Electrical Machines-II:2130411

Course Objective:

- To develop basic concepts about AC machines, their constructional details and working principles and to understand the practical applications and operational issues of three phase transformer and other rotating machines

UNIT-I Transformer: Three phase transformers, Special construction features, Single phase Transformers connected as 3 phase bank, Phasor diagram of star/star, Star/delta, Delta/delta, Delta/star, connected 3 phase transformers and their uses, Phase conversion, Three to two phase open delta or V connection, Parallel operation of single phase and three phase Transformers, load sharing, harmonics in transformer, Magnetization current wave form, Tertiary winding.

UNIT-II Induction Motor II: Circle diagram and its experimental determination, cogging and Crawling Losses, Efficiency and Testing I.M, Double cage induction motor, Operation on unbalanced voltages, Speed control, Rotor resistance control, pole changing method, Frequency control, Induction generator, Introduction to Single phase Induction motor.

UNIT-III Synchronous Machine I: Constructional features, Salient pole and cylindrical synchronous machines, Relation between speed, Frequency and no. of poles, excitation, Voltage generation, Generator mode, Interaction between excitation flux and armature EMF, Voltage regulation, phasor diagram on load, Leakage reactance and synchronous reactance, Steady state parameters of synchronous machines, open circuits, short circuit and zero power factor tests, Determination of voltage regulation by synchronous impedance method, MMF method and Potier triangle method.

UNIT-IV Synchronous Machine II: Two reaction theory, Slip test, Expression for power developed and power angle curves, Synchronization of alternators Dark and bright lamp method, Synchro scope Parallel operation and load string, Effect of governor characteristics on load sharing, Operation on infinite bus bar.

UNIT-V Synchronous Machine III: Motoring mode, transition from motoring to generating mode, V curves starting, Synchronous condenser, Hunting, damper winding synchronizing torque and power analysis under sudden short circuit, Transient parameters of synchronous machines, Various transient and sub transient reactance, Time constant, Expression of transient and sub transient reactance Analysis of3 phase short circuit oscillogram and determination of transient parameters from oscillogram, Short circuit ratio.

Recommended Books:

1. Theory of Alternating current Machinery by Alexender S Langsdorf.
2. The performance and design of AC machines by M.G. Say,CBS Publication.
3. Electric machine by Nagrath and Khotari. TMH.
4. Generalized theory of electrical machine by P.S. Bimbhra, Khanna publication
5. Electrical machines by P.S. Bimbhra, Khanna publication
6. The Performance and Design of AC Commutator Machines by Openshaw Taylor. CBS Publication

Course Outcomes: After completion of this course, students will be able to:

CO 1. Explain the constructional details and working principle and various configurations of three phase transformers.
CO 2. Describe the performance of 3-phase induction and synchronous machines using equivalent circuits & phasor diagrams under different loading conditions.
CO 3. Determine voltage regulation of an alternator and its steady state performance.
CO 4. Determine time constant, various sequence reactance and equivalent circuit parameters under transient conditions for synchronous machines.
CO 5. Analyze the behavior of synchronous machine connected to infinite bus and parallel operation of alternators.

Power System-II:2130412

Course Objectives:

- To expose the students to the concepts of Load Flow Studies, Symmetrical and Unsymmetrical Faults, Power System Stability, Power System Control, Underground Cables and HVDC Transmission System.
- To enable the students to solve problems related to Load Flow Studies, Fault analysis, Power System Stability, Power System Control and Underground Cables.

Unit I: System Representation and Load Flow Analysis: Single line representation, Per unit system, Network Model formulation, Formulation of YBUS, Formation of static load flow equations, solution of load flow problem by Gauss-Seidel, Newton-Raphson (polar and rectangular) and fast decoupled load flow methods.

Unit II: Symmetrical and unsymmetrical fault: Review of symmetrical components, sequence networks, symmetrical fault analysis, unsymmetrical fault analysis, analysis of open conductor fault, fault calculations for symmetrical and unsymmetrical faults.

