Registration No. : | | | | | | | | | | |

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B. Tech

PCEL 4301

# Fifth Semester Regular Examination – 2014

## POWER ELECTRONICS

### BRANCH(S) : EEE, ELECTRICAL

### QUESTION CODE : H 148

**Full Marks – 70**

**Time : 3 Hours**



*Answer Question No. **1** which is compulsory and any **five** from the rest.*
*The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2 ×10

   (a) Enumerate advantages of power BJT over power MOSFET.

   (b) Give protection of SCR against over current.

   (c) What is over drive of power BJT? Why is it not desirable?

   (d) What will be the peak reverse voltage rating of the power switching device used in a 1-phase center tap type full converter if primary supply voltage is 100 V ac (rms) and primary to secondary turn ratio is 1:3?

   (e) A single phase fully controlled rectifier has 100 sin (314t) as input supply voltage and resistor R as load. What will be the average output voltage for firing angle of 60° for this rectifier?

   (f) What are the advantages of Cuk converter over Buck-Boost converter?

   (g) At what duty cycle the load ripple current becomes maximum for a Buck converter?

   (h) A 3-phase sine-PWM inverter operates from a dc link voltage of 600 V. What will be the rms magnitude of line voltage of fundamental frequency for modulation index of 1.0.

P.T.O.

(i) What are the advantages of Space Vector Modulation (SVM)?

(j) What is trickle charge setting in a battery charger? Why is it necessary?

2. (a) Discuss the turn on and turn off characteristics of IGBT. 5

(b) What is the totempole configuration of base drive circuit of BJT? In which mode do the transistors in totempole configuration operate? 5

3. (a) Explain with circuit diagram, the UJT triggering scheme. 5

(b) How is a power BJT protected against 'dv/dt' and 'di/dt'? Explain with relevant circuit diagram. 5



4. (a) A three phase full converter fed from a three phase, 415 V, 50 Hz ac source is connected to load R = 20 Ω , E = 300 V and large inductance so that output current is ripple free. Determine the power delivered to load and input power factor for firing angle of 60°. 5

(b) Derive the expression for average output voltage of three phase fully controlled rectifier feeding R-L load and operating in continuous conduction mode. 5

5. (a) Give a comparison between single phase full converter and single phase semi converter with regards to displacement factor, distortion factor and input power factor presenting relevant waveforms and mathematical expression. 5

(b) Explain the principle of working of single phase cycloconverter with relevant circuit diagram and waveforms. 5

6. A Boost Regulator has an input voltage of 10V dc. The average output voltage is 30 V and the average output current is 1.0 A. The switching frequency is 25 kHz. If the input side inductance L=150 μH and output side capacitance C=220 μF, determine 10

(a) The duty cycle

(b) The ripple current of inductor

(c) The peak current of inductor

(d) The ripple voltage of filter capacitor.

7. (a) Explain the methods of generating the base/gate drive signals for a single phase sine-PWM voltage source inverter. 5

(b) With an appropriate power circuit diagram, discuss the working principle of a three phase bridge type voltage source inverter. Draw phase and line voltage wave forms on the assumption that each controlled switch conducts for 120° and three phase resistive load is star connected. 5

8. Write short notes on any two of the following: 5×2

(a) V-I characteristic of RCT

(b) AC voltage controller with PWM control

(c) Buck- Boost regulator

(d) UPS.