3E2072

Roll No. : _____ Total Printed Pages : 7

# 3E2072

**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 $M_n$ of electron and holes respectively.

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OR

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.

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(b) Prove that the magnitude of maximum electric field $E_m$ at a graded (step) junction with $N_A >> N_D$ is given by $E_m = \frac{2V_j}{W}$, where W is the thickness of depletion layer.

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## 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 ?

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(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.

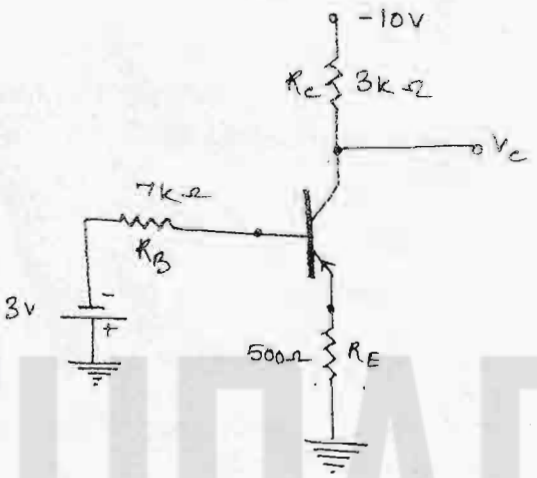


Figure 2.1

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OR

2 (a) Show by means of a circuit diagram, how a BJT can be used as a doide.

4

(b) Calculate the maximum and minimum collector current in the circuit as given in **fig. 2.2.**

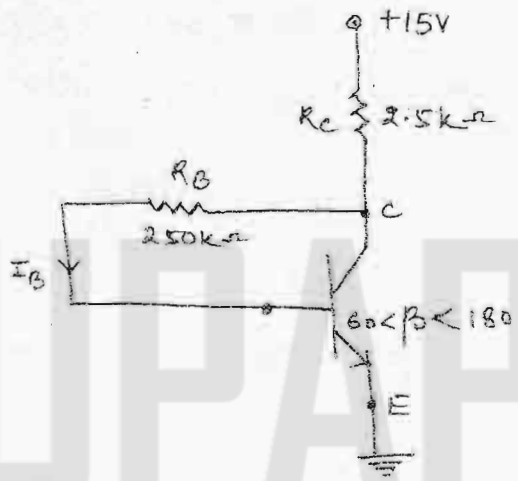


Figure 2.2.

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

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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.

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(b) Analyze the circuit given in **fig. 3.1**, to determine the voltage gain.

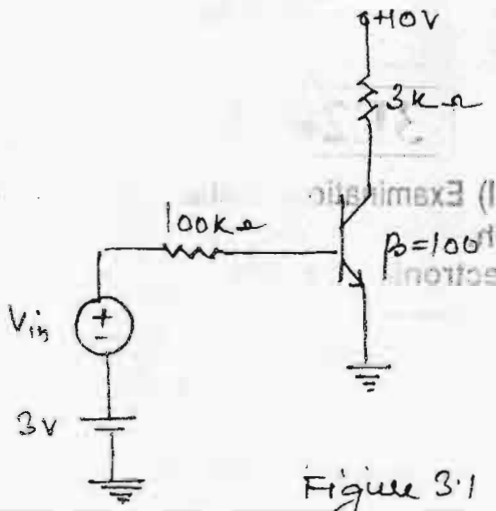


Figure 3.1

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

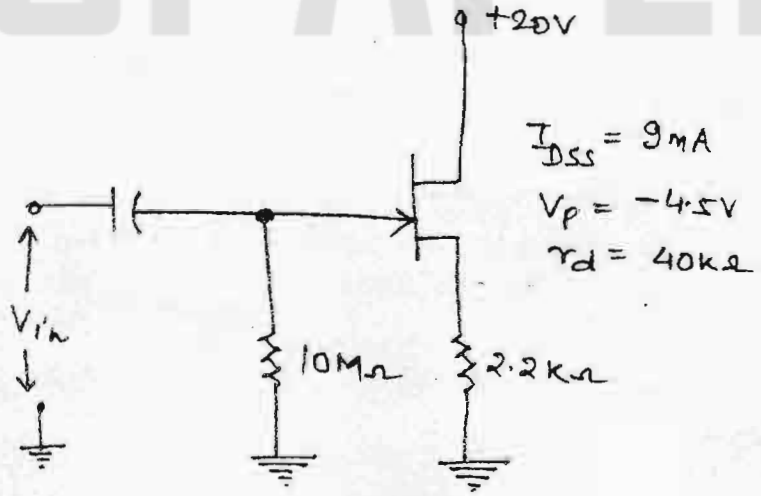


Figure 3.2

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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) $\mu$

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(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 ?

