Program : **Diploma in Electrical and Electronics Engineering**	
Course Code : **5033B**	Course Title: **Industrial Drives and Control**
Semester : **5**	Credits: **4**
Course Category: **Program Elective**	
Periods per week: **4 (L:3 T:1 P:0)**	Periods per semester: **60**

Course Objectives:

- To familiarise electric drives and their applications.
- To understand control methods in various industrial drives.
- To develop concepts on electric traction systems.

Course Prerequisites:

Topic	Course code	Course name	Semester
Basics of motors		1. DC Machines and Traction motors	3
		2. Induction Machines	4
Basics of power electronics		Power Electronics devices and circuits	4

Course Outcomes:

On completion of the course, the students will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Classify electric drives and explain control methods for dc drives.	14	Understanding
CO2	Explain AC motor drives and illustrate their speed control.	14	Understanding
CO3	Identify the selection of motor drives and their industrial applications.	15	Applying
CO 4	Identify the characteristics of electric traction drive systems and mechanics of train motion	15	Applying
	Series Test	2	

CO – PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	3						
CO4	3						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcome	Description	Duration (Hours)	Cognitive Level
CO1	**Classify electric drives and explain control methods for dc drives.**		
M1.01	Summarize electric drives and explain its functional block diagram.	2	Understanding
M1.02	Classify electric drives and interpret the selection of drives.	3	Understanding
M1.03	Classify and explain speed control methods of DC motor drives.	6	Understanding
M1.04	Explain the braking methods of DC motor drives.	3	Understanding
Contents: **Electric drives-** parts of electric drives - block diagram- Advantages of electric drives. **Electric drive classification-** Individual drive- group drive,-multi motor drive- Factors affecting selection of drives. **DC motor drives**- applications- advantages- disadvantages.-Speed control of DC motor drives- Single phase semi controlled- fully controlled bridge rectifier drives (Circuit diagram, waveforms and explanation)- Chopper controlled drives (block diagram approach only). **Braking of DC motor**- advantages of electric braking- Rheostatic braking- Regenerative braking- dynamic braking- plugging.			
CO2	**Explain AC motor drives and illustrate their speed control**		
M2.01	Summarize the features of ac motor drives.	3	Understanding
M2.02	Explain the speed control of single phase induction motor drives.	3	Understanding
M2.03	Explain the speed control of three phase induction motor drives.	5	Understanding
M 2.04	Classify the braking methods employed in induction motor drives.	3	Understanding
	Series Test – I	1	
Contents:			

AC motor drives-induction motor-single phase - three phase-synchronous motor. applications - advantages

Speed control of single phase induction motor- stator voltage control (circuit representations by SCRs and TRIAC)- inverter circuit control (block diagram representation only).

Speed control of three phase induction motor- Stator voltage control-Stator frequency control-V/f control-Rotor resistance control (schematic representations using power electronic controllers and brief explanation only).

Braking of induction motor drives- rheostatic braking - regenerative braking (single phase and three phase induction motors).

CO3	**Identify the selection of motor drives and their industrial applications.**		
M3.01	Select appropriate rating of motors for industrial applications.	4	Applying
M3.02	Summarize the applications of electric drives in the manufacturing process.	4	Understanding
M3.03	Explain operation of solar and battery powered drives	4	Understanding
M3.04	Summarize energy conservation methods of electric drives.	3	Understanding

Contents:

Selection of motor- classes of motor duty-graphical representation,-Estimation of motor power rating for continuous duty, short time duty and intermittent duty.

Application of drives in manufacturing process- Steel mills- cement mills- textile mills- paper mills- sugar mills- type of motors used- steps involved in manufacturing (elementary concepts only)

Solar powered pump drives- block diagram representation (using DC motor drives, induction motor drives, Battery powered drives). Battery powered vehicles- advantages- circuit representation and operating modes (elementary concepts only).

Energy conservation in electrical drives-Losses involved in the electrical drive system-Measures for energy conservation in electrical drives.

CO4	**Identify the characteristics of electric traction drive systems and mechanics of train motion.**		
M4.01	Explain the characteristics of Electric Traction	3	Understanding
M4.02	Illustrate the Speed Time Curve and its applications	4	Understanding
M4.03	Apply a simplified speed time curve to find principal quantities in train movement	4	Applying
M4.04	Interpret the meaning of traction effort and Specific Energy Consumption.	4	Understanding
	Series Test – II	1	

Contents:

Electric Traction - types - advantages - requirement of an ideal traction system - supply

system - types-specifications - layout of electric locomotive system. Traction motors (listing only) - dc series motor - single phase ac series motor - three phase induction motors.

Speed time curve-Types of passenger services - Speed time curve - importance of speed time curve - stages in a typical speed time curve - speed time curve for different services - terms related with train movement - average speed, scheduled speed and crest speed (definition only).

Speed time curve-Sketch simplified speed time (trapezoidal) curve and derive the relation between various principal quantities - solve simple problems using speed time curve.

Tractive effort-Explain traction effort - specific energy consumption- factors affecting specific energy consumption - derive relation for tractive force for propulsion of train.

Text / Reference

T/R	Book Title/Author
T1	Theraja, B. L. ;Theraja, A. K., A Text Book of Electrical Technology Vol-III, S. Chand and Co. Ramnagar, New Delhi, ISBN :9788121924900
T2	N. V. Suryanarayana, Utilization of Electric Power, Second Edition, New Age International Publishers, ISBN-13 : 978-8122436815
T3	R. K. Rajput, Utilization of Electric Power, First Edition, Laxmi Publications (P) Ltd., New Delhi. ISBN: 8131808297
T4	P. S. Bhimbra. Power Electronics, Third Edition, Khanna Publishers, New Delhi, ISBN: 8174090568
R1	Gopal K. Dubey, Fundamentals of Electrical Drives, Second Edition, Narosa Publishing House, New Delhi.ISBN :9788173194283
R2	Austin Hughes, Electric Motors and Drives Fundamentals, Types and Applications, Third edition.
R3	Subrahmanyam, Vedam, Electrical Drives Concepts and Applications, Mcgraw-Hill Publishing CompanyLimited, New Delhi.ISBN:9780070701991
R4	UA Bakshi, MV Bakshi, Electrical Drives and Controls, First Edition 2009
R5	Pillai, S.K., A first course on Electrical Drives, Wiley Eastern Ltd. New Delhi, ISBN :13: 9780470213995

Online Resources

Sl.No	Website Link
1	NPTEL >> Courses >> Electrical Engineering >> Power Electronics
2	**www.electrical4u.com/electrical-engineering-articles/power-electronics**
3	www.swayam.gov.in
4	www.youtube.com
5	wikipedia.org