

<b>NR/R09</b>
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Code No: A4302/C4908, C0710, C4202, C4302, C5402, C6408

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech I Semester Examinations, March/April 2011

**ANALYSIS OF POWER ELECTRONIC CONVERTERS**

(COMMON TO ELECTRICAL POWER ENGINEERING, ELECTRICAL POWER SYSTEMS, POWER AND INDUSTRIAL DRIVES, POWER ELECTRONICS AND ELECTRIC DRIVES, POWER ENGINEERING AND ENERGY SYSTEMS, POWER ELECTRONICS)

**Time: 3hours**

**Max. Marks: 60**

**Answer any five questions**  
**All questions carry equal marks**

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1. a) Explain the operation of 1- $\phi$  voltage controller with RL-load with neat circuit and wave forms.  
b) Discuss the concept of synchronous tap changes. [12]
2. A 3-phase, 3-wire AC regulator supplies a star connected resistive load of  $R=10.0$  ohm and line to line input voltage is 230 V (rms), 50 Hz. The firing angle is  $30^\circ$ . Determine:
  - i) rms output voltage.
  - ii) Input power factor
  - iii) Expression for instantaneous output voltage of phase R. [12]
3. A single phase voltage controller feeds power to a resistive load of  $3\Omega$  from 230V, 50 Hz source. Calculate:
  - i) The maximum values of average and rms thyristor currents for any firing angle, ' $\alpha$ '.
  - ii) The minimum circuit turn-off time for any firing angle,  $\alpha$ .
  - iii) The ratio of 3<sup>rd</sup> harmonic voltage to fundamental voltage for  $\alpha = \pi/3$
  - iii) The angle, ' $\alpha$ ' at which the greatest forward or reverse voltage is applied to either of the thyristors and magnitude of these voltages. [12]
4. Explain the operation of dual converter both circulating and non circulating modes of operation. Mention its applications, advantages and disadvantages. [12]
5. What is pulse width modulation control of converters and what are the applications? A single phase full converter is connected to RLE load. The source voltage is 230 V, 50 Hz. The average load current of 10A is continuous over the working range. For  $R=0.4\Omega$  and  $L = 2\text{mH}$ , compute the firing angle delay for  $E=120$  V. [12]

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6. A three-phase, half wave converter is operated from a 3-phase, Y-connected 440 V, 50 Hz supply and the load resistance is  $R = 20\Omega$ . If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, calculate:
- a) Firing angle,  $\alpha$ .
  - b) rms and average output currents.
  - c) Rectification efficiency.
  - d) Input power factor. [12]
7. Discuss about switched mode regulators. Explain the operation of buck and boost regulators. Mention the applications and advantages of these regulators. [12]
8. Write about:
- i) Single phase bridge inverter.
  - ii) Harmonic reduction techniques. [12]

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