Department of Electrical and Electronics

New course introduced

SL. NO.	COURSE CODE	COURSE OFFERED
1	SEEA3018	Industrial Drives and Automation
2	SEEA3019	Computer Control of Electric Drives

SEEA3018	INDUSTRIAL DRIVES AND AUTOMATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Provide strong foundation to solve control and instrumentation problems in continuous or batch problems.
- Technical competence through hands-on experience with industrial hardware and software.
- Systematic design approach to engineering projects through solving tutorial problems and completing the major assignment.
- To introduce basic concepts of load and drive interaction, speed control concepts of ac and dc drives, speed reversal, regenerative braking aspects, design methodology.

UNIT 1 INTRODUCTION TO ELECTRIC DRIVES AND SELECTION OF CONVERTERS 9 Hrs.

Fundamentals of Electric Drive dynamics- Stator and Rotor-Power and Torque-Efficiency-Typical Operating Conditions-Speed Control of Electrical Motors-Reversing-Torque Control-Dynamic Braking-Motor heating and Thermal monitoring. Direct Converters-Converters with Intermediate Circuit-Inverter Modulation Principles-Converter, Rating from Motor Specification-Overload Capacity-Control Range-Derating factor- Regenerative Energy.

UNIT 2 CONTROL OF DC DRIVES 9 Hrs.

Conventional methods of DC motor speed control, single phase and three phase-controlled DC drives-four quadrant operation-Chopper fed DC drives-Braking and speed reversal-Closed-loop control of DC Drives-Design of controllers

UNIT 3 SCALAR AND VECTOR CONTROL OF AC DRIVES 9 Hrs.

Scalar Control with Compensation - Servo Control – Voltage Vector Control - Standards and Legislations. Space Vector Control-Flux Vector Control – Direct torque control – Sensor less control

UNIT 4 INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLERS AND ITS PROGRAMMING METHODS 9 Hrs.

Advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC. Ladder diagram, STL, functional block diagram, SFC, Instruction List. Creating ladder diagram from process control descriptions, Introduction to IEC61131 international standard for PLC.

UNIT 5 INTRODUCTION TO SCADA AND DISTRIBUTED CONTROL SYSTEM 9 Hrs.

Data acquisition system, Evolution of SCADA, Communication Technologies, Monitoring and Supervisory Functions. DCS detail engineering, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc. Performance Criteria for DCS and other automation tools.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Describe the fundamental concepts of electric drives. Identify the suitable power converters and fix its rating based on requirement.

CO2 - Classify the different types of DC drives and construct its controller.

CO3 - Categories the AC drives and differentiates from DC drives. Compare scalar and vector control of AC drives

CO4 - Select and interface hardware for an automatic control system and Use PLC for an automatic control system confining to standards.

CO5 - : Plan the hardware and software component required to constitute a SCADA system..

CO6 - Develop code and configure DCS to handle local and distributed automation tasks

TEXT / REFERENCE BOOKS

1. Rokosh Das Begamudre, "Extra High Voltage AC Transmission Engineering"– Wiley Eastern LTD., NEW DELHI 1990.
2. S. Rao, "HVAC and HVDC Transmission, Engineering and Practice" Khanna Publisher, Delhi, 1990.
3. Subir Ray, "An Introduction to High Voltage Engineering", Prentice Hall of India Private Limited, 2013.
4. RD Begamudre, "Extra High Voltage AC Transmission Engineering"– New Academic Science Ltd; 4 edition 2011.
5. Edison," EHV Transmission line"- Electric Institution, GEC, 1968

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100 **Exam Duration:3 Hrs.**

PART A: 10 Question of 2 marks each – No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks **80 Marks**

SEEA3019	COMPUTER CONTROL OF ELECTRIC DRIVES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand fundamentals of microcontroller and power electronic devices
- To develop comprehensive approach towards building an industrial drive system.
- To apply drive system to real world application scenarios.

UNIT 1 REVIEW OF MICRO CONTROLLERS AND POWER ELECTRONICS DEVICES 9 Hrs.

Typical Micro controller's 8bit 16 bit (only block diagram) Digital Data Acquisition system, voltage sensors, current sensors, frequency sensors and speed sensors. Power semiconductors devices used for drives control, GTO, BJT, power MOSFET, IGBT, MCT and IGCT structures, Ratings, comparison and their applications. Block diagram of power integrated circuit for D C motor drives.

UNIT 2 A C MACHINE DRIVES 9 Hrs.

General classification and National Electrical Manufacturer Association (NEMA) classification, Speed control of Induction motors with variable voltage constant frequency, constant voltage variable frequency, (v/f) constant operation, drive operating regions. Variable stator current operation. Effect of Harmonics. Principle of Vector Control of A C Drives, Phasor diagram, digital Implementation block diagram, Flux vector estimation, indirect vector control block diagram with open loop flux control, synchronous motor control with compensation.

UNIT 3 SYNCHRONOUS MACHINE DRIVES 9 Hrs.

Wound field machine, comparison of Induction and wound field synchronous machines, Torque angle characteristics of salient pole synchronous machines, synchronous reluctance permanent magnet synchronous machines (SPM), variable reluctance machines (VRM).Series Hybrid Electric Drive Train Design-Sizing of the Major Components- The Hybrid Electric Vehicle-Energy Use in Conventional Vehicles-Energy Savings Potential of Hybrid Drive trains-HEV Configurations-Series Hybrid System-Parallel Hybrid System-Series-Parallel System-Complex Hybrid System.

UNIT 4 PHASE CONTROLLED CONVERTERS AND SLIP POWER RECOVERY SCHEMES 9 Hrs.

Converter controls, Linear firing angle control, cosine wave crossing control, phase locked Oscillator principle, Electrro magnetic Interference (EMI) and line power quality problems, cyclo converters, voltage fed converters, Rectifiers, Current fed converters.Static Kramer's drive system, block schematic diagram, phasor diagram and limitations, Static Scherbins scheme system using D.C link converters with cyclo converter modes of operation, modified Scherbins Drive for variable source, constant frequency (VSCF) generation.

UNIT 5 CASE STUDIES: APPLICATION TO DRIVES 9 Hrs.

Expert system shell, Design methodology, ES based P-I tuning of vector controlled drives system, Fuzzy logic control for speed controller in vector control drives, structure of fuzzy control in feedback system. Introduction to Solar and battery powered Drives; Introduction to traction Drives; Servo motor drive requirement – control and implementation.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the basic concepts of microcontroller and power electronic devices pertaining to drive system.
CO2 - Apply the vector control method for AC drives.
CO3 - Analyze synchronous motor drives.
CO4 - Comprehend Phase Controlled Converters and Slip Power Recovery Schemes.
CO5 - Implement drives system using fuzzy logic controllers.
CO6 - Solve the given societal challenge using drive system.

TEXT / REFERENCE BOOKS

1.Werner Leonhard , Control of Electrical Drives, 3e,Springer 2006
2.Gopal K. Dubey , Fundamentals of Electrical Drives, Wiley2010
3.Robbins Mohan,Power Electronics: Converters Applications and Design, Media Enhanced, 3ed,Wiley 2007.

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END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100 Exam Duration:3 Hrs.

PART A: 10 Question of 2 marks each – No choice 20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks 80 Marks