

# C.U. SHAH UNIVERSITY

## Winter Examination-2015

**Subject Name: Power Electronics - I**

**Subject Code: 4TE05PEL1**

**Branch: B.Tech (Ele,EEE)**

**Semester :5    Date: 02/12/2015    Time: 2:30 To 5:30    Marks: 70**

**Instructions:**

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
  - (2) Instructions written on main answer book are strictly to be obeyed.
  - (3) Draw neat diagrams and figures (if necessary) at right places.
  - (4) Assume suitable data if needed.
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**Q-1**

**Attempt the following questions:**

**(14)**

- a) The SCR is turn-off when the anode current falls below
  - (i) Forward current rating
  - (ii) Break-over voltage
  - (iii) Holding current
  - (iv) Latching current
- b) Optocoupler combine
  - (i) SIT and BJT
  - (ii) IGBT and MOSFET
  - (iii) Power transistor and silicone transistor
  - (iv) Infrared light emitting diode and silicon phototransistor
- c) Which semiconductor power device out of the following is not a current triggered device?
  - (i) Thyristor
  - (ii) GTO
  - (iii) Triac
  - (iv) MOSFET
- d) Which following is a two terminal three-layer device?
  - (i) Power BJT
  - (ii) Power diode
  - (iii) Power MOSFET
  - (iv) Power IGBT
- e) Power MOSFET is a
  - (i) Voltage controlled device
  - (ii) Current controlled device
  - (iii) Frequency controlled device
  - (iv) None of the above
- f) Chopper control for DC motor provide variation in
  - (i) Input voltage
  - (ii) Frequency



- (iii) Both (1) and (2)  
 (iv) None of the above
- g)** Cyclo-converter converts \_\_\_\_\_  
 (i) ac voltage to dc voltage  
 (ii) dc voltage to dc voltage  
 (iii) ac voltage to ac voltage at same frequency  
 (iv) Ac voltage at supply frequency to ac voltage at load frequency
- h)** Triac can be used only in  
 (i) Inverter  
 (ii) Rectifier  
 (iii) Chopper  
 (iv) Cyclo-converter
- i)** In a single phase full wave converter (M2 connection) feeding a highly inductive load, the firing angle for each thyristor is  $\alpha$  in the respective half cycle. The period of conduction of each Thyristor is  
 (i)  $\pi - \alpha$   
 (ii)  $\pi$   
 (iii)  $\pi + \alpha$   
 (iv)  $\pi - 2\alpha$
- j)** In a single phase semi converter number of Thyristor is  
 (i) 16  
 (ii) 8  
 (iii) 4  
 (iv) 2
- k)** In a 3 phase bridge inverter, the gating signal for the three phases have a phase difference of  
 (i)  $120^\circ$   
 (ii)  $60^\circ$   
 (iii)  $240^\circ$   
 (iv)  $90^\circ$
- l)** A 3 phase fully controlled converter is a  
 (i) 3 pulse converter  
 (ii) 6 pulse converter  
 (iii) 8 pulse converter  
 (iv) 12 pulse converter
- m)** The commutation method in an inverter is  
 (i) Line commutation  
 (ii) Forced commutation  
 (iii) Either (i) or (ii)  
 (iv) None of the above
- n)** Inverter find application in  
 (i) HVDC transmission  
 (ii) UPS  
 (iii) Variable speed ac drive  
 (iv) All of the above



**Attempt any four questions from Q-2 to Q-8**

- Q-2**            **Attempt all questions**            **(14)**
- a) Draw the symbol and V-I characteristics of following power device,  
i) Power BJT  
ii) Power MOSFET  
iii) SCR  
iv) TRIAC.            **7**
  - b) Give the comparison between power MOSFET and power BJT.            **7**
- Q-3**            **Attempt all questions**            **(14)**
- a) Explain operation of SCR using two transistor analogy            **7**
  - b) A single phase full-wave controlled rectifier is operated from a 230V, 50Hz supply, if load resistance is  $100\Omega$  and firing angle is  $\pi/4$ . Determine,  
i) PIV for SCR  
ii) Average value of output voltage and current  
iii) RMS value of output voltage and current            **7**
- Q-4**            **Attempt all questions**            **(14)**
- a) Explain principle of step-down chopper with necessary waveforms.            **7**
  - b) Explain single phase full-bridge controlled converter for inductive load.            **7**
- Q-5**            **Attempt all questions**            **(14)**
- a) Explain single phase ac voltage controller for resistive load with necessary waveforms.            **7**
  - b) Draw the waveforms of three-phase half wave converter with resistive load for firing angle  $0^\circ$ ,  $45^\circ$ ,  $90^\circ$ ,  $135^\circ$ .            **7**
- Q-6**            **Attempt all questions**            **(14)**
- a) Explain basic principle and operation of single phase to single cyclo-converter.            **7**
  - b) Explain single phase full bridge inverter with resistive load.            **7**
- Q-7**            **Attempt all questions**            **(14)**
- a) List voltage control technique for inverter and explain any two in detail.            **7**
  - b) Explain dynamic (switching) characteristic of SCR.            **7**
- Q-8**            **Attempt all questions**            **(14)**
- a) List triggering circuit and explain any one in detail.            **7**
  - b) Explain  $180^\circ$  conduction mode of three-phase inverter with necessary waveform.            **7**

