1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

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Principal

Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING
(Recognised by A.I.C.T.E., New Delhi & Govt. of Maharashtra, Affiliated to R.T.M.Nagpur University)
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1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years

B.E–ELECTRONICS & POWER ENGINEERING

Sr. No.	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain	Page No
1	ELECTRICAL POWER 0SYSTEM–II	BEELE702T	**Power System**	**2-10, 11-24**
2	HIGH VOLTAGE ENGINEERING	BEELE704T		
3	EHVAC-HVDC TRANSMISSION	BEELE801T		
4	COMPUTER APPLICATIONS IN POWER SYSTEM	BEELE804T		
5	POWER STATION PRACTICE	BEELE601T		
6	ELECTRICAL POWERSYST-I	BEELE501T		
7	UTILIZATION OF ELECTRICENERGY	BEELE502T		
8	NON CONVENTIONAL ENERGY SOURCES	BEELE302T		
9	CONTROLS YSTEM-II	BEELE701T		
10	CONTROLS YSTEM-I	BEELE605T		
11	ELECTRICAL MACHINES-I	BEELE404T	**Electrical Machines**	**2-10, 32-40**
12	POWER SEMICONDUCTOR BASED ELECTRIC DRIVES	BEELE802T		
13	ELECTRICAL MACHINES II	BEELE505T		
14	ELECTRICAL DRIVES & THEIR CONTROL	BEELE603T		
15	ELECTRICAL MACHINE DESIGN	BEELE503T		
16	FLEXIBLE AC TRANSMISSION SYSTEMS	BEELE703T	**Electrical Protection ,Installation and Audit**	**2-10, 11-24, 25-31**
17	ENERGY MANAGEMENT AND AUDIT	BEELE703T		
18	ELECTRICAL INSTALLATION DESIGN	BEELE705T		
19	ELECTRICAL DISTRIBUTION SYSTEM	BEELE802T		
20	SWITCHGEAR & PROTECTION	BEELE803T		
21	POWER ELECTRONICS	BEELE604T	**Others**	**25-31**
22	ELECTRICAL ENGINEERING WORKSHOP	BEELE606P		
23	MICROPROCESSOR & INTERFACING	BEELE504T		
24	COMP. AIDED ELECT.ENGG. DRAWING	BEELE506P		
25	INDUSTRIAL VISITS &REPORT WRITING	BEELE608P		
26	DIGITAL AND LINEAR ELECTRONIC CIRCUITS	BEELE403T		
27	COMPUTER PROGRAMMING	BEELE405T		
28	ELECTRICAL MEASUREMENT AND INSTRUMENTATION	BEELE303T		
29	NETWORK ANALYSIS	BEELE304T		

Domain : Electrical Power System , Electrical Protection, Installation andAudit, Electrical Machine

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	NON CONVENTIONAL ENERGY SOURCES	BEELE302T	**Electrical Power System Electrical Protection , Installation andAudit And Electrical Machine**
2	ELECTRICAL INSTALLATION DESIGN	BEELE705T	
3	POWER SEMICONDUCTOR BASED DRIVES	BEELE802T (3)	
4	UTILIZATION OF ELECTRIC ENERGY	BEELE502T	

Electrical Engineering Department

BEELE302T	**NON CONVENTIONAL ENERGY SOURCES**	**L = 4**	**T = 0**	**P = 0**	**Credits = 4**
Examination Scheme	College Assessment	University Examination		Total	Univ. Exam. Duration
	20	80		100	3 Hrs

Learning Objective	Learning Outcomes
• Students will understand the various sources of Non-conventional energy, such as solar wind, small hydro, ocean & wave energy.	A student will be able to • Learn fundamentals of solar radiation geometry, application of solar energy • Selection of sites for wind farm, different types of wind generators. • Understand the basic of small hydro, ocean & wave energy.

UNIT-I

Solar Radiation & its Measurement: Solar Constant, Solar radiation at earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surfaces.

UNIT -II

Solar Energy Collectors: Physical Principles of the conversion of solar radiation into heat,flat plate collectors, transitivity of cover systems, energy balance equation and collector efficiency, concentrating collectors, comparison of concentrating and flat plate collectors, selective absorber coatings.

Solar Energy Storage :

Solar Energy Storage system (Thermal, Electrical, Chemical, Mechanical), Solar ponds.

UNIT-III

Application of Solar Energy: Solar water heating, space heating, space cooling, solar thermal heat conversion, solar photovoltaic energy conversion, solar pumping, solar cooking, online grid connected solar photovoltaic generation system.

UNIT - IV

WIND ENERGY: Basic principles of wind energy conversion, wind energy conversion system, wind data & energy estimation, site selection consideration, basic components of wind energy conversion system (WECS), classification of WEC system, generating system, energy storage,application of wind energy.

UNIT-V

ENERGY from OCEANS: Ocean thermal electric conversation (OTEC), Claude & Anderson cycles, evaporators, Bio-fouling, Hybrid cycle, components of OTEC for power generation. ,

Energy from Tides: Introduction, basic principles of Tidal power, components of Tidal Power Plants, operation methods of utilization of Tidal Energy; Estimation of Energy & Power in simple single basin Tidal system, Advantages & limitations of Tidal Power Generations, energy & power from wares, wave energy conversions devices.

UNIT- VI

OTHER NONCONVENTIONAI, ENERGY SOURCE: Brief Introduction to operating principles only): small scale hydro electric power generation, Energy from Bio –Mass, Geothermal Energy, MHD power generation, fuel cell etc.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Non Conventional Energy Sources	G.D. Rai	Khanna publishers
Non Conventional Energy Resources	B. H. Khan	2nd , The McGraw Hill Companies
Energy Technology : Nonconventional, Renewable and Conventional	S. Rao & B. B. Parulekar	1st, Khanna Publisher
Solar Energy: Principles of thermal collection and storage	S. P. Sukhatme	2nd edition, Tata McGraw Hill Publishing Company Ltd.
Solar Photovoltaics : Fundamental, Technologies and Applications	Chetan Singh Solanki	PHI Learning Pvt. Ltd.

BEELE 705 T - ELECTRICAL INSTALLATION DESIGN

Learning Objectives	Learning Outcomes
The course will prepare students The course will prepare students to understand methodology of load forecasting and assessment of electrical loads, types of electric loads and selection of apparatus for controlling electrical power. The course will prepare students to design the distribution system for residential, commercial, industrial applications and utility distribution networks and illumination design The course will prepare students to understand methods of installation, testing and commissioning of electrical apparatus and conductors. The course will prepare the students to understand statutory requirements related to electrical design, safety and protection.	Upon the completion of this course, a. The students will understand concept of load forecasting, solve problems based on regression analysis. b. The students will be able to draw single line diagrams with specifications for electrical distribution networks for residential and commercial installations. c. The students will be able to draw single line diagrams with specifications for distribution networks, motor and power control centers for industrial installations and design reactive power compensation. d. The students will be able to understand construction, types and selection of PVC/ XLPE cables and overhead conductors e. Students shall be able to design 11kV and 33 kV substations for utility and industrial installations and specify the ratings and specifications of apparatus used f. Students shall be able to understand procedure for receipt, storage, testing and commissioning of transformers along with its accessories viz OTI, WTI, Silica Gel Breather, MOG, Buchholz relay etc g. Students will be able to determine fault level at various locations in radial networks and be able to find rating and location of series reactors h. Students will understand the relevant provisions of IE rules for low medium and high voltage installations i. Students will be able to understand provisions for system and equipment earthings as per IS 3043

Unit 1:

Electrical load assessment: **(4H)**

Concept of electrical load, categories of load, types of loads, connected load, demand factor, Maximum demand, diversity factor, load factor, power factor, TOD Tariff, Industrial Electric Bills.

Cables, conductors & bus-bars: *(4H)*

Construction, selection, installation, testing of LT/ HT cables, overload & short circuit ratings, rating factors; Overheadline conductors, copper and aluminium busbars.

Unit 2:

Switching & protection devices: **(5H)**

Types, specifications; selections of isolators, switches, switch fuse units, MCB, ELCB, MCCB,ACB, VCB, SF6 breakers, dropout/ horn gap fuses, AB switches, contactors for voltages upto 33 kV. Various types of protective relays for above circuit breakers.

