

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) Sketch the cross-section of Depletion MOSFET and explain its working. **10**
Draw and explain its drain and transconductance curves.

(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**:---

(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**:---

(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**:---

(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**:---

(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 $R=10 K\Omega$ 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_{GSOFF} 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 $V_{CC} = 12V$, $V_{CE(SAT)} = 0.2 V$, $V_{BE} = 0.6 V$, $R_{C1} = 2.2 K\Omega$, $R_{C2} = 4.7 K\Omega$ and $R_E = 1 K\Omega$. 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 $R_1=10K\Omega$, $R_2=20 K\Omega$ and $C = 10 nF$. 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 $V_{cc} = 12 V$, then, calculate the slope of the ramp for emitter resistance, $R_E = 10K\Omega$ and $100K\Omega$ (Given : $V_{BE} = 0.7 V$) **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**