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

Total number of printed pages – 3

B. Tech

PCEL 4301

Fifth Semester Examination – 2013

POWER ELECTRONICS

BRANCH : ELECTRICAL, EEE

QUESTION CODE : C-411

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) What is Baker's clamp ? Where and why is it used ?

   (b) Why is 'dv/dt' rating important for a power semiconductor switch ? What is the protection against it ?

   (c) Draw the source current waveform for a single-phase semiconverter feeding R-L load under the assumption that the load current is continuous and ripple free having a value of 20 A and for a firing angle of 30° . Find the rms value of thyristor current.

   (d) What is the advantage of PWM rectifier over phase control rectifier ?

   (e) How can the ripple in the output voltage be minimized for Buck converter ?

   (f) What are the advantages of soft switched converter over hard switched converter ?

   (g) What are the advantages of Space Vector Modulation over SPWM control of inverter ?

   (h) What are the benefits of Cuk converter over the Buck Boost converter ?

   (i) What is the advantage of bipolar switching over unipolar switching in SPWM inverters ?

   (j) How is zero voltage switching realized in case of resonant inverter.

P.T.O.

2. (a) Draw and explain the switching behavior of power MOSFET. 5

(b) A MOSFET is switching a 20 A inductive load from a 100 V d.c. source. The fall time of the device is 0.5 μs. Calculate the shunt snubber capacitance value. 5

3. (a) For a varying load current that has a maximum value of 10 A, design a proportional base drive circuit for a BJT. 5

(b) What are the base drive techniques to increase the switching speed of BJTs ? What is antisaturation control of BJTs ? 5

4. A single-phase semiconverter feed power to RLE load. For discontinuous load current, draw the output voltage, load current, source current and free wheeling diode current waveforms as a function of time when (i) extinction angle $\beta > \pi$, (ii) $\beta < \pi$ with $V_m \sin \beta < E$. 10

5. (a) A single phase semiconverter, connected to 230 V, 50 Hz source , is feeding a load R = 10 Ω in series with large inductance that makes the load current ripple free. At firing angle of 60° , calculate the input reactive power, input power factor, total harmonic distortion and rectification efficiency. 5

(b) A single phase voltage controller feeds power to a resistive load of 3 Ω from 230 V, 50 Hz source. Calculate the maximum values of average and rms thyristor currents for any firing angle α. 5

6. (a) For a Buck-Boost converter the input d.c. voltage is 14 V. The duty cycle is 0.6 with switching frequency of 25 kHz. The inductance L = 180 μH and filter capacitance C = 220 μF. If the average load current is 1.5 A, compute 5

(i) The average output voltage

(ii) The peak to peak output voltage ripple

(iii) The peak to peak current in the inductor

(iv) The peak current of the device.

(b) Explain the working of Cuk converter with power circuit diagram and relevant waveforms. 5

7. (a) With relevant circuit diagram and waveforms, explain the zero current switching resonant inverter. 5

(b) With neat power circuit diagram, explain the working principle of three-phase VSI operating in 120° conduction mode. Draw phase voltage waveforms assuming three-phase resistive load connected in star. 5

8. Write short notes on any **two** : 5×2

(a) Three-phase PWM rectifier

(b) Single-phase cycloconverter

(c) Three-phase VSI with 120° conduction mode

(d) VAR compensator.