Code No: **R31024** **R10** **Set No. 1**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) Draw the symbol of a thyristor and list the merits and demerits of thyristors. [7]
b) Define and explain *delay time, rise time* and *spread time* of a thyristor. [8]

2 Explain in detail the two transistor analogy of an SCR. [15]

3 a) What is pulse number of a converter? Explain with an example. [7]
b) What is half wave converter? Derive the expression for an average DC output voltage of a single-phase half wave converter with R load [8]

4 A single-phase fully controlled bridge rectifier supplies R load. By assuming the constant output current, find the following performance factors if the supply voltage is 230V and if the firing angle is $\pi/6$ and R = 5Ω. [15]
(**i**) Average output voltage, (**ii**) Supply RMS current, (**iii**) Supply fundamental current, (**iv**) Fundamental power factor, (**v**) Input power factor and (**vi**) Voltage ripple factor.

5 a) Explain the advantages of three-phase converters over single-phase converters. [7]
b) Discuss the operation of single-phase dual converter. [8]

6 a) What do you mean by ac voltage controller? Give the merits and demerits of it. [7]
b) Give the principle of integral cycle control for a single-phase ac voltage controller. [8]

7 With a neat sketch, explain the working principle of type B and type C choppers. [15]

8 Calculate the output frequency of a series inverter for the following parameters and find out the attenuation factor: [15]
L=10 H, C=0.1μF, R=400Ω, T_{off}=0.2 sec

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Code No: **R31024** **R10** **Set No. 2**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) Discuss the basic operation of a thyristor and list the different applications of thyristors. [8]

b) Define and explain *reverse recovery time* and *gate recovery time* of a thyristor. [7]

2 a) With a neat schematic diagram, explain the UJT firing circuit. [8]

b) SCR with rating of 1200V and 250A are used in a string to handle 5kV and 2kA.Calculate the number of series and parallel units required in case derating factor is i) 0.2 and ii) 0.4 [7]

3 a) Define and explain firing angle. [4]

b) Give the classification of phase controlled converters. [6]

c) What are line-commutated converters? Explain. [5]

4 a) Give some examples for RL type loads. [5]

b) A single-phase full converter is connected to 230V, 50Hz supply. The load current 'I_0' is assumed to be continuous and the turns ratio is unity. Find E_{dc}, E_{rm}, and power factor for a delay angle of $\pi/3$. [10]

5 What are dual converters? What are their applications? Explain the operation of a three-phase dual converter. [15]

6 a) Give the difference between two SCRs connected in antiparallel and a traiac for the same purpose. [7]

b) What is a Triac? Discuss the operation of a Triac with R-L load. [8]

7 Derive an expression for output voltage in terms of duty cycle for a step up, step down and step down/up chopper. [15]

8 What is a full bridge inverter? Draw the circuit schematic for a single phase full bridge inverter and hence explain its operation. [15]

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Code No: **R31024** **R10** **Set No. 3**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 a) Draw and discuss static V-I characteristics of a thyristor. [8]
b) Explain the operation of IGBT. Also mention its advantages compared to SCR. [7]

2 a) What is the need for snubber circuit? Explain. [7]
b) A 150A SCR is to be connected in parallel with a 200A SCR. The ON state voltage drops of the SCRs is given as 2.0V and 1.9V respectively. Calculate the series resistance that should be connected with each SCR, if the two SCRs have to share the current of 350A in proportion to their ratings. [8]

3 With a neat circuit diagram and waveforms, explain the operation of a single-phase half wave converter with RL load. [15]

4 With a neat schematic diagram and necessary waveforms, explain the operation of a fully controlled bridge converter with R-L load. [15]

5 A three-phase fully controlled bridge rectifier is supplied at 230V/phase and at a frequency of 50Hz. The source inductance L_s=5mH and the load current on dc side is constant at 12A. If the load consists of a dc source voltage of 230V having an internal resistance of 0.9Ω, find the following [15]
a) Firing angle
b) Overlap angle

6 a) What are cycloconverters? Explain its purpose. [7]
b) What are different applications of ac voltage controllers? Explain the operation of single-phase ac voltage controller with R-load. [8]

7 Explain the working of first quadrant or type A chopper with suitable voltage and current waveforms. Give the complete time domain analysis of type A chopper. [15]

8 A single-phase full bridge inverter has a resistive load of R=5Ω and the DC input voltage of E_{dc} = 220V. Calculate [15]
i) The RMS output voltage at the fundamental frequency denoted by E_1
ii) The output power P_0
iii) The average and peak currents of each thyristor
iv) The peak inverse voltage of each thyristor
v) Output voltage at the fundamental frequency

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Code No: **R31024** **R10** **Set No. 4**

III B.Tech I Semester Supplementary Examinations, May/June - 2015

POWER ELECTRONICS

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 List and discuss in detail different turn-on methods of a thyristor. [15]

2 a) What is snubber circuit? Give the procedural steps for the design of snubber circuit. [8]

b) It is required to operate 200A SCR in parallel with 300ASCR with their respective on state voltage drops of 1.4V and 1.2V. Calculate the value of resistance to be connected in series with each SCR so that they share the total load of 500A in proportion to their current ratings. [7]

3 A single-phase halfwave converter is fed from a 230V ac supply and connected to a resistive load of 5Ω. If the delay angle is π/4, find the [15]
(i) Rectification efficiency (ii) Form factor
(iii) Ripple factor (iv) Transformer utilization factor
(v) Peak inverse voltage

4 a) What is freewheeling diode? Explain its purpose. [6]

b) Discus the effect of source impedance on the performance of single-phase full converter. [9]

5 With a neat schematic diagram and waveforms, explain the operation of a three-phase full wave bridge converter R-L load. [15]

6 A single-phase voltage regulator is employed for controlling the power flow from 230V, 50Hz source into a load circuit consisting of R=5Ω and ωL=4Ω. Determine [15]
i) The control range of firing angle
ii) Maximum value of RMS load current
iii) The maximum power and power factor
iv) The maximum value of average and RMS thyristor currents
v) The maximum possible value of di/dt that occurs in the thyritor and its valve.

7 a) The input voltage of a step down chopper being 220V, the load voltage is 100V. Assuming a chopping frequency of 5KHz, find the ON and OFF intervals of the thyristors in each cycle. [7]

b) With a neat circuit diagram, explain the principle of operation of a buck-boost converter. [8]

8 a) What are different types of inverters? Explain. [8]

b) What is meant by series inverter? Explain it through suitable waveforms. [7]

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