

Seat  
No.

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मध - 017

## Semiconductor Devices and Circuits (1050)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Use of programmable calculator is not allowed.
6. Assume suitable data wherever necessary.

### UNIT - I

1. Attempt **any two**.

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- a) Draw and explain V-I characteristics of diode. Also explain diode current equation.
- b) State mass - action law. Find out the conductivity of Si for -
  - i) Intrinsic condition at room temp.
  - ii) With donor impurity of 1 in  $10^8$ .
  - iii) With acceptor impurity of 1 in  $5 \times 10^7$ .
  - iv) With both the above impurities added simultaneously.

Given  $n_i$  for Si at  $300^\circ\text{K} = 1.5 \times 10^{10} / \text{cm}^3$

$$\mu_n = 1300 \text{ cm}^2 / \text{v} - \text{s}$$

$$\mu_p = 500 \text{ cm}^2 / \text{v} - \text{s}$$

Number of Si atoms =  $5 \times 10^{22} / \text{cm}^3$

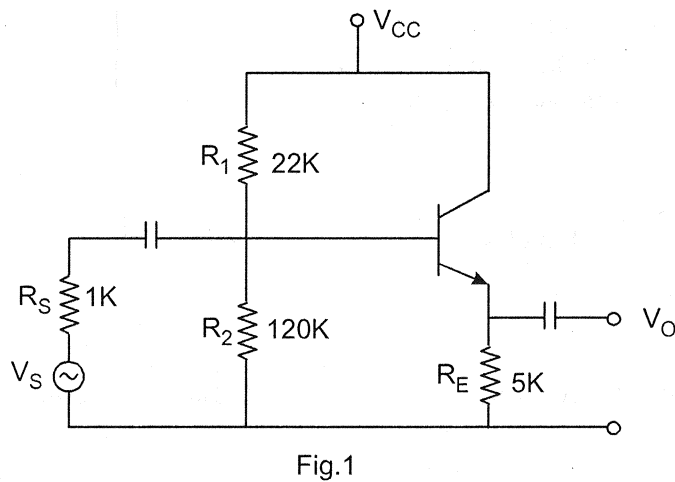
- c) Derive the expression for ripple factor of a FWR with capacitor filter.

## UNIT - II

2. Attempt **any two**.

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- Draw collector to base bias ckt & derive expression for  $I_{CQ}$ ,  $V_{CEQ}$  & the stability factor 's'.
- Explain different bias compensation techniques in detail.
- For the ckt shown in fig. 1 determine  $A_i$ ,  $R_i$ ,  $A_v$  &  $R_o$ .  
Using approximate analysis.



Given  $h_{ie} = 1.5 \text{ k}$   
 $h_{fe} = 85$   
 $h_{oe} = 2 \times 10^{-6}$   
 $h_{re} = 2.5 \times 10^{-4}$

Fig.1

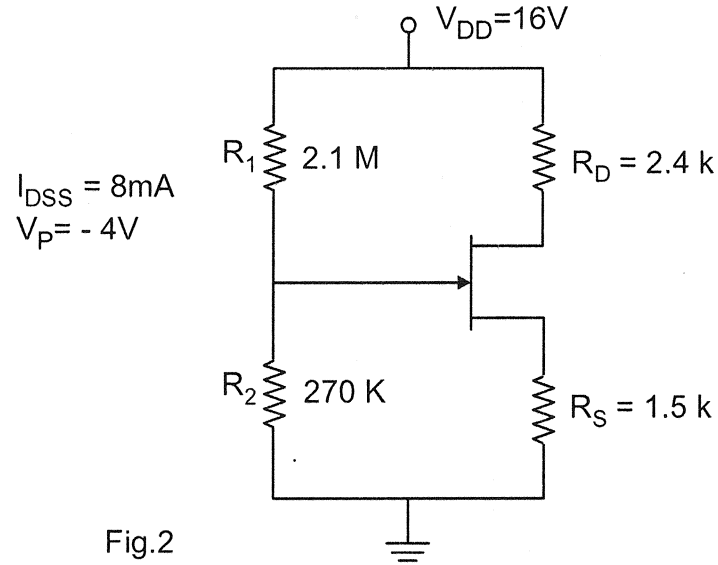
## UNIT - III

3. Attempt **only two**.

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- Write short notes on :
  - FET parameters.
  - V-I characteristics of n-channel FET.

- b) For the circuit shown in fig. 2 determine the Q-points analytically.



- c) Explain in detail the potential divider biasing scheme in FET.

#### UNIT - IV

4. Attempt **any two**.

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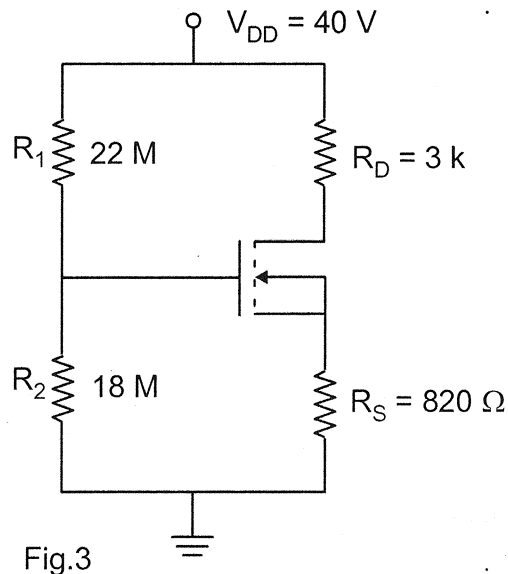
- With neat diagram & O/P characteristics of P-channel enhancement MOSFET, explain its working in detail.
- Write short notes on -
  - Power MOSFET.
  - Body Effects in MOSFET.

- c) For the ckt. shown in fig. 3 determine the Q - points  $I_D$ ,  $V_{DS}$  &  $V_{GS}$ .

Assume  $I_{D(on)} = 3\text{mA}$

$V_{GS(on)} = 10\text{V}$

$V_{GS(Th)} = 5\text{V}$



### UNIT - V

5. Attempt **any two**.

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- Derive the expression for  $F_{Ln}$  &  $F_{Hn}$  for n-stage cascade amplifier.
- Derive an expression for  $f_L$  &  $f_H$  for square wave testing of an amplifier.
- Write short notes on -
  - Effect of coupling & bypass capacitor on frequency response of BJT.
  - Gain - Bandwidth product.

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