Basic Electronics & Mechatronics

Time: 3 Hrs.]   Prelim Question Paper   [Marks : 100

Instructions :   (1) All questions are compulsory.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary.
(5) Preferably, write the answers in sequential order.

1. (a) Attempt any **SIX** of the following :   **[12]**
   (i)   What is extrinsic Semiconductor?
   (ii) Draw the symbols of LED?
   (iii) Draw the symbols of BJT (npn and pnp)
   (iv) List types of coupling used in Multistage Amplifier.
   (v)   List any four application of OP-Amp.
   (vi) List application of Dual timer IC '556'.
   (vii) Explain in brief with neat sketches : Fan in.
   (viii)Enlist advantages of LVDT.

   (b) Attempt any **TWO** of the following :   **[8]**
   (i)   Draw and explain Energy level diagram of semiconductor and insulator.
   (ii) Explain the operation of PN junction under reverse bias condition.
   (iii) Explain construction and working principle of zener diaode.

2. Attempt any **FOUR** of the following :   **[16]**
   (a) Describe V-I characteristics of point contact diode, with application.
   (b) Draw the circuit diagram of a half wave rectifier. Draw its input-output waveforms.
   (c) Define the following forms :
   (i) Peak inverse voltage.
   (ii) Ripple factor
   (iii) Rectification efficiency
   (iv) Transformer utilization factor (TUF)
   (d) Explain the principle of operation of capacitor input (or π filter) with advantages and disadvantages.
   (e) With a neat diagram. Explain the working of NPN transistor.

3. Attempt any **FOUR** of the following :   **[16]**
   (a) Given β = 150, i_B = 15μA and transistor is biased in the forward active mode to find i_c = ?, i_E =? and α = ?

(b) Explain common Emitter configuration with the help of input and output characteristics.

(c) Explain need of cascade Amplifier and coupling used in Amplifiers.

(d) "Explain two stage impedance coupled CE amplifier with neat sketch"

(e) Compare to different types of coupling on the basis of following factor :

(i) Cost	(ii) Space and weight
(iii) Frequency response	(iv) Impedance matching
(v) Distortion	(vi) Hum
(vii) Voltage gain	(viii) Application

4. Attempt any **FOUR** of the following :   [16]

(a) Define the following parameters of 'OP-amp'
   (i)   Input bias current (I_B)
   (ii) Input offset current (Iios)
   (iii) Open Loop voltage gain.
   (iv) Differential input resistance (Ri)

(b) Determine S.R. of a OP-amp at room temp. which has unity cross-over frequency of 5MHz.

(c) Explain with symbol inverting and Non-inverting Amplifier.

(d) Explain summing scaling and averaging amplifier?

(e) Explain process of instrumentation amplifier with any four requirement of instrumentation amplifier.

5. Attempt any **FOUR** of the following :   [16]

(a) With neat block diagram explain operation of Time ic 555.

(b) Give the symbol, truth table and function for the following gates.
   (i) NOT   (ii) OR   (iii) AND   (iv) NOR

(c) Prove the following logic expression using Boolean algebra.
   AB + CD = (A + C) (A + D) (B + C) (B + D)

(d) Design AND using NOR gate.

(e) Design a Half adder, using K-map.

6. Attempt any **FOUR** of the following :   [16]

(a) Define transducer & classified on the basic of active type and passive type.

(b) Explain with block diagram "AC signal conditioning system".

(c) Describe "AC tachogenerator".

(d) Explain procedure of "LVDT" with neat sketch.

(e) Explain with neat sketch. "Rotameter".

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