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INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Four Year B.Tech V Semester End Examinations (Regular) - November, 2019

Regulation: IARE – R16
POWER ELECTRONICS

Time: 3 Hours

(EEE)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain in detail, the operation and switching characteristics of MOSFET. [7M]
 (b) An SCR has half cycle surge current rating of 3000A for 50Hz supply. Calculate its one cycle surge current rating and I^2t rating [7M]
2. (a) Draw and explain RC half-wave trigger circuit for a SCR and describe the function of various components [7M]
 (b) Design a suitable snubber circuit, from the following parameters having its minimum value of load resistance 5Ω . Repetitive peak current, $I_p = 100\text{ A}$, $(di/dt)_{\max} = 25\text{ A}/\mu\text{s}$, $(dv/dt)_{\max} = 100\text{ V}/\mu\text{s}$. Assume a factor of safety of for I_p , $(di/dt)_{\max}$ and $(dv/dt)_{\max}$, where thyristor operating at a supply voltage of 200 V, with $R_s = 25\ \Omega$ and damping factor = 1.3 values. [7M]

UNIT – II

3. (a) Describe the working of a single phase fully controlled converter with RLE load with appropriate waveforms. [7M]
 (b) A single phase full converter is made to deliver a constant load current. For zero degree firing angle, the overlap angle is 15° . Calculate the overlap angle when firing angle is 30° . [7M]
4. (a) Explain the operation of a three phase fully controlled bridge converter feeding RL load with the help of waveforms. [7M]
 (b) A resistive load of 10Ω is connected through a half-wave controlled rectifier circuit to 220V, 50 Hz, single phase source. Calculate the power delivered to the load for a firing angle of 60° . Find also the value of input power factor [7M]

UNIT – III

5. (a) Discuss the principle of phase control in single phase full wave AC voltage controller with R load. obtain the expression for the rms value of its output voltage. [7M]
 (b) A single phase half wave AC voltage controller feeds power to a resistive load of 50Ω from 230 V, 50 Hz source. The firing angle of SCR is $\pi/2$. Calculate i) The rms value of output voltage ii) Input power factor iii) The average input current [7M]

6. (a) Describe the basic principle of working of single-phase to single-phase step down cycloconverter for both continuous and discontinuous conductions for a bridge type cycloconverter. [7M]
- (b) A single-phase full wave ac voltage controller has a load of $R=5\Omega$ and the input voltage is 230V, 50 Hz. If load power is 5kW, find i) Firing angle delay of thyristors ii) Input power factor. [7M]

UNIT – IV

7. (a) Describe the working of type E chopper with relevant circuit diagram and its operation in all four quadrants. [7M]
- (b) A battery is charged from a constant dc source of 220V through a chopper. The DC battery is to be charged from its internal emf of 90V to 122 V. The battery has internal resistance 1 ohm. For a constant charging current of 10A. Compute the range of duty cycle. [7M]
8. (a) Explain with neat circuit diagram and waveform, working of Cuk regulator. [7M]
- (b) For a type-A chopper, source voltage $V_s = 220V$, chopping frequency $f=500Hz$, $T_{on} = 800\mu s$, $R=1\Omega$, $L=1mH$ and $E=72V$.
- i) Find whether load current is continuous or not.
- ii) Calculate the values of average output voltage and average output current.
- iii) Compute the maximum and minimum values of steady state output current. [7M]

UNIT – V

9. (a) Explain the operation of 3 phase bridge inverter for 180° degree mode of operation with aid of relevant phase and line voltage waveforms. [7M]
- (b) For a three-phase 120° mode bridge inverter feeding a delta connected resistive load having a source voltage of V_s , sketch line voltage waveform. From this waveform, calculate RMS value of line voltage. [7M]
10. (a) Explain principle of operation of single phase basic parallel inverter with neat sketches [7M]
- (b) A series inverter has the following specifications. Capacitor, $C = 0.5\mu F$ Inductor, $L = 12 mH$ resistor, $R=100\Omega$ and $T_{off} = 0.5 ms$ then determine the output frequency and attenuation factor load current. [7M]

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