Symmetrical Short Circuit Calculations: *(4H)*

Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current. Overcurrent protection with two phase fault & one ground fault relays.

Unit 3:

Electric supply to Induction Motors in industries: **(5H)**

Types of motors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices.

Reactive power management in industries: *(4H)*

Reactive power compensation in industries using static capacitors, use of Power Triangle, Calculating payback period for capacitor investment due to reduced system currents.

Unit 4:Transformers: *(4H)*

Specifications, ratings, selection, installation, testing & commissioning.

Substations: *(4H)*

11kV & 33 kV, indoor/ outdoor substations, plan/ elevations, Earthing Arrangement

Unit 5:

Design of Industrial Electrical Installations: **(8H)**

Preparing load list, assessing various factors associated with loads, selection of transformer, design of PCC & MCC, selection of all the associated electrical apparatus, busbars, cables, switchgear, protective devices, earthing system, testing, commissioning.

Unit 6:

Earthing (IS 3043): **(4H)**

Necessity of earthing, concept of system & equipment earthing, definitions of various terms, types of earthing, earth tester and measurement of earth resistance.

IE Rules: *(4H)*

Important IE Rules applicable to residential, commercial & industrial installations.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Electric Power Distribution system	A.S.Pabla,	Tata McGraw-Hill
Course in Electrical Power	P. V. Gupta, M. L. Soni, U. S. Bhatnagar	Dhampat Rai and Sons., 1987
Electrical Substation Engineering & Practice	S. Rao	Kanna Tech. Publ., 1992
Reference Books		
Design of Electrical Installations	V. K. Jain, Er. V.K. Jain & Er. Amitabh Bajaj	Laxmi Publications Pvt Limited, 01-Jan-1993
Electrical Engineering Handbook	C. L. Wadhwa	
Indian Electricity Regulation 1956		

BEELE 802 T (3) -POWER SEMICONDUCTOR BASED DRIVES

Learning Objectives	Learning Outcomes
• To study the converter and Chopper control of DC drives. • To study the semiconductor based control of Induction and Synchronous motors. • To learn the basics of Switched reluctance motor and Brushless DC motor. • To Study the non conventional and renewable energy based drives.	The student will be able to :- • work with confidence on the various drives used in the Industry. • The students can carry research on the newer Switched Reluctance motor and Brushless DC motor. • Understands the traction drives with ac and dc motors.

Unit 1: Dynamics of electric drives and control of electric drives,

Unit 2: D.C. motor drives: Controlled rectifier fed d.c. drives, single phase and three phase rectifier control of d.c. separately excited motor. Dual converter control of D.C separately excited motor. Power factor, supply harmonics and ripple in motor current. Chopper controlled dc drives of separately excited dc motor, chopper control of series motor, source current harmonics.

Unit 3: Induction motor drives: Stator voltage control, variable frequency control using voltage source invertors, and current sources invertors. Concept of scalar control of 3-ph Induction Motor, Basicphilosophy of vector control of 3-ph I.M. their advantages and list of applications.

Basic idea of energy conservation in fan and pump type loads using scalar controlled induction motordrives.(Numericals excluded)

Unit 4: Synchronous Motor Drive ; Starting Braking of synchronous motor, variable frequency control self controlled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting of large synchronous motors.

Unit 5: Brushless de motor, stepper motor, switched reluctance motor drives and eddy current drives. introduction tosolar and battery powered drives. Energy conservation in electric drives.

Unit 6: Traction drives: Conventional dc and ac traction drives, semiconductors converter controlled Drives, 25KV AC traction using semiconductor converter controlled dc motor. DC traction using semiconductor, chopper controlled dc motors, polyphase AC motors for traction drives.

BOOKS:

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Fundamentals of Electric drives	G. K. Dubey	CRC Press
Modern Electric Traction	H. Partab	Pritam Surat, 1973
Power Electronics and drives	B. K. Bose	Pearson
Reference Books		
Electric drives concepts and applications	Vedam Subrahmanyam	McGraw-Hill, 1996

BEELE502T	**UTILIZATION OF ELECTRIC ENERGY**	**L = 4**	**T = 1**	**P = 0**	**Credits = 5**
Examination Scheme	College Assessment	University Examination		Total	Univ. Exam. Duration
	20	80		100	3 Hrs

Learning Objective	Learning Outcomes
Students will • understand application of electrical supply for different applications • to calculate electrical equivalent rating for mechanical application	students should be able to • understand applications for heating, welding, illumination using electric power • understand applications for fan, lowers, compressor, pumps and refrigeration using electric power

Unit I: Electric Heating: **(8 Hrs)**

i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat, types & application of electric heating equipments, transfer of heat.
ii) Resistance Ovens : General constructions, design of heating elements, efficiency & losses, radiant heating.
iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating.
iv) Dielectric heating: Principle and application.
v) Arc furnace : Direct & indirect arc furnace, power supply, characteristics & control.

Unit II: Electric Welding: **(8 Hrs)**

i) Importance, Advantages & Disadvantages of welding, classification of welding processes.
ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding.
iii) Electric arc welding: Carbon arc welding, metal arc welding, submerged arc welding, Stainless Steel welding
iv) Ultrasonic welding, electron beam welding, laser beam welding.

Unit III : Illumination : **(8 Hrs)**

Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index(CRI), Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood
lighting, street lighting, energy saving in lighting systems.

Unit IV: **Refrigeration & Air conditioning**: **(8 Hrs)**

Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, drinking water cooler, desert air cooler.

Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effectivetemperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, andcentral air conditioning.

Unit V: Fans & Pumps: **(10 Hrs)**

Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities.

Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.

Unit VI: Compressors and DG Sets: **(8 Hrs)**

Compressors: Compressor types, Compressor efficiency, Compressed air system components.

Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performanceassessment in DG sets, energy saving measures for DG sets.

Books :

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Utilization of Electric Power & Electric Traction	J.B. Gupta	Kataria & Sons
Art and Science of Utilization of Electrical Energy	H Partap	Dhanpat Rai & Sons, Delhi
Utilization of Electrical Power	Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International
Electronics in Industry	Chute & Chute	McGraw Hill
Utilization of Electric Energy	E. Openshaw Taylor	Orient Longman
Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency		

Project Report

On

SOLAR BASED AUTOMATIC SANITIZATION OF CLASSROOM

PROJECT REPORT SUBMITTED IN THE PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF ENGINEERING IN ELECTRICAL (ELECTRONICS & POWER)

(2020-21)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

UNDER THE GUIDANCE OF

Prof. H.P.Thakre

Submitted by

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PRANAV BHADADE

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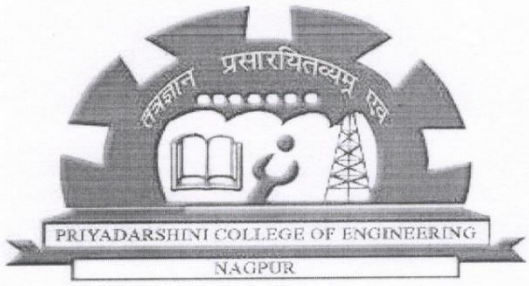
PRATYUSH NANDGAVE



DEPARTMENT OF ELECTRICAL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING,

NAGPUR 440019

2020-2021

DEPARTMENT OF ELECTRICAL ENGINEERING PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR- 440 019(INDIA)

2020-21

CERTIFICATE

1) This is to Certify that the project report entitled, "Solar Based Automatic Sanitization Of Classroom" is a bonafied work done under my guidance by Yugal korde,Pranav Bhadade,Prajwal Hajare , Meet Malviya ,Pratyush Nandgave in partial fulfillment of the requirements for the award of degree of Bachelor of Engineering in Electrical (Electronics & Power).

Date:

Prof. H.P.Thakre(Project Guide)

Dr. K. B. Porate (Head of the Department)

Dr.M.P. Singh(Principal)

Principal
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CHAPTER 1: INTRODUCTION

According to the study, this device can be mounted anywhere and it works in an automated manner. The device can be installed in any premises. The machine will spray sanitizer. this will sanitize the person's entire body, clothes, and shoes. This device can be installed at any place where there is movement of people, so that the person getting sanitized.

