($2\frac{1}{2}$ 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**.
(4) Symbols have their usual meaning unless otherwise stated.
(5) Use of **log table** or **non-programmable** calculator is allowed.

1. (a) Attempt any **one:---**
   (i) Draw a circuit diagram of a JFET Common Source Amplifier. Using small signal ac model, derive an expression for its voltage gain. **10**
   (ii) Explain the use of SCR as a Full wave rectifier. Derive the expressions for its average output voltage and current. **10**
   (b) Attempt any **one:---**
   (i) Explain the terms holding current and forward current rating for a SCR. An SCR has a current fusing rating of $70A^2s$. Determine the highest surge current value that SCR can withstand for a period of 20ms. **5**
   (ii) Describe the applications of JFET as a series switch and analog multiplexer. **5**

2. (a) Attempt any **one:---**
   (i) Explain with the help of necessary circuit diagram, the ac analysis of an emitter coupled differential amplifier with single ended input and differential output. Derive an expression for its output voltage gain. **10**
   (ii) Draw circuit diagram of transistorized monostable multivibrator with negative triggering mode. With the help of necessary waveforms, explain its working and derive an expression for its output pulse width. State and justify the limiting criterion for the trigger frequency. **10**
   (b) Attempt any **one:---**
   (i) Define and explain Load regulation, line regulation, output resistance and headroom voltage for a power supply. State the use of a regulator. **5**
   (ii) Explain following terms with respect to Differential Amplifier: **5**
   1) Input Bias Current 2) Input Offset Voltage

3. (a) Attempt any **one:---**
   (i) With the help of necessary circuit diagram, explain the working of a ramp generator using 555 Timer. Derive the expressions for the slope and time period of the ramp waveform. **10**
   (ii) Explain the working of Wein Bridge Oscillator using OPAMP. State the expressions of its fundamental frequency, gain and feed back factor. **10**
   (b) Attempt any **one:---**
   (i) Explain the use of OPAMP in voltage controlled current source with grounded load. **5**
   (ii) Explain the working of First order active low pass filter using OpAmp in the inverting and non-inverting mode. **5**

4. (a) Attempt any **one:---**
   (i) Explain the working of Decade counter. Draw its timing diagrams. **10**

(ii) What are Tristate devices? With the help of neat circuit diagram explain the operation of tristate inverter **10**

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

(i) Explain the working of CMOS NOR gate. **5**

(ii) Show that an Amplitude modulated wave is a combination of three sinusoidal waves--carrier wave and two side bands **5**

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

(i) An n-channel JFET has a gate current of 1nA 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} =10mA? **4**

(ii) A half-wave rectifier circuit using SCR is adjusted to have a gate current of 1mA. If a sinusoidal voltage of 200V peak is applied to this circuit, then, conduction angle of SCR is 150^0. Find the forward breakover voltage and the average output voltage. **4**

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

(i) For an astable multivibrator, base resistors $R_1 = R_2 = 10K\Omega$. What must be the minimum value of load resistance (R_C) to provide saturated operation of the transistors ? (Given : Each transistor has $\beta = 50$) **4**

(ii) A series regulator with OpAmp has R_1 = 4.7 K Ω, R_2 = 3.3 K Ω and V_Z = 6.4 V. What is the output voltage? If R_L =200 Ω, V_{in}=15 V, find the power dissipation in the pass transistor. **4**

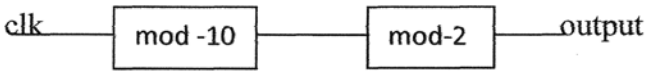
(c) Attempt any **one:**---

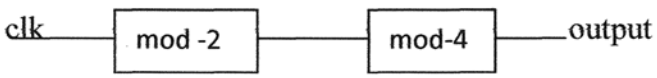
(i) In the circuit of astable multivibrator using IC555 timer with $R_A = 10K\Omega$, $R_B = 100\ K\Omega$, C = 0.01μF. Calculate frequency and duty cycle of the output pulse. **4**

(ii) A 555 Timer is connected for monostable operation. If R = 10 KΩ and C = 0.047 μF. Find the pulse width of the Output pulse. If V_{CC} = 12 Volts, then find the minimum trigger voltage which will produce Output pulse. Also find the maximum voltage across the capacitor. **4**

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

(i) Determine the overall modulus of cascade connections of counters given below. Also determine the output frequency if the clock frequency is 100KHz **3**





(ii) A carrier wave of 40 KWatts is subjected to 100% amplitude modulation. What is the carrier power after modulation? How much audio power is required if the efficiency of the modulated RF amplifier is 72 %? **3**