Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Fourth Year Bachelor of Engineering (Electrical Branch)

With effect from: Academic Year 2020-21

Subject Code: EE704-N	Subject Title: **Electrical Power Utilization &Traction**

Course Objective:

- To study in detail operational aspects of various devices used by industry for effective utilization of electrical power.
- To focus on the illumination practices adopted.
- To address the underlying concepts of electrical traction drives.
- To study in detail the concepts of electrical heating & welding.
- To study concepts of Electrolysis and electroplating

A. Teaching / Examination Scheme

Teaching scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		IE Marks	CIA Marks	Pract. Marks	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks				
3	0	0	3	3	3	70	30	20	00	120

B. Outline of the Course:

ELECTRIC DRIVES:

Introduction concept of electric drives, classification of electric drives, factors effecting selection of drive, Running characteristics of D.C, Series and shunt motor, 3-phase induction motor,3-phase synchronous motor and A.C series motors Starting methods of D.C series and shunt motors, starting methods of 3-phase induction motors, examples, starting methods of synchronous motors and single-phase induction motor. Speed control of D.C series and shunt motors, examples. Speed control of 3-phase induction motor. Examples, Methods of electric braking, of D.C motor, examples. Braking of 3-phase induction motor, Mechanical features of electric drive, Load equalization, flywheel calculations, examples. Temperatures rise of electric drives beating and cooling curves, standard ratings of motors, examples Applications of electric drives and selection of drives for particular service, conservation approach to be considered.

ELECTRICAL TRACTION:

Introductions, different traction systems, various systems of electric traction. Locomotives, tramways, trolleys, track electrification, comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, examples. Mechanics of train movement, tractive effort, power, output, examples., Energy output from driving axles, energy output using

simplified speed-time curves, examples, Factors affecting energy consumption, dead weight, accelerating weight, adhesion weight, examples., Traction motors and their characteristics, starting and speed control of D.C series and shunt motors, examples, Starting and speed control of A.C series and 3-phase induction motors, Braking of traction motors and mechanical considerations, conservation approach to be considered.

ELECTRICAL HEATING & WELDING:
Advantages of electric heating, modes of transfer of heat, classification of electric heating methods, Resistances heating methods, requirements of heating elements, design of heating elements, methods of temperature control, problems, Induction heating: principle, types of induction furnaces, direct core type, vertical core type, indirect core type, core less type, advantages and disadvantages, eddy current heating, applications examples., Arc-furnace: principle, types, direct and indirect arc furnaces, power supply and control, condition for maximum output, examples., Dielectric heating: principles, advantages and disadvantages, applications, choice of frequency, examples., Electric welding: different types of resistance welding and electric arc welding, conservation approach to be considered.

ELECTROLYTIC PROCESS:
Principle, Faradays laws of electrolysis, current efficiency, energy efficiency etc., Rating of metals, production of chemicals, Electrodeposition, electroplating, power supply for electrolytic processes.

ILLUMINATIONS:
Nature of light, definitions, laws of illumination, different types of lamps, tungsten lamp, discharge lamp, sodium vapour lamp, fluorescent lamp, LCD and LED, design of lighting scheme, methods of lighting, calculations, examples., flood lighting, factory lighting and street lighting, examples., conservation approach to be considered.

C. Lesson Planning

SR No.	Lectures (Hours)	Weigh tage in % in Exam	Topic
1	04	25	**ELECTRIC DRIVES:** Introduction concept of electric drives, classification of electric drives, nature of load, factors effecting selection of drive, Running characteristics of D.C, Series and shunt motor, 3-phase induction motor,3-phase synchronous motor and A.C series motors, Starting methods of D.C series and shunt motors, starting methods of 3-phase induction motors, examples, starting methods of synchronous motors and single-phase induction motor. Speed control of D.C

			series and shunt motors, examples. Speed control of 3- phase induction motor. Examples, Methods of electric braking, of D.C motor, examples.
	06		Braking of 3-phase induction motor, Mechanical features of electric drive, Load equalization, flywheel calculations, examples. Temperatures rise of electric drives beating and cooling curves, standard ratings of motors, examples Applications of electric drives and selection of drives for particular service, conservation approach to be considered.
2	06	25	**ELECTRICAL TRACTION:** Introductions, different traction systems, various systems of electric traction. Locomotives, tramways, trolleys, track electrification, comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, examples. Mechanics of train movement, tractive effort, power, output, examples., Energy output from driving axles, energy output using simplified speed-time curves, examples, Factors affecting energy consumption, dead weight, accelerating weight, adhesion weight, examples.
	04		Traction motors and their characteristics, starting and speed control of D.C series and shunt motors, examples, Starting and speed control of A.C series and 3-phase induction motors, Braking of traction motors and mechanical considerations, conservation approach to be considered.
3	07	25	**ELECTRICAL HEATING :** Advantages of electric heating, modes of transfer of heat, classification of electric heating methods, Resistances heating methods, requirements of heating elements, design of heating elements, methods of temperature control, problems, Induction heating: principle, types of induction furnaces, direct core type, vertical core type, indirect core type, core less type, advantages and disadvantages, eddy current heating, applications examples., Arc-furnace: principle, types, direct and indirect arc furnaces, power supply and control, condition for maximum output, examples., Dielectric heating: principles, advantages and disadvantages, applications, choice of frequency, examples.
	03		**ELECTRIC WELDING:** Different types of resistance welding and electric arc welding, conservation approach to be considered.

9	06	12	**ELECTROLYTIC PROCESS:** Principle, Faradays laws of electrolysis, current efficiency, energy efficiency etc., Rating of metals, production of chemicals, Electrodeposition, electroplating, power supply for electrolytic processes.
10	06	13	**ILLUMINATIONS:** Nature of light, definitions, laws of illumination, different types of lamps, tungsten lamp, discharge lamp, sodium vapour lamp, fluorescent lamp, design of lighting scheme, methods of lighting, calculations, examples., flood lighting, factory lighting and street lighting, examples., conservation approach to be considered.
	42	100	

D. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

E. Students Learning Outcomes

On successful completion of the course

- The student can be acquired the basic knowledge of electric power system, electrical fundamentals, thus being prepared to pursue any area of engineering spectrum in depth as desired.
- The students will be able to effectively employ electrical systems and lead the exploration of new applications and techniques for their use.

F. Reference Books:

1 Electrical Power Utilization – Taylor, Pitman Publications
2. Electrical Power Utilization – J. B. Gupta.
3. Electric Traction – H. Partab. Dhanpat Rai & Co
4. Electrical Power Utilization – B.L. Theraja. S. chand
5. A text book on Power System Engg. – Soni, Gupta, Bhatnagar, Dhanpat Rai and Co.
6. Generation and utilization of electrical energy by s. sivanagaraju, m. balasubba reddy, d. srilatha; Pearson