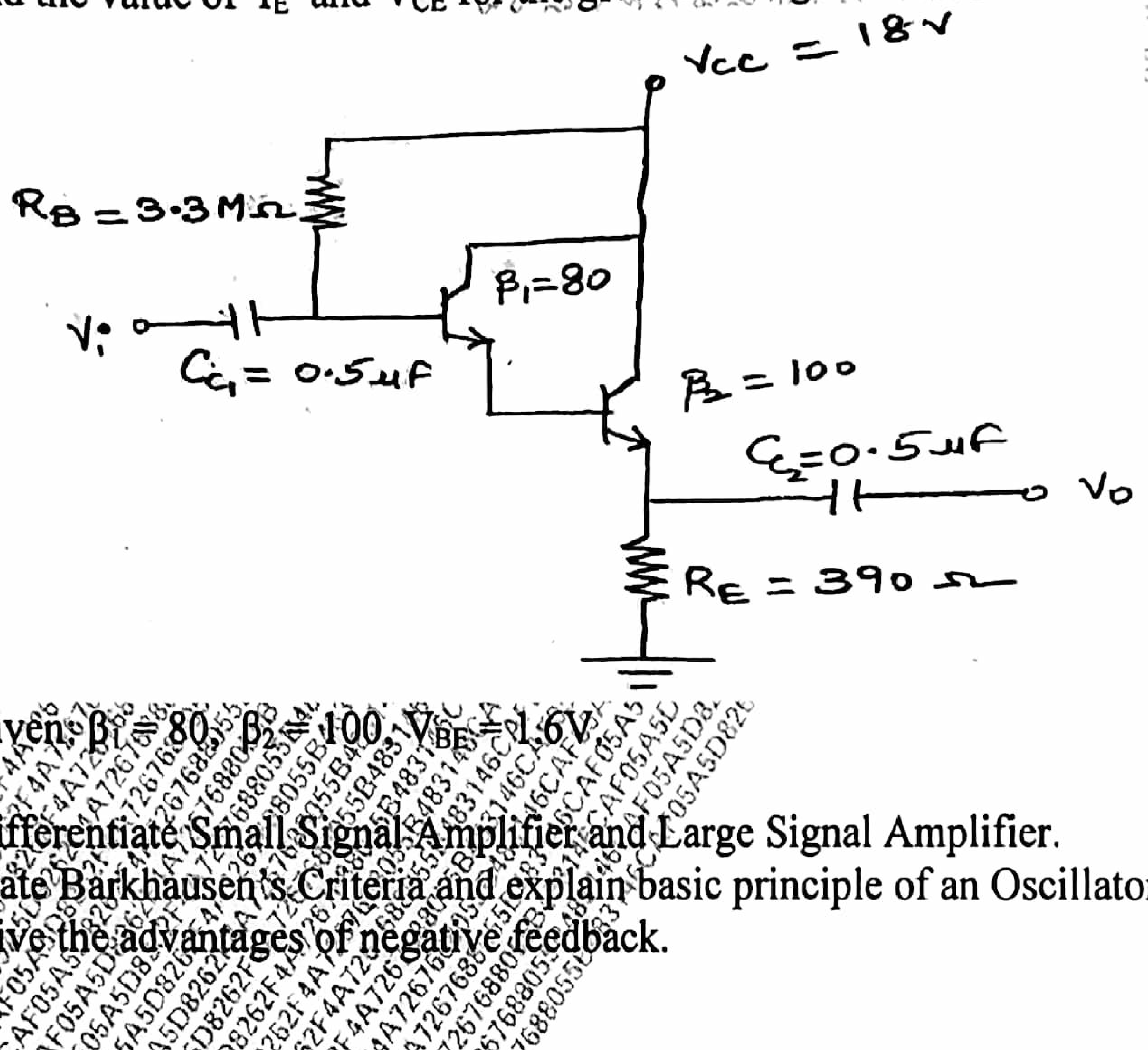
(3 Hours) [Total Marks: 80]

3. (1) Question No. 1 is **compulsory.**
(2) Solve any **three** questions from remaining **five** questions.
(3) **Figures** to the right indicate **full marks.**
(4) Assume suitable data if necessary and mention the same in answer sheet.

Attempt any **Four** of the following: **20**

a) Draw a neat labelled diagram of Depletion Type MOSFET and explain its operation.

b) Find the value of I_E and V_{CE} for the given Darlington configuration:



Given: $\beta_1 = 80$, $\beta_2 = 100$, $V_{BE} = 1.6V$

c) Differentiate Small Signal Amplifier and Large Signal Amplifier.

d) State Barkhausen's Criteria and explain basic principle of an Oscillator.

