College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra, Permanently Affiliated to S.P. Pune University)

Department of Electrical Engineering

Curriculum Structure & Detailed Syllabus (UG Program)

Third Year B.Tech.

(Revision: A.Y. 2016-17, Effective from: A.Y. 2017-18)

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Program Education Objectives (PEOs)

The Undergraduate students will demonstrate…

I. To produce around 75 electrical graduates annually who, immediately following graduation, are employable in the diversified sectors of the industry, government organizations, public sector and multinational corporations and/or pursue higher Educational in electrical or other fields of their interests, at institutes of repute and high standard.
II. To prepare graduates who demonstrate measurable progress in the fields they choose to pursue.
III. To prepare graduates, who are able to communicate effectively, adopt lifelong learning, act with integrity and have inter-personal skills needed to engage in, lead and nurture diverse teams, with commitment to their ethical and social responsibilities.

Program Outcomes (POs)

The Undergraduate Students will demonstrate...

On successful completion Graduates will demonstrate:

1. Knowledge of science, mathematics, and engineering principles.
2. Ability to apply this knowledge of science, mathematics, and engineering principles for solving problems.
3. Ability to identify, formulate and solve electrical engineering problems in the broad areas like electrical machines, analog and digital electronics, power systems and control systems.
4. Ability to understand and use different software tools in the domain of circuit, field, power system, control system simulations.
5. Ability to design and conduct experiments and analyze and interpret data.
6. Ability to function as a member of a multidisciplinary team.
7. Demonstrated sensitivity towards professional and ethical responsibility.
8. Ability to communicate effectively in writing as well as through public speaking.
9. Demonstrated ability to appreciate and engage in lifelong learning.
10. Demonstrated knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
12. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Correlation between the PEOs and the POs

PO→ PEO↓	1	2	3	4	5	6	7	8	9	10	11	12
I	✓	✓	✓	✓	✓						✓	✓
II		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
III						✓	✓	✓	✓	✓		✓

Note: The cells filled in with ✓ indicate the fulfillment/correlation of the concerned PEO with the PO.

List of Abbreviations

Abbreviation	Title
S.P. P.U.	Savitribai Phule Pune University
A.Y.	Academic Year
BSC	Basic Science Course
EFC	Engineering Foundation Course
MLC	Mandatory Learning Course
ILOE	Institute Level Open Elective Course
SLC	Self-Learning Course
HSMC	Humanities/Social Sciences/Management Course
LLC	Liberal Learning Course
SBC	Skill Based Course
PCC	Program Core Course
DEC	Department Elective Course
LC	Laboratory Course

Semester V

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Mathematics Course to be taught by the department {FEM, Probability, Statistics, optimization, random Processes, etc.}	3	0	0	3
2	MLC	Constitution of India	1	0	0	0
3	SBC	Signal Processing	3	1	0	4
4	PCC1	Microcontrollers	3	0	0	3
5	PCC2	Ac Machines	3	1	0	4
6	PCC3	Power System Analysis	3	0	0	3
7	LC1	Power System Analysis Lab	0	0	2	1
8	LC2	AC Machines Lab	0	0	2	1
9	LC3	Microcontroller Lab	0	0	2	1
10	ILOE in Humanities/ HSMC	Institute will offer courses (select any one) • English Proficiency-I • Finance for Engineers-I • Engineering economics-I • Industrial Psychology-I • Personal Psychology-I • Japanese Language-I • German Language-I	2	0	0	2
11	HSMC	Entrepreneurship	1	0	0	1
		Total	**19**	**2**	**6**	**23**
		Total Academic Engagement and Credits	**27**			**23**

No.	Semester	Electrical Minor Course	Honors Course	Lectures	Credits
1	V	Electrical Circuit Analysis and Automatic Control Systems	Optimization Techniques	3	3
2	VI	Machines and Drives	Embedded System Design	3	3
3	VII	Power Systems	Advanced Power electronics	3	3
4	VIII	Power Converters/ Industrial Electrical Systems	Sliding Mode Control	3	3

No.	Semester	Renewable Minor Course	Honors Course	Lectures	Credits
1	V	Solar Energy Systems	Optimization Techniques	3	3
2	VI	Wind Energy Systems	Embedded System Design	3	3
3	VII	Bioenergy Systems	Advanced Power Electronics	3	3
4	VIII	Hydro Energy Systems	Sliding Mode Control	3	3

Semester VI

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	SLC	Industrial Electrical Systems {Industry Floated Course}/ Communication Engineering {MOOCs}	3	0	0	3
2	MLC	Environmental Studies	1	0	0	0
3	SBC	Mini Project in Power Electronics	1	0	2	2
4	PC1	Control System Engineering	3	1	0	4
5	PC2	Power System Operation and Control	3	0	0	3
6	PC3	Power Electronics	3	1	0	4
7	LC1	Power system operation and control Lab	0	0	2	1
8	LC2	Control System Engineering Lab	0	0	2	1
9	LC3	Power Electronics Lab	0	0	2	1
10	ILOE in Humanities/HSMC	Institute will offer courses (select any one) • English Proficiency-II • Finance for Engineers-II • Engineering Economics-II • Industrial Psychology-II • Personal Psychology-II • Japanese Language-II • German Language-II	2	0	0	2
			16	**2**	**8**	**21**
		Total Academic Engagement and Credits	**27**			**21**

Semester-V

(EE-17008) Probability Theory and Statistical Inference

Teaching Scheme:
Lectures: 3 Hrs/week

Examination Scheme:
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:
Students will be able to

1. Know and recall the core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. Understand the concept. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
4. Give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Unit I: **[6 Hrs]**

Review of basic probability theory along with examples, conditional probability and Bayes' Rule, concept of independent events.

Unit II: **[14 Hrs]**

Random Variables, Standard discrete and continuous distributions like Binomial, Poisson, Hyper geometric, Negative Binomial, Geometric, Normal, Exponential, Central Limit Theorem and its significance, sampling distributions of means, S^2,t, and F.

Unit III: **[8 Hrs]**

One - and Two - Sample estimation problems: Introduction, statistical inference, classical methods of estimation, single sample: estimating the mean and variance, two samples: estimating the difference between two means and ratio of two variances.

