

December 2018

**INDUSTRIAL ELECTRONICS***Time Allowed: 3 Hours**Full Marks: 70*

**Answer to Question No.1 is compulsory and to be answered first.**

**This answer is to be made in separate loose script(s) provided for the purpose.**

**Maximum time allowed is 45 minutes, after which the loose answer scripts will be collected and fresh answer scripts for answering the remaining part of the question will be provided.**

**On early submission of answer scripts of Question No.1,  
a student will get the remaining script earlier.**

**Answer any five questions from Group-A & B, taking at least two from each group.**

1. Choose the correct answer from the given alternatives (any twenty): 20x1
- i) To make a signal diode suitable for high current & high voltage carrying applications with minimum losses – (a) a lightly doped n layer is grown between the two p & n layers, (b) a heavily doped n layer is grown between the two p & n layers, (c) a lightly doped p layer is grown between the two p & n layers, (d) a heavily doped p layer is grown between the two p & n layers.
  - ii) The controlling parameter in MOSFET is – (a)  $V_{DS}$  (b)  $I_G$  (c)  $V_{GS}$  (d)  $I_S$ .
  - iii) An astable multivibrator has – (a) One stable state, (b) Two stable states, (c) No stable state, (d) None of the above.
  - iv) \_\_\_\_\_ multivibrator is a square wave oscillator – (a) Monostable, (b) Astable, (c) Bistable, (d) one of the above.
  - v) If a square wave is fed to a differentiating circuit, the output will be – (a) Sine wave, (b) Sharp narrow pulses, (c) Rectangular wave, (d) Triangular wave.
  - vi) An SCR is considered to be a semi controlled device because – (a) It can be turned OFF but not ON with a gate pulse, (b) It conducts only during one half cycle of an alternating current wave, (c) It can be turned ON but not OFF with a gate pulse, (d) It can be turned ON only during one half cycle of an AC.
  - vii) Which statement is true for latching current? – (a) It is related to turn off process of the device, (b) It is related to conduction process of device, (c) It is related to turn on process of the device, (d) Both C and D.
  - viii) In reverse blocking mode of a thyristor – (a) Junction  $J_2$  is in reverse bias and  $J_1, J_3$  is in forward bias, (b) Junction  $J_3$  is in forward bias and  $J_1, J_2$  in reverse bias, (c) Junction  $J_1, J_3$  is in reverse bias and  $J_2$  is in forward bias, (d) Junction  $J_1$  and  $J_2$  is in forward bias and  $J_3$  is in reverse bias.
  - ix) Bidirectional semiconductor device is – (a) Diode, (b) BJT, (c) SCR, (d) TRIAC.
  - x) What is basically a two-terminal parallel-inverse combination of semiconductor layers that permits triggering in either direction? – (a) Diac, (b) Triac, (c) Quadac, (d) Shockley Diode.
  - xi) PUT stands for – (a) Programmable Unijunction Transistor, (b) Programmable Universal Transistor, (c) Pulse Unijunction Transistor, (d) Pulse Universal Transistor.
  - xii) The three terminals of a triac are – (a) drain, source, gate, (b) two main terminals and a gate terminal, (c) Cathode, anode and gate, (d) anode, source, gate.

- xiii) A triac is equivalent to two SCRs – (a) in parallel, (b) in inverse-parallel, (c) in series, (d) in inverse-series.
- xiv) The p-type emitter of a UJT is \_\_\_\_\_ doped. – (a) lightly, (b) moderately, (c) heavily, (d) none.
- xv) Which of the following is the normal way to turn on a diac? – (a) By break over voltage, (b) By gate voltage, (c) By gate current, (d) By anode current.
- xvi) The function of snubber circuit connected across the SCR is to – (a) Suppress  $dv/dt$ , (b) Increase  $dv/dt$ , (c) Decrease  $dv/dt$ , (d) Decrease  $di/dt$ .
- xvii) The advantage of using free - wheeling diode in half controlled bridge converter is that – (a) There is always a path for the dc current independent of the ac line, (b) There is always a path for the ac current independent of the ac line, (c) There is always a path for the dc current dependent of the ac line, (d) There is always a path for the ac current independent of the ac line.
- xviii) In a 3 phase bridge rectifier the ripple frequency is – (a) Equal to the input frequency, (b) Twice the input frequency, (c) Three times the input frequency, (d) Six times the input frequency.
- xix) The switching regulators can operate in – (a) Step up, (b) Step down, (c) Polarity inverting, (d) All the mentioned.
- xx) Switching regulator efficiencies can be greater than \_\_\_\_\_ percent. – (a) 60, (b) 70, (c) 80, (d) 90.
- xxi) When smooth and precise speed control over a wide range is desired, the motor preferred is – (a) Synchronous motor, (b) squirrel cage induction motor, (c) Wound rotor induction motor, (d) dc motor.
- xxii) The torque speed characteristics of a AC servomotor is approximately – (a) parabola, (b) linearised, (c) hyperbola, (d) any of the above.
- xxiii) Which of the following motors are suitable for computer printer drive? – (a) Reluctance motor, (b) Hysteresis motor, (c) Shaded pole motor, (d) Stepper motor.
- xxiv) The speed of a D.C. series motor is – (a) proportional to the armature current, (b) proportional to the square of the armature current, (c) proportional to field current, (d) inversely proportional to the armature current.
- xxv) No-load speed of which of the following motor will be highest? – (a) Shunt motor, (b) Series motor, (c) Cumulative compound motor, (d) Differentiate compound motor.
- xxvi) If an AC servomotor has one of its winding excited by AC, then voltage measured at the other winding with rotor running will be – (a) zero, (b) proportional to rotor speed, (c) proportional to square of rotor speed, (d) constant independent of speed.
- xxvii) The most common two-phase ac servomotor differs from the standard ac induction motor because it has – (a) Higher rotor resistance, (b) higher power rating, (c) motor stator windings, (d) greater inertia.

#### Group-A

2. How the Power Semiconductor devices differ from signal level semiconductor devices? Describe construction and operating principle of power MOSFET. Why power MOSFET are predominantly n-channel. 2+6+2
3. Draw the circuit diagram, input and output waveform and explain the operation of clipper circuit and Voltage doubler circuit. 5+5

4. What are the different type of multivibrator what are there number of stable state? Draw the circuit diagram and explain operating principle of astable multi-vibrator. How you can create 50% duty cycle of this circuit. 3+5+2
5. Draw two-transistor model of SCR and obtain the condition of anode current flow without gate current. Draw the current voltage characteristic of an SCR and explain— (i) holding current (ii) latching current and (iii) break-over voltage from it. 6+4
6. Draw construction and symbol of IGBT. What are the constructional difference between SCR and PUT? Draw and explain circuit diagram of relaxation oscillator using UJT. 3+2+5

**Group-B**

7. Explain circuit diagram of electronic fan regulator using TRIAC. What are the advantages of switch mode regulator over linear regulator? What are difference between online and offline UPS? 6+2+2
8. What are the difference between a controlled rectifier and a diode rectifier? Draw the circuit diagram & input /output waveform of Single phase fully controlled Full Wave rectifier with high inductive load, and calculate Output DC voltage Output RMS voltage and Ripple factor from it. 2+8
9. Draw the circuit diagram, Input & Output waveforms and describe the operating principle of single phase cyclo-converter. Explain buck-boost converter circuit? 7+3
10. How a stepper motor works? What are the difference between stepper motors and servomotors? Using block diagram explain how you can control speed of DC servomotor. 4+3+3