This device has been made according to today's requirement. We are using normal sanitizer currently being used by the government. Due to this sanitization , it is possible to avoid most of the viruses that cause harm to the person. Validation of the dose, exposure time, frequency is under process. However, even after being sanitized with this device, one is required to wear masks, make social distancing and wash hands with soap at regular intervals.

In today's global environment, everyone is trying to fight against the covid-19 virus. At present, the only way to defend ourselves from corona is to sanitize properly and maintain social distance.this device helps to prevent from viruses by sprinkling the sanitizer to person and entair objects of area of classroom by automatically operate .

1.1 SOLAR CHARGE CONTROLLER

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis.It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

The working of the module is divided into 3 major parts :

The charging of the battery by the solar system panel and regulation of charge by the charge controller, Operation of module through mobile application , Operation of the pump to sprinkle the sanitizer.

The panel that we are using is monocrystalline panel and the output current of solar panel is 2A. The output of solar panel is connected to the input of solar charger and the charge controller is connected to battery.The AC source is connected to the 12V SPDT. Power supply, output of the charge controller and SPDT is connected to the Toggle switch(DPDT).

Here we are using 12V DC pump, 2 bridge rectifiers, two filter capacitors and 2 voltage regulators to operate GSM sim 800L module which is connected to the ARDUINO UNO R3 mode. 4,5 is connected to manual push button. 16×2 LCD display is connected to 8,9,10,11,12,13 and SPDT relay is used to switch ON/OFF the pump.

After supplying power to the device,the LCD screen shows call to sim. So first call the no of GSM module and after disconnection of the call, pump will turn ON and we will get a message "pump ON successful". It is called to ON/OFF system. To switch OFF the pump, call again to the no of GSM module and after disconnection of the call,the motor will turn OFF and we will receive a message "pump OFF successful". The motor can be switched ON/OFF by manual push button and after switching ON by push button, we will get a message of "manual pump ON successful" and after switching OFF manually we will get a message of "manual pump OFF successful".The pump is operated by relay drive. The inlet of the pump is connected to the sanitizer tank and outlet of the pump is connected to the nozzle and pipe connected to it.

The pipes and sprinklers are arranged in a ceiling of the classroom in such a way that it covers the complete area of the classroom. When the pump will turn ON, the nozzle of the sprinkle will sanitize the whole classroom.

Conclusion

this chapter gives the brief information of Block diagram, Circuit diagram and working of solar based automatic sanitization of classroom device.the block diagram and circuit diagram consist of information of each section which are use in our device.

Domain : Electrical power system , Electrical Protection , Installation andAudit and Electrical Machines

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	COMPUTER APPLICATIONS IN POWER SYSTEM	BEELE804T	**Electrical Power System and Electrical Protection , Installation andAudit**
2	ELECTRICAL POWER SYST - I	BEELE501T	
3	ELECTRICAL INSTALLATION DESIGN	BEELE705T	
4	POWER SEMICONDUCTOR BASED DRIVES	BEELE802T (3)	

BEELE804T - COMPUTER APPLICATIONS IN POWER SYSTEM.

Learning Objectives	Learning Outcomes
This subject exposes students to the mathematical foundational concepts that are necessary in the field of electrical engineering such as a) Load flow. b) Short Circuit studies. c) Transient Stability Studies.	On successful completion of this course, students will be able to • Determine Bus Impedance & Admittance matrix (required for Load flow & Short circuit Studies) by graphically, Inspection & building algorithm. • Load flow study of a power system by Newton-Raphson & Gauss-Seidal Iterative Method. • Short circuit studies. • Transient stability by using Eulers, Modified Eulers & RK-4th order differential method.

Unit 1: Incidence & Network Matrices: Graph incidence Matrices, Primitive network, formation of network matrices by Singular transformations.

Unit 2: Algorithm for formation of Bus Impedance and Bus Admittance matrix' for system without mutual coupling.

Unit 3: Three phase Networks: Three phase balance network elements with balanced and unbalanced excitation, incidence and network matrices *for* three phase element. Algorithm forformation of three phase bus impedance matrices without mutual coupling.

Unit 4: Load Flow Studies: Power system load flow equations, solution Technique; Gauss Seidel Newton Raphson and fast decoupled technique with and without voltage control buses.Representation of tap changing and phase shifting transformers, Elementary load flow programs.

Unit 5: Short circuit studies: Three phase network short circuit calculations using bus impendence matrix for balance and unbalanced faults. Computer programme for short circuit studies on simple system.

Unit 6: Transient Stability studies: Modelling of synchronous machine. power system network for transient stability studies, Numerical, solution of swing equation by modified Euler and Runge Kutta 4th order method. Elementary computer programme for the transient stability study.

BOOKS:

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Computer method in power system analysis	Stagg and E1e Abid	McGraw Hill
Elements of power system analysis	William D. Stevenson	Mcgraw-Hill Book Comp., 1982
Computer Analysis of Power system	R N Dhar	
Reference Books		
Electric Energy System Theory and introduction	Ole Elegard	Tata McGraw-Hill, 1983

BEELE501T	**ELECTRICAL POWER SYST - I**	**L = 4**	**T = 1**	**P = 0**	**Credits = 5**
Examination Scheme	College Assessment	University Examination		Total	Univ. Exam. Duration
	20	80		100	3 Hrs

Learning Objective	**Learning Outcomes**
Students will develop the ability ▪ To model and represent the system components used in power system. - To represent and understand the transmission line parameters. • To understand the load flow analysis of power system.	students should be able to ▪ Modeling and representation of the system components used in power system. - Concept of designing transmission line parameters • The basic concept of load flow analysis.

UNIT- 1:

Structure of electrical power system, brief exposure to generation, transmission and distribution aspects, elementary consideration of economic bulk power supply system, use of high voltage general system consideration, idea about substation, concept of real, reactive and complex power. Load and their characteristics, voltage and frequency dependence of loads. (10hrs)

UNIT- 2:

UNIT-3:

Representation of power system elements, models and parameters of generator, transformer and transmission lines, Transmission line parameters calculation (R,L,C), per unit system representation. 8hrs

Elementary distribution scheme: Feeders and distributors. LT and HT cables, Introduction to distribution automation.
Concept of insulator, types of insulator, string efficiency. 10 hrs

UNIT-4:

Voltage regulation and efficiency of power transmission lines using equivalent pi and T representation. Representation using circle diagram with generalized constants. 10 hrs

UNIT-5:

Interconnection of system elements to form two bus systems. Illustration of active and reactive power transmission, types of buses. Introduction to load flow studies in multibus system (Methods of solution not expected). Introductionof frequency and voltage as system state indicators. 10 hrs

UNIT-6:

Elementary concepts of real and reactive power control. Steady state performance of turbine governors, load sharingbetween generators, preliminary concepts of automatic voltage regulator, 8 hrs

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Elements of power system analysis	W. D. Stevenson	**PHI**
Modern Power system analysis	Nagrath I.J. & Kothari D.P.	Mc-Graw Hill
Power system analysis	Wadhwa C.L.	New-Age international
Power System Analysis	Asfaque Hussain	CBS
Reference Books		
A Text book of Electric Power Distribution Automation	Dr. M. K. Khedkar & Dr. G. M. Dhole	Laxmi Publications
Electric Energy System Theory	O. E. Elgerd	
Westinghouse transmission and distribution handbooks		

BEELE 705 T - ELECTRICAL INSTALLATION DESIGN

Learning Objectives	Learning Outcomes
The course will prepare students The course will prepare students to understand methodology of load forecasting and assessment of electrical loads, types of electric loads and selection of apparatus for controlling electrical power. The course will prepare students to design the distribution system for residential, commercial, industrial applications and utility distribution networks and illumination design The course will prepare students to understand methods of installation, testing and commissioning of electrical apparatus and conductors. The course will prepare the students to understand statutory requirements related to electrical design, safety and protection.	Upon the completion of this course, j. The students will understand concept of load forecasting, solve problems based on regression analysis. k. The students will be able to draw single line diagrams with specifications for electrical distribution networks for residential and commercial installations. l. The students will be able to draw single line diagrams with specifications for distribution networks, motor and power control centers for industrial installations and design reactive power compensation. m. The students will be able to understand construction, types and selection of PVC/ XLPE cables and overhead conductors n. Students shall be able to design 11kV and 33 kV substations for utility and industrial installations and specify the ratings and specifications of apparatus used o. Students shall be able to understand procedure for receipt, storage, testing and commissioning of transformers along with its accessories viz OTI, WTI, Silica Gel Breather, MOG, Buchholz relay etc p. Students will be able to determine fault level at various locations in radial networks and be able to find rating and location of series reactors q. Students will understand the relevant provisions of IE rules for low medium and high voltage installations r. Students will be able to understand provisions for system and equipment earthings as per IS 3043

Unit 1:

Electrical load assessment: **(4H)**

Concept of electrical load, categories of load, types of loads, connected load, demand factor, Maximum demand, diversity factor, load factor, power factor, TOD Tariff, Industrial Electric Bills.