Unit IV: **[12 Hrs]**

One - and Two – Sample tests of hypotheses: Introduction, testing a statistical hypothesis, tests on single sample and two samples concerning means, proportions and variances, goodness of fit test, One way analysis of variance for completely randomized design.

Textbooks:

- Ronald E, Walpole, Sharon L. Myers, Keying Ye, Probability and Statistics for Engineers and Scientists (8th Edition), Pearson Prentice Hall, 2007

Reference Books:

- Douglas C. Montgomery, Design and Analysis of Experiments (7th Edition), Wiley Student Edition, 2009.
- S. P. Gupta, Statistical Methods, S. Chand & Sons, 37th revised edition, 2008
- William W. Hines, Douglas C. Montgomery, David M. Goldsman, Probability and Statistics for Engineering, (4th Edition), Willey Student edition, 2006.

Note:

All the Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5 will be judged by 25 % of questions.

(ML 17001) Constitution of India

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme
40 marks: Assignments/Quiz
End-Sem Exam- 60 Marks

Course Outcomes:

1. Student will be able to understand how India has come up with a Constitution which is the combination of the positive aspects of other Constitutions.
2. Student will be able to understand the interpretation of the Preamble.
3. Student will be able to understand the basics of governance of our nation.
4. It helps in understanding the different aspects covered under the different important Articles.
5. Student will be able to understand the basic law and its interpretation. Understand the important amendments which took place and their effects.
6. Student will be able to understand our Union and State Executive better.
7. Student will be able to understand the basic that along with enjoying the rights one needs to fulfill one's duties.
8. Student will be able to understand and Gain confidence on our Constitution by knowing it better.

Unit I **[3 Hrs]**

Meaning and history of Constitution. Understanding the concept of Human Rights and Fundamental rights.

Unit II **[6 Hrs]**

Introduction to The Constitution of India, understanding its objects. Preamble to the constitution of India. Fundamental rights under Part – III, exercise of rights, limitations and important cases. Prerogative Writs.

Unit III **[4 Hrs]**

Relevance of Directive principles of State Policy under Part – IV, Fundamental duties & their significance

Unit IV **[3 Hrs]**

Union Executive – President, Prime Minister, Parliament & the Supreme Court of India.

Unit V **[3 Hrs]**

State executive – Governors, Chief Minister, State Legislature and High Courts

Unit VI **[4 Hrs]**

Constitutional Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes. Emergency Provisions.

Unit VII **[3 Hrs]**

Electoral process. Amendment procedure, 42nd, 44th, 73rd,74th, 76th , 86th , 91st , 98th and latest amendment. Constitutional amendments.

Textbooks

- Introduction to the Constitution of India by Durga Das Basu (Students Edn.) Prentice – Hall EEE, 19th/20th Edn., 2001.
- Engineering Ethics by Charles E.Haries, Michael. S.Pritchard and Michael J.Robins Thompson Asia, 2003-08-05.

Reference Books

- An Introduction to Constitution of India by M.V. Pylee, Vikas Publishing**.**

(EE-17004) Signal Processing

Teaching Scheme:
Lectures : 3 Hrs/week
Tutorial : 1 Hrs/week

Examination Scheme:
Assignments /Quiz- 40 Marks
End sem exam -60 Marks

Course Outcomes:

By the end of the course, students will be able to

1. Realize the abstraction of signals and systems, from the point of view of analysis and characterization.
2. Perform convolution and correlation operations on signals
3. Use mathematical tools like Laplace transform, Z transform, Fourier representation for frequency domain analysis of CT and DT signals.
4. Design and realization of FIR and IIR filters.

Unit I: Basics of Signals and Systems **[6 Hrs]**

Introduction and Classification of Continuous Time Signals, Discrete Time Sequences and Systems, Elementary Operations on Signals and Sequences, Properties of Systems, Sampling theorem, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of Samples. Discrete Time

processing of Continuous -time Signals, Continuous Time Processing of Discrete-Time Signals.

Unit II: Linear Time Invariant Systems [6 Hrs]

Time Domain Representations of Continuous and Discrete time Linear Time Invariant (LTI) Systems, Properties of LTI Systems, Impulse Response, Convolution, Differential Equation Representation for continuous time LTI system, Linear Constant - Coefficient Different Equation Representation for discrete time LTI system

Unit III: Laplace Transform and its Applications [6 Hrs]

Laplace Transform, Analysis and Synthesis of Network Systems Using Laplace Transforms, Solving Differential Equations with Initial Condition.

Unit IV: Z-Transform [6 Hrs]

Definition, convergence. Properties of Z-Transform, Inverse Z-Transform. System Function for Discrete-Time systems Characterized by Linear Constant-Coefficient Difference Equations. Recursive and Non-recursive Structure, Block Diagram and Signal Flow Graph Representation of Discrete-Time systems. Basic Structure for FIR and IIR Systems.

Unit V: Fourier Representation of the Signals [6 Hrs]

Signal Analysis - Discrete and Continuous, Periodic and Non-Periodic, and Synthesis In Fourier Domain, Properties of Fourier Representations, Application of Fourier Representations.

Unit VI: Discrete Fourier Transform: [8 Hrs]

Discrete time Fourier series and its convergence, discrete time Fourier Transform, its properties, frequency response. Introduction to DFT in time domain and frequency domain, Derivation of DFT from DTFT, Inverse DFT, Convolution using DFT, Computational Complexity of the DFT, Decimation-in-time FFT Algorithm, Decimation In Frequency FFT Algorithm, Comparison of DIT AND DIF algorithms. Introduction to FIR and IIR Filter Design.

Textbooks:

- Signals and systems by Oppenheim, Willsky and Nawab 2nd, Ed., Pearson (low price), 1996.
- DSP: Principles, algorithms and applications‟ by Proakis and Manolakis, 4th edition, Prentice Hall, 1996

Reference Books:

- Signals and systems by Hwei Hsu, 2nd Ed., Schaum‟s series, McGraw Hill, August 2010
- Signals and Systems by Simon Haykins and Barry Van Veen, 2nd Ed., John Wiley and sons,2005.
- Discrete-Time Signal Processing (3rd Edition) by Alan V. Oppenheim, Ronald W. Schafer, Prentice Hall; Aug 2009.
- Signals and Systems by Michael J. Robert, TMH, 2007.
- Linear Systems and Signals by B. P. Lathi, 2nd Ed., Oxford University Press, 200

(EE-17001) Microcontrollers

Teaching Scheme:
Lectures: 3Hrs/week

Examination Scheme:
Quiz/Assignments– 40 marks
End-Sem Exam - 60 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Demonstrate the limitations and strengths of different types of microcontrollers and their Comparison.
2. Know the internal architecture of 8051/AVR microcontroller and their programming and other salient features.
3. Show the technical knowhow about interfacing with different devices and develop and implement for experimentation.
4. Design and program for the applications like speed control of motors etc.
5. Build and experiment with microcontrollers for simple applications.

