

3E2072	Roll No. : _____	Total Printed Pages : 7
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	B. Tech. (Sem. III) Examination, January - 2013 Information Tech. 3CS2 & 3IT2 Electronics Devices & Circuits	

Time : 3 Hours]

[Total Marks : 80

[Min. Passing Marks : 24

Attempt any five questions. Selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL

2. NIL

UNIT - I

1. (a) Explain the formation of potential barrier in a PN junction diode. Derive an expression for contact potential. Also, describe qualitatively, how the width of this layer changes with the applied voltage ?

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(b) Draw the neat circuit of a voltage Doubler ? Explain its operation with its output waveform for the voltage across the two capacitors.

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(c) For a particular semiconductor material $n_c = 1.5 \times 10^{24} / m^3$

$n_v = 1.3 \times 10^{25} / m^3$ and $E_G = 1.43 eV$ at $300k$.

(i) Determine the intrinsic carrier concentration of the semiconductor at $T=300k$.

(ii) Determine the effective masses M_e and M_h of electron and holes respectively.

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OR

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[Contd...

1

- (a) What do you mean by energy density function ? Estimate the position of fermi level in conductor having N number of free electron per CC. Deduce all steps necessary for deriving the threshold. 8
- (b) Prove that the magnitude of maximum electric field E_m at a graded (step) junction with $N_A \gg N_D$ is given by $E_m = \frac{2V_j}{W}$, where W is the thickness of depletion layer. 8

UNIT - II

- 2 (a) Explain different components of current flowing through the structure of a NPN transistor. How the emitter's injection efficiency and base transport factor influences the amplification factor ? 8
- (b) For the circuit shown in **fig. 2.1**, assuming $h_{FE} = 100$ and $V_{BE} = 0.8V$, determine,
- (i) if the silicon transistor is in cutoff, saturation or active region.
 - (ii) Find V_C .
 - (iii) Find the minimum value for base resistor for which the transistor operates in active region.

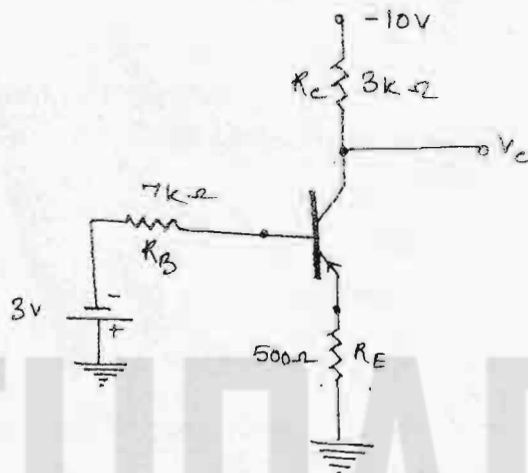


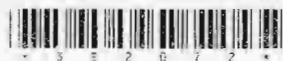
Figure 2.1

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OR

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- 2 (a) Show by means of a circuit diagram, how a BJT can be used as a diode. 4
- (b) Calculate the maximum and minimum collector current in the circuit as given in fig. 2.2.

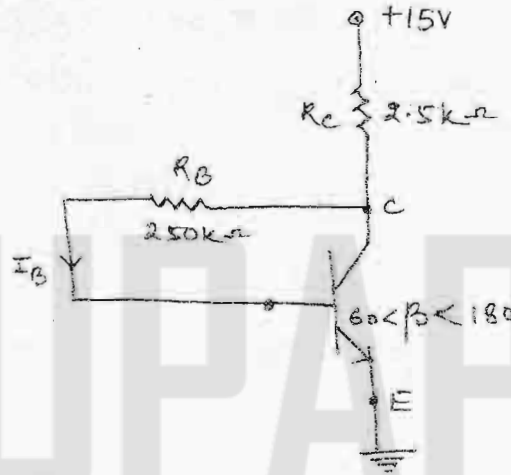


Figure 2.2.

- (c) What do you understand by Thermal resistance of BJT? Explain its significance. To ensure thermal stability of a BJT, it is necessary that $V_{CE} = \frac{1}{2} V_{CC}$. Justify the above statement. 6

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UNIT - III

- 3 (a) Explain the transfer characteristics of a N-channel and P-channel MOSFET along with their output characteristics of N-channel enhancement MOSFET. 6
- (b) Analyze the circuit given in fig. 3.1, to determine the voltage gain.