Cables, conductors & bus-bars: *(4H)*

Construction, selection, installation, testing of LT/ HT cables, overload & short circuit ratings, rating factors; Overheadline conductors, copper and aluminium busbars.

Unit 2:

Switching & protection devices: **(5H)**

Types, specifications; selections of isolators, switches, switch fuse units, MCB, ELCB, MCCB,ACB, VCB, SF6 breakers, dropout/ horn gap fuses, AB switches, contactors for voltages upto 33 kV. Various types of protective relays for above circuit breakers.

Symmetrical Short Circuit Calculations: *(4H)*

Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current. Overcurrent protection with two phase fault & one ground fault relays.

Unit 3:

Electric supply to Induction Motors in industries: **(5H)**

Types of motors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices.

Reactive power management in industries: *(4H)*

Reactive power compensation in industries using static capacitors, use of Power Triangle, Calculating payback period for capacitor investment due to reduced system currents.

Unit 4:Transformers: *(4H)*

Specifications, ratings, selection, installation, testing & commissioning.

Substations: *(4H)*

11kV & 33 kV, indoor/ outdoor substations, plan/ elevations, Earthing Arrangement

Unit 5:

Design of Industrial Electrical Installations: **(8H)**

Preparing load list, assessing various factors associated with loads, selection of transformer, design of PCC & MCC, selection of all the associated electrical apparatus, busbars, cables, switchgear, protective devices, earthing system, testing, commissioning.

Unit 6:

Earthing (IS 3043): **(4H)**

Necessity of earthing, concept of system & equipment earthing, definitions of various terms, types of earthing, earth tester and measurement of earth resistance.

IE Rules: *(4H)*

Important IE Rules applicable to residential, commercial & industrial installations.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Electric Power Distribution system	A.S.Pabla,	Tata McGraw-Hill
Course in Electrical Power	P. V. Gupta, M. L. Soni, U. S. Bhatnagar	Dhampat Rai and Sons., 1987
Electrical Substation Engineering & Practice	S. Rao	Kanna Tech. Publ., 1992
Reference Books		
Design of Electrical Installations	V. K. Jain, Er. V.K. Jain & Er. Amitabh Bajaj	Laxmi Publications Pvt Limited, 01-Jan-1993
Electrical Engineering Handbook	C. L. Wadhwa	
Indian Electricity Regulation 1956		

BEELE 802 T (3) -POWER SEMICONDUCTOR BASED DRIVES

Learning Objectives	Learning Outcomes
• To study the converter and Chopper control of DC drives. • To study the semiconductor based control of Induction and Synchronous motors. • To learn the basics of Switched reluctance motor and Brushless DC motor. • To Study the non conventional and renewable energy based drives.	The student will be able to :- • work with confidence on the various drives used in the Industry. • The students can carry research on the newer Switched Reluctance motor and Brushless DC motor. • Understands the traction drives with ac and dc motors.

Unit 1: Dynamics of electric drives and control of electric drives,

Unit 2: D.C. motor drives: Controlled rectifier fed d.c. drives, single phase and three phase rectifier control of d.c. separately excited motor. Dual converter control of D.C separately excited motor. Power factor, supply harmonics and ripple in motor current. Chopper controlled dc drives of separately excited dc motor, chopper control of series motor, source current harmonics.

Unit 3: Induction motor drives: Stator voltage control, variable frequency control using

voltage source invertors, and current sources invertors. Concept of scalar control of 3-ph Induction Motor, Basicphilosophy of vector control of 3-ph I.M. their advantages and list of applications.

Basic idea of energy conservation in fan and pump type loads using scalar controlled induction motordrives.(Numericals excluded)

Unit 4: Synchronous Motor Drive ; Starting Braking of synchronous motor, variable frequency control self controlled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting of large synchronous motors.

Unit 5: Brushless dc motor, stepper motor, switched reluctance motor drives and eddy current drives. introduction tosolar and battery powered drives. Energy conservation in electric drives.

Unit 6: Traction drives: Conventional dc and ac traction drives, semiconductors converter controlled Drives, 25KV AC traction using semiconductor converter controlled dc motor. DC traction using semiconductor, chopper controlled dc motors, polyphase AC motors for traction drives.

BOOKS:

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Fundamentals of Electric drives	G. K. Dubey	CRC Press
Modern Electric Traction	H. Partab	Pritam Surat, 1973
Power Electronics and drives	B. K. Bose	Pearson
Reference Books		
Electric drives concepts and applications	Vedam Subrahmanyam	McGraw-Hill, 1996

A

PROJECT REPORT

ON

"LOAD FLOW ANALYSIS OF 11Kv PCE SUBSTATION BY ETAP – A CASE STUDY"

A Project Report Submitted in the partial fulfillment of the requirements for the Degree

of

Bachelor of Engineering in Electrical
(Electronics & Power)

Rashtrasant Tukdoji Maharaj, Nagpur University, Nagpur

Under the guidance of

Dr. K.B. PORATE

Assistant Prof. RUTUJA PAWAR

SUBMITTED BY

VAIBHAVI GHORE

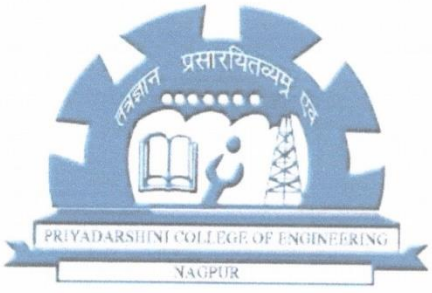
SHIVANI GANVIR

SAMIKSHA AKKEWAR

RUCHIKA GAURKAR

SHWETA GEDAM

DIVYAPRAKASH RAUT



DEPARTMENT OF ELECTRICAL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR

440019

2018-2019

DEPARTMENT OF ELECTRICAL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR - 440019

2018-2019

CERTIFICATE

This is to Certify that the project report entitled, **"Load Flow Analysis of 11KV PCE substation by ETAP – A Case Study"** is a bonafied work done under my guidance by **Vaibhavi Ghore, Shivani Ganvir, Ruchika Gaurkar, Shweta Gedam, Samiksha Akkewar and Divyaprakash Raut** in partial fulfilment of the requirements for the award of degree of Bachelor of Engineering in Electrical (Electronics & Power).

Date:

RUTUJA PAWAR
(Assistant Prof. Electrical Engineering)
(Co-guide)

4/4/2019
Dr. K. B. PORATE
(HOD, Electrical Engineering)
(Project Guide)

4/4/2019
Dr. K. B. PORATE
(HOD, Electrical Engineering)

04-04-19
Dr. M. P. SINGH
(Principal)

H.O.D.
Electrical Engineering
Priyadarshini College of Engineering
Nagpur

CHAPTER 1

INTRODUCTION

1 Power Flow Analysis

In operation and planning for the power system, the most expressive and dvantageous approach for the examination of problem relating to power system can be carried t by means of load flow analysis of power flow analysis. In power system under voltage is the ain problem causes disturbances in power system the reactive power cannot be send over the ng separation in case of heavy load. And the load flow study is vital for monetary scheduling epth provisioning and also arranging its future expansion.

This chapter defines definition and explains the usages of different tools you will eed to run power flow studies. Theoretical back round for different load flow calculation ethod is also provided. Power flow analysis using software is accurate and gives highly reliable esults. This research makes effective use of Electrical Transient Analyser Program (ETAP) to arry out load flow analysis of 11Kv PCE substation. ETAP provide package of complete set of lectrical design programming tool which consist of transient steady state, transfer coordination.