Unit I: Microcontroller Basics **[8 Hrs]**

Difference between microprocessor and microcontroller, CISC Vs RISC design philosophy, Von-Neumann vs Harvard architecture.8-bit and 16-bit microcontroller. Architecture of microcontroller. I/O ports, stack and use of stack pointer, priority. Memory structure, Data Memory, Program Memory and execution of programs, different registers (SFR's), addressing modes, timing diagram.

Unit II: Integrated Development Environment (IDE) for Microcontrollers **[8 Hrs]**

Editor, linker, loader, debugger, simulator, emulator. Instruction set, instruction formats, concept of assembler directives and various addressing modes of AVR microcontroller. Basic programming using AVR assembly instructions. Introduction to embedded- C, Integrated Development Environment (IDE), cross compiler, ISP, simple program for delay generation.

Unit III: Peripheral Interfaces-1 **[10 Hrs]**

I/O programming, interfacing with simple switch, LED. 8bit and 16 bit Timers, various modes of operations of timers, counters, PWM programming.

Unit IV: Peripheral Interfaces-2 **[8 Hrs]**

Interrupt structure, Interrupt priority, Interrupt programming. Analog to Digital Converter, UART programming, RS232, RS 485 transceivers, I/O expansion techniques, Memory expansion

Unit V: External Interfaces: **[8 Hrs]**

LCD, Keyboard interfacing, Digital to Analog Converters, Stepper Motor interfacing, DC motor interfacing. Introduction to CAN Protocol and its interfacing. Introduction to Bluetooth and USB protocols.

Unit VI: Introduction to Other Advanced Microcontrollers **[6 Hrs]**

Introduction to ARM and PIC processors of MSP 430 microcontroller, 16 bit Micro-controllers overview; features, architecture, addressing modes. Low power feature of MSP 430.

Textbooks:

- The 8051 Microcontroller: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2012.
- The AVR Microcontroller and Embedded Systems: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2013.

Reference Books:

- Arm System Developer's Guide: Designing and Optimizing System Software - Andrew N. Sloss, Elsevier Publication, 2005
- Embedded System - Raj Kamal, 2nd Ed.,TATA McGraw Hill, 2009.
- Embedded C Programming and the ATMEL AVR by R H Barnett 2nd Ed., Cengage Learning Publication, 2006
- Designing Embedded System with PIC microcontroller, Tim Wilmshurst, 2nd Ed., Newnes Publiaction, 2009

*Texas Instruments MSP 430 microcontroller, Guide and Datasheet

(EE-17002) AC Machines

Teaching Scheme:
Lectures : 3 Hrs/week
Tutorial:1 Hrs/week

Examination Scheme:
Quiz/Assignments– 40 marks
End-Sem Exam - 60 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Analysis of constructional details of AC machines
2. To evaluate the steady state behavior and basic operating characteristics of A.C Machines
3. Analysis of Armature winding in A.C machines.
4. Development of analytical skills to assess machine performance in steady state

Unit I: Basic Concepts in A.C. Machines **[7 Hrs]**

Classification of A.C. Machines, principle of operation and constructional features of synchronous and induction machines, rotating mmf waves in A.C. Machines.

Unit II: Armature windings **[7 Hrs]**

Introduction, ac machine windings, winding factors, the emf equation, harmonics in generated emf, causes of harmonics and their suppressions.

Unit III: Synchronous Machines : [9 Hrs]

Construction, types, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle characteristics, parallel operation of synchronous generators, synchronizing to infinite bus bars, two axis theory, synchronous motor operation, characteristic curves, synchronous condenser, dynamics.

Unit IV: Three phase Induction (Asynchronous) Motor [8 Hrs]

Types of induction motor, flux and mmf waves, development of circuit model, across air gap, torque and power output, oc and sc tests, circle diagram, starting methods, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator, induction machine dyn17amics, high efficiency induction motors.

Unit V: Fractional Kilowatt Motors [6 Hrs]

Introduction, single phase induction motors, double revolving field theory, circuit model of single phase induction motor, determination of circuit parameters.

Unit VI: Special A.C. Machines [6 Hrs]

Single phase synchronous motors, permanent magnet ac motors, ac servomotors

Textbooks:

- D. P. Kothari,I. J. Nagrath,"Electric Machines ", Tata McGraw Hill Publication, Fourth edition, reprint 2012.
- A.E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans ,"Electric Machinery ", Tata McGraw Hill Publication, sixth edition 2002.

Reference Books:

- M. G. Say," Alternating current machines", fifth edition, E.L.B.S. Publication.
- A.F. Puchstein, T.C. Lloyd, A.G. Conrad, "Alternating current machines", John Wiley and Sons, New York 1954.
- P.C. Sen, "Principles of Electric Machines and Power Electronics ", John Wiley and Sons
- Publication, secondedition 1997.

(EE-17003)Power System Analysis

Teaching Scheme
Lectures : 3 Hrs/week

Examination Scheme
Assignments /Quiz-40 Marks
End em exam -60 marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Get the knowledge of power system and its components, structure, evolution and national level scenario.
2. Estimate the parameters of transmission line, understand its operation, role and select the model for various studies.
3. Be able to model and analyze different power system components like generators, transformers etc.

4. Analyze symmetrical and unsymmetrical faults on power system, compute fault currents and use the information for protection purpose.
5. Power flow studies and interpret the results using commonly available Perform techniques.
6. Analyze the concept of steady state stability, its evaluation and its importance.

Unit I: Introduction and basic concepts of Power systems [8 Hrs]

Structure of power systems, Power system scenario in India, concept of regional and National GRID, overview of conventional and non-conventional power generation. Complex power: Introduction, concept of real, reactive and complex power and their effects on power system operation, per unit system. Transmission line parameters: Resistance, inductance and capacitance of single phase and three phase line, concept of GMR and GMD, Skin effect, Proximity Effect.

