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EC-301



No. of Printed Pages-5

B.TECH.

THIRD SEMESTER EXAMINATION, 2002-2003 SOLID STATE DEVICES & CIRCUITS

Time : 3 Hours

Total Marks : 100

- Note : (1) Attempt ALL the questions.
 - (2) All questions carry equal marks.
 - (3) Assume missing data suitably.
- \sim 1. Attempt any FOUR from the following :-- (5×4)
 - (*a*) Draw the circuit diagram of a full-wave rectifier. Derive the expression for
 - (i) the d.c. load voltage;
 - (ii) the d.c. load current;
 - (iii) the d.c. diode voltage; and
 - (iv) the r.m.s. load current.
 - (b) What will be the peak inverse voltage in a bridge rectifier with and without capacitor filter ? Explain why mainly capacitor is employed as filter. What will be the effect if large value capacitor is used as filter in a rectifier circuit ?
 - (c) Draw the circuit of transistor in C.E. configuration. Sketch the output characteristic curves. Indicate the cut off, active and saturation regions and explain.
 - (d) Is $|V_{BEsat}|$ greater or less than $|V_{CEsat}|$? Explain.
 - (e) Draw the Ebers-Moll model for a *p*-*n*-*p* transistor and explain.

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(f) Find the region in which the Q point of following transistor circuit will lie :---



2. Attempt any FOUR from the following :---

(5×4)

- (a) Define the pinch off voltage V_p , trans conductance g_m , drain resistance r_d and amplification factor μ . Find relationship among μ , g_m and r_d .
- (b) Compare the Bipolar Junction transistor and Junction Field effect transistor. Draw the circuit of a MOFET NOT circuit and explain its working.
- (c) Draw the circuit diagram of a common source amplifier. Derive the expression for voltage gain at low frequencies. What is the maximum value of voltage gain A_v ?
- (*d*) For the following circuit, find the expressions for
 - (i) voltage gain,
 - (ii) input impedance,
 - (iii) output impedance :---



The power supplies are not shown. Neglect capacitances.

- (e) Draw the common source drain characteristic of a n-channel field effect transistor and explain the shape of curve.
- (f) Show that the transconductance g_m of a JFET is related to drain current I_{ps} by

$$g_m = \frac{2}{|V_P|} \sqrt{I_{DSS} \ I_{DS}}$$

- 3. Attempt any TWO from the following :--
 - (a) Why is multistaging done at all ? List the advantages and disadvantages of multistaging. Draw the circuit diagram of a two stage R-C coupled amplifier and explain its operation. What will happen if both bypass capacitors are open circuited simultaneously?
 - (b) How are the power amplifiers classified ? Explain each type. What are advantages of push-pull system ? Draw the circuit diagram of a class B push-pull amplifier and explain its working.
 - (c) For a transistor CE stage, as shown in the

following figure with
$$\frac{1}{h_{oe}} \cong \infty$$
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 (10×2)



calculate the percentage tilt in the output, if input current I is a 100 Hz square wave. What is the lowest frequency square wave that will suffer less than 1% tilt ?

4. Attempt any TWO from the following :-- (10×2)

- (*a*) Draw the small signal hybrid π model at high frequency. Explain all the components of your model. Prove that $h_{fe} = g_m r_{b'e}$.
- (b) Define f_{β} and f_{τ} . Derive the expressions for both f_{β} and f_{τ} and hence find the mathematical relation between f_{β} and f_{τ} .
- (c) (i) Write short note on Cascode Amplifier.
 - (ii) What do you mean by Tuned Amplifier ? Draw the circuit diagram of a tuned amplifier and explain its working. What are the applications of tuned amplifier ?

5. Attempt any TWO of the following :-- (10×2)

- (a) What are the different characteristics of Amplifier that are modified with negative feedback ? Define desensitivity D and discuss the effect of large value of D.
- (b) What are the Barkhausen conditions

required for sustained sinusoidal oscillation ? Sketch the circuit of a Wien bridge Oscillator. Derive the expressions for frequency of oscillations. Does the oscillation take place with balanced bridge ?

- (c) For the following feedback network, find :--
 - (*i*) the transfer function,
 - (ii) input impedance,
 - (iii) the frequency of oscillation and minimum amplifier voltage gain, if this network is used in a phase shift oscillator. (Assume no loading to take place),



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