Course Code: 25EE2103 **R25**

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QUESTION BANK (DESCRIPTIVE)

Subject with Code: DC DRIVES (25EE2103) **Course & Branch**: M.Tech - PE

Year & Sem: I-B.Tech & I-Sem **Regulation:** R25

UNIT –I
CONTROLLED BRIDGE RECTIFIER (1-Φ & 3-Φ) WITH DC MOTOR LOAD

1		Explain the operation of a single-phase semi-converter feeding a DC motor load with neat diagrams.	**[L2][CO1]**	**[10M]**
2		Describe the effect of freewheeling diode on the performance of a single-phase full converter drive.	**[L2][CO1]**	**[10M]**
3		Illustrate the voltage and current waveforms of a single-phase full converter with a highly inductive load.	**[L2][CO1]**	**[10M]**
4		Derive the expression for the average output voltage of a single-phase full converter feeding a DC motor.	**[L3][CO1]**	**[10M]**
5		Calculate the input power factor and DC motor current for a single-phase full converter with given parameters.	**[L3][CO1]**	**[10M]**
6		Compare the performance of semi-converter and full-converter drives under continuous and discontinuous conduction modes.	**[L4][CO1]**	**[10M]**
7		Analyze the torque-speed characteristics of a DC motor when operated with a three-phase full converter.	**[L4][CO1]**	**[10M]**
8		Evaluate the performance improvement achieved by adding a freewheeling diode in a three-phase converter drive.	**[L5][CO1]**	**[10M]**
9		Illustrate the operation of a three-phase semi-converter feeding a DC motor	**[L4][CO1]**	**[10M]**
10		Develop a MATLAB/Simulink model to study the performance of a single-phase full converter-fed DC drive.	**[L5][CO1]**	**[10M]**

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UNIT- II

THREE PHASE NATURALLY COMMUTATED BRIDGE CIRCUIT AS A RECTIFIER OR AS AN INVERTER

1		Explain the operation of a three-phase bridge rectifier with resistive load using circuit diagram and waveforms.	**[L2][CO2]**	**[10M]**
2		Describe the function of each component in a three-phase converter circuit.	**[L2][CO2]**	**[10M]**
3		Discuss the operation of a three-phase converter with highly inductive load and draw relevant waveforms.	**[L2][CO2]**	**[10M]**
4		Explain how a three-phase converter operates as an inverter with appropriate gating sequence.	**[L3][CO2]**	**[10M]**
5		Derive the average and RMS output voltage expressions for a three-phase full converter.	**[L3][CO2]**	**[10M]**
6		Compute the input current and power factor for a converter with given load and firing angle.	**[L3][CO2]**	**[10M]**
7		Compare the characteristics of converter operation in rectification and inversion modes.	**[L4][CO2]**	**[10M]**
8		Analyze the effect of source inductance on the output voltage and commutation overlap.	**[L4][CO2]**	**[10M]**
9		Evaluate the performance improvement achieved by using shunt capacitor compensation in converter circuits.	**[L4][CO2]**	**[10M]**
10		Design a three-phase naturally commutated converter capable of operating in both rectifier and inverter modes for regenerative braking.	**[L5][CO2]**	**[10M]**

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UNIT- III PHASE CONTROLLED DC MOTOR DRIVES

1		Explain the working principle of a three-phase fully-controlled converter-fed DC motor drive.	**[L2][CO3]**	**[10M]**
2		Define phase control and list its advantages in DC drives.	**[L1][CO3]**	**[10M]**
3		Describe the control circuit of a three-phase converter drive with a neat block diagram.	**[L2][CO3]**	**[10M]**
4		Explain the steady-state speed-torque characteristics of a DC drive under different firing angles.	**[L2][CO3]**	**[10M]**
5		Derive the transfer function of a converter-fed DC motor drive system.	**[L3][CO3]**	**[10M]**
6		Calculate the speed and torque of a converter-fed DC motor under specified load and firing angle conditions.	**[L3][CO3]**	**[10M]**
7		Compare the performance of one-quadrant and two-quadrant converter-controlled DC drives.	**[L4][CO3]**	**[10M]**
8		Analyze the effect of varying converter firing angle on armature current and torque response.	**[L4[CO3]**	**[10M]**
9		Evaluate the performance of a three-phase converter-fed DC drive with respect to efficiency and power factor.	**[L4][CO3]**	**[10M]**
10		Develop a closed-loop control strategy for a phase-controlled DC motor drive using digital control techniques.	**[L5][CO3]**	**[10M]**

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UNIT- IV CURRENT AND SPEED CONTROLLED DC MOTOR DRIVES

1		Explain the function of current and speed controllers in a DC drive system.	**[L2][CO4]**	**[10M]**
2		Define the roles of current reference generator and feedback loop in drive control.	**[L2][CO4]**	**[10M]**
3		Describe the working of a closed-loop speed control system for a DC motor using block diagram.	**[L2][CO4]**	**[10M]**
4		Explain the function of filters in the speed feedback loop and their impact on stability.	**[L2][CO4]**	**[10M]**
5		Design a proportional-integral (PI) speed controller for a given DC motor drive.	**[L4][CO4]**	**[10M]**
6		Derive the dynamic model equations of a current-controlled DC motor drive.	**[L4][CO4]**	**[10M]**
7		Compare open-loop and closed-loop speed control systems in terms of response and stability.	**[L4][CO4]**	**[10M]**
8		Analyze the harmonic torque components and their effect on performance of converter-fed DC drives.	**[L4][CO4]**	**[10M]**
9		Evaluate the stability of a speed-controlled DC drive using Bode or root locus method.	**[L4][CO4]**	**[10M]**
10		Design and simulate a digital current controller for closed-loop DC motor speed control using MATLAB.	**[L5][CO4]**	**[10M]**

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UNIT- V CHOPPER CONTROLLED DC MOTOR DRIVES:

1	**a**	Explain the principle of operation of a DC-DC chopper used for motor speed control.	**[L2][CO5]**	**[10M]**
2		Define four-quadrant operation of a chopper-fed DC drive with neat waveforms.	**[L2][CO5]**	**[10M]**
3		Describe the working of a step-down chopper feeding a DC motor with voltage and current waveforms.	**[L3][CO5]**	**[10M]**
4		Discuss the operation of a chopper in regenerative braking mode.	**[L2][CO6]**	**[10M]**
5		Derive the expression for average armature voltage and current in a chopper-fed DC motor.	**[L3][CO6]**	**[10M]**
6		Calculate the duty ratio and chopper frequency for a given motor voltage and speed requirement.	**[L4][CO5]**	**[10M]**
7		Analyze the current and torque waveforms in a chopper-controlled DC drive under motoring and braking conditions.	**[L4][CO5]**	**[10M]**
8		Develop the detailed model of a current controller in chopper-controlled DC drives	**[L4][CO5]**	**[10M]**
9		Evaluate the effect of chopper frequency and duty cycle on torque pulsations and efficiency.	**[L5][CO5]**	**[10M]**
10		Explain the operation of hysteresis current controller used in DC chopper drives	**[L4][CO5]**	**[10M]**

PREPARED BY

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