Unit II: Models and performance of transmission line [7 Hrs]

Transmission line models -short, medium and long lines, voltage and current waves, surge impedance loading of Transmission Line, Phenomenon of Corona, complex power flow through transmission lines, power transmission capability, Ferranti effect, Tuned power lines, methods of voltage control.

Unit III: Modeling of power system components [8 Hrs]

Synchronous generators: generator model, steady state characteristics, power transformer: Three phase power transformer and its modelling, network model formulation, synchronous machine transients, determination of transient constants, DC component of stator currents.

Unit IV: Power flow analysis [7 Hrs]

Power flow equations and solution techniques. formation of bus admittance matrix, Gauss-Seidal method, Newton-Raphson method, decoupled and fast decoupled methods, comparison of power flow methods, power flow simulation software.

Unit V: Symmetrical and unsymmetrical fault analysis [6 Hrs]

Internal voltages of loaded machines under transient conditions, selection of circuit breakers, Symmetrical components of unsymmetrical phasors, effect of the transformation on power, sequence impedances and sequence networks of power system, single Line to Ground (LG) faults, Line-to-Line (LL) faults, Double Line to Ground (LLG) faults and open conductor faults.

Unit VI: Power system stability [6 Hrs]

Steady-state and transient stability concepts, rotor dynamics and swing equation, equal area criterion, step by step solution of swing curve, multi-machine stability, factors affecting transient stability.

Textbooks

- Grainger John J and W D Stevenson Jr,"Power system analysis" Mc-Graw Hill.
- I. J. Nagrath, D. P. Kothari, "Modern Power System Analysis" (3rd Edition), Tata McGraw Hill Publishing Co. Ltd., 2003.

Reference Book

- O. I. Elgerd, "Electrical energy systems theory: An introduction" Tata McGraw Hill, edition 1999.
- Hadi Sadat, "Power system analysis", McGraw Hill International, 1999.
- A. R. Bergen and Vijay Vittal, "Power system analysis", (2nd edition), Pearson Education Asia, 2001.
- J. D. Glover and M. Sarma ,"Power System Analysis and Design ", (3rd Edition), Brooks/ Cole Publishing,2002

(EE-17005) Power System Analysis Lab

Teaching Scheme:
Practical: 2Hrs/week
Tutorial : --

Examination Scheme:
Term Work : 50 Marks
Oral/Practical : 50 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Model electrical power system for steady state and transient studies.
2. Use MATLAB and ATP/PSCAD on power system studies.
3. Analyze the reactive power requirement of lines, voltage profile along the line and VAR compensation.
4. Analyze the symmetrical and unsymmetrical faults.
5. Compute the Y-bus matrix, perform load flow and interpret the results.

The laboratory consists of minimum ten experiments from following list and any other experiment based on the prescribed syllabus

List of Experiments:

GROUP I

1. Effect of VAR compensation on receiving end voltage profile of distribution line.
2. To validate Ferranti effect on an unloaded transmission line.
3. To determine A, B, C, D constants of a given transmission line.
4. Measurement of sub-transient reactance of a salient pole machine by static method.
5. Measurement of sequence reactance of a synchronous machine.
6. Synchronization of synchronous generators with Grid and study real and reactive power sharing.
7. Visit to HV/EHV substation, power generating station.

Group II (minimum four using MATLAB/ PSCAD)

1. Simulation of typical power system- familiarization with generator, line and load models.
2. Simulation of the effect of line parameters on performance of transmission line.
3. Formulation of Y-bus matrix using computer program.
4. Computer aided solution of power flow problem by Gauss Siedal/ Newton-Raphson method.

5. Simulation and analysis for a symmetrical three phase fault by simulation.
6. Simulation and analysis of unsymmetrical fault - LL, LG and LLG.

(EE-17006)AC Machines Lab

Teaching Scheme:
Practical: 2 Hrs/week
Tutorial : --

Examination Scheme:
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Analysis of constructional details of Synchronous and Induction machines.
2. Determination of Induction motor parameters by performing no load and blocked rotor tests.
3. Determination of efficiency Induction machine by performing load test.
4. Evaluation of steady state characteristics of synchronous machine.
5. Determination of efficiency and regulation of Alternator.

List of Experiments:

1. The student has to perform any 8 experiments from following list;
2. O.C. and S.C. test on Alternator: Determination of its regulation by the EMF method and MMF method. Direct loading test on three phase Alternator.
3. Determination of axis reactance's of salient pole synchronous machine- Slip Test.
4. Zero power factor test on alternator: Regulation by Potier method and A.S.A. method. Synchronizing of alternators: Lamp Methods and use of synchroscope.
5. Self and separately excited alternator operation.
6. Load test on three phase squirrel cage induction motor.
7. Determination of Squirrel cage induction motor performance from Circle diagram.
8. Load test on three phase Slip ring induction motor.
9. Effect of rotor resistance on starting torque and maximum torque for three phase Slip ring induction motor.
10. Determination of equivalent circuit parameters of single phase induction motor.
11. Load test on single phase induction motor.
12. Operation of induction motor on unbalanced supply.
13. Operation of induction motor as induction generator.
14. “V" and inverse V" curves of synchronous motor at no load and constant load.
15. Measurement of load angle of synchronous machine.
16. Load test on Synchronous motor at various voltages and frequency.
17. Load test on Induction motor at various voltages and frequency.
18. To study test codes for Induction machines.
19. To study test codes for Synchronous machines.
20. Study of induction motor starters.

21. Study of ISI- standards for Energy efficient motors.
22. To study the flux distribution and saturation of Synchronous machine at various load angle using FEM package.

(EE-17007) Microcontroller Lab

Teaching Scheme:
Practical: 2 Hrs/week

Examination Scheme:
Term Work: 50 Marks
Oral/Practical: 50 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Get the hands on experience with the software-tools like assembler, simulator, C
2. Compiler.
3. Interpret the datasheets related to the microcontroller and its peripheralsProgram microcontroller and associated peripheral devices.
4. Interface microcontroller with commonly used devices.
5. Use microcontroller for specific applications such as speed control of stepper motor.