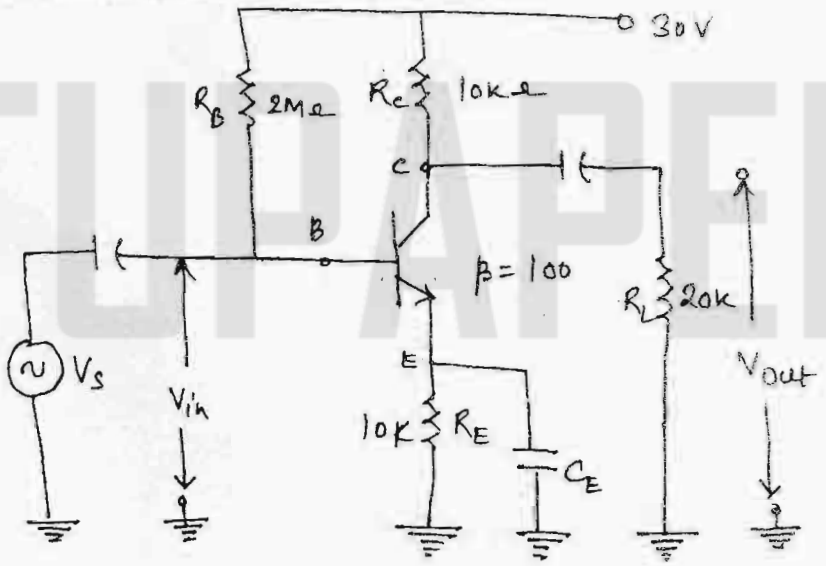


Figure 3.3.

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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.

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

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**OR**

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

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

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

Find :

(i) $A_{vf}$

(ii) $R_{inf}$

(iii) $R'_{outf}$

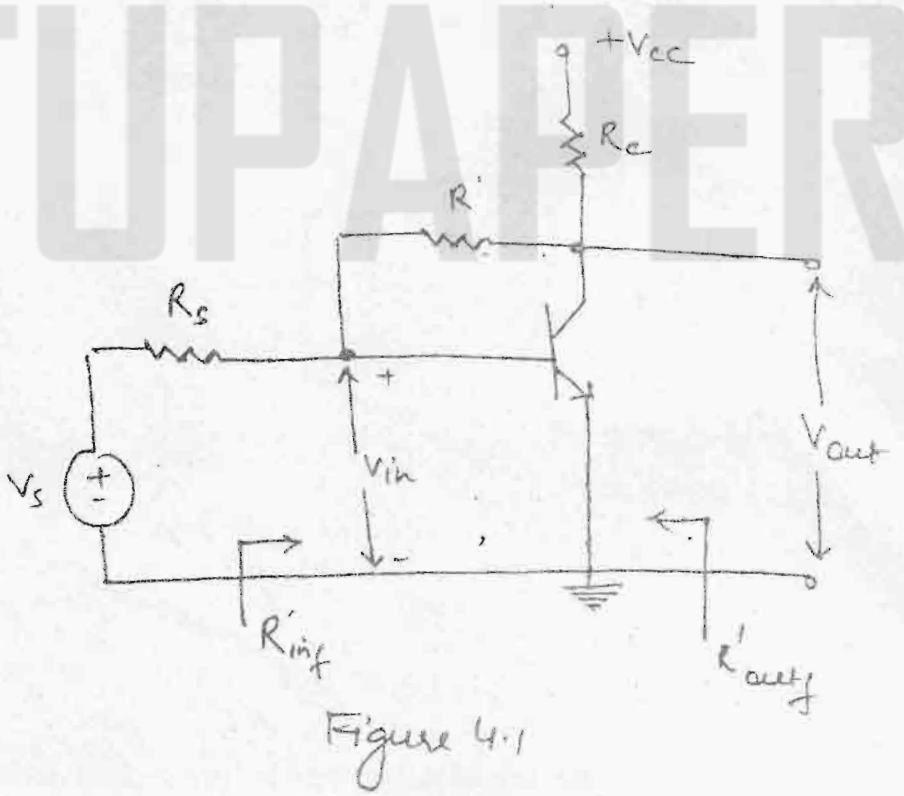


Figure 4.1

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

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## UNIT - V

5 (a) Write short note on :

(i) Hartley oscillator

(ii) Crystal oscillator

5×2

(b) A Colpitt's oscillator is designed with $C_1 = 100\,pF$ and $C_2 = 7500\,pF$. The inductance is variable. Determine the range of inductance values, if the frequency of oscillation is varied between 950 kHz and 2050 $kH_3$.

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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 µs duration. Assume, $h_{fe(\min)} = 25$; $I_{CE(sat)} = 5\,mA$; $V_{CC} = 10\,V$; $V_{BB} = -4V$; $V_{CE(sat)} = 0.4V$ and $V_{BE(sat)} = 0.8V$; $I_{B2(actual)} = 1.5 \times I_{B_2(\min)}$; $V_{BE(off)} = -1V$.

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