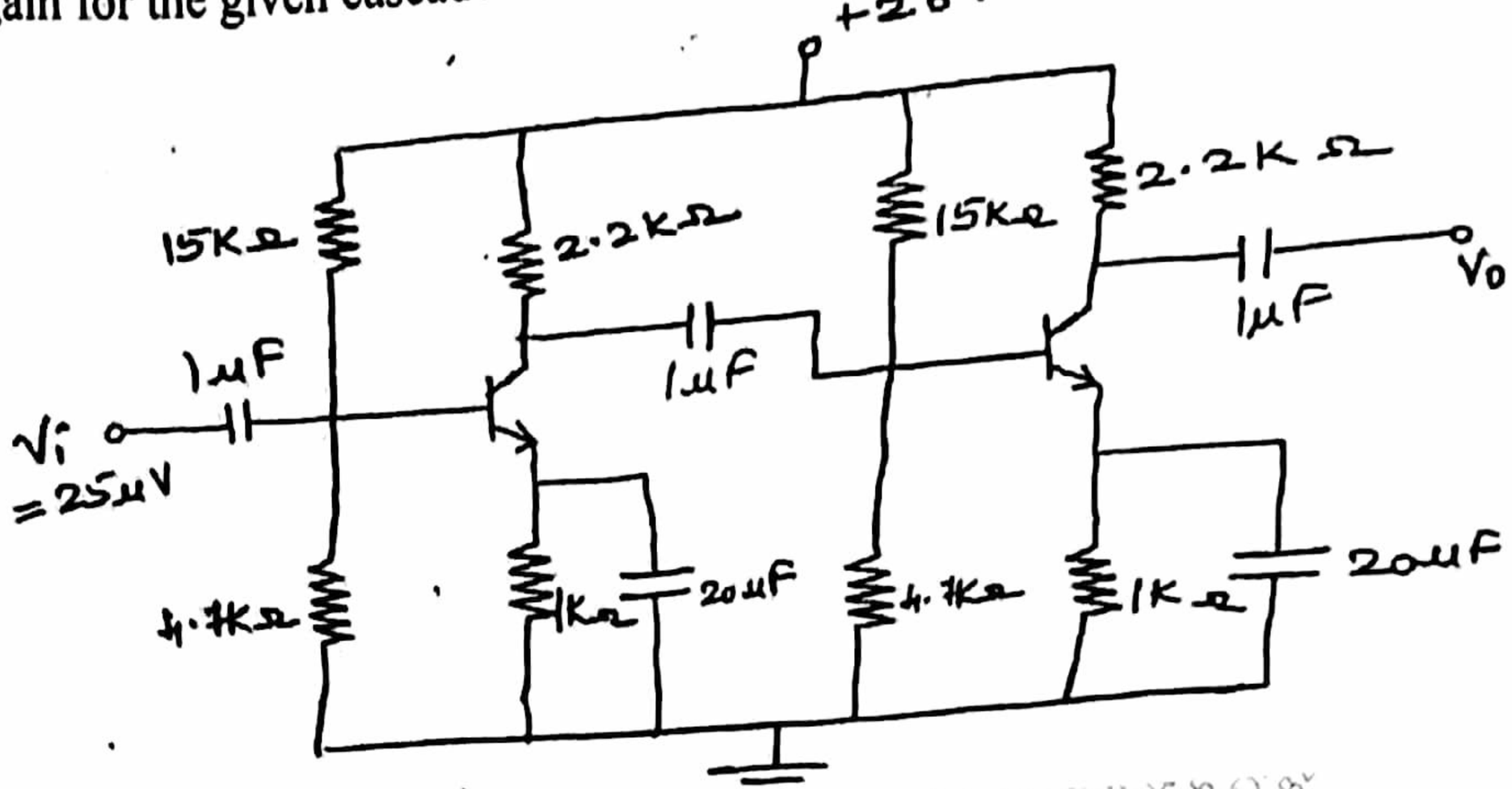
e) Give the advantages of negative feedback.

(a) Design a two stage RC coupled CS Amplifier to meet following specifications: $A_v \geq 100$, $V_o = 4V$, $I_{DQ} = 1.2\ mA$, $f_L = 20\ Hz$. **15**

Assume: g_{mo}=5m℧, I_{DSS}=7mA, r_d= 50kΩ, V_P=−4V. Assume suitable V_{DD}.

(b) Compare RC Coupled, Direct Coupled and Transformer Coupled Amplifiers. **05**

Determine input impedance, output impedance, voltage gain and current gain for the given cascaded BJT amplifier as shown in the figure below: **10**



Given: $h_{fe} = 200$ and $h_{ie} = 1.3k\Omega$.

