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**Question Paper Code : X10401**

**B.E./B.Tech. DEGREE EXAMINATIONS NOVEMBER / DECEMBER 2020**

**Fifth Semester**

**Electrical and Electronics Engineering**

**EE8552 - POWER ELECTRONICS**

**(Common to: Mechatronics Engineering)**

**(Regulations 2017)**

Time: 3 Hours

Answer ALL Questions

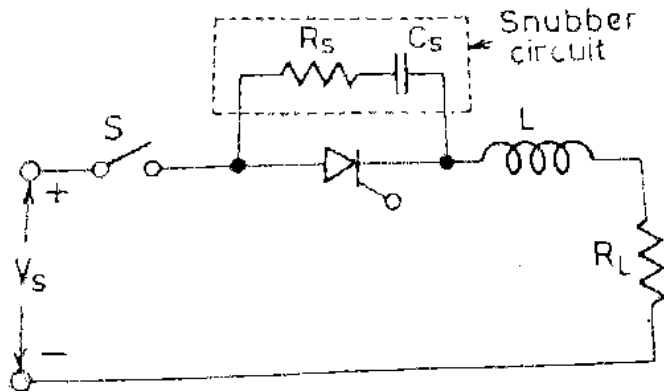
Max. Marks 100

**PART- A (10 x 2 = 20 Marks)**

1. Differentiate holding current from latching current
2. What do you mean by second breakdown in power BJT?
3. Define pulse number
4. Differentiate the device turn off time from the circuit turn-off time.
5. List the uses of class B chopper
6. What are the effects of quick or fast charging (storage) or high –energy recovery (discharge) from a battery?
7. What are integral body diodes?
8. Why PWM strategies are used in inverters?
9. What is bidirectional switch?
10. What is the disadvantage of ON-OFF control?

**PART- B (5 x 13 = 65 Marks)**

11. a) (i) Discuss the basic structure and working of power GTO. (6)  
(ii) Figure shows a thyristor controlling the power in a load resistance  $R_L$ . The supply voltage is 240V dc and the specified limits for  $di/dt$  and  $dv/dt$  for the SCR are  $50A/\mu\text{sec}$  and  $300V/\mu\text{sec}$  respectively. Determine the values of the  $di/dt$  inductance and the snubber circuit parameters  $R_s$  and  $C_s$ .



(7)

**OR**

- b) (i) Draw the two transistor model of SCR and derive an expression for anode current. (6)  
 (ii) Develop a UJT based Trigger circuit for SCR (7)

12. a) Show that the performance of a single – phase full converter as effected by source inductance is given by the relation

$$\cos(\alpha + \mu) = \cos \alpha - \frac{\omega L_s I_0}{V_m}$$

**OR**

- b) Describe the working of single –fully controlled bridge converter in the Rectifying mode and inversion mode. And derive the expressions for average output voltage and rms output voltage.

13. a) (i) With relevant sketches explain the operation of a buck-boost converter (8)  
 (ii) With neat block diagrams, explain the principle of operation of battery operated vehicles. (5)

**OR**

- b) (i) The buck regulator has an input range of  $V_s = 12V$ . The regulated average output voltage is  $V_a = 5V$  at  $R=500\Omega$  and the peak to peak output ripple voltage is  $20mV$ . The switching frequency is  $25\text{ kHz}$  if the peak to peak ripple current of inductor is limited to  $0.8A$ . Determine ,  
 (a). The duty cycle  
 (b). The filter inductance  
 (c). The filter capacitance  $C$ , and  
 (d). The critical value of  $L$  and  $C$  (5)

- (ii) Describe the working of four quadrant chopper (8)

14. a) (i)With neat sketches, explain the operation of three phase voltage source inverter. Draw phase and line voltage waveforms on the assumption that each thyristor conducts for  $180^\circ$  and the resistive load is star connected. (10)  
 (ii) Write short notes on the principle of induction heating (3)

**OR**

- b) (i) With suitable circuits, mode diagrams and waveforms explain any one of CSI (9)  
 (ii) Discuss about different modified SPWM strategies. (4)

15. a) (i). Describe the operation of a 3-phase thyristorised AC voltage controller with neat power diagram and waveforms.  
 (ii). Explain in detail about multistage control in ac voltage controllers.

**OR**

- b) (i) With the suitable circuit, discuss about the matrix converter (7)  
(ii) For a single – phase voltage controller feeding a resistive load, show that power factor is given by the expression

$$\left[ \frac{1}{\pi} \{(\pi - \alpha) + \frac{1}{2} \sin 2\alpha\} \right]^{1/2} \quad (6)$$

**PART- C (1 x 15 = 15 Marks)**

16. a) (i) A three phase fully controlled bridge converter operating from a 3 phase 220V, 50 Hz supply is used to charge a battery bank with nominal voltage of 240V. The battery bank has an internal resistance of  $0.01\Omega$  and the battery bank voltage varies by  $\pm 10\%$  around its nominal value between fully charged and uncharged condition. Assuming continuous conduction find out.
- (a). The range of firing angle of the converter  
(b). The range of ac input power factor.  
(c). The range of charging efficiency. When the battery bank is charged with a constant average charging current of 100 Amps through a 250 mH lossless inductor. (10)
- (ii) The manufacturer of a selected diode gives the rate of fall of the diode current  $di/dt=20A/\mu s$ , and its reverse recovery time  $t_r=5\mu$ . What value of peak reverse current do you expect. (5)

**OR**

- b) (i) With help of suitable diagram explain the dynamic characteristics of Power diode (6)  
(ii) With neat circuit diagram explain the working of Class E Resonant Rectifier (9)