It is used for making the highly controllable power balance among the utilized and oads. These power study provide many technical approaches available on the power flow nalysis. It is absolutely necessary used by the engineers in designing , running ,maintaining & conomic scheduling of electrical power system through these analysis very important parameter f bus and transmission line are determined i.e. phase angle and magnitude of voltage and flow f active/ reactive power respectively.

Power flow study usually uses simplified notation such as a one line diagram and per-unit system and it calculates the voltage drop on each feeder, the voltage at each bus, and the power flow in all branch and feeder circuits. Determine if system voltages remain within specified limits under various contingency conditions, and whether equipment such as transformers and conductors are overloaded. The program allows for swing, voltage regulated and unregulated power source with multiple utility and generation connection. Different methods are provided for you to select in order to achieve the best calculation efficiency.

In power flow study there are three method of power flow analysis,

- Gauss seidel method
- Newton raphson method
- Fast decoupled method

In this case we use newton raphson method because there are more advantages of newton raphson method as compared to other method. Newton raphson method is fastest, reliable, more accurate and less computational time per iteration.

- Gauss Seidel Method, Newton Raphson Method, Fast De-Coupled Method are available.
- Result sheets for the analysis are available in tabulation and graphical format.

1.3.5 Power Station Analysis Modules

Different types of modules available in ETAP Power Station Analysis are

- Load Flow Analysis
- Short Circuit Analysis
- Transient Stability Analysis
- DC load flow
- DC short circuit
- Harmonics
- Batten' sizing and discharge
- Reliability assessment
- Cable pulling
- Ground grid systems
- Data exchange
- Generator start up
- Power station management system.
- Motor acceleration
- Panel systems
- Optimal power how
- Transformer sizing
- Parameter estimation
- Device co-ordination
- Cable raceway system

1.4 Scope of work

Scope of the work is restricted to

- Determination of power flow.
- Determination of line flow.
- Determination of power factor.
- Determination of under and over voltages buses.

1.5 Organization of the Report

Chapter 1 dedicated to an introduction of the planning and analysis. For analysis purpose, different types of tools available are mentioned. Systems under consideration is also briefed. Briefing is done regarding collection of various data required for the analysis.

Chapter 2 discusses the review of literature, in this chapter, collection of various proceeding, books, and books on the internet is made. With the help of this literature, work is streamlined and hence importance of this proposed work is concluded.

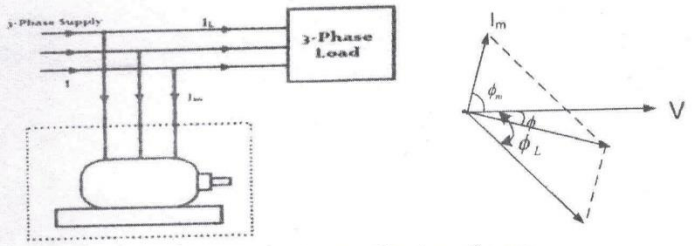


Fig 2.4 synchronous condenser and its phasor diagram

When a synchronous condenser is connected across supply voltage (in parallel) then it draws leading current and partially eliminates the re-active component and this way, power factor is improved. Generally, synchronous condenser is used to improve the power factor in large industries.

Advantages:

- Long life (almost 25 years)
- High Reliability
- Step-less adjustment of power factor.
- No generation of harmonics of maintenance
- The faults can be removed easily
- It's not affected by harmonics.
- Require Low maintenance (only periodic bearing greasing is necessary)

Disadvantages:

- It is expensive (maintenance cost is also high) and therefore mostly used by large power users.
- An auxiliary device has to be used for this operation because synchronous motor has no self-starting torque
- It produces noise

3. **Phase Advancer**

Phase advancer is a simple AC exciter which is connected on the main shaft of the motor and operates with the motor's rotor circuit for power factor improvement. Phase advancer is used to improve the power factor of induction motor in industries.

As the stator windings of induction motor takes lagging current 90° out of phase with Voltage, therefore the power factor of induction motor is low. If the exciting ampere-turns are excited by external AC source, then there would be no effect of exciting current on stator windings. Therefore the power factor of induction motor will be improved. This process is done by Phase advancer.

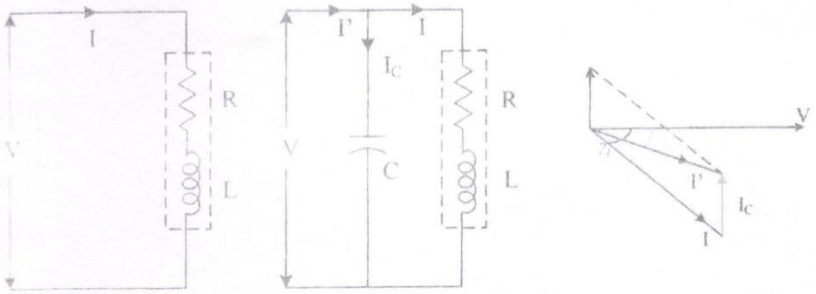


Fig 2.1 static capacitor and its phasor diagram

These capacitors are installed in Vicinity of large inductive load e.g. Induction motors and transformers etc, and improve the load circuit power factor to improve the system or devices efficiency.

Advantages:

- Capacitor bank offers several advantages over other methods of power factor improvement.
- Losses are low in static capacitors
- There is no moving part, therefore need low maintenance
- It can work in normal conditions (i.e. ordinary atmospheric conditions)
- Do not require a foundation for installation
- They are lightweight so it is can be easy to installed

Disadvantages:

- The age of static capacitor bank is less (8 – 10 years)
- With changing load, we have to ON or OFF the capacitor bank, which causes switching surges on the system
- Easily damaged for higher voltages compare to rated.
- Once the capacitors spoiled, then repairing is costly

2. Synchronous Condenser

When a Synchronous motor operates at No-Load and over-exited then it's called a synchronous Condenser. Whenever a Synchronous motor is over-exited then it provides leading current and works like a capacitor.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

The power sector is in its fast growing phase to meet the growing demand for electricity. The power system has dynamic behaviour faces disturbances faults, etc. Hence, the power flow study is a very important and fundamental tool for the analysis of any power systems and in the operations as well as planning stages. The principal information of power flow analysis is to find the magnitude and phase angle of voltage at each bus and the real and reactive power flowing in each transmission lines. This power study is provide many technical approaches available on power flow analysis. In this project, an operational comparison between Gauss-Seidel and Newton Raphson method is depicted. The test system is simulated and results are verified using Electrical Transient Analyzer Program [ETAP] software.

2.2 Review of Load Flow Methods

Load flow is also required to study and check the performance of existing system as well as in the expansion of the system. Tools available for simulation are Newton Raphson Method, Fast Decoupled Method and Gauss Seidel Method. In 1967, Tinny and Hart developed classical Newton based load How solution method [1]. Later the fast decoupled method by Scott and Alsac [2]. Fast decoupled and Newton Raphson method are suitable for transmission system, its convergence performance is poor for most distribution system due to their high r/x ratio. It deteriorates the diagonal dominance of the Jacobian matrix. Then C.S. Cheng and I.W. Hang have proposed several non-Newton types of Methods [3-4]. W.I. Tinny and C.E. Hart decoupled fast decoupled method, which is most suitable for the transmission system and hence widely used. [5] In Energy Management (EMS) and the Distribution Management also, the Load Flow Analysis plays an important role. In a steady state condition load flow analysis gives the information regarding power generation, power delivered and losses occur in the system, current through each branch, active and reactive power, voltages at each buses, etc.[6]-[8].Gauss Seidel method is also used in transmission system. Distribution load flow is very important tool for the analysis of distribution system and is used in operational as well as planning environments as described by Lin and Chan [1986][9]-[10].

2.3 Review of Power Factor Improvement

Methods for Power Factor Improvement

The following devices and equipment are used for Power Factor Improvement.

