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**Printed Pages: 6** 

EEC-401/EC-401 (MTU)

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 131401

Roll No.					ſ
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#### **B.TECH.**

Theory Examination (Semester-IV) 2015-16

## **ELECTRONICS CIRCUITS**

Time : 3 Hours

Max. Marks : 100

Note : Attempt all Sections.

### Section-A

- 1. This question consist of short answer questions. Attempt all parts. All parts carry equal marks.  $(2 \times 10 = 20)$ 
  - (a) What is Op-amp? Give its equivalent circuit.
  - (b) For NMOS transistor, write the drain current expression for all its region.
  - (c) Draw a high frequency T model of n-channel MOSFET incorporating output resistance.



- om Draw the circuit diagram for CB amplifier. (d)
- Calculate  $\beta$  and  $\alpha$  for a transistor if emitter current is (e) 10mA and collector current is 9mA.
- (f) Define input offset voltage of MOS differential pair.
- Explain why voltage divider biasing is preferred. Define Unity gain frequency. (g)
- (h)
- (i) Draw a large-signal equivalent circuit model NPN transistor, incorporating the output resistance.
- Give the Barkhausan conditions to obtain sustained (j) oscillations.

#### Section-B

#### 2. Attempt any FIVE questions. All questions carry equal $[10 \times 5 = 50]$ marks.

(i) Define and give the significance of Slew rate and (a) CMRR. For an op-amp having a slew rate of 60 V/  $\mu$ s, what is the highest frequency at which a 20V



peak to peak sine wave can be produced at the output?

- (ii) Describe the characteristics of an Op-amp. Draw the circuit diagram of difference amplifier using opamp and calculate the differential gain  $(A_d)$ , common mode gain  $(A_{cm})$  and differential input resistance  $(R_{rad})$ .
- (b) (i) Describe classification of output stage power amplifier.
  Describe the methods of biasing for class AB power amplifier.
  - (ii) What do you mean by cross over distortion. Describe how can it be overcome.
- (c) Describe the construction and operation of N-channel enhancement MOSFET. Describe the role of substrate (the body effect) in MOSFET.
- (d) Draw the high frequency equivalent circuit model for the MOSFET and list all MOSFET internal Capacitances.
- (e) (i) Give the circuit for CC amplifier and calculate  $R_{in}$  and  $R_{out}$  for the CC amplifier.

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(ii) Draw the circuit diagram of CB amplifier and calculate expression for short-circuit current gain with T-model.

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- (f) (i) Discuss the various internal capacitances for BJT. A particular small geometry BJT has  $f_{T}$  of 5 GHz and  $C_{\mu}$ = 1pF when opertated at  $I_{C} = 0.5$ mA. What is  $C_{\pi}$  in this situation? Also find  $g_{m}$ . For  $\beta = 150$ , find  $r_{\pi}$  and  $f_{\beta}$ .
  - (ii) Draw the circuit diagram of a Wien-bridge oscillator and derive an expression for the frequency of oscillations.
- (g) (i) Explain the operation of MOS differential pair with differential input voltage. Also calculate the range of input differential signals.
  - (ii) For the active loaded BJT differential amplifier let I = 0.8 mA,  $V_A = 100 \text{V}$  and  $\beta = 160$ . Find  $G_m$ ,  $R_o$ ,  $A_d$  and  $R_{id}$ .
- (h) (i) Design a series shunt feedback amplifier and derive expressions for  $A_f$ ,  $R_{of}$  and  $R_{if}$ .
  - (ii) For the Colpitt's oscillator, derive an expression for the frequency of oscillation.



Attempt any TWO questions. Each question carry equal marks. (15×2=30)

- (a) Explain the effect of finite open loop gain and bandwidth on the circuit performance. Calculate the frequency response of closed loop inverting amplifier.
  - (b) Explain the working of BJT as an amplifier and as a switch with the help of neat diagram and necessary equations. Also calculate the amplifier gain.
- (a) Discuss a common- source amplifier, draw its ac equivalent circuit and obtain expression for its terminal characteristics.
  - (b) Describe the operation of class B push-pull power amplifier giving its circuit, also obtain its efficiency.
- (a) Draw the NMOS differential amplifier with a commonmode input signal and calculate the common Mode Gain and CMRR. Also explain the effect of R<sub>D</sub> mismatch on CMRR.



(b) Explain the merits and demerits of negative feedback. Also explain in brief the various topologies used in negative feedback.

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