Time: 3 hrs.   **Marks : 100**

N.B.:
1. **All questions are compulsory.**
2. **Figures to the right indicate full marks.**
3. **Draw neat diagrams wherever necessary.**
4. **Symbols have usual meaning unless otherwise stated.**
5. **Use of non-programmable calculator is allowed.**

Q1.   Attempt any **two**

(i)   Explain various methods of biasing JFET in active region.   **10**

(ii)   Explain the construction and working of an n-channel depletion mode   **10**
MOSFET. Draw and discuss its drain and transfer characteristics.

(iii)   Explain the use of SCR as a half wave rectifier and derive the   **10**
expressions for its average output voltage and current.

(iv)   Explain the construction and working of a UJT. Draw the V-I   **10**
characteristics and explain it.

Q2   Attempt any **two**

(i)   Draw a circuit of an emitter coupled differential amplifier having   **10**
double ended input and single ended output. Using AC analysis derive
an expression for voltage gain and input impedance.

(ii)   In a differential amplifier explain what is meant by common mode   **10**
signal. Using ac analysis derive an expression for common mode gain.

(iii)   With the help of a neat circuit diagram explain the working of an   **10**
inverting Schmitt trigger using operational amplifier. Derive an
expression for its feedback factor and hysteresis. Draw a neat circuit
diagram of a non-inverting Schmitt trigger using operational amplifier.

(iv)   Explain with the help of neat circuit diagram, the principle and
working of Wien bridge oscillator using operational amplifier. State
the expression for its frequency of oscillation.

Q3   Attempt any **two**

(i)   Draw the circuit diagram of voltage controlled oscillator using IC 555.   **10**
Discuss its working. Derive the expressions for output time period.

(ii)   Draw the circuit diagram of astable multivibrator using transistors.   **10**
Explain its working. Sketch the waveforms at both collectors and both
base terminals.

(iii)   What is a bistable multivibrator? Draw the circuit diagram of bistable   **10**
multivibrator using transistors. Discuss its working. What is the
relation between input and output frequency of a bistable multivibrator
circuit?

(iv)   Draw the diagram of voltage feedback regulator circuit. Explain its   **10**
working. Derive the expression for power dissipation in pass
transistor.

Q4 Attempt any **two**

(i) Explain the working of a two – input Transistor Transistor Logic NOR gate. **10**

(ii) Explain CMOS characteristics in terms of Sinking, Floating Inputs and transfer characteristic. **10**

(iii) Explain Basic Pulse Code Modulation. Explain companding process used to overcome problems of distortion and noise in the transmission of audio signals. **10**

(iv) Explain benefits of digital communication. **10**

Q5. Attempt any **four**

(i) The data sheet of a JFET gives the following information: I_{DSS} = 3 mA, $V_{GS(off)}$ = -6 V and g_{mo} = 5000 µS. Determine the transconductance for V_{GS} = -4V and find drain current I_D at this point. **05**

(ii) An ac voltage $v = 240sin314t$ is applied to an SCR half wave rectifier. If SCR the forward breakdown voltage of 180 V, find the time, during which SCR remains off. **05**

(iii) In a relaxation oscillator circuit using operational amplifier the timing components are R=4.7 kΩ and C = 0.1 µf. The feedback to non-inverting terminal is applied by a potential divider with R_1 = 5 kΩ and R_2 = 5 kΩ such that voltage across R_1 is the feedback voltage. Find the period of the output waveform. **05**

(iv) In an active one pole low pass filters using operational amplifier, R = 2.2 kΩ and C = 0.047µF. What is the cut-off frequency? **05**

(v) Calculate the time period of oscillation of an astable multivibrator using IC 555 if R_A = 1500Ω, R_B = 10KΩ, C = 0.47µF and V_{CC} = 12V. Also calculate frequency of oscillation and duty cycle. **05**

(vi) A voltage feedback regulator with fold back current limiting uses following components: R_4 = 100Ω, R_5= 4.7KΩ, R_6= 10KΩ, V_{BE} = 0.7V and Vo = 7.2V. Calculate shorted load current and maximum load current. **05**

(vii) A TTL circuit drives an LED. When the TTL output is high, the LED is dark. When the TTL output is low, the LED lights up. If the LED voltage drop is 1.75 V, Calculate LED current for a low TTL output. **05**
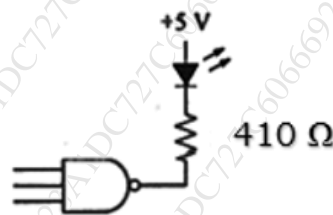
(viii) The input voltage of a compander with a maximum voltage range of 1.2 V and a µ of 255 is 0.25V. What are the output voltage and gain? **05**

****