1. Static Capacitor
2. Synchronous Condenser
3. Phase Advancer

1. Static Capacitor

We know that most of the industries and power system loads are inductive that take lagging current which decrease the system power factor. For Power factor improvement purpose, Static capacitors are connected in parallel with those devices which work on low power factor. These static capacitors provides leading current which neutralize (totally or approximately) the lagging inductive component of load current (i.e. leading component neutralize or eliminate the lagging component of load current) thus power factor of the load circuit is improved.

Advantages:

- Lagging Kvar (Reactive component of Power or reactive power) drawn by the motor is sufficiently reduced because the exciting ampere turns are supplied at slip frequency (fs).
- The phase advancer can be easily used where the use of synchronous motors is Unacceptable

Disadvantage:

- Using Phase advancer is not economical for motors below 200 H.P. (about 150kW)

2.4 Conclusion

The project deals with the load flow for the distribution system. In this we have used capacitor bank to improve the power factor and as capacitor is highly reliable and is not affected harmonics.

Domain: Electrical Protection,Installation and Audit, and Others

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	ENERGY MANAGEMENT AND AUDIT	BEELE703T (4)	**Electrical Protection , Installation andAudit and others**
2	POWER ELECTRONICS	BEELE604T	

Elective- I BEELE703T (4) ENERGY MANAGEMENT AND AUDIT

Learning Objectives	Learning Outcomes
To understand the need of energy audit and the mechanism through which it should be carry out and also to manage the electric and thermal energy.	A student will able to • Know Present energy scenario with need of energy audit and energy conservation. • Understand various aspects of energy audit such as planning, monitoring and implementation • Manage electric and thermal energy in the industry.

Unit 1: Basics of Energy Management and Conservation (10 Hrs)

Global and Indian energy scenario. Global environmental concerns, Climate Change, Concept of energy management, energy demand and supply, economic analysis; Carbon Trading & Carbon foot prints.

Energy Conservation: Basic concepts, Energy conservation in household, transportation, agricultural, service and industrial sectors; Lighting & HVAC systems in buildings.

Unit2:Energy Audit(8 Hrs)

Definition, need, and types of energy audit; Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements; Fuel & energy substitution; Energy audit instruments; Energy Conservation Act; Duties and responsibilities of energy managers and auditors.

Unit 3: Material & Energy balance and Waste Heat Recovery (8 Hrs)

Facility as an energy system; Methods for preparing process flow; material and energy balance diagrams. Cogeneration and waste heat recovery;

Unit 4: Energy Action Planning, Monitoring and Targeting: (8 Hrs)

Energy Action Planning : Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning.

Monitoring and Targeting : Defining monitoring & targeting; Elements of monitoring & targeting; Data and information analysis; Techniques: energy consumption, production,

cumulative sum of differences (CUSUM); Energy Service Companies; Energy management information systems; SCADA systems.

Unit 5: Electrical Energy Management: (8 Hrs)

Supply side: Methods to minimize supply-demand gap, renovation and modernization of power plants, reactive power management, Demand side management: conservation in motors, pumps and fan systems; energy efficient motors.

Unit 6: Thermal energy Management: (8 Hrs)

Energy conservation in boilers, steam turbines and Furnaces; Application of FBC, Heat exchangers and heat pumps.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Handbook on Energy Audits and Management	Amit Kumar Tyagi	TERI
Energy Management Handbook	Wayne C. Turner	Wiley Inter Science Publication
Reference Books		
Principles of Energy Conservation	Archie, W Culp	McGraw Hill, 1991
Energy Management	P. O'Callaghan	McGraw - Hill Book Company, 1993
Handbook of Energy Engineering	Thuman A and Mehta D Paul	The Fairmount Press
Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV.		
Handbook of Energy Audit and Environment Management	Y.P. Abbi, Shashank Jain	TERI

BEELE604T : POWER ELECTRONICS

BEELE604T	**POWER ELECTRONICS**	**L = 4**	**T = 1**	**P = 0**	**Credits = 5**
Examination Scheme	College Assessment			Total	
		Examination			Duration
	20	80		100	3 Hrs

Learning Objectives	**Learning Outcomes**
To introduce students the basictheory of power semiconductor devicesand their practical application inpower electronics. To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits andtheir applications. To provide the basis for furtherstudy of electronics circuits power and systems.	A student who successfully fulfills the course requirements willbe able to • understand basic operation of various power semiconductordevices. • understand the basic principle of switching circuits. • analyze and design an AC/DC rectifier circuit. • analyze and design DC/DC converter circuits. • analyze DC/AC inverter circuit. • understand the role power electronics play in the improvement of energy usage efficiency and the development of renewableenergy technologies.

Unit 1: SCR and Its characteristics: Gate characteristics, SCR turn off, ratings, series and parallel connections of SCRs, Protection of SCR gate circuit protection, over voltage and over current protection, snubber circuit design, commutation methods. 10 Hrs

Unit 2: Static controllable switches: Characteristic and working of MOSFET Gate turn off thyristor and insulated gate bipolar transistor, Triac, AC regulator, Uni-junction transistors, Triggering circuits

and optocouplers. 8 Hrs

Unit 3: Line commutated converters: Working of single pulse converter, two pulse midpoint converter, three pulse midpoint converter and' 3 phase six pulse bridge converter, effect of source inductance in converters, effect of freewheeling diode. 8 Hrs

Unit 4: Single phase and three phase half controlled converters: Speed control of d.c. motors using line commutated converters. Power factor improvement methods, Cyclo-converters (single phase), dual converter. 8 Hrs

Unit 5: D.C. Choppers: Principles of step down chopper, step up chopper classification, impulse commutated and resonant pulse choppers. Multi phase choppers. Application of choppers, Inverters: Basic series resonant inverter, half bridge and full bridge series resonant inverters. 10 Hrs

Unit 6: Single phase and three phase bridge inverters, commutation and trigger-circuits for forced commutated thyristor inverters. Output voltage control, Harmonics in output voltage waveform, Harmonic attenuation by filters. Harmonic reduction by pulse width modulation techniques. Analysis for pulse width, modulation. Working of current source inverters few applications of inverters. 10 Hrs

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Power Electronics circuits Devices and Applications	M. H. Rashid	Prentice Hall India
Power Electronics	Ned Mohan, T.M. Undeland and W.P. Robbins	John Wiley and Sons,Inc
Thyristors and their Applications	G.K.Dubey and Doralda, Joshi and Sinha	New Age
Power Electronics	Khanchandani	Tata McGraw Hill
Power Electronics	P. C. Sen	
Reference Books		
Power Electronics	C.W. Lander	

"ADVANCED TECHNIQUE TO REDUCE POWER CONSUMPTION IN DOMESTIC APPLIANCES"

This project report is submitted to in partial fulfilment of the requirement

For the Degree

Of

Bachelor of Engineering

In

Electrical Engineering (Electronics and power)

Rashtrasant Tukadoji Maharaj, Nagpur University, Nagpur

Under the guidance of

Dr. K. B. PORATE

Professor & Head of Department of Electrical Engineering

Submitted by:

Final year students of Electrical Engineering Department

Name of candidate:

Mr. DEVENDRA MADARKAR

Miss. SURABHI KUBDE

Mr. PANKAJ MESHRAM

Miss. ANKITA MANKE

Mr. DEEPU DAYAL

Mr. KUMAR VIKAS

DEPARTMENT OF ELECTRICAL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR- 440019

2017-18

DEPARTMENT OF ELECTRICAL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR-440019

(INDIA)

CERTIFICATE

This is to certify that the project report entitled, **"ADVANCED TECHNIQUE TO REDUCE POWER CONSUMPTION IN DOMESTIC APPLIANCES"** is a bonafied work done under my guidance by **ANKITA MANKE, DEEPU DAYAL, DEVENDRA MADARKAR, KUMAR VIKAS, PANKAJ MESHRAM, SURABHI KUBDE** in partial fulfilment of the requirements of the award of degree Bachelor of Engineering in Electrical Engineering (Electronics & Power).

Date:

16/4/18

Project Guide

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Chapter 1

Introduction

1.1 Introduction

Power consumption technologies have grown slowly, required improvement in electronics circuit design. While very large scale integration (VLSI), Complementary metal oxide semiconductor (CMOS) technologies have had an exponential growth. Power consumption is often directly related to performance. Higher the power available for consumption, the better can be the performance of the devices.

