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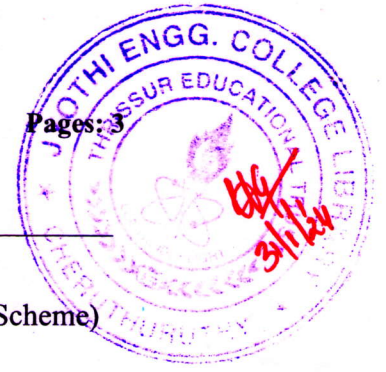
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Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) / S4 (PT) (S) Examination January 2024 (2019 Scheme)



Course Code: EET306

Course Name: POWER ELECTRONICS

Max. Marks: 100

Duration: 3 Hours

Graph sheet may be provided

PART A

Answer all questions, each carries 3 marks.

Marks

- | | | |
|----|---|-----|
| 1 | Explain the peripheral effects of power electronic converters. How can it be remedied? | (3) |
| 2 | Write short notes on wide band gap devices. | (3) |
| 3 | Explain with relevant sketch, the concept of phase control employed in phase controlled rectifiers. | (3) |
| 4 | Explain the effect of freewheeling diode in phase controlled rectifier circuit. | (3) |
| 5 | With neat circuit diagram and waveforms explain the working of a single phase AC voltage controller feeding an RL load. | (3) |
| 6 | Explain the advantages of internal voltage control method employed in inverters. | (3) |
| 7 | Explain the current limit control employed in dc-dc converters. | (3) |
| 8 | Derive the relationship between input and output voltages in a step down chopper. | (3) |
| 9 | Explain the advantages of an electric drive. | (3) |
| 10 | Explain the components of load torque. | (3) |

PART B

Answer one full question from each module, each carries 14 marks.

Module I

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|----|--|------|
| 11 | a) Explain in detail, the different turn on methods of an SCR. | (10) |
| | b) Explain the switching characteristics during turn off of an IGBT. | (4) |

OR

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|----|---|-----|
| 12 | a) Explain the two transistor analogy of an SCR. | (8) |
| | b) Explain the reverse recovery characteristics of a power diode. | (6) |

Module II

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| 13 | a) Explain with a neat circuit diagram the working of a half controlled bridge | (9) |
|----|--|-----|

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rectifier with freewheeling diode feeding RLE load. Also draw the output voltage, output current, freewheel diode current and source current waveforms. Derive the expression for average output voltage.

- b) A single phase full converter is supplied from 230V, 50 Hz source. The load consists of load $R=10\Omega$ and a large inductance so as to render the load current constant. For a firing angle delay of 30° , determine (a) average output voltage (b) average output current (c) average value of thyristor current. (5)

OR

- 14 Explain the working of a three phase half controlled bridge converter feeding RLE load in continuous conduction mode with a neat circuit diagram and output voltage waveform. Assume the firing angle to be 30° . Show the conducting devices. Derive the output voltage equation. (14)

Module III

- 15 a) With neat circuit diagram and waveforms, explain the working of a single phase full bridge inverter feeding RL load. (7)
b) Explain with a neat circuit diagram and waveforms the working of a single phase capacitor commutated current source inverter with R load. (7)

OR

- 16 Explain the 120° conduction mode of operation of three phase voltage source inverter with output voltages indicating the devices conducting in each state. (14)

Module IV

- 17 a) With a neat circuit diagram, explain a four quadrant chopper. (7)
b) With a neat circuit diagram, explain the working of a step up chopper. Also derive the relationship between input and output voltages. (7)

OR

- 18 a) With neat circuit diagram, explain the working of boost regulator. Also derive the design expression for L and C. (7)
b) The buck regulator has an input voltage of 12V. The required average output voltage is 5V at $R=500\Omega$ and the peak-to-peak output ripple voltage is 20 mV. The switching frequency is 25 kHz. If the peak-to-peak ripple current of inductor is limited to 0.8 A, determine (a) the duty cycle d, (b) the filter inductance L, (c) the filter capacitor C. (7)

Module V

- 19 a) Explain with neat circuit diagram and waveforms the working of a single phase fully controlled DC drive. (7)
- b) A dc chopper is used for regenerative braking of a separately excited DC motor. (7)
The dc supply voltage is 400V. The motor has $r_a=0.2 \Omega$ and torque constant to be 1.2Vs/rad. The average armature current during regenerative braking is kept constant at 300A with negligible ripple. For a chopper with duty cycle of 60 %, determine (i) power returned to DC supply(ii) minimum and maximum possible braking speeds (iii) speed during regenerative braking

OR

- 20 a) Explain the stator voltage control method of speed control of a three phase induction motor drive. (7)
- b) Explain the block diagram of an electric drive (7)
