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) 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 voltage and current. **10**
   - (ii) Explain the construction, working and V-I characteristics of TRIAC. **10**

   (b) Attempt any **one:---**
   - (i) Explain the construction and working of n-channel enhancement mode MOSFET. **5**
   - (ii) An n-channel JFET has I_{DSS} = 10 mA 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 astable multivibrator. With the help of necessary waveforms explain its working and derive an expression for frequency of its output wave. **10**
   - (ii) With the help neat circuit diagram, explain the working of zener follower as series voltage regulator. **10**

   (b) Attempt any **one:---**
   - (i) Explain with the help of neat circuit diagram, the ac analysis of an emitter coupled differential amplifier with inverting input configuration and single ended output. Derive an expression for the single ended output voltage gain. **5**
   - (ii) Explain with neat circuit diagram working of three terminal LM317 voltage regulator. Derive an expression for its output voltage. **5**

3. (a) Attempt any **one:---**
   - (i) Draw the circuit diagram of triangular wave generator using Schmitt trigger and integrator. Explain its working. State the expression for frequency of output triangular and square wave. Sketch the waveforms at output terminals of Schmitt trigger and integrator. **10**
   - (ii) Draw the circuit diagram of free running multivibrator using IC 555. Explain its working. Derive the expression for output time period. Explain how circuit can be modified to work as voltage to frequency converter. **10**

   (b) Attempt any **one:---**
   - (i) Draw the diagram of first order active low pass filter in non-inverting configuration. State the expression for cut-off frequency and pass band gain. Sketch the frequency response curve. **5**
   - (ii) Draw the circuit diagram of Wein bridge oscillator using op-amp. Calculate the output frequency if $R_1 = R_2 = 2K\Omega$ and $C_1 = C_2 = 0.047\mu F$. **5**

4. (a) Attempt any **one:**---
   (i) Draw neat diagram of two inputs CMOS NAND gate and explain its working. Write its truth table. **10**
   (ii) Explain with the help of neat block diagram, the general principles of radio broadcasting, transmission and reception. **10**

   (b) Attempt any **one:**---
   (i) Explain the working of mod-3 counter with logic diagram. Write its truth table. **5**
   (ii) A carrier wave of 500 Watts is subjected to 80 % amplitude modulation. Determine a) power in sidebands b) power of modulated wave. **5**

5. (a) Attempt any **one:**---
   (i) A 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**
   (ii) The JFET has g_{mo}= 6000 µSiemen, I_{DSS}=12 mA. Find its drain current at V_{GS} = - 2V. **4**

   (b) Attempt any **one:**---
   (i) Schmitt trigger circuit using discrete components has V_{CC} =12 V, $V_{CE(SAT.)}$ = 0.2 V, V_{BE} = 0.6 V, R_{C1}= 4.7 KΩ, R_{C2} = 10 KΩ and R_E = 1 KΩ. Find the values of switching levels and hysteresis voltage. **4**
   (ii) The differential amplifier with double ended input and single ended output circuit using discrete components has V_{CC}= + 12 V, V_{EE} = -12 V, R_C = 10KΩ, R_E = 6.8 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**

   (c) Attempt any **one:**---
   (i) A square wave generator using op-amp is designed to produce output square wave of 3KHz and β=0.6. If C=0.5µF and R_1=2KΩ, calculate R_F and R_2. **4**
   (ii) Calculate the output of log amplifier constructed using op-amp, for an input of 100mV. R_i =1KΩ , k=1.38 x 10^{-23}J/^{0}K, T=300^{0}K and I_s for diode = 0.02µA. **4**

   (d) Attempt any **one:**---
   (i) How many flip flops are required to construct a mod-64 counter? What is the largest decimal number that can be stored in a mod-64 counter? **3**
   (ii) A sinusoidal carrier voltage of frequency 1 MHz and amplitude 100 volts is amplitude modulated by sinusoidal voltage of frequency 5 KHz producing 50 % modulation. Calculate the amplitude of lower and upper sideband terms. **3**
