

(2 1/2 Hours)

- 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:--- 10
  - (i) Sketch the cross-section of Depletion MOSFET and explain its working. Draw and explain its drain and transconductance curves. 10
  - (ii) Explain the use of SCR as half wave rectifier and derive the expressions for its average output voltage and current. 10
- (b) Attempt any one:--- 5
  - (i) Explain the voltage divider bias of a JFET. State and explain the condition under which the drain current in a voltage divider bias is approximately constant for any JFET. 5
  - (ii) Draw the V-I characteristics of a Triac. Explain how Triac can be used to control the intensity of high power lamp? 5
2. (a) Attempt any one:--- 10
  - (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 its output frequency. 10
  - (ii) With the help of a neat diagram, explain the working of a voltage regulator with a current limiting arrangement. State the expression of the shorted load current. 10
- (b) Attempt any one:--- 5
  - (i) Explain the working of a three terminal LM 317 voltage regulator as a variable voltage regulator. Derive an expression for its output voltage. 5
  - (ii) With the help of neat circuit diagram, explain the use of transistorized Bistable multivibrator as a RS- FlipFlop. 5
3. (a) Attempt any one:--- 10
  - (i) Draw a neat circuit diagram of the basic configuration of instrumentation amplifier using 3 OpAmps. Explain its working and derive an expression for its CMRR. 10
  - (ii) Draw neat circuit diagram and explain working of one-shot multivibrator using IC555. Derive an equation of pulse width of the output wave. Sketch expected waveforms at threshold and output terminal. 10

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- (b) Attempt any **one**:---
- (i) In the circuit of first order low pass filter operated in non-inverting mode,  $R_{in}=1K\Omega$ ,  $R_f=10K\Omega$ . Calculate cutoff frequency if the filter section uses  $R=10K\Omega$  and  $C=0.01\mu$ . Also find pass band gain of the filter. 5
- (ii) Draw and explain functional Block diagram of IC555. 5
4. (a) Attempt any **one**:---
- (i) Draw the circuit diagram of 4 bit asynchronous Up/ Down counter. With the help of relevant timing diagrams and truth table, explain its working. 10
- (ii) Explain the working of TTL two input NAND and NOR gates. 10
- (b) Attempt any **one**:---
- (i) Explain the working of CMOS NAND gate. 5
- (ii) Explain the working of transistorized AM modulator. 5
5. (a) Attempt any **one** :---
- (i) For an n channel JFET, calculate the ratio of  $V_{GS}$  against  $V_{GS(OFF)}$  to obtain a drain current equivalent to 30% of the maximum value of the drain current ( $I_{DSS}$ ). 4
- (ii) An ac voltage  $v = 240\sin 314t$  is applied to an SCR half wave rectifier. If SCR conducts for 7.3ms in one cycle, then, find the forward breakdown voltage of SCR and the average output voltage of the rectifier. 4
- (b) Attempt any **one** :---
- (i) The Schmitt Trigger circuit using discrete components has  $V_{CC} = 12V$ ,  $V_{CE(SAT)} = 0.2V$ ,  $V_{BE} = 0.6V$ ,  $R_{C1} = 2.2K\Omega$ ,  $R_{C2} = 4.7K\Omega$  and  $R_E = 1K\Omega$ . Find the values for the switching levels and the hysteresis voltage. 4
- (ii) A transistorized monostable multivibrator has output pulse with of 75 % duty cycle. Its timing resistor is  $33K\Omega$  and capacitor is  $33\mu F$ . Find the value of input trigger frequency and the pulse width of output pulse. 4
- (c) Attempt any **one**:---
- (i) A 555 Timer connected for an astable operation, has  $R_1=10K\Omega$ ,  $R_2=20K\Omega$  and  $C = 10nF$ . Find the duty cycle and the time period of the Output pulse. If  $V_{CC} = 12$  Volts, then find the minimum and maximum voltage across the capacitor. 4
- (ii) In the circuit of ramp generator using IC555, the potential divider arrangement at base of transistor is developed with  $R_1= 10K\Omega$ ,  $R_2= 10K\Omega$ . If  $C = 1\mu F$  and  $V_{CC} = 12V$ , then, calculate the slope of the ramp for emitter resistance,  $R_E = 10K\Omega$  and  $100K\Omega$  (Given :  $V_{BE} = 0.7V$ ) 4
- (d) Attempt any **one**:---
- (i) Draw a logic diagram of mod-5 counter and write its truth table. 3
- (ii) The antenna current of an AM transmitter is 10A when only carrier is sent. It changes to 11.5A when the carrier is sinusoidally modulated. Find the percentage of modulation. 3