Code No: R1631025 **R16** SET - 1

III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Define Latching and holding current. [2M]
   b) What is commutation angle or overlap angle? [2M]
   c) What are the advantages of 3-ϕ fully controlled rectifier over 3-ϕ semi controlled rectifier? [2M]
   d) What are the applications of DC chopper? [3M]
   e) What is meant by PWM control? What are the advantages? [3M]
   f) What is the difference between On-Off control and phase control? [2M]

PART –B (56 Marks)

2. a) List the different members of the thyristor family. Draw their characteristics and explain in brief. [7M]
   b) Draw and explain the output characteristics of n-channel enhancement mode MOSFET. [7M]

3. a) Describe the working of single-phase fully controlled bridge converter in the Rectifying mode. [7M]
   b) A single phase half wave rectifier is used to supply power to a load of impedance 10 Ω from 230 V, 50 Hz a.c. supply at the firing angle of 30^0. Calculate: i) Average load voltage, ii) Load current, iii) Effective value. [7M]

4. a) Derive an expression for output voltage of a three phase fully controlled bridge converter by considering source-inductance. [7M]
   b) For the 3-ϕ converter operating from 3ϕ, 415V/50Hz supply, find out the SCR rating if the load resistance is 100 Ω in series with a large smoothing inductor. [7M]

5. a) Discuss the operation of Boost converter with the help of neat circuit diagram and waveforms. [7M]
   b) With the help of a neat circuit diagram and associated waveforms, discuss the operation of Buck-Boost converter. List the advantages and disadvantages of this type of converter. [7M]

6. a) Explain the cross conduction or shoot through fault in inverters. How will you overcome it? [7M]
   b) Compute the output frequency of a series inverter with the following specifications: L=10 mH; C=0.1μF; R= 150Ω; T_{off} = 0.2 ms. Also, find the attenuation factor. [7M]

7. a) Describe the operation of single phase half wave a.c. voltage regulator with the help of voltage and current waveforms. Also, derive the expression for average value of output voltage. [7M]
   b) Discuss the various important factors to be considered while feeding transformers through a.c. regulators. [7M]

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Code No: R1631025 **R16** SET - 2

III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Define circuit turn off time, why it should be greater than the thyristor turn-off time? [2M]
   b) What are the advantages of single phase bridge converter over single phase mid converter? [2M]
   c) Explain briefly continuous conduction mode. [3M]
   d) What is meant by duty cycle? [2M]
   e) What are the disadvantages of the harmonic present in the inverter system? [3M]
   f) What are the disadvantages of unidirectional or half-wave a.c. voltage controller? [2M]

PART –B (56 Marks)

2. a) With the help of neat structural diagram and suitable waveforms, explain the operation of IGBT. [7M]
   b) Briefly discuss the gate drive design considerations of the MOSFET. [7M]

3. a) Describe the operation of single–phase, two-pulse, mid-point converter with relevant voltage and current waveforms. [7M]
   b) Explain the half-waving effect in a single-phase symmetrical half-controlled converter. [7M]

4. a) Explain the operation of three phase, half-wave controlled converter with resistive load, and inductive load. Sketch the associated wave forms. [7M]
   b) A 3 phase full converter is operated from a Δ-Y connected transformer whose secondary rating is 3-ϕ, 415 V, 50 Hz. Derive an equation for the transformer utilization factor. [7M]

5. a) Derive the expression for peak-to peak ripple current and ripple voltage in case of Buck-Boost converter. [7M]
   b) List the advantages and disadvantages of the Buck chopper. [7M]

6. a) Compare 180^0 and 120^0 conduction mode of 3ϕ transistorized bridge inverter. [7M]
   b) Give the circuit analysis of CSI with resistive load. [7M]

7. a) Explain the various triggering modes of a Triac. Compare their sensitivity. [7M]
   b) Derive an expression for the output current in terms of source voltage, load impedance and firing angle for a single-phase a.c. regulator with RL load. [7M]

