

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**BE - SEMESTER-VI (NEW) - EXAMINATION – SUMMER 2017**

**Subject Code: 2160902**

**Date: 03/05/2017**

**Subject Name: Power Electronics – II**

**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.

|            |                                                                                                                                                                                                                                                                            | MARKS     |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Q.1</b> | <b>Short Questions</b>                                                                                                                                                                                                                                                     | <b>14</b> |
| 1          | Define inverter.                                                                                                                                                                                                                                                           | 1         |
| 2          | What should be pulse width in single pulse modulation of PWM inverter to eliminate third harmonic?                                                                                                                                                                         | 1         |
| 3          | If amplitude ratio of carrier to modulation signal is 4, What is modulation index?                                                                                                                                                                                         | 1         |
| 4          | The amplitude of phase voltage in $120^\circ$ conduction scheme is _____ $V_{dc}$ . (1/2, 2/3)                                                                                                                                                                             | 1         |
| 5          | AC voltage controller can vary _____ but cannot vary _____. (frequency, voltage magnitude)                                                                                                                                                                                 | 1         |
| 6          | If power factor angle is greater than firing angle, can AC voltage controller control the output power? (Yes, No)                                                                                                                                                          | 1         |
| 7          | How much percentage of more output obtained by SVPWM technique over sine PWM technique?                                                                                                                                                                                    | 1         |
| 8          | Write down equation for average value of output voltage for half wave AC voltage controller.                                                                                                                                                                               | 1         |
| 9          | Give the name of commutation technique used in AC voltage controller.                                                                                                                                                                                                      | 1         |
| 10         | How many thyristors are required in three phase to three phase three pulse cycloconverter?                                                                                                                                                                                 | 1         |
| 11         | Mention any two applications of cycloconverter.                                                                                                                                                                                                                            | 1         |
| 12         | Why voltage to frequency ratio kept constant in I.M. drive.                                                                                                                                                                                                                | 1         |
| 13         | What is derating of machine?                                                                                                                                                                                                                                               | 1         |
| 14         | Give comparison of AC voltage controller, Inverter and Cycloconverter with reference to input given and output obtained from this device.                                                                                                                                  | 1         |
| <b>Q.2</b> | <b>(a) Compare VSI with CSI.</b>                                                                                                                                                                                                                                           | <b>03</b> |
|            | <b>(b) A three phase bridge inverter delivers power to a resistive load from 450 V d.c. source. For a star connected load of <math>10 \Omega</math> per phase, find rms value of load current for both (a) <math>180^\circ</math> and (2) <math>120^\circ</math> mode.</b> | <b>04</b> |
|            | <b>(c) Explain operation of single phase bridge inverter with RLC underdamped load. Draw waveform of output voltage and current for R, RL, RLC over damped and RLC under damped load.</b>                                                                                  | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                                                                                                  |           |
|            | <b>(c) Discuss 3-phase <math>180^\circ</math> mode VSI. Draw waveform of any two phase voltage and any one line voltage for Y connected resistive load.</b>                                                                                                                | <b>07</b> |

- Q.3** (a) Sketch unipolar and bipolar PWM technique. **03**  
(b) For sine PWM technique with ratio  $f_c/f_r=15$ , deduce the harmonic spectrum. **04**  
(c) Discuss SVPWM technique in brief. **07**

**OR**

- Q.3** (a) Discuss requirement of gating circuits. **03**  
(b) Draw circuit diagram and explain operation in brief of 1-phase Auto Sequential Commutated Inverter with inductive load. **04**  
(c) Explain concept of selective harmonic elimination technique. Write equations using which third and fifth harmonics can be eliminated from the inverter output voltage. **07**
- Q.4** (a) Explain concept of phase control strategy for regulating the power flow in ac voltage controllers. **03**  
(b) A single phase full wave ac voltage controller feeds a load of  $R=20\ \Omega$  with an input voltage of 230 V, 50 Hz. Firing angle of both thyristors is  $45^\circ$ . Calculate (a) rms value of output voltage (b) load power. **04**  
(c) With neat circuit diagram and waveform explain single phase voltage controller with RL load. **07**

**OR**

- Q.4** (a) Explain concept of integral cycle control strategy for regulating the power flow in ac voltage controllers. **03**  
(b) A single phase voltage controller is employed for controlling the power flow from 230 V, 50 Hz source into a load circuit consisting of  $R=3\ \Omega$  and  $\omega L=4\ \Omega$ . Calculate (a) the control range of firing angle (b) the maximum value of rms load current and (c) the maximum power. **04**  
(c) Draw different possible configuration of ac voltage controller. Explain basic principle of matrix converter. **07**
- Q.5** (a) Discuss effect of harmonics on machine performance. **03**  
(b) Discuss self-controlled synchronous motor drive employing load commutated inverter. **04**  
(c) Draw torque-speed characteristics of induction motor. Discuss motoring and braking region with necessary equations. **07**

**OR**

- Q.5** (a) Draw circuit diagram of static Kramer drive. How slip power can be recovered using this circuit? **03**  
(b) Discuss self-controlled synchronous motor drive employing cycloconverter. **04**  
(c) Discuss closed loop V/f technique used for induction motor drive. **07**

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