Unit III: Power System Stability: Basic concepts of steady state, dynamic and transient stability, power angle equation, synchronizing power coefficient, equal area criterion, critical clearing angle, Swing equation, Concept of multi-machine transient stability studies with classical machine representation, factor affecting stability and methods of its improvement.

Unit IV: Power System Control: Elementary idea of load-frequency control, automatic generation control, reactive power and voltage control. Series and shunt compensation techniques, tap changing transformers, phase shifting transformers, Induction regulator, Economic limit of VAR control.

Unit V: Underground Cables and HVDC Transmission: Types of cables, Insulation resistance of cable, Electrostatic stress and grading of cables, rating and power factor of cables, Brief history of DC transmission, comparison of HVDC with EHV AC transmission systems, Basic converter circuit used in HVDC system, types of HVDC links.

Recommended Books:

1. Advanced Power System Analysis and Dynamics, L.P. Singh, Wiley Eastern Ltd, 6th Ed. 2017.
2. Modern Power System Analysis, Nagrath& Kothari, TMH Publishers, 4th Ed. 2016.
3. Elements of Power System Analysis, W.D. Stevenson, McGraw-Hill, 4th Ed. 2017.
4. Power system operation and control, A.J. Wood &Woollenberg, 2nd Ed. 2010.
5. HVDC Power Transmission Systems: Technology and System Interactions, K. R. Padiyar, New Age International, 3rd Ed. 2017.

Course Outcomes

After the completion of this course, students will be able to:

CO 1. **Explain** the concepts of single line diagram and per unit system.
CO 2. **Apply** different load flow techniques to solve load flow problem.
CO 3. **Compute** the fault calculations for symmetrical and unsymmetrical faults.
CO 4. **Explain** the theoretical and practical aspects of Power System Stability and its enhancement.
CO 5. **Explain** the automatic generation control reactive power, voltage control, series and shunt compensation.
CO 6. Discuss the insulation resistance, capacitance of various types of cables and the need of HVDC transmission.

Microprocessors & Embedded Systems: 2130413

Course Objective:

- To provide fundamental operating concepts of microprocessors and microcontrollers.
- This course aims to provide students with a solid theoretical basis as well as comprehensive professional understanding of Arduino and Raspberry Pi.

Unit I. Microprocessors:8085-architecture, operation, pin configuration and functions, bus organization, control signal generation for external operations- fetch, IO/M, read/write, machine cycles and bus timings. Addressing mode, instruction set, Overview/concept of peripheral interfacing devices- 8251, 8253, 8255 and 8279.

Unit II. Microcontrollers: 8051-architecture, operation, pin configuration and functions, memory organization, register, I/O ports, addressing modes, instruction sets, instruction classification. Assembly language programming, Interrupts in 8051. Timer/Counter programming for time delay generation and waveform generation. Interfacing with ADC, DAC, LEDs and seven segment display.

Unit III. Arduino: Introduction to the Arduino, creating an Arduino programming Environment, Arduino IDE, creating an Arduino program, Arduino Libraries, Analog and Digital Interfacing, Adding Interrupts, communicating with devices and sensors.

Unit IV. Raspberry Pi: Introduction to the Raspberry Pi, basic functionality of the Raspberry Pi board and its processor, setting and configuring the board, programming on Raspberry Pi, python programming environment, python expressions, general purpose IO pins, Protocol pins, RPi,GPIO library, communicating with devices and sensors.

Unit V. IoT application using Arduino and Raspberry Pi: Arduino- Playing tones and a melody, alphanumeric LCD display, speed and direction control, temperature and humidity sensor interfacing. Raspberry Pi -controlling LED, interfacing an LED and Switch, Interfacing a Light Sensor (LDR), camera interfacing etc.