The laboratory should consist of minimum eight experiments based on the following topics:

List of Experiments:

1. 189c51 Assembly language programming using cross-assembler.
2. Stack and Stack arithmetic operations, Subroutines and parameter passing via register, Stack.
3. Timers, counters and their applications, PWM generation
4. Serial Communication.
5. 5Interfacing with Push buttons, LEDs, Key matrix, Seven Segment and LCDs, ADC,
6. Stepper motors, Sensors, External memory

[AS (ILE)-17001] English Proficiency-I

Teaching Scheme:
Lectures: 1 hr/week
Practical: 4 Hrs/week

Examination Scheme:
T1 & T2: 25 Marks each
End-Sem Exam: 50 Marks

Course Outcomes:

Students will be able to-

1. Communicate well using meaningful sentences for conversation or speech.
2. Reproduce their understanding of concepts of communicating using English language
3. Read and comprehend communication well and write an effectively and enhance formal communication
4. Better Presentation skills and participate in healthy discussions both formal and informal among peers
5. Become more confident in facing interviews, acquiring professional skills and will be industry ready

Unit I: **[3 Hrs]**

Communication as a skill: Review of the basic understanding of communication as a skill and its need for effective business communication for Engineers

Unit II: **[3 Hrs]**

Conversational Skill Development: Formal and informal expressions, general discussions, Vocabulary Building

Unit III: **[4 Hrs]**

Business Communication: Letter Writing, Note making, Minutes, Summarizing

Unit IV: **[3 Hrs]**

Business Etiquette: Basic Mannerisms and Grooming required for professionals

Textbooks:

- Communication Skills for Technical Students by T.M. Farhathullah (Orient Longman)
- Communication for Business: A Practical Approach by Shirley Tailor (Longman)

Reference Books:

- Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson)
- Written Communication in English by Saran Freeman (Orient Longman)
- Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP)
- Enhancing Employability at Soft Skills by Shalini Varma (Pearson)

(AS (ILE)-17002) Finance for Engineers –I

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme:
T1 (Assignment): 20 marks
T2 (Written Test): 20 marks
End Semester Exam: 60 marks

Course Outcomes:

Students will be able to-

1. To understand the importance of financial literacy.
2. To understand the basics of accounting & accounting principles.
3. To analyze & solve the problems based on the above concepts.

Unit I: Accounting, Cost accounting & Management accounting, Various types of business entities, Accounting principles, postulates & meaning of accounting standards, Accounting cycle, Capital and revenue, Revenue, Expenses, Gains & Losses, Types of accounts & their rules, Journal Entries

Unit II: Create ledger, Preparation of Trial Balance, Finalizations, Preparation of Trading & Profit & Loss account, Understanding of Assets & Liabilities, Concept of Balance Sheet, Preparation of Balance sheet

Textbooks:

- "Financial Accounting", Dr. Kaustubh Sontakke [Himalaya Publishing House]

Reference Books:

- Accounting Theory & Practice Prof Jawahar Lal [Himalaya Publishing House]

[AS (ILE)-17003] Engineering Economics-I

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme:
Field Work/Assignment: 40
End Semester Exam: 60

Course Outcomes:

Students will be able to-

1. Understand the nature of markets and competition
2. Learn about Basic Concepts of Economics, Micro and Macro
3. Understand the importance of how industries behave
4. Understand the basis in our day to day life to gain personal financial control
5. Learn about start-up culture and economics
6. Get to know finance generation and funding rounds

Unit I: Basic Concepts of Economics **[6 Hrs]**

Definitions, Overview of Micro and Macro Economics, Explanation of theories of demand, supply and market equilibrium and Economics Basics – Cost, efficiency and scarcity**,** Opportunity Cost

Unit II: Micro Economics **[8 Hrs]**

Differences and Comparison, Theories of Utility and Consumers Choice, Competition and Market Structures, Markets and Prices, Market Failures, Income Distribution and Role of Government

Unit III: Macro Economics **[6 Hrs]**

Aggregate Demand and Supply, Economic Growth and Business Cycles, The role of the Nation in economic activity, New Economic Policy in India, Fiscal Policy, GDP and Inflation, Consumption, savings and investments, Commercial and Central banking

Unit IV: **Industrial Economics** **[8 Hrs]**

Behaviour of firms: Strategies with regard to entry, pricing, advertising, and R & D and innovation. The development of Firms and Market and Industrial Structure: Stochastic models of firm growth, and market structure, inter-industry differences in growth rate variance, economies of scale, technical change, mergers and market concentration. Development of Competitive capabilities: Role of Technology and Skills, FDI and Technology Transfer, Technological Spillovers, Globalization and Technology Intermediation.

Textbooks:

- Baumol, William J., Economic Theory and Operations Analysis, [Prentice Hall India Ltd.] Fourth Edition, 1985.
- Sloman, John H., Economics [Prentice Hall India Ltd.] Second Edition, 1994.
- Varian, Hal, ` Intermediate Microeconomics: A Modern Approach, Fifth Edition [Norton, 1999].
- P.A. Samuelson & W.D. Nordhaus, Economics, McGraw Hill, New York, 1995.
- Koutsoyiannis, Modern Microeconomics, Macmillan, 1975.
- R. Pindyck and D.L. Rubinfeld, Microeconomics, Macmillan Publishing Company, New York, 1989.

Reference Books:

- R.J. Gordon, Macroeconomics 4th Edition, Little Brown & Co., Boston, 1987.
- William F. Shughart II, The Organization of Industry, Richard D. Irwin, Illinois, 1990. (Chapter 3).

[AS (ILE)-17004] Industrial Psychology-I

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme:
Field Work/Assignment: 40
End Semester Exam: 60

Course Outcomes:
Students will be able to-

1. Understand the nature, scope, challenges and role of technology in Industrial Psychology
2. Learn about major psychological factors that influence individual differences in behaviour at work
3. Understand the importance of motivation and involvement in determining satisfaction at work
4. Understand the elements of psychometric testing and develop skills to face the same in future
5. Learn about physical and psychological aspects related to workplace in terms of environmental conditions, safety and health
6. Get to know the stressors of work and learn coping strategies to strike work-life balance
7. Understand the role of human factors, especially sensory systems and cognitive abilities, in designs that promote man-machine harmony
8. Demonstrate the knowledge gained through practical implementation

Unit I: Introduction to Industrial Psychology **[6 Hrs]**
Nature and Development of Industrial/Work Psychology Historical background- Time and Motion Study, Hawthorne Studies, World War I & II, Scope & Challenges: Current status, Role of Technology