Find the necessary condition for oscillations to occur and frequency of oscillations of Hartley Oscillator. Also, explain its working. **10**

With the help of neat block diagram, derive expression for R_{IF}, R_{OF}, G_{mF} for Current Series Negative Feedback Amplifier. Give significance of the above mentioned parameters. **08**

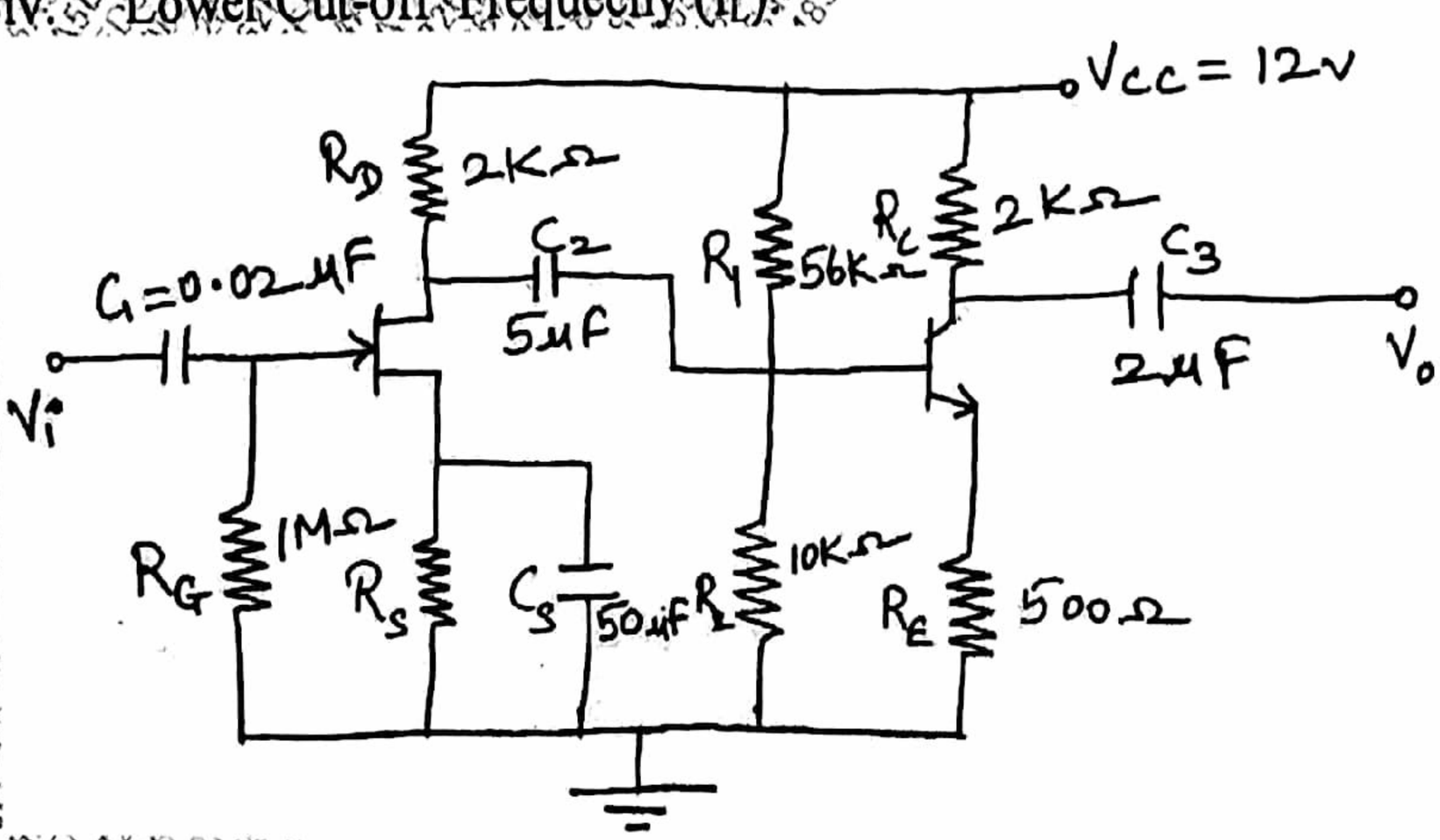
For the circuit shown below, determine the following: **12**

i. R_S

ii. Q-point of each stage.

iii. AC equivalent model.

iv. Lower Cut-off Frequecny (f_L).



Given: $V_{GS} = -1V$, $I_{DSS} = 8mA$, $V_P = -4V$ for JFET and $h_{ie} = 1k\Omega$, $h_{fe} = 100$, $V_{BE} = 0.6V$ for BJT.