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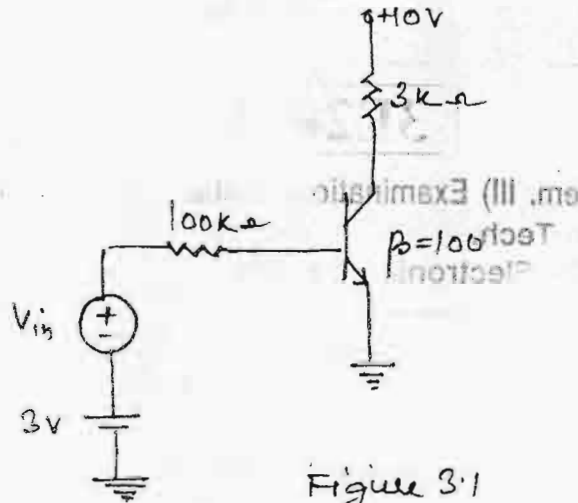


Figure 3.1

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(c) Calculate Z_{in} , Z_{out} and A_v for the circuit given in fig. 3.2.

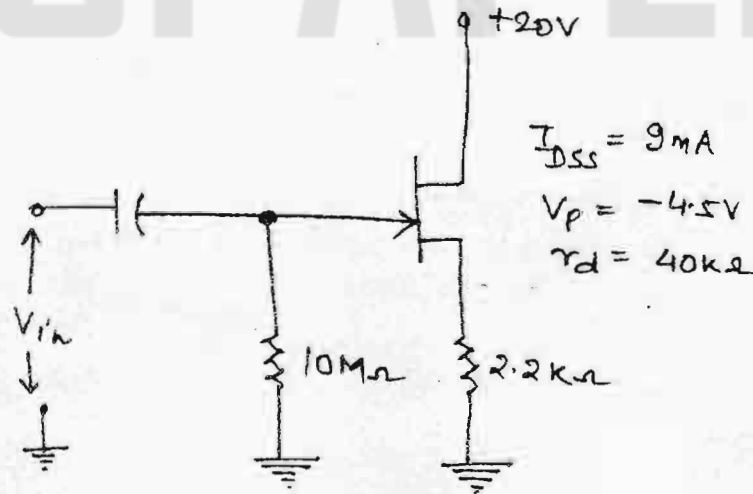


Figure 3.2

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OR

3 (a) Explain the meaning of Pinch off voltage in a JFET. How does the current flow in a JFET after Pinch-off point? Also, explain the terms related to JFET.

- (i) g_m
- (ii) r_d
- (iii) μ

8



- (b) In a CE amplifier, shown in fig. 3.3, employing emitter feedback, find :
- (i) R_{in}
 - (ii) R_{ac}
 - (iii) A_v
 - (iv) A_p and
 - (v) G_p

Take $\beta = 100$. How will these values change, if emitter bypass capacitor is removed ?

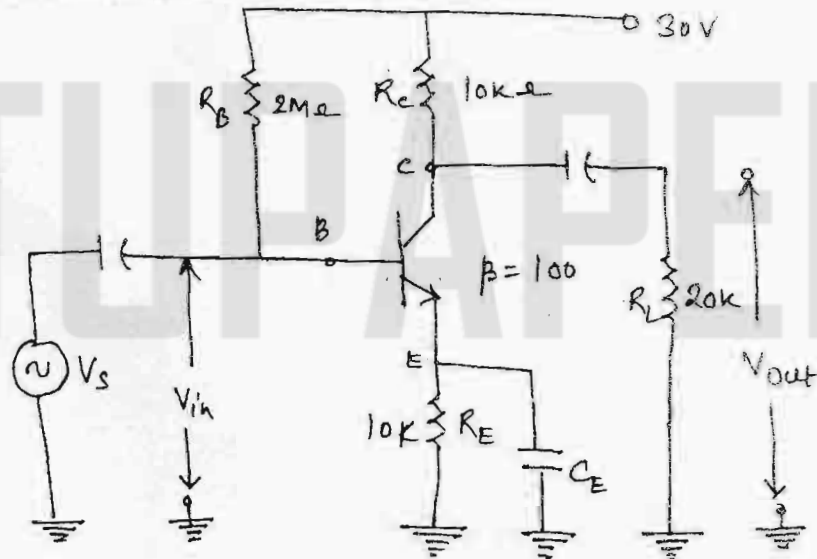


Figure 3.3.