Unit II: People at Work **[8 Hrs]**
Individual Differences: Personality, Intelligence, Emotional Intelligence, Creativity & Innovation, Perception & Attitudes, Motivation- N-Ach, Expectancy Theory & Equity Theory, Modern Approach to Motivation; Job Satisfaction- Job Diagnostic Model, Measuring Job Satisfaction, Psychometric Testing at Work- Cognitive Abilities, Personality, Emotional Intelligence

Unit III: Characteristics of Workplace **[6 Hrs]**

Working Conditions- Physical (e.g. Work Schedule, etc.) & Psychological (E.g. Fatigue, Boredom, etc.), Safety & Health Practices at Workplace- Accidents, Violence, Harassment, Alcoholism & Drug, Stress at Workplace- Individual Responses to Stress; 3 Cs of Stress- Causes, Consequences & Coping with Work Stress

Unit IV: Engineering Psychology-I **[6 Hrs]**

Brief History and Scope, Person-Machine Systems- Basic Human Factors: Sensory systems- Visual (light, colour, night vision, depth perception), Auditory (sound, alarms, noise) Tactile & Vestibular senses; Cognition & Decision Making, Displays: Visual & Auditory Control

Textbooks:

- Schultz, D. & Schultz, S. E. (2013). *Psychology and Work Today: An Introduction to Industrial and Organizational Psychology*. 7th Edition. Pearson Education: New Delhi.
- Matthewman, L., Rose, A. & Hetherington, A. (2009). *Work Psychology*. Oxford University Press: India.
- Wickens, C. D.; Lee, J. D., Liu, Y. & Gordon Becker, S. E. (2015). *An Introduction to Human Factors Engineering*. 2nd Edition. Pearson Education: New Delhi.

Reference Books:

- Landy, F. J. & Conte, J. M. (2010). *Work in the 21st Century: An Introduction to Industrial and Organizational Psychology*. 2nd Edition. Wiley India: New Delhi.
- Schultz, D. & Schultz, S. E. (2002). *Psychology and Work Today*. Pearson Education: New Delhi.

[AS (ILE)-17005] Personnel Psychology-I

Teaching Scheme:
2 lectures/week

Examination Scheme:
3 Assignments for 60 marks
End semester of 40 marks

Course Outcomes:

Students will be able to-

1. Have understanding of organizational concepts and behavior.
2. Have understanding about their own personality for corporate world.
3. Understand importance of groups and its dynamics.
4. Understand the importance of self-management and development.

Unit I: Introduction **[2 Hrs]**

Basic concepts in organizational set up and its importance

Unit II: Personality and corporate world **[8 Hrs]**

Know and accept you, preparing for corporate world, approaches towards work

Unit III: Group behavior and leadership **[8 Hrs]**
Group behavior and effectiveness, effective Leadership and management principles

Unit IV: Self-management & development **[4 Hrs]**
Efficient working habits, self-training and self-development

Textbooks:

- Khana S.S.- (2016) Organizational Behaviour(Text and Cases) Chand and company Pvt. Ltd. Delhi.
- Rae Andr'e :- (2008) organizational behavior. Dorling Kindersley (India) Pvt. Ltd.
- Wallace Hand Masters L.- (2008) Personality development. C-engage Learning India Pvt. Ltd.

Reference books:

- Robbins S, Judge A, Vohra N:- (2013)Organizational behavior.(15th ed.) Pearson Education, Inc.
- Singh Kavita:- (2010) Organizational behavior-Text and cases. Dorling Kindersley (India) Pvt. Ltd.

[AS (ILE)-17006] Japanese Language-I

Teaching Scheme:
2 Hrs/week

Examination Scheme:
Oral Exam: 20 Marks
Written Exam: 80 Marks

Course Outcomes:
Students will be able to-

1. Know the basic information of Japan
2. Be familiar with the pronunciation, Accent, Intonation and Japanese writing System Hiragana, Katakana and Kanji
3. Speak daily greetings
4. Count the numerals
5. Introduce themselves, Family members
6. Form basic questions
7. Understand Colors, Years ,Months and Days, Time expressions, Directions to read the city map

Unit I: **[6 Hrs]**
Introduction to Japanese Syllables (phonetic alphabet), greetings & Self introduction, Identifying things, point objects and listen to their names, Listen to things and places etc.; Creating shopping lists

Unit II: **[6 Hrs]**
Introduction to Time, day of the week, simple inquiries on telephone, Means of transport, Basic conversations of everyday life

Unit III: **[6 Hrs]**
Frame questions in Japanese. Vocabulary of giving and receiving objects, Stating impressions/things surrounding us, Expressing likes and dislikes, good/bad, possessions, Talking about the country, town and the environment

Unit IV: **[6 Hrs]**

Quantity, number of people, time, period etc., Stating thoughts and impressions, Conveying movement (e.g. go / come)

Textbooks:

- Minnano no Nihongo 1-1.Goyal Publishers& Distributors Pvt. Ltd. Delhi, India

[AS (ILE)-17007] German Language-I

Teaching Scheme:
2 Hrs/week

Examination Scheme:
Oral Exam: 20 Marks
Written Exam: 80 Marks

Course Outcomes:

Students will be able to-

1. Know the basic information of Germany
2. Be familiar with the pronunciation of German letters and greetings
3. Count till 100
4. Introduce themselves
5. Form basic questions
6. to read city maps

Unit I: Start auf Deutsch (Begin in German) **[8 Hrs]**

Deutschland, Deutsch sehen und hören, erste Kontakte, Texte: Lied, Postkarte, Wortfelder: Internationale Wörter, deutsche Namen

Unit II: Café: (Café): **[6 Hrs]**

Gespräche im Café, Texte: Getränkekarte, Telefonbuch, Rechnungen, Wortfelder: Gespräche im Café, Zahlen bis 100, Strukturwörter

Unit III: Städte, Länder, Sprachen (Cities, Countries, Languages) **[5 Hrs]**

Sehenswürdigkeiten in Europa, Sprachen in Europa, Nachbarsprachen, Texte: Landkarten, ein Statistik, Wortfelder: Himmelsrichtungen, Sprachen

Unit IV: Menschen und Haüser (People and Houses) **[5 Hrs]**

Wohnwelten, Texte: Möbelkatalog, E-Mail, Wohnungsgrundriss, Wortfelder: Räume und Möbel, Wohnformen

