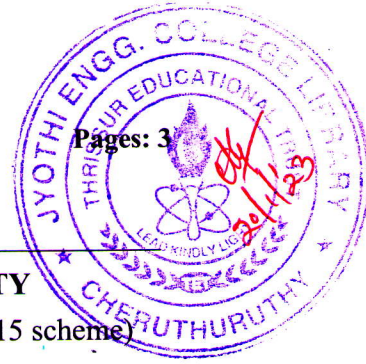


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Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Fifth Semester B.Tech Degree (S,FE) Examination January 2023 (2015 scheme)

Course Code: EE305

Course Name: POWER ELECTRONICS

Max. Marks: 100

Duration: 3 Hours

(Graph sheets may be supplied on demand)

PART A

Answer all questions, each carries 5 marks.

Marks

- 1 What is holding current and latching current of a SCR? Draw a typical static VI characteristic and mark mentioned current in it (5)
- 2 Describe, using neat circuit diagram, the RC triggering circuit for SCR. Mention its anyone major advantage over R triggering. (5)
- 3 Draw the circuit of 3-phase half wave rectifier and sketch the output voltage waveform at a firing angle of 30° . (5)
- 4 Sketch the circuit diagram and output voltage waveform of a single-phase half bridge Voltage Source Inverter with R load and describe the working. (5)
- 5 A single-phase full wave ac voltage controller (with two thyristors) has a resistive load of 10 ohms and input voltage is 120 V (rms), 60 Hz. The delay angle of both thyristors is $\pi/2$. Determine (i) rms output voltage (ii) input power factor (iii) average current of thyristors. (5)
- 6 With the help of waveform, explain sinusoidal pulse width modulation used in single phase inverter. (5)
- 7 With circuit diagram and waveforms, describe the working of Type C chopper: (5)
- 8 Obtain the equation for output voltage in terms of duty cycle and input voltage for buck converter. (5)

PART B

Answer any two full questions, each carries 10 marks.

- 9 a) Explain neatly the structure, principle of operation and symbol of IGBT (5)
- b) SCR with rating 1000V and 200A are available to be used in a string to handle 6kV and 1kA. Calculate the number of series and parallel units needed, if the derating factor is 0.2 (5)

- 10 a) With the help of circuit diagram, explain briefly the working of silicon-controlled rectifier using two transistor analogy. (5)
- b) Obtain an expression for average dc output voltage of a 1-phase fully controlled rectifier for R load with firing angle, α . (5)
- 11 a) A single phase fully controlled bridge rectifier supplies a RLE load. The inductance L in the circuit is so large that the output current may be considered to be virtually constant. Assume ideal SCR s used. (5)
RMS supply voltage = 220 V, load resistance = 0.5 ohms, output dc current = 10A. Determine firing angle (α), if $E = -145V$
- b) Explain how Thyristor based 1-phase fully controlled rectifier can be used to convert ac to dc operating in discontinuous conduction mode with RL load. Draw waveforms of output voltage and output current for $\alpha=60^\circ$. (5)

PART C

Answer any two full questions, each carries 10 marks.

- 12 Sketch the circuit diagram and explain the working of a 3-phase full wave-fully controlled rectifier with RLE load. Draw the output voltage waveforms corresponding to $\alpha = 60^\circ$ and $\alpha = 90^\circ$ (10)
- 13 a) Explain in detail the operation of single-phase dual converter with circulating current. (5)
- b) Compare Current source inverter with Voltage source Inverter. (5)
- 14 a) Draw the circuit and explain the operation of a 3-phase bridge inverter with R load, operating in 120° conduction mode. Draw the output line voltage and phase voltage waveforms. Derive expressions for output line voltage and phase voltage. (10)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) With the help of circuit diagram, explain the operation of single-phase ac voltage controller with R-load. Draw the wave forms for output voltage and current waveforms. (5)
- b) Distinguish the terms amplitude modulation index and frequency modulation index in sine PWM technique. How it affects the inverter output. (5)
- 16 a) Explain single pulse modulation control for single phase full bridge inverter. (5)

- b) With the help of relevant waveforms, Explain the operation of four quadrant dc- (5)
dc chopper
- 17 a) A step-down chopper has dc source voltage 100 V, load resistance is 10 Ω . For (5)
a duty cycle of 0.5, calculate the average dc output voltage.
- b) With the help of relevant waveforms, derive the expression for output voltage of (5)
a Buck-Boost regulator in continuous conduction mode of operation