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UNIT - IV

- 4 (a) Discuss the biasing problem in darlington pair. How it is solved ? Explain boots trapping principle and how effectively it is used in darlington pair.

8

- (b) A negative feedback amplifier in voltage series configuration feeds 10% of the output back to the input. Voltage gain of the amplifier without feedback is 100. Input and output resistances are $10\text{ k}\Omega$ and $1\text{ k}\Omega$ respectively. Find % reduction in voltage gain, input resistance and output resistance with feedback.

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OR

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[Contd...

4 (a) The circuit of a given fig. 4.1, has the following parameters :

$$R_c = 4k\Omega, \quad h_{ie} = 1.1k\Omega, \quad R' = 40k\Omega, \quad h_{fe} = 50, \quad R_s = 10k\Omega.$$

$$h_{re} = h_{oe} = 0.$$

Find :

- (i) A_{vf}
- (ii) R_{inf}
- (iii) R'_{outf}

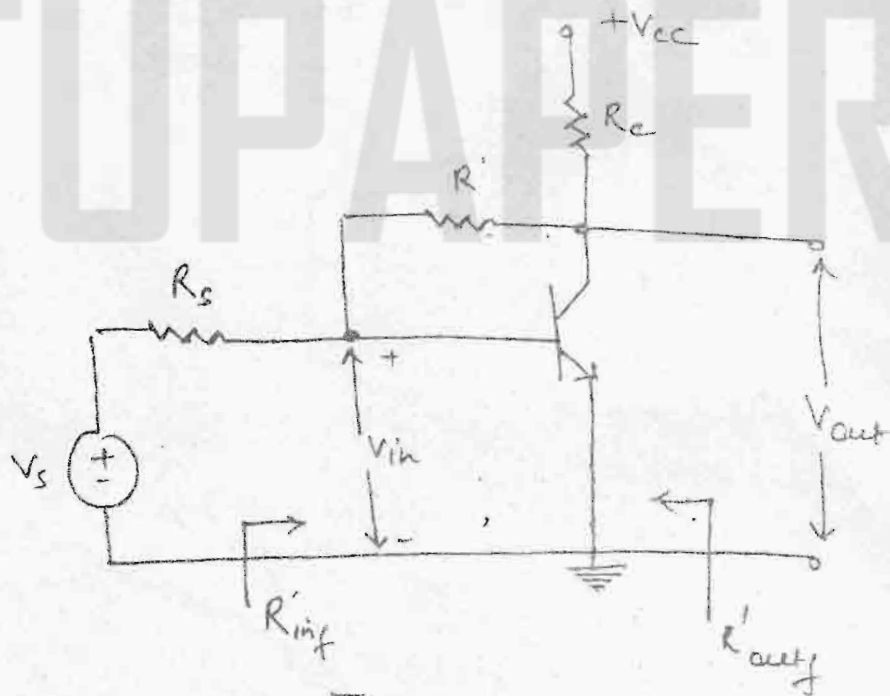


Figure 4.1

(b) Explain the working of an emitter follower and show how it performs the function of impedance transformation.

UNIT - V

- 5 (a) Write short note on :
- (i) Hartley oscillator
 - (ii) Crystal oscillator

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5×2

- (b) A Colpitt's oscillator is designed with $C_1 = 100 \text{ pF}$ and $C_2 = 7500 \text{ pF}$. The inductance is variable. Determine the range of inductance values, if the frequency of oscillation is varied between 950 kHz and 2050 kHz.

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OR

- 5 (a) Show that the gate width of a collector-coupled monostable multivibrator is $0.69 RC$.

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- (b) Calculate the component values of monostable multivibrator developing an output pulse of $500 \mu\text{s}$ duration. Assume,

$$h_{ie(\text{min})} = 25; \quad I_{CE(\text{sat})} = 5 \text{ mA}; \quad V_{CC} = 10 \text{ V}; \quad V_{BB} = -4 \text{ V};$$

$$V_{CE(\text{sat})} = 0.4 \text{ V} \quad \text{and} \quad V_{BE(\text{sat})} = 0.8 \text{ V};$$

$$I_{B2(\text{actual})} = 1.5 \times I_{B2(\text{min})}; \quad V_{BE(\text{off})} = -1 \text{ V}.$$

10

