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Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, December 2020

Course: Power Electronics Program: B.Tech Electrical Engineering Course Code: ECEG 3031	Semester: V Time: 03 hrs. Max. Marks: 100
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SECTION A

- 1. Each Question will carry 5 Marks**
2. Instruction: Complete the statement / Select the correct answer(s)

S. No.		CO
Q 1	Enlist any 5 members of the “thyristor family”.	CO 1
Q 2	Below are given two lists. Match the items given in list 1 and those in list 2 and type the answer from the options given below. List 1: Single Phase Rectifier Topology feeding resistive load A. Uncontrolled – half wave B. Controlled – half wave C. Controlled – full wave D. Semi-controlled full wave List 2: Average Output Voltage 1. $V_m (1 + \cos \alpha)/\pi$ 2. $(2V_m \cos \alpha)/\pi$ 3. V_m/π 4. $V_m (1 + \cos \alpha)/2\pi$ Options: a. A-3, B-2, C-4, D-1 b. A-1, B-4, C-2, D-3 c. A-3, B-4, C-2, D-1 d. A-1 B-2, C-4, D-3	CO 2
Q 3	DC Choppers are commonly used for _____, _____, _____, _____ and _____ applications.	CO 3
Q 4	Identify whether the following statements are true or false: a. A single phase half wave rectifier can operate in four quadrants. b. For four quadrant operation dual converter is required. c. A rectifier is a dc to ac converter. d. In phase controlled rectifiers, thyristors undergo line or natural commutation. e. Uncontrolled rectifiers employ diodes as switches.	CO 2
Q 5	Consider following devices: SCR, GTO, BJT, MOSFET, IGBT. Which of the above devices do not belong to the family of transistors?	CO 1
Q 6	a. An ac voltage controller converts _____ to _____. b. A cycloconverter converts _____ to _____.	CO 4

SECTION B

1. Each question will carry 10 marks

2. Instruction: Write short / brief notes

Q 7	<p>a. Explain fully labelled static V-I characteristics of a thyristor. Draw relevant diagram.</p> <p>b. Discuss the purpose of di/dt and dv/dt protection in SCR circuits.</p> <p style="text-align: right;">(7+3=10)</p>	CO 1
Q 8	<p>A 1-ϕ full converter bridge is connected to RLE load. The source voltage is 230V, 50Hz. The average load current of 10A is continuous over the working range. For $R=0.4\Omega$ and $L= 2mH$. Determine,</p> <p>a. Firing angle delay for $E= 120V$</p> <p>b. Firing angle delay for $E= -120V$</p> <p>For a. & b. indicate which source is delivering power to the load.</p> <p style="text-align: right;">(4+4+2=10)</p>	CO 2
Q 9	<p>Describe the working of a 1-Φ fully controlled rectifier with RL load. Discuss how one pair of thyristors is commutated by incoming pair of thyristors. Assume continuous conduction. Illustrate your answer with suitable circuit diagram and relevant voltage and current waveforms (fully labelled).</p>	CO 2
Q 10	<p>a. Differentiate between an SCR and a TRIAC.</p> <p>b. Describe the current commutation technique for SCRs.</p> <p>(Draw suitable diagrams where necessary.)</p> <p style="text-align: right;">(5+5=10)</p>	CO 1
Q 11	<p>A step down dc-dc converter has a resistive load of $R=20\Omega$ and input voltage $V_s= 220V$. When the converter remains on its voltage drop across the switch is 1.5V and chopping frequency is 10kHz. If the duty cycle is 80%, determine</p> <p>a. Average output voltage</p> <p>b. RMS output voltage</p> <p>c. Converter efficiency</p> <p>d. Effective input resistance</p> <p style="text-align: right;">(2.5*4=10)</p>	CO 3

Section C

1. Each Question carries 20 Marks.

2. Instruction: Write long answer.

Q 12	<p>A star connected balanced 3-Φ load of “r” Ω per phase is fed from dc source (V_s) through a 3-phase bridge inverter.</p> <p>a. Explain the operation in 180^0 conduction mode.</p> <p>b. Draw associated circuits and waveforms.</p> <p>c. Describe the problem associated with 180^0 conduction mode.</p> <p style="text-align: center;">(OR)</p> <p>A star connected load of 15 Ω per phase is fed from 420 V dc source through a 3-phase bridge inverter. Explain the operation in 120^0 conduction mode. Also, draw associated circuits and waveforms.</p>	CO 4
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