Textbooks:

- Funk, Kuhn, & Demme. Studio d A1. Deutsch als Fremdsprache. 2011. Goyal Publishers & Distributors Pvt. Ltd. Delhi, India

Minor Course

(EE(MI)-17002) Electric Circuit Analysis and Automatic Control Systems

Teaching Scheme:
Lecture 3 Hrs/week

Examination Scheme:
Assignment/Quiz: 40 marks
End sem Exam – 60 marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Solve simple electric circuit
2. Solve two port network.
3. Appreciate role of control system and its applications
4. Analyze control system response in time domain
5. Use bode plot for frequency response analysis
6. Implement PID controller for simple systems

Unit I: Introduction to Electric circuit [7 Hrs]

Electric circuit components. Transient response with initial conditions, Initial conditions in circuit elements. Step response of RL, RC and RLC circuits. Steady state response of RL, RC and RLC circuit

Unit II: Two Port Network and Network Functions [7 Hrs]

Network function for one port and two Port Network. Impulse response and system function. Poles and zeros, restrictions on pole and zero locations for driving point and transfer functions, time domain behavior from pole and zero plot. Two port parameters. Relationship of two port variables

Unit III: Introduction to Control System [7 Hrs]

Introduction to control system block diagram. Importance of Control Systems. Components of control. Explanation with the help liquid level control system. Significance of actuators and sensors. Types of actuators, Types of sensors. Open loop control and closed loop control. Use of relays, switches and contactors in developing simple and sequential control system.

Unit IV: Control system representation and Analysis in time domain [8 Hrs]

Mathematical representation of simple mechanical, electrical, thermal, hydraulic system. Transfer function of these systems. Pole zero concepts. Analysis of step response. Use of root locus for time domain analysis of the system. Concept of stability.

Unit V: Control system analysis in frequency domain [8 Hrs]

Concept of frequency domain behavior, Bode Plot for analyzing system in frequency domain. Frequency domain performance specifications. Analysis of simple mechanical, electrical, thermal, hydraulic system.

Unit VI: PID controller [6 Hrs]

Introduction to PID controller, Tuning rules, PID controller for temperature control system, motion control system, level control system.

Textbooks:

- M.E.Van Vulken burg , "Network Theory", 3rd edition Pearson Education 2006
- Nagrath & M. Gopal "Control System Engineering", Anshan, 2008
- S Mukhopadyay, S. Sen, A. K. Deb, "Industrial Instrumentation, Control and Automation",Jaico Publishing house, 2013.

Reference Books:

- Norman S. Nice, "Control System Engineering", 2008, Wiley.
- Smarajit Ghosh, "Control Systems Theory & Applications", Pearson Education 2007.
- D.Roy Choudhury,"Networks And Systems" New Age International Publications, 2nd edition.

Renewable Minor Course

(EE(MI)-17001) Solar Energy Systems

Teaching Scheme:
Lectures: 3 Hrs/week
Practical: As necessary
Field Visit: As necessary

Examination Scheme:
MCQ-1: 20 Marks
Review Project: 30 Marks
End-Semester Exam: 50 Marks

Course Outcomes:

Students will be able to:

1. Understand the basics of solar energy, availability, applications, heat transfer as applied to solar thermal systems, various types of solar thermal and photovoltaic systems, introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics.
2. Field visits will be designed for firsthand experience and demonstration of the system elements.
3. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of multiple choice type or of the type define, identify, state, match, list, name etc.)
4. Understand basic concepts. (To measure this outcome, questions may be of the type explain, describe, illustrate, evaluate, give examples, compute etc.)

Unit I: Basics of Solar Energy **[6 Hrs]**

Sun, Earth, solar radiation, losses, radiation reaching the Earth, rotation of Earth, seasons and variations in solar radiation, solar angles and nomenclature, solar radiation spectrum, basics of heattransfer, conduction, convection, radiation of heat, absorption, reflection and transmission of radiation; movement of Sun in the sky, solar tracking, types of solar tracking systems, methods and algorithms for solar tracking, tracking control

Unit II: Introduction to Solar Thermal Technologies and Systems [7 Hrs]

Introduction to solar thermal systems, non-concentrating and concentrating type systems, flat plate collectors, properties of flat plate collectors, systems using flat plate collectors, Evacuated tube collectors, various types of solar concentrating systems, viz. parabolic trough, dish type, linear Fresnel, Heliostat, non-imaging type.

Solar water heating systems and solar air heating systems; Solar cookers: low cost, box, concentrating, standalone dishes and large-scale cooking systems; flat plate collectors, evacuated tube collectors, heat pipes; their designs, components, materials, equipment, characteristics, life

Unit III: Introduction to Solar Photovoltaic Technologies and Systems [7 Hrs]

Physics of photovoltaic (PV) electricity, Photodiode and solar cell, Solar radiation spectrum for PV, Types of solar cell and comparison, Introduction to various types of solar module manufacturing, Basic system design, Types of systems, Common applications of solar PV, Introduction to solar PV (SPV) systems, SPV appliances, Solar inverters, Batteries, Operation and maintenance of SPV, Software tools for SPV, Standards and certification for SPV, Basics of SPV systems, Elements of SPV appliances and power plants, Procurement versus production, Bought-outs, assemblies, sub-assemblies, Manufacturing and assembly, Manufacturing standards, Quality assurance and standards, Certification, Site assembly and fabrication, Typical shop layouts, Inventory management, Economics of manufacturing.

Unit IV: Solar Power Plants [6 Hrs]

Various types of solar thermal power plants, parabolic trough, heliostat or central tower, dish, etc., balance of plant for solar thermal systems; Small capacity SPV power plants, Grid tied SPV power plants, Large scale SPV power plants, Balance of system; designs, components, materials, equipment, characteristics, life, site requirements, installation, quality assurance, operations and maintenance, hybrid systems, etc.

Unit V: [6 Hrs]

Life cycle costing, payback, return on investment; calculations for selection, costing and payback for solar water heating system and solar thermal power plants; Financial modeling of SPV, Environmental impact assessment.

Unit VI: Field Visit and Practical [8 Hrs]

One or more of the following visits may be undertaken.

