Time : 2.30 Hours **[Total Marks : 75]**

N.B. : (1) **All** questions are **compulsory**.

(2) **Figures** to the **right** indicate **full** marks.

(3) Draw **neat** diagrams wherever **necessary**.

(5) Symbols have usual meaning unless otherwise stated.

(5) Use of **non-programmable** calculator is allowed.

1. (a) Attempt any **one:---**

(i) Discuss the construction and working of an n – channel enhancement type MOSFET. Draw and explain its drain characteristics and transconductance curve. **10**

(ii) Explain the construction and working of SCR. Explain the working of half wave rectifier using SCR as a rectifying device. Derive an expression for its DC output current and voltage. **10**

(b) Attempt any **one:---**

(i) Explain the voltage divider bias of a JFET. State and explain condition under which the drain current in a voltage divider is approximately constant for any JFET. **5**

(ii) An n-channel JFET has I_{DSS} = 10mA. and $V_{GS(off)}$ = - 4V. Calculate the gate source voltage and drain current at the half cut off point. **5**

2. (a) Attempt any **one:---**

(i) Draw a neat circuit diagram of a transistorized monostable multivilbrator. With the help of necessary waveforms, explain its working and how it is used for pulse shaping. **10**

(ii) With the help neat circuit diagram, explain the working of series voltage feedback regulator. Derive an expression for its output voltage and power dissipation. **10**

(b) Attempt any **one:---**

(i) Define and explain following terms with respect to differential amplifier, tail current, input bias current, input offset current, output offset voltage and input offset voltage **5**

(ii) Explain with the help of neat circuit diagrams common mode gain. Derive an expression for common mode voltage gain using emitter coupled differential amplifier. **5**

3. (a) Attempt any **one:---**

(i) Draw the circuit diagram of astable multivibrator using op-amp. Discuss its working. Derive the expression for time period of output square wave. Sketch the waveform across capacitor and at output terminal. **10**

(ii) Draw the schematic diagram of IC 555 connected as free running oscillator. Discuss its working with necessary waveforms. Derive expression for duty cycle. **10**

(b) Attempt any **one:**---

(i) What is voltage controlled oscillator? Draw the circuit diagram of voltage controlled oscillator using IC 555. Explain its working. **5**

(ii) Draw the circuit diagram of Wein bridge oscillator using op-amp. Calculate the oscillating frequency of Wein bridge using R_1=2KΩ, R_2=5KΩ, C_1=0.02μF and C_2=0.02μF. **5**

4. (a) Attempt any **one:**---

(i) Draw neat diagram of two inputs TTL NOR gate and explain its working. Write its truth table. **10**

(ii) Explain frequency modulation with neat diagram. What are the advantages of frequency modulation over amplitude modulation? **10**

(b) Attempt any **one:**---

(i) Explain the working of transistorized AM modulator with neat circuit diagram. **5**

(ii) Draw a logic diagram of decade counter that counts in a straight binary sequence. Write its truth table. **5**

5. (a) Attempt any **one:**---

(i) An n-channel JFET has a gate current of 1 nA when the reverse gate voltage is 20V. What is the input resistance of the JFET? What is its ohmic resistance if V_p = 4V and I_{DSS} = 10 mA. **4**

(ii) An SCR has a current fusing rating of 70A^2S. Determine the highest surge current value that SCR can withstand for a period of 20 msec. **4**

(b) Attempt any **one:**---

(i) The differential amplifier with double ended input and single ended output circuit using discrete components has V_{CC} = 15 V, V_{EE} = -15 V, R_C = 20 KΩ, R_E = 20 KΩ, If V_{BE} = 0.7 V for silicon transistor and V_1 = V_2 = 0 V. What is the dc emitter current in each silicon transistor? Find tail current and dc voltage at the output. **4**

(ii) Schmitt trigger circuit using discrete components has V_{CC} =12 V, $V_{CE(SAT.)}$ = 0.2V, V_{BE} = 0.6 V, R_{C1}= 10 KΩ, R_{C2} = 20 KΩ and R_E= 4.7 KΩ. Find the values of switching levels and hysteresis voltage. **4**

(c) Attempt any **one:**---

(i) A first order active high pass filter in non-inverting configuration, uses R=2KΩ, C=0.05μF, R_i=1KΩ and R_F=3KΩ. Calculate cut-off frequency. Also calculate pass band gain. **4**

(ii) A monostable multivibrator is constructed using IC 555 and R=10KΩ. The output pulse width is 10ms. Calculate capacitance C. What will be pulse width if C is doubled? **4**

(d) Attempt any **one:**---

(i) How many flip flops are required to construct each of the following counters? a) mod-3 b) mod-8 c) mod-16 **3**

(ii) A carrier with an amplitude 140 V is modulated by a signal with an amplitude of 80 V. What is the percentage modulation and amplitude of lower sideband frequency ? **3**
