

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2018

Subject Code:2150903

Date:04/12/2018

Subject Name:Power Electronics – I

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

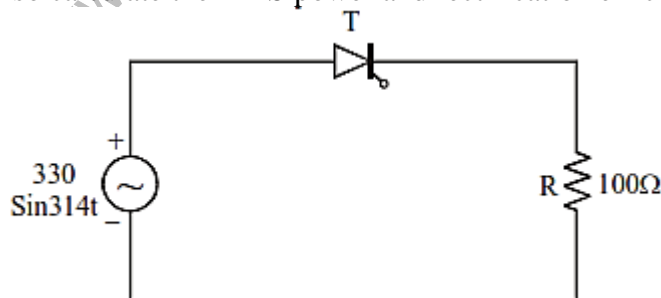
Instructions:

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

- Q.1** (a) Draw the symbol and basic structure of IGBT. **03**
 (b) Justify the statement, “Higher the gate current, lower is the forward breakover voltage. **04**
 (c) Explain the need of commutation in thyristor circuits. Discuss one of commutation scheme involving two thyristors, with neat schematic and waveforms. **07**
- Q.2** (a) Compare power MOSFETs with BJTs **03**
 (b) Explain following terms in brief. **04**
 (i). Forward Breakover Voltage (ii). Peak Inverse Voltage (iii). On-State Voltage drop (iv). Finger Voltage.
 (c) Describe how two series connected SCRs are subjected to unequal voltage distribution during their static conditions. Derive an expression for parallel resistance R used in static equalizing circuit for n series connected SCRs. **07**

OR

- (c) Draw and explain the working of an UJT oscillator. Discuss how the amplitude of output voltage pulse can be estimated in this oscillator. **07**
- Q.3** (a) Give at least six applications of phase controlled rectifiers. **03**
 (b) Draw the circuit diagram of single phase full wave controlled bridge rectifier. Also draw the waveform of output voltage with R-L load with $\alpha = 60^\circ$ **04**
 (c) What will be the average power in the load for the circuit shown, when $\alpha = \frac{\pi}{4}$. Assume SRC to be ideal. Supply voltage is $330 \sin 314t$. Also calculate the RMS power and rectification efficiency. **07**



OR

- Q.3** (a) State the role of free-wheeling diode in any mid-point full wave converter. **03**
 (b) Explain the concept of “quadrant operation” of converters. **04**
 (c) Draw the circuit diagram of 3- Φ full converter connected to RL load with continuous conduction. Draw the waveforms of output voltage, output current for firing angle equal to 30° **07**

- Q.4** (a) How do you control the output voltage of chopper? List the methods. **03**
 (b) Show the circuit diagram and waveforms of step-up chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle. **04**
 (c) A step up chopper has supply voltage of 250V while output voltage is 500V. If the period of the chopper is 500μsec., determine the pulse width of the output voltage. If the pulse width is reduced to one third for constant frequency operation, find the output voltage. **07**

OR

- Q.4** (a) What is current limit control for chopper? Explain in brief. **03**
 (b) Draw the circuit diagram and waveforms for voltage commutated chopper. **04**
 (c) Describe the principle of operation of buck-boost DC-DC converter. **07**

- Q.5** (a) Give the concept of DC drive. Illustrate answer with examples. **03**
 (b) Describe the working of a single-phase semi-converter fed dc separately-excited motor with relevant waveforms. **04**
 (c) What is regenerative braking? Describe the regenerative braking of a chopper-fed dc motor. Illustrate your answer with circuit diagram and relevant waveforms. **07**

OR

- Q.5** (a) List the speed control methods for dc motor. **03**
 (b) Explain four quadrant operation of dc drive. **04**
 (c) Give block diagram for closed loop speed control of DC drive. Explain working of each block. **07**

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