Recommended Books:

1. "8085 Microprocessors Architecture Application and Programming", Ramesh S. Goankar, Penram International, 5th Edition.
2. "The 8051 Microcontroller", Kenneth J. Ayala, Cangage learning, 3rd Edition.
3. "Arduino Cookbook", Michael Margolis, O'Reilly Media, Inc., 1st Edition.
4. "Arduino for beginners: Essential Skills Every Maker Needs", John Baichtal, Person Education, Inc., 1st Edition.
5. "Raspberry Pi User Guide", Eben Upton and Gareth Halfacree, August 2016, 4th Edition, John Wiley & Sons.
6. "Programming with Raspberry Pi: Getting Started with Python", Simon Monk, January 2012, McGraw Hill Professional.

Course Outcomes:

After the completion of the course, the student will be able to –

CO 1. **Describe**the fundamentals of microprocessor along with the peripheral interface devices.

CO 2. **Describe** architecture, memory organization, operation and interfacing of 8051microcontroller.

CO 3. **Create** Arduino development program using libraries for communication with devices & sensors.

CO 4. **Configure** Raspberry Piin Python environment

CO 5. **Develop** interfacing between different sensors and Arduino / Raspberry Pi.

CYBER SECURITY: 2100009

UNIT - 1: Overview of Cyber Security: Introduction to Cyber Security, Cyber-crime, Types of Cyber Attacks, Cyber Vandalism (Hacking), Cyber Stalking, Internet Frauds and Software Piracy

UNIT - 2: Basics of Internet and Networking, Network Topologies, Wired and Wireless networks, E-commerce, OSI Model, Internetworking Devices, Firewall

UNIT - 3: Security Principles and Attacks, Cryptography, Symmetric key Cryptography, Symmetric key Ciphers, Public key cryptography, SSL

UNIT - 4: Hacker, Types of Hacker Malicious Softwares (Part 1) Malicious Softwares (Part 2)

UNIT - 5: Introduction of Intellectual Property and patent More About Patent Topic of the lecture: All about Trademark Topic of the lecture: Industrial Design Topic of the lecture: Geographical Indication Topic of the lecture: All about copyright Topic of the lecture: IT act 2000 Topic of the lecture: Digital Crime Investigation

Course Outcomes

After the completion of the course, the student will be able to

CO1. Explain the basic terminologies of Cyber Security, networking & Internet.

CO2. Analyze methods used to protect data in the internet environment in real world situations.

CO3. Discover the concept of IP security & architecture.

CO4. Compare the types of Cyber security threats/vulnerabilities.

CO5. Develop the understanding of cyber crime investigation and IT ACT 2000.

Electrical Machines-II Lab: 2130411

List of Experiments

1. To conduct No Load & Blocked Rotor test on 3-Phase squirrel Cage Induction Motor and plot circle diagram.
2. To conduct Load Test on 3-Ph Sq. Cage Induction Motor and plot performance curve.
3. To conduct No Load & Blocked Rotor Test on 3-Ph Slip Ring Induction Motor and plot performance curve.
4. To conduct Load Test on 3-Ph Slip Ring Induction Motor and plot performance curve.
5. To study the cascaded connection of two 3-Phase Slip Ring induction motor.
6. To find out OCC and SCC of an Alternator and its regulation using synchronous impedance method.
7. To find regulation of Alternator using Zero Power Factor (ZPF) method.
8. To draw V Curves of Synchronous motor.
9. To perform Synchronization of Alternators.
10. To determine the X_d&X_q of an alternator using Slip Test.
11. To determine the X_d&X_q of an alternator (Positive sequence Reactance).
12. Virtual lab simulation of Conventional Electrical Machines**.**

Course Outcomes:

At the end of the Laboratory work the students will be able to

CO1. Demonstrate the fundamental control practices associated with AC machines such as starting, reversing, braking, plugging, etc.).

CO2. Conduct test on electrical machines for computing the efficiency, regulation and parameters of equivalent circuit.

