

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- VIIth SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 170801****Date: 24/05/2012****Subject Name: Power Electronics & Industrial Drives****Time: 02:30 pm – 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) With neat sketch describe the operation of half wave uncontrolled rectifier with R-L load. **07**

(b) A single phase full wave rectifier with R-L-E load type has $R=2.5\ \Omega$, $L=7\ \text{mH}$, $E=10\ \text{V}$. It is fed by a voltage source of $240\ \text{V}$, $50\ \text{Hz}$ through a transformer with transformation ratio of 2:1. Draw neat sketch and wave form. Determine (i) Steady state load current I_1 at $\omega t=0$ (ii) the average diode current I_d (iii) the rms diode current I_r . **07**

Q.2 (a) Derive the equation of output voltage for on/off a.c. voltage controller. Draw neat sketch of circuit diagram and waveform. **07**

(b) A single phase bidirectional a.c. controller supplies a resistive load of $R=10\ \Omega$ and the input voltage of $150\ \text{V}_{\text{rms}}$, $50\ \text{Hz}$. The delay angle of thyristors T_1 and T_2 are equal: $\alpha_1 = \alpha_2 = \alpha = \pi/2$. Determine (i) the rms output voltage V_o , (ii) the input power factor (iii) the average current of thyristor I_a (iv) rms current of thyristor I_r . **07**

OR

(b) Briefly describe the operation of single phase cycloconverter with necessary waveform. **07**

Q.3 (a) Briefly discuss the operation of three phase inverter for 120 degree mode of conduction. Draw necessary waveforms. **07**

(b) Briefly discuss the principle of single pulse width modulation with necessary waveform. **07**

OR

Q.3 (a) Briefly describe the performance characteristics of induction motor. **07**

(b) Briefly describe the rotor voltage control method for induction motor using thyristor. **07**

Q.4 (a) Discuss the role of snubber circuit from protection aspect. **07**

(b) Describe voltage protection phenomena by selenium diodes and metal oxide varistors. **07**

OR

Q.4 (a) Briefly discuss the excitation angle control method for power factor improvement with neat sketch and necessary waveforms. **07**

(b) Briefly discuss with neat sketch the operation of semi converter rectifier circuit with R-L-E type load. Draw necessary waveforms. **07**

Q.5 (a) Briefly discuss the operation of single phase semi converter d.c. drives. **07**

- (b) The speed of a separately excited d.c. motor is controlled by a single phase bidirectional converter. The field circuit is also controlled by a full converter and the field current is set to the maximum possible value. The a.c. supply voltage to the armature and field converter is one phase, 440 V rms, 50 Hz. The armature resistance $R_a = 0.25 \text{ ohm}$, the field circuit resistance is 100 ohm. The motor voltage constant is $K_v = 1.4 \text{ V/A-rad/s}$. The armature current corresponding to load demand is 45 A. The viscous friction and no load losses are negligible. The inductances of the armature and field circuit are sufficient to make the armature and field currents continuous and ripple free. If the delay angle of the armature converter is 60 degree and armature current is 45 A. Determine (i) the torque developed by the motor (ii) the speed of the motor. 07

OR

- Q.5** (a) Briefly discuss the operation of current source inverter with necessary waveform. 07
- (b) A resistive load of value 2.5 ohm is being controlled by thyristor T1 that takes its input from the transformer. The transformer is having the turns ratio of 2:1 and its primary is connected to a.c. source of 215 v rms, 50 Hz. The delay angle is $\alpha = \pi/2$. Determine (i) the rectification efficiency. (ii) the form factor (iii) Ripple factor (iv) Transformer utilization factor. Draw neat sketch of circuit and its waveform. 07