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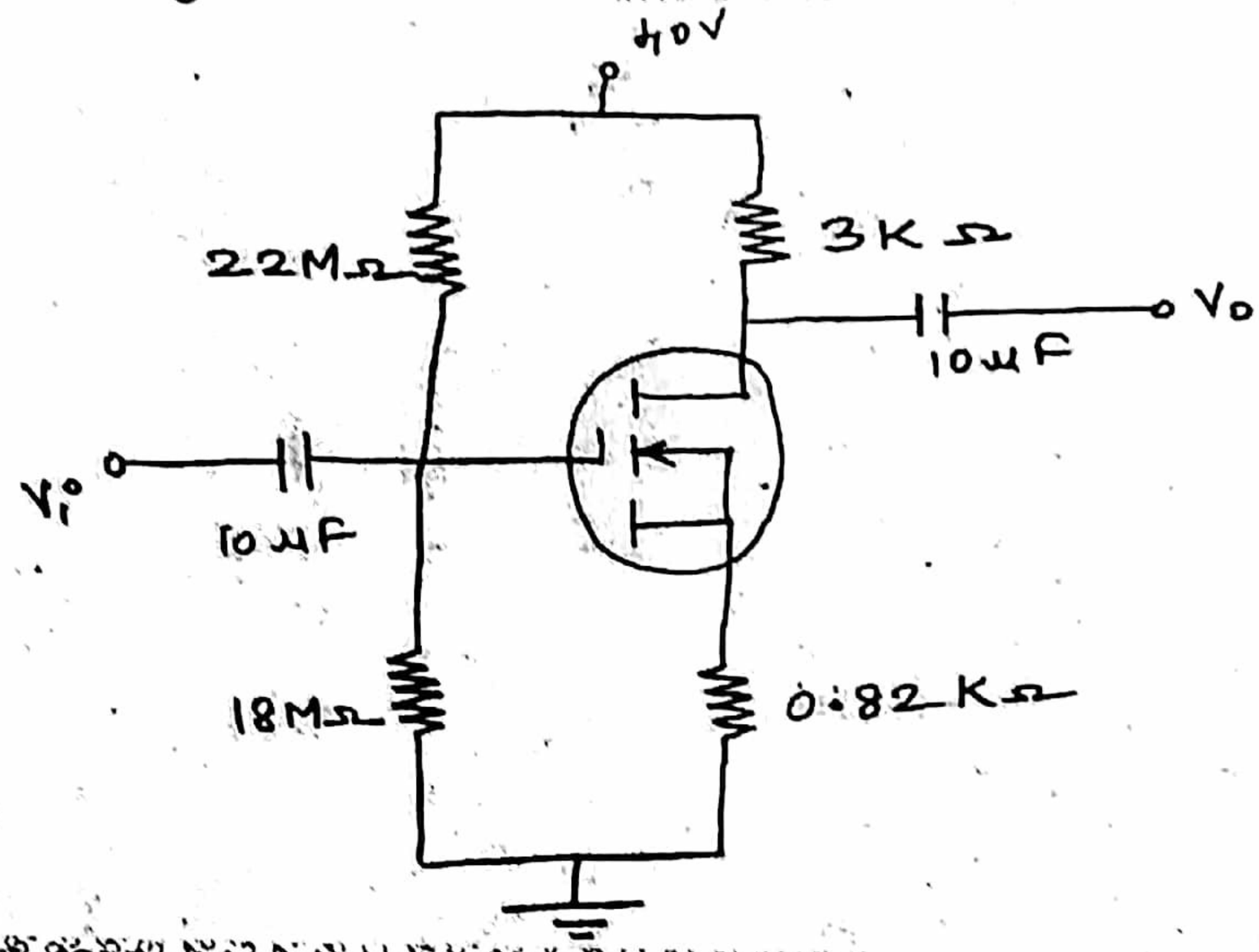
Design an RC phase shift Oscillator to generate 5kHz sine wave with 20V peak to peak amplitude. Assume $h_{fe} = 150$ and $h_{ie} = 1k\Omega$. **10**

Draw circuit diagram of Class B Push Pull Power amplifier and explain its working. Find its maximum efficiency and maximum power dissipation in each transistor. What is cross-over distortion? How it can be overcome? **10**

Determine I_{DQ} and V_{DSQ} for the given network of Enhancement type MOSFET arrangement. **05**



Given $I_{D(ON)} = 3mA$, $V_{GS(ON)} = 10V$, $V_{GS(Th)} = 5V$.

In Colpitts Oscillator $C_1 = 0.2\mu F$, $C_2 = 0.02\mu F$. If the frequency of oscillator is 10 kHz, find the value of inductor. Also, find the required gain for oscillation. **05**

Write a Short Note on: Cascode Amplifier. **10**