CO3. Develop the ability to work is team with professional ethics

CO4. Prepare an organized written report

Power System-II Lab: 2130412

List of Experiments

1. Demonstration of EHV AC transmission line simulation panel.
2. Measurement of resistance, inductance and capacitance of EHV AC transmission line simulation panel.
3. Study of cables, insulators and line supports used in transmission and distribution systems.
4. Calculation of generalized circuit constants for short, medium and long transmission lines.
5. Simulation of L-G, L-L, L-L-G, L-L-L, L-L-L-G faults using MATLAB.
6. Development of MATLAB code to determine the maximum power without loss of synchronism using equal area criterion.
7. Development of MATLAB code to determine the critical clearing angle and critical fault clearing time.
8. To determine the system stability from the swing curve.
9. Use MATLAB rlocus function to obtain the root locus plot.
10. A visit and study of 33kV Substation.

Renewable Energy Lab: 2130414

List of Experiments

1. To study the Rooftop PV module & wind turbine.
2. To setup a Solar PV standalone system and calculate power in different branches of the system.
3. To set up a Solar PV Grid Connected system and calculate power in different branches of the system.
4. To set up a Solar PV Power plant with the help of a Hybrid inverter.
5. To set up a Wind Energy standalone system and calculate power in different branches of the system.
6. To set up a Solar PV- Wind Energy Hybrid standalone system and calculate power in different branches of the system.
7. Utilizing smart house as a load and analyzing load waveforms.
8. Utilizing Load analysis kit and understanding about loads connected in series.
9. Observing different weather parameters using weather station.
10. Comparing the different types of grid connected systems and analyzing their waveforms with the help of linear loads.

Course Outcomes:

On the successful completion of the lab experiments students will be able to:

CO 1. **Develop** the understanding of renewable energy sources.

CO 2. **Investigate** the solar PV & wind energy operation and find their performance curves.

CO 3. **Examine** smart house & load analysis kit.

CO 4. **Develop** teamwork skills for working effectively in groups.

CO 5. **Prepare a technical** report on experiments conducted in the lab.

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Skill Based Mini Project List

1. Draw the following connection diagram of three phase transformers (a) Yd1 (ii) Dy11 (c) Yy6 (d) Dy1
2. Draw the phasor diagrams of Star and Delta Connection
3. Discuss the armature reaction with phasor diagram of Synchronous generator and synchronous motor at following load (a) unity power factor load (b) ZPF lag (c) ZPF lead (d) pf lag (e) pf lead
4. Explain the working of a single phase induction motor and how a rotating magnetic field is produced? Discuss the graphical representation?
5. How can synchronization be done in a synchronous generator? Draw the connection diagram?
6. Draw the phasor of the synchronous motor with varying effect of excitation and also discuss the effect of the power factor?
7. Explain in detail the concept of Skin effect? How is this concept utilized to improve the starting torque of an induction motor?
8. Explain the principle of operation of Induction generator?
9. Write the nameplate details of all Induction and synchronous machines available in the laboratory?
10. Write the various applications of three phase induction and synchronous motors?

Power System-II Lab: 2130412

Skill Based Mini Project List

1. **Drawing Based**
   Single line/ Reactance/ Impedance Diagram of
   - Substation
   - Practical Distribution System
   - Practical Transmission System
   - Industrial Installation
   - Any Special case domestic and/or Industrial wiring etc.

2. **Calculation Based**
   - Industrial load calculation
   - Institutional/Laboratory load calculation
   - Energy conservation solution of above along with pay back calculation

3. **Design Based**
   - Wring diagram and load estimation of Apartment having at least three floors
   - Indusial Writing diagram with load calculation etc.

4. **Software Based using MATLAB, PSCAD, SKM Power System Tools or any other adequate software**
   - Load flow calculation
   - PU system conversion
   - Stability Analyses of Power System
   - Fault calculation
   - Problem of L-F, Voltage Control with solution

5. **Hardware Based**
   - Asynchronous Tie
   - Applications of HVDC and HVAC
   - Special case wiring etc.

6. **Any other relevant problem of syllabus of Power System II**