Reg. No. | | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Sixth Semester

EE18602 – ELECTRICAL DRIVES

(Electronics and Communication Engineering)

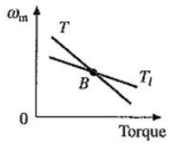
(Regulation 2018)

TIME:3 HOURS **MAX. MARKS: 100**

CO 1 Select the type and rating of motor for a known load characteristic.
CO 2 Select, design, and analyze a converter for a DC drive.
CO 3 Model DC and AC Electric Drives and design a controller.
CO 4 Learn the distinctive features of traction schemes.
CO 5 Choose and design a drive for industrial applications.

PART- A(10x2=20Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Examine the stability at the operating point B. 	**1**	**4**
2.	Summarize the factors to be considered for the selection of motor power rating for a specific application.	**1**	**2**
3.	List the limitations of thyristor when it is preferred for chopper fed DC drives.	**2**	**2**
4.	Compute the ON time of a DC chopper that operates on 220V DC and frequency of 500Hz, feeding an RL Load with output of 150V.	**2**	**3**
5.	Comment on the drawback of phase-controlled converter fed DC motor drives.	**2**	**4**
6.	Depict the PLL circuit and justify how precise speed control is achieved in DC motor drives on implementation.	**3**	**3**
7.	Constant power mode of operation is called as field-weakening mode. Justify the statement with equation.	**3**	**4**
8.	Brief the vector decoupled control of Induction motor.	**3**	**3**
9.	A suburban train runs with an average speed of 36 km/h between two stations 2 km apart. Calculate the time in seconds.	**4**	**3**
10.	Identify the control strategy to limit the tact time in crane drives.	**5**	**2**

PART- B (5x 14=70Marks)

			Marks	CO	RBT LEVEL
11. (a)		The continuous duty rating of a motor is P. Derive the expression by what factor can it be overloaded when it is subjected to an intermittent duty and short time duty load?	**(14)**	**1**	**4**
		(OR)			
(b)		A motor having a suitable control circuit develops a torque by the relationship $T_M = a\omega + b$, where a and b are positive constants. This motor is used to drive a load whose torque is expressed as $T_L = c\omega^2 + d$, where c and d are positive constants. The total inertia of the rotating masses is J. a) Determine the relations among the constants a, b, c and d in order that the motor can start together with the load and have an equilibrium operating speed. b) Calculate the equilibrium operating speed. c) Will the drive be stable at this speed? d) Determine the initial acceleration of the drive. e) Determine the maximum acceleration of the drive.	**(14)**	**1**	**4**
12. (a)		Elucidate the two quadrant operation of a single phase converter fed separately excited DC motor with neat wave forms and derive the speed torque characteristics using suitable expressions.	**(14)**	**2**	**3**
		(OR)			
(b)	**(i)**	A 230V, 960 rpm, 200A separately excited dc motor has an armature resistance of 0.02Ω. The motor is fed from a dc source of 230V through a chopper. Assuming continuous conduction, (a) Calculate the duty ratio of chopper for motoring operation at rated torque and 350 rpm. (b) If maximum duty ratio of chopper is limited to 0.95, find maximum permissible speed obtainable without field weakening.	**(6)**	**2**	**3**
	(ii)	Interpret the multi-quadrant operation of a DC - DC separately excited motor drive with mode diagrams.	**(8)**	**2**	**3**
13. (a)		Derive the transfer function of DC motor with load and converter system.	**(14)**	**3**	**4**
		(OR)			
(b)		Design the speed controller with inner current controller of a separately excited dc motor.	**(14)**	**3**	**4**
14. (a)	**(i)**	Explicate the need for constant $\frac{V}{f}$ ratio in variable voltage induction motor drives.	**(8)**	**3**	**3**
	(ii)	Depict and explain the closed loop CSI fed induction motor drive.	**(6)**	**3**	**3**
		(OR)			
(b)		Briefly discuss and analyse the Brush-less DC motor drive for servo applications	**(14)**	**3**	**3**

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15. (a)	Obtain the relationship between principal quantities involved in Traction Mechanics for Trapezoidal speed time curve, also find the schedule speed of an electric train for a run of 1.5 km if the ratio of its maximum to average speed is 1.25. It has a braking retardation of 3.6 km/h/s, acceleration of 1.8 km/h/s and stop time of 21 second.	**(14)**	**4**	**3**
	(OR)			
(b)	A 350-tonne electric train runs up an ascending gradient of 1% with the following speed/time curves: 1. uniform acceleration of 1.6 km/h/s for 25 seconds 2. constant speed for 50 seconds 3. coasting for 30 seconds 4. braking at 2.56 km/h/s to rest. Compute the specific energy consumption if train resistance is 50 N/t, effect of rotational inertia is 10%, and overall efficiency of transmission gear and motor is 75%.	**(14)**	**4**	**3**

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Obtain the PLC based drive schematic of steel mills and discuss its control operation.	**(10)**	**5**	**4**

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