PARUL UNIVERSITY FACULTY OF ENGINEERING & TECHNOLOGY B.Tech. Summer 2018–19 Examination

Semester: 4 Subject Code: 03106254 Subject Name: Industrial Electronics-I

Date: 06/05/2019 Time: 02:00pm to 04:30pm Total Marks: 60

Instructions:

(c) 30 V

- 1. All questions are compulsory.
- 2. Figures to the right indicate full marks.
- 3. Make suitable assumptions wherever necessary.
- 4. Start new question on new page.
- Q.1 Objective Type Questions (Fill in the blanks, one word answer, MCQ-not more than Five in case of (15) MCQ) (All are compulsory) (Each of one mark)
- 1. In 1-phase full converter with RL load, if input supply voltage is 325.2sinot then output RMS voltage is (a) 325.2 volt (b) 460 volt (c) 230 volt (d) 187.7 volt 2. V_{LDC} of 1-phase full wave controlled rectifier for R load is (a) $(2Vm/\pi)(\cos\alpha)$ (b) $(Vm/2\pi)(1+\cos\alpha)$ (c) $(Vm/\pi)(1+\cos\alpha)$ (d) $(Vm/\pi)(\cos\alpha)$ 3. di/dt protection for an SCR is achieved by using (a) R in series with SCR (b) R across SCR (c) L in series with SCR (d) L across SCR 4. For $\alpha < 90^{\circ}$ and $\alpha > 90^{\circ}$, phase controlled rectifier respectively works as a (a) Inverter and rectifier (b) Rectifier and inverter (c) Only rectifier (d) Only inverter 5. Ideally form factor (FF) should be _____ and ripple factor (RF) should be _____ (a) 1 and 0 (b) 0 and 1 (d) 0 and 0(c) 1 and 1 6. Choose the correct statement: (a) Both MOSFET and BJT are voltage (b) Both MOSFET and BJT are current controlled controlled devices devices (c) MOSFET is a voltage controlled devices (d) MOSFET is a current controlled devices whereas whereas BJT is a current controlled devices BJT is a voltage controlled devices 7. Thyristors can be turned off by (a) Reducing the gate current (b) Reducing the current below the holding current (c) Applying the negative voltage to the anode (d) b and c both of the device 8. For UJT employed for triggering an SCR, stand-off ratio n=0.64 and dc source voltage VBB is 20 V. The UJT would trigger when the emitter voltage is (voltage drop across the diode is 0.7 V) (a) 12.8 V (b) 10 V (c) 5 V (d) 13.5 V 9. In three phase full converter, three SCRs pertaining to one group are fired at an interval of (a) 120° (b) 60° (c) 90° (d) 30° 10. In three phase full converter, the output voltage pulsates at a frequency equal to (a) f (b) 3f (c) 6f (d) 2f 11. What is the input voltage required in step up chopper for output voltage of 400 V with duty cycle of 40%? (a) 1000 V (b) 160 V (c) 240 V (d) 400 V 12. The half bridge SMPS is fed from 100 V dc source to deliver the load voltage with duty cycle of 60%, then output voltage is (a) 60 V (b) 100 V

(d) 50 V

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- 13. ______ are semiconductor thyristor devices which can be turned-on by light of appropriate wavelengths.
- 14. Circuit turn off time (tc) is ______ than device (tq) turn off time.
- 15. A step down chopper is fed from a 220 V dc source to deliver a load voltage of 110 V. If the switch off time of thyristor is 100 μ s, the required switch on time would be
 - (a) 200 µs (b) 100 µs
 - (c) 300 µs (d) 50 µs

Q.2 Answer the following questions. (Attempt any three)

- 1. A 1-phase half wave rectifier is used to supply power to a load of 10 ohm from 230 V, 50 Hz AC supply at the firing angle $\alpha = 30^{\circ}$. Calculate the average and RMS load current.
- 2. A step up chopper has input voltage 220 V and output voltage of 660 V. If the non-conducting time of thyristor chopper is 100 µsec, compute the pulse width of output voltage. In case the pulse width is halved for constant frequency operation, find the new output voltage.
- 3. A 3-phase HWCR is operated from star connected 50 Hz. The load is inductive and load current is continuous and ripple free, equal to 7 A. If it is required to obtain an average output voltage of 50% of maximum possible output voltage. If this output voltage is 230 V. Calculate input RMS phase voltage and SCR average and RMS current.
- 4. Compare the linear regulator and switched mode regulator.
- 5. Analyse the average and RMS load voltage of 1-phase full converter with R load using waveform.
- Q.3
- A) Explain the operation of 1-phase full converter with RL load, draw the circuit diagram and following (07) waveforms of i) input voltage, ii) output voltage, iii) output current iv) supply current v) thyristor current and vi) thyristor voltage $\alpha = 30^{\circ}$.
- B) For 3-phase half wave controlled rectifier with RL load, draw the circuit diagram and following (08) waveform of i) input voltage, ii) output voltage and iii) thyristor current. Also analyse the output average load voltage for $30^{\circ} < \alpha < 90^{\circ}$.

OR

- B) Describe the IGBT construction and draw the structure of it. Give the advantages of IGBT over BJT (08) and MOSFET.
- Q.4
- A) Analyse the following for the step down chopper with necessary circuit diagram: i) Average load (07) voltage ii) RMS output voltage iii) Form factor iv) Ripple Factor and v) input power.

OR

- A) A 1-phase semiconverter connected to 120 V, 60 Hz source is feeding a load R=10 ohm. For a firing (07) angle 90 degree, calculate the i) Average load voltage ii) Normalized output voltage iii) RMS load voltage iv) Average and RMS load current v) Average and RMS thyristor current vi) Form Factor and vii) Ripple Factor.
- B) Compare the Step down and Step up chopper.

(08)

(15)