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Code No: R1631025 **R16** SET - 3

III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) What is a snubber circuit? [2M]
   b) What is meant by commutation? [2M]
   c) Explain briefly discontinuous conduction mode. [2M]
   d) What is meant by step-up and step-down chopper? [3M]
   e) Compare CSI and VSI. [3M]
   f) What type of gating signal is used in single phase ac voltage controller with RL load? [2M]

PART –B (56 Marks)

2. a) Briefly explain the V-I characteristics of an IGBT. [7M]
   b) Explain the basic requirements for the successful firing of thyristor in detail. [7M]

3. a) Discuss the effect of source inductance on the performance of a single phase fully controlled converter, indicating clearly the conduction of various thyristors during one cycle. [7M]
   b) Describe the working of single phase fully controlled bridge converter in the inversion mode. [7M]

4. a) Explain the operation of a three phase, half-controlled bridge converter with associated waveforms. [7M]
   b) A three phase, half-wave converter is supplying a load with a continuous constant current of 40 A over a firing angle from 0 to 75^0, what will be the power dissipated by the load at these limiting values of firing angles? The supply voltage is 415 V(line). [7M]

5. a) Derive the expressions for peak to peak ripple current of inductor and peak to peak ripple voltage of capacitor in terms of circuit components, supply voltage, frequency and duty-ratio, for a Buck converter. [7M]
   b) What are the advantages and disadvantages of Buck-Boost regulator? [7M]

6. a) Explain sinusoidal pulse modulation as used in PWM inverters. Write the important features of the same. [7M]
   b) Give the performance comparison of PWM, AVI and CSI. [7M]

7. a) Describe the operation of a 3-ϕ, three wire a.c. thyristor controller with neat power-diagram and voltage and current waveforms. [7M]
   b) A single–phase, half-wave a.c., voltage regulator, using one SCR in antiparallel with a diode, feeds 1 KW, 230 V heater. Find the load power for a firing angle of : i) 0^0, ii) 180^0 iii) 70^0? [7M]

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Code No: R1631025 **R16** SET - 4

III B. Tech I Semester Regular/Supplementary Examinations, March - 2021

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) What losses occur in thyristor during working conditions? [2M]
   b) What is the function of freewheeling diodes in controlled rectifier? [2M]
   c) What are the advantages of six pulse converter? [2M]
   d) Write the principle of operation of fly back converters in CCM. [3M]
   e) How is the inverter circuit classified based on commutation circuitry? [3M]
   f) What is meant by sequence control of ac voltage regulators? [2M]

PART –B (56 Marks)

2. a) With the help of a neat sketch, explain the static characteristics of SCR. [7M]
   b) Explain briefly Turn-on and Turn–off methods of SCR. [7M]

3. a) Explain the operation of single-phase, half-controlled bridge converter with resistive load and inductive load with the associated waveforms. [7M]
   b) Explain the effect of freewheeling diode in detail. Also, justify the statement "Freewheeling diode improves the power factor of the systems". [7M]

4. a) Explain the effect of source inductance on the performance of a three phase, fully-controlled bridge converter. [7M]
   b) Calculate the average output voltage of a three phase half controlled bridge operating with a triggering angle of Π/2 and connected to a three phase a.c. supply of 400 V and 50 Hz. The load current i_d is assumed to be continuous. [7M]

5. a) With the help of a neat circuit diagram and associated waveforms discuss the operation of a Buck converter. [7M]
   b) What are the advantages and disadvantages of Boost regulator? [7M]

6. a) Explain the principle of operation of an inverter. How are their classified? [7M]
   b) Compare voltage source and current source inverters. [7M]

7. a) Draw the V-I characteristics of a Triac and explain its working principle. [7M]
   b) Explain why the single phase a.c, regulator using two SCR's must have its trigger sources isolated from each other? [7M]

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