

**FACULTY OF ENGINEERING & TECHNOLOGY**  
**TE (EC/ECT/IE/E&C) - Year Examination June- 2015**  
**Power Electronics**  
**(Revised)**

[Time: Three Hours]

[Max. Marks: 80]

“Please check whether you have got the right question paper.”

- i) Question no.1 from section A & question no.6 from section B are compulsory
- ii) Solve any two questions from Q.2 to Q.5 in section ‘A’ & from Q.7 to Q.10 in section ‘B’
- iii) Assume suitable data wherever necessary
- iv) Symbols have their usual meanings unless stated

**SECTION A**

- Q.1 Solve any two questions from the following: 10
- i) Explain integral cycle control method.
  - ii) Define cyclo-converter? Explain .step-up cyclo-converter?
  - iii) Why  $I_g$  ceases, once the SCR comes into conduction? Justify.
  - iv) The reverse recovery time of a diode is  $t_{rr} = 3\mu s$  and  $\frac{di}{dt} = 30A/\mu s$   
 Determine, A)  $Q_{RR}$ , B)  $I_{RR}$
- Q.2
- a) With the help of neat diagram, explain structure of IGBT & V.I characteristics? 07
  - b) A bipolar transistor has current gain  $\beta = 40$ . the load resistance  $R_L = 10\Omega$ ,  $V_{cc} = 130v$ . Input voltage to base circuit  $V_B = 10v$  for  $V_{CES} = 1.0v$  &  $V_{BES} = 1.5v$  calculate, 08
    - 1) Value of  $R_B$  for the operation in the saturated state
    - 2) Value of  $R_B$  for an overdrive factor of 5.
    - 3) Forced current gain
    - 4) Power loss in the transistor
- Q.3
- a) Explain class – B communication technique with neat circuit diagram & waveforms? 07
  - b) A relaxation oscillator, using an UJT is to be designed for triggering on SCR. The UJT has the following data:  $n = 0.7$ ,  $I_p = 0.5mA$ ,  $V_p = 15.0v$ ,  $V_V = 0.8v$ ,  $I_V = 2mA$ ,  $R_{BB} = 6K\Omega$  normal  $I_L$  with emitter open = 3mA. The firing frequency is 1.5KHz for  $C=0.05\mu F$ , compute the values of charging resistor & the external resistors connected in the base circuits 08
- Q.4
- a) With the help of circuit diagram & wave forms, explain operation of rectifier & Inverter mode of  $I - \phi$  full converter with  $R - L$  load? 07
  - b) Calculate peak value of the circulating current for 3 –  $\phi$  dual converter for the given data, per phase supply rms voltage = 230v,  $\omega = 315rad/sec$ ,  $L = 12mH$ ,  $\alpha_1 = 60^\circ$ ,  $\alpha_2 = 120^\circ$  08
- Q.5
- a) For a 1 –  $\phi$  A.C. voltage controller with a resistive load, show that power factor is given by the expression  $\left[ \frac{1}{\pi} \left\{ (\pi - \alpha) + \frac{1}{2} \sin 2\alpha \right\} \right]^{\frac{1}{2}}$  08
  - b) Explain phase – angle control method of AC volt Controller with neat circuit diagram & waveforms 07

## SECTION B

- Q.6 Solve any two questions from the following: 10
- i) Voltage control techniques of an inverter
  - ii) Four Quadrant chopper
  - iii) Ring counter circuit
  - iv) Source filter
- Q.7
- a) With neat circuit diagram & waveforms, explain working of  $3 - \phi$   $180^\circ$  conduction mode bridge inverter 07
  - b) Calculate O/P frequency of series inverter with  $L = 10mH$ ,  $C = 0.1\mu$  &  $R_L = 500\Omega$ ,  $T_{off} = 250 \mu sec$ ,  $t_q = 25\mu sec$  08
- Q.8
- a) Explain voltage commutated chopper with neat circuit diagram & waveforms? 07
  - b) For type- A chopper,  $V_s = 220v$ ,  $f = 500Hz$ ,  $T_{on} = 800 \mu sec$ ,  $R = 1 \Omega$ ,  $L = 1 mH$  &  $E = 72v$  08
    - a) Find whether load current  $I_L$  is continuous or not
    - b) Compute the  $I_{Max}$  &  $I_{Min}$
- Q.9
- a) Explain flasher circuit with neat wave- forms & circuit diagram 07
  - b) Explain servo controlled voltage stabilizer 08
- Q.10
- a) With the help of neat circuit diagram & waveforms, explain  $1 - \phi$  series inverter 07
  - b) Explain various control strategies used for obtaining variable O?P voltage from DC chopper 08