Loses through heat are a significant part of lower consumption. But for smaller devices, heat loses are negligible or sometimes almost non-existent. This becomes a problem in bigger devices where lot of power is lost through heat, requiring heat-sinks. The devices can go to sleep mode, whenever feasible, to reduce power consumption. You can increase power consumption temporarily with an interrupt and the system goes back to using lesser power. The most convenient method to reduced power consumption is the Advanced technique to reduce power consumption in domestic appliances. It is a power consumption device which is also mention as the energy meter. Apparently just by keeping the device connected to the load it will start immediately reduce your power consumption. The application notes the single phase power. The design measures active power. Voltage and current in a single phase distribution environment.

All the measurements results can be calibrated in the digital domain and measurements results are display on the LCD display.
The heart of our project is PIC microcontroller and the brain of our project is software firmware code, the software code is entirely written in C-language. This makes alternate easy. There are many fluctuations, raise and falls in the current. So, we used static devices in our project because this unstable current may damage instruments.
By generating a firing angle with the help of microcontroller, using this method voltage is gradually decreases and keep the current constant as per the parameters of load. Initially on no load condition, output voltage will be 230 V that means microcontroller does not fire the TRIAC and gradually increases a firing angle as a result voltage decreases. The voltage drop is measured by a PT and current is measured by CT, at the point when current deflects on that particular point CT gives the command to the PIC controller and PIC controller controlled the triggering voltage [1]

Main objectives of our project are to saves power in domestic appliances and measure the output power (voltage and current) of domestic appliances..

To measure the power of domestic appliances generally we used the following formulas:

$$P = VI\cos\Phi$$

Where,

P is the power Watt

V is the voltage in Volt

I is the current Ampere

CosΦ is the power factor

For the domestic power we assume power factor should be 0.9 pf.

1.2 Scope of project

- As the requirement of power increases the power consumption is also increases
- Therefore we required some controller to reduced power consumption.
- The advanced technique to reduced power consumption is used to reduced the power in domestic appliances which is automatically operate by varying the firing angle(α) of TRIAC by using microcontroller.
- To overcome the drawbacks of conventional methods of power saving and to make the operation more efficient.

1.3 Need of Power Saving

- Conservation can save money. This one of the biggest reasons many begin to cultivate a culture of conservation. However as more and more people learn it is certainly not the only reason.
- Less electricity used means less fossile fuels burns. Its true that we can obtained electricity from cleaner sources of energy such as wind and solar power, but much of the electricity that we used is still from sources such as oil and coal. Fosile fuels are not renewable sources and the more electricity we consume the faster the source will be depleted.
- Fossil fuel are not a clean source of energy either. Conservation of electrical energy can help to lessen pollution and reduced greenhouse gas emission.
- As part of the big picture, conservation can also help reduced the risk of oil spills and the threats that coal and oil procurement pose to our ecosystems around the world.

Domain : Electrical Machines

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	POWER SEMICONDUCTOR BASED ELECTRIC DRIVES	BEELE802T	**Electrical Machines**
2	ELECTRICAL MACHINES I	BEELE404T	
3	ELECTRICAL DRIVES & THEIR CONTROL	BEELE603T	

BEELE404T	**ELECTRICAL MACHINES-I**	**L = 4**	**T = 1**	**P = 2**	**Credits = 6**
Examination Scheme	College Assessment	University Examination	**Total**		Univ. Exam
	20	**80**	**100**		**3 hrs**

Learning Objective	Learning Outcomes
• To understand the basic principle of transfer of electrical power, operation, construction of 3-phase transformers, their classification, connections and phasor diagrams. • To understand the basic principle, construction, operation, performance characteristics, steady state analysis and applications of electrical motors and induction generator.	The student will be able to understand • Principle, construction, connections, vector grouping, operation and testing of 3-phase transformer • conversion of 3-phasse supply to 2-phase supply, parallel operation of 3-ph. Transformers. • Principle, armature and field construction, types, operation characteristics, armature reaction, commutation, methods to improve commutation in dc generators. • Principle, types, voltage build up, performance characteristics, torque evaluation in dc motors • Principle, construction, types, torque development, performance characteristics, tests to determine performance indices & parameters of equivalent circuit of 3-phase and double cage induction motors, methods of starting, speed control and braking of induction motors. • Revolving and cross field theories, operation, characteristics, types, equivalent circuit & tests.

UNIT-1

SINGLE PHASE TRANSFORMER :- Transformer phasor diagram, equivalent circuit diagram. Transformer equivalent circuit parameter calculation using O.C. & S.C. test. Polarity test and parallel operation of single phase transformer.

3-PHASE TRANSFORMER: principle and operation of three phase transformer and, O.C. & S.C. test on three phase transformer, determination of equivalent circuit parameters, Regulation, Efficiency, Magnetizing current and harmonics, winding identifications, various connections with vector group.

UNIT-2

Three phase to two conversion, parallel operation of three phase transformer, methods of cooling, back to back test, maintenance of transformer, insulation of transformer.

UNIT-3

D.C. MACHNIES: - Basis principle & operation, Armature reaction & commutation,

Compensating winding, interpoles. Type of excitation. Characteristics of shunt series & compound motor andgenerator speed control of d.c. shunt & series motor, constant horse power & constant torque drive of d.c. motor.

UNIT-4

THREE PHASE INDUCTION MOTOR: - Types of induction motor and production of torque. Torque-slip characteristics, No load blocked rotor test, circle diagram, losses, efficiency, double cage motor, operating characteristics & influence of machine parameter on the performance of motor. Induction motor as a induction generator.

UNIT-5

Starting of 3 phase I.M. speed control of I.M. by pole changing, frequency control, rotor resistance by varying supply voltage, braking regenerative braking, plugging, dynamic braking Crawling & cogging.

UNIT-6

SINGLE PHASE I.M.: - Double field revolving and cross field theory split phase motor shaded pole motor, equivalent circuit, Torque-slip characteristics.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Electrical Machines	P.K. Mukherjee & S. Chakraborty	Dhanpat Rai Publication (P) Ltd.
Electrical Machines	I. J. Nagrath & Dr. D.P. Kothari	3rd , Tata McGraw Hill
Electrical Machines	P. S. Bhimbra	Tata McGraw Hill
Reference Books		
Performance & Design of A.C. M/C	M.G. Say	CBS PUBLISHERS AND DISTRIBUTORS PVT. LTD. 3rd ed. Rev.

BEELE 802 T (3) -POWER SEMICONDUCTOR BASED DRIVES

Learning Objectives	Learning Outcomes
• To study the converter and Chopper control of DC drives. • To study the semiconductor based control of Induction and Synchronous motors. • To learn the basics of Switched reluctance motor and Brushless DC motor. • To Study the non conventional and renewable energy based drives.	The student will be able to :- • work with confidence on the various drives used in the Industry. • The students can carry research on the newer Switched Reluctance motor and Brushless DC motor. • Understands the traction drives with ac and dc motors.

Unit 1: Dynamics of electric drives and control of electric drives,

Unit 2: D.C. motor drives: Controlled rectifier fed d.c. drives, single phase and three phase rectifier control of d.c. separately excited motor. Dual converter control of D.C separately excited motor. Power factor, supply harmonics and ripple in motor current. Chopper controlled dc drives of separately excited dc motor, chopper control of series motor, source current harmonics.

Unit 3: Induction motor drives: Stator voltage control, variable frequency control using voltage source invertors, and current sources invertors. Concept of scalar control of 3-ph Induction Motor, Basicphilosophy of vector control of 3-ph I.M. their advantages and list of applications.

Basic idea of energy conservation in fan and pump type loads using scalar controlled induction motordrives.(Numericals excluded)

Unit 4: Synchronous Motor Drive ; Starting Braking of synchronous motor, variable frequency control self controlled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting of large synchronous motors.

Unit 5: Brushless dc motor, stepper motor, switched reluctance motor drives and eddy current drives. introduction tosolar and battery powered drives. Energy conservation in electric drive

Unit 6: Traction drives: Conventional dc and ac traction drives, semiconductors converter controlled Drives, 25KVAC traction using semiconductor converter controlled dc motor. DC traction using semiconductor, chopper controlled dc motors, polyphase AC motors for traction drives.

