Ref No: **Ex/EE/T/322/2019**

B.E. ELECTRICAL ENGINEERING THIRD YEAR SECOND SEMESTER – 2019

SUBJECT: - POWER ELECTRONICS

Full Marks: 100

Time: Three hours (**50** marks for this part)

Use a separate Answer-Script for each part

No. of Questions		PART -I Answer any Three (Two marks reserved for well organized answers)	Marks
1)	(a)	Derive the expression of average load voltage for a single phase half wave controlled rectifier with freewheeling diode feeding an R-L load. Also draw the load voltage and source current waveforms for the same.	(8)
	(b)	Describe the working principle of a single phase fully controlled rectifier feeding an R-L load. Also show necessary waveforms.	(8)
2)	(a)	Develop the expression for the output average voltage for a single phase half controlled rectifier with freewheeling diode feeding R-L load. Also draw necessary waveforms.	(8)
	(b)	A single phase half controlled rectifier with free-wheeling diode supplied from 230 V, 50 Hz A.C. mains is feeding a battery at 50 V d.c. The resistance connected between the converter and the battery is 1 Ω and the inductance is large enough to make current continuous and flat. Find the triggering angle so that the current taken by the battery is 10 Amp. Also calculate the r.m.s current for the free-wheeling diode and each thyristor.	(8)
3)	(a)	Develop the expressions for output average and r.m.s voltage of a three phase full wave diode rectifier feeding an inductive load. Also show the effect of source inductance on output voltage.	(8)
	(b)	A three phase fully controlled full bridge rectifier fed from 415 V, 50 Hz, three phase a.c. source is connected with an R-L load. The triggering angle is 60°. The rectifier delivers 30 A to the load. Determine (a) output average voltage (b) input power (c) input power factor. Assume no device drop and a flat load current.	(8)
4)	(a)	With the help of necessary circuit diagram, show how two single phase fully controlled rectifiers can be operated as dual converter for four quadrant operation. Also develop the expression for output average voltage for the same.	(8)
	(b)	For the circuit diagram given below, Vp = 100sin100t Volts.	

[Turn over

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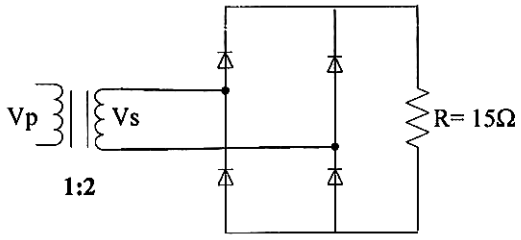
		Determine (a) output average voltage, (b) output r.m.s voltage, and (c) input r.m.s current at primary side of transformer. Assume the diodes and transformer to be ideal.  Fig. Q.4.(b)	(8)
5)	a)	Describe the operation of single phase cyclo-converter for ac-ac voltage conversion. Draw circuit diagrams and necessary waveforms.	(8)
	b)	A 3-phase diode bridge rectifier supplies a d.c. load of 250 V, 60 A from a 415 V, 50Hz, 3-phase supply through a Δ/Y transformer. Determine the diode r.m.s current and transformer VA rating and turns-ratio. Assume no diode voltage drop and flat load current.	(8)

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B.E. ELECTRICAL ENGINEERING 3RD YEAR 2 ND SEMESTER EXAMINATION, 2019

Time: Three Hours
Full Marks: 100

POWER ELECTRONICS

Use a separate Answer-Script for each part.

PART- II (50 marks)

Answer any THREE questions.

Two marks are reserved for neat and well organized answer.

1.a) Classify power diodes according to their reverse recovery time. Explain the reverse recovery effect in a power diode ? 8

b) Explain the operating principle of an IGBT sketching its structure. 8

2.(a) Exlpain the reverse recovery effect in an SCR. 8

(b) Explain why negative base drive is used in power BJT and how is it implemented ? 8

3. (a)) Derive the expression of output voltage of a Buck- Boost chopper with the help of necessary circuit diagram and relevant waveforms.In what type of application it is mainly used ? Explain why PWM tecnique is prefered over FM tecnique for controlling the duty ratio. 8

(b) A step-down chopper has input voltage of 200 Volts and output voltage of 90 Volts.Compute the duty ratio of the chopper.If the OF time of the chopper is 40 microsecond compute the switching frequency of the chopper. 8

4. (a) Explain the working principle of a Push Pull inverter with necessary circuit diagram and relevant waveform for inductive load. Also mention how the output voltage of the inverter is controlled ? 8

(b) Explain the working principle of a Full-Bridge inverter for getting distorsionlees output voltage waveforms even in the case of an inductive load. 8

5. (a)) Explain the working principle of a half bridge inverter with necessary circuit diagram and relevant waveforms for inductive load. What will happen if the feed back diodes are not connected across the switches? 8

(b) Explain why paralleling of power MOSFETS are easier than paralleling of power BJT. 4

(c) Explain what is steady state power loss and switching power loss in power semiconductor devices. 4