BOOKS:

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Fundamentals of Electric drives	G. K. Dubey	CRC Press
Modern Electric Traction	H. Partab	Pritam Surat, 1973
Power Electronics and drives	B. K. Bose	Pearson
Reference Books		
Electric drives concepts and applications	Vedam Subrahmanyam	McGraw-Hill, 1996

BEELE603T	**ELECTRICAL DRIVES & THEIR CONTROL**	**L = 4**	**T = 1**	**P = 0**	**Credits = 5**
Examination Scheme	College Assessment	University Examination		Total	Univ. Exam. Duration
	20	80		100	3 Hrs

Learning Objective	**Learning Outcomes**
• To understand the starting, speed control/braking, heating and cooling characteristics of electric motors and to learn the necessity of flywheel. • To learn the basics of Programmable Logic Controllers and become familiar with Ladder Programming. • To Study the motors used in Electric Traction.	The student will develop an ability • To solve numericals on starting, speed control and braking. • To solve numericals on heating and cooling of motors. • It will lay the foundation for studying the advanced subject Power Semiconductor based drives to be studied in 8th semester. • to work on the drives used in the Industry. • to work with PLC's in the Industry • will gain an insight in the working of drives used in traction.

UNIT-1;
Definition classification and speed torque characteristics of common drive motors and their characteristics under starting, running, braking and speed control. 8 Hrs.

UNIT-2:
SELECTION OF MOTOR: Power capacity for continuous and intermittent periodic duties flywheel effect. 10 Hrs

UNIT-3:
PLC, its Programming and its application in electrical drives. 8 Hrs.

UNIT-4:
AC AND DC CONTACTORS AND RELAYS: Lock out contactors, magnetic structure, operation arc interruption contactor rating, H.V. contactors, control circuits for automatic starting and braking of DC motor and three phase induction motor. Control panel design for MCC. 10 Hrs

UNIT-5:
TRACTION MOTORS: Motors used in AC/DC traction, their performance and desirable characteristics, requirements and suitability of motor for traction duty. Traction motor control – control of DC traction motor. Series parallel control with numerical starting and braking of traction motor. 10Hrs

UNIT-6:
Brief idea about drives commonly used in industries. Digital control of electric motor. Block diagram arrangement, comparison with other methods of control. 8 Hrs

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
A course in Electrical Power	Soni, Gupta and Bhatnagar	
Modern Electrical Traction	H. Pratap	
Art and Science of Utilization of Electrical Energy	H. Pratap	
Magnetic Control of Industrial motors	Heumann	
Industrial Electronics	Petru Zula	McGraw Hill
Industrial Electronics	Bhattacharya	
Basic course in Electrical Drives	S. K. Pillai	

"SPEED CONTROL OF SINGLE PHASE INDUCTION MOTOR BY USING MICROCONTROLLER BASED PHASE ANGLE CONTROL TECHNIQUE"

This project report is submitted to in partial fulfilment of the requirement

For the Degree

Of

Bachelor of Engineering

In

Electrical Engineering (Electronics and power)

Rashtrasant Tukadoji Maharaj, Nagpur University, Nagpur

Under the guidance of

Dr. K. B. Porate

Professor in Electrical Engg. Department

Submitted by:

Final year students of Electrical Engineering Department

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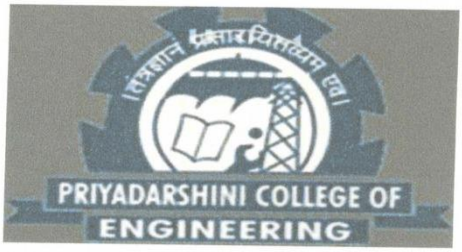

DEPARTMENT OF ELECTRICAL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR- 440019

2016-17

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(INDIA)

CERTIFICATE

This is to certify that the project report entitled, **"SPEED CONTROL OF SINGLE PHASE INDUCTION MOTOR BY USING MICROCONTROLLER BASED PHASE ANGLE CONTROL TECHNIQUE"** is a bonafied work done under my guidance by **DARSHAN KIRPAL, PAYAL SHAMBHARKAR, SANKET DESHMUKH, SHAMAL DHENGE, SHIVANI CHANNE, SHWETA AMGAONKAR, TEJASVI RATNAPARKHI** in partial fulfilment of the requirements of the award of degree Bachelor of Engineering in Electrical Engineering (Electronics & Power).

Date: 27/03/2017

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ABSTRACT

AC motors, especially induction motors are superior to dc motors due to their simplicity in structure, robustness, maintainability, less expensive, free of spark and reliability. However, for many years, AC motors could not match the DC motors in controllability and the DC motors continued to increase their share of motor market due to their good starting and stopping capabilities, easy speed control and quick control response. Induction motor is basically a constant speed motor and hence it becomes quite difficult to control its speed. The speed of induction motor can be controlled but it can be achieved at the cost of decrease in efficiency and low power factor. To obtain energy efficiency instead of running machine at constant speed, speed control method is used. The main disadvantage of induction motor is that when the load is applied speed drops and it affects the performance of induction motor. The main objective behind a motor speed controller is to receive a signal representing the demanded speed and to drive the motor at that desired speed. Precise control is required to maintain constant speed and generally this can be achieved by varying the input parameters of motor such as voltage, current, etc. So many techniques are available to vary the input parameters of motor to maintain the constant speed. This report deals with the speed control of 1Φ induction motor by using microcontroller based phase angle control technique, its implementation and test results.

Important features of each chapter are as follows:

CHAPTER 1 incorporates the projects objectives, methodology and scope of project. It also introduces the need of speed control.

CHAPTER 2 provides the information about the construction of single phase induction motor and working principle of it. Its also introduces the types of single phase induction motor.

CHAPTER 3 comprises of different methods of speed control techniques used to control speed of induction motor.

CHAPTER 4 includes the simulation of single phase induction motor in MATLAB and phase angle control using TRIAC.

Chapter 1

Introduction

1.1 Introduction

Induction motor has replaced by dc motor in many industrial and domestic applications due to its rugged construction, cost effectiveness, etc. It is basically a constant speed motor and hence it becomes quite difficult to control its speed. The main disadvantage of induction motor is that when the load is applied speed drops and it affects the performance of the induction motor. To eliminate this drawback, some control techniques are required. In the previous days, the variable speed drives had various limitations such as larger space, poor efficiencies, lower speed, etc. But, the invention of power electronics devices change the situation so now, variable speed drives are constructed in small size, high efficiencies and high reliability. The relationship between synchronous speed N_s, rotor speed N_r and the slip s is given by[3],

$$s = 1 - \frac{N_s}{N_r} \qquad (1.1.1)$$

The synchronous speed of induction motor is given by[3],

$$N_s = \frac{120f}{p} \qquad (1.1.2)$$

where,

f = frequency of the supply

P = Number of poles

Thus, the speed of an induction motor depends on slip, frequency of the stator supply and the number of poles. The ability of varying any one of the above 3 parameters will provide method of speed control of an induction motor. Our project deals with micro-controller based phase angle control technique.

1.2 Project objectives

Hardware circuit of speed control of single phase induction motor by using micro-controller based phase angle control technique is developed and have the following objectives:

- To maintain constant speed of 1-Φ Induction motor irrespective of change in load.
- To measure voltage, current & speed of 1-Φ Induction motor on different load conditions without micro-controller.
- To measure voltage, current & speed of 1-Φ Induction motor on different load conditions with micro-controller based system in closed loop manner.
- Performance comparison for all parameters i.e. voltage, current and speed without micro-controller and with micro-controller.

1.3 Methodology

Methodology of this project is given below:

- ❑ Simulation using MATLAB:
  - ▸ Performance of 1-Φ induction motor without any controller at full load condition (voltage, current, torque & speed).
  - ▸ Performance of 1-Φ induction motor with controller at full load condition (voltage, current, torque & speed).
  - ▸ Comparison between voltages, current, torque & speed of 1-Φ induction motor without and with controller.
- ❑ Hardware:
  - ▸ Fabrication & performance of 1-Φ induction motor without any micro-controller (voltage, current & speed)
  - ▸ Fabrication & performance of 1-Φ induction motor with micro-controller (voltage, current & speed)
  - ▸ Comparison between voltages, current & speed of motor without & with micro-controller.