- SPV power plant
- Testing and certification facility for solar energy systems
- Solar thermal system manufacturing facility

  One or more of the following practical may be undertaken.
- SPV module characterization
- Effect of temperature on SPV performance
- Estimating efficiency of flat plate solar collector
- Estimating efficiency of solar concentrator

Reference Books:

- Trainers Textbook Solar Thermal Systems Module, Ministry of New and Renewable Energy, Government of India
- Students Workbook for Solar Thermal Systems Module, Ministry of New and Renewable Energy, Government of India
- S. Sukhatme -Solar Energy: Principles of Thermal Collection and Storage McGraw Hill
- Solar Energy Fundamentals, Technology, and Systems, Klaus Jäger et al, Delft University of Technology, 2014

Honors Course Syllabus for Electrical and Renewable

(PEPS-16008) Optimization Techniques

Teaching Scheme:
Lectures: 3 Hrs/week

Examination Scheme:
T1, T2 – 20 marks each
End-Sem Exam – 60

Course Outcomes:

Upon successful completion of this course students will be able to,

1. Explain and use the basic theoretical principles of optimization and various optimization techniques.
2. Develop and select appropriate models corresponding to problem descriptions in engineering and solve them using appropriate techniques
3. Analyze and solve complex optimization problems in power system and machines
4. Design optimization models and use them in solving problems in power system planning and operation
5. To develop and Implement optimization algorithms and use software tools to solve problems in engineering
6. Make sound recommendations based on these solutions, analysis and limitations of these models.

Syllabus Contents:

Introduction to optimization, classical optimization: single variable, multivariable optimization techniques, linear programming: simplex method, duality, transportation problems, non-linear programming: one dimensional minimization methods, unconstrained optimization, dynamic programming: development of dynamic programming, principle of optimality, practical aspects of optimization: reduced basic techniques, sensitivity of optimum solution to problem parameters, modern optimization techniques, solving problems related to power system operation and control

Textbooks:

- S. S. Rao, “Engineering Optimization-Theory and practice”, Fourth edition, Wiley Easter Publications, January 2009.

References:

- R. Fletcher, “Practical Optimization”, Second edition, John Wiley and Sons, New York, 1987.
- S. S. Rao, “Engineering Optimization-Theory and practice”, Fourth edition, Wiley Easter Publications, January 2009.
- K. V. Mital and C. Mohan, “Optimization Methods in Operations Research and System Analysis”, New age International Publishers, Third edition, 1996.
- Gillette, “Computer Oriented Operation Research”, Mc-Graw Hill Publications.
- Bazaraa M. S., Sherali H.D. and Shetty C. “Nonlinear Programming Theory and Algorithms”, John Wiley and Sons, New York 1993.
- Bertsekas D. P., “Constrained Optimization and Lagrange Multiplier Methods”, Academic Press, New York, 1982.
- D. P. Kothari an d J. S. Dhillon, “ Power System optimization”, PHI Learning Pvt. Ltd., 2004

SEMESTER-VI

Technical MOOC/Industry floated Course

The department will be floating a set of MOOC courses and/or courses in association with industry based on the latest technology trends and available courses.

(ML – 17003) Environmental Studies

Teaching scheme:

ONE interactive session per week (TOTAL – 12 lectures including field work like exposure visit/ interaction/ actual contribution/ small project etc.)

Scheme for evaluation:

T1: Noting the classroom discussions & presentations on selected topics (50 marks

T2: Report on field work &group activity/ies (50 marks)

Course Outcomes:

1. Students will understand the concept of environment and its importance for the mankind.
2. Students will also become aware of the current issues and environmental problems at local, national and global level
3. Students will be sensitized towards the protection, conservation and sustainable development
4. Students will think seriously about the impact human actions on environment and measures to minimize and mitigate them as an engineer
5. Students will learn about their role as professionals in protecting the environment from degradation

Unit I: The Global environmental issues **[2 Hrs]**

Human population and environment: Population growth, Environment and human health, Women and child welfare.Social issues and environment: People and environment, Social consequences of development and Environmental changes.

Unit II: Natural resources **[2 Hrs]**

Concept, spheres, Direct & Indirect utilization of natural resources, Types - Renewable and non-renewable, Overexploitation & pollution, Conservation - 3R principle

Unit III: Ecosystem **[4 Hrs]**

Concept, Types – Terrestrial & aquatic with subtypes, Function, Food chain & web, Energy pyramid, Niche, Ecotone

Unit IV: Biodiversity **[4 Hrs]**

Introduction, levels, Types, Distribution & Magnitude, Threats, Conservation

Unit V: Pollution **[4 Hrs]**

Concept, Types & Sources, Direct & indirect Impacts, Prevention, control and mitigation measures, Disaster management

Unit VI: Environmental rules and regulations **[4 Hrs]**

Concepts, Local, national and Global level framework, tools like Environmental Impact Assessment, Environmental Management System, Certifications, Role of an engineer in environmental management

Textbooks:

- Bharucha, E. (2013) Textbook of Environmental Studies for Undergraduate Courses.
- Rajgopalan, R (2011) Environmental Studies: From Crisis to Cure. Oxford University Press
- Wright, RT (2007) Environmental Science. Pearson Education (Low Prise 9th Edition) 712 p.

Reference books:

- Carson, Rachel (1962) The Silent Spring
- Leelakrishnan, P. (2006) Environmental Law Case Book (IInd Edition) LexisNexis Butterworths (Student Serise) 466 p.
- McKibben, Bill (1989) The end of Nature
- Meadows, Donella, Meadows Dennis & Randers Jorgen (1996) Beyond the limits
- Odum, EP (1971) Fundamentals of Ecology, W.B. Saunders (Publi.). 574 p.
- United Nations Environment Program (2005) Atlas of Our Changing Environment
- Weisman, Alan (2007) The World without us

Important web resources**:** Official websites of UNEP, UNESCO, MoEFCC, various NGO's

(EE-17013) Miniproject in Power Electronics

Teaching Scheme:
Lectures: 1 Hrs/week
Practical: 2 Hrs/week

Examination Scheme:
Quiz/Assignments– 40 marks
End-Sem Exam - 60 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. To demonstrate the design skills for power electronics converters and their controllers.
2. To understand and use the datasheets of different components for power converters.
3. Handling of test and measuring instruments for analysis and debugging.

A group of students 2 to 4 may take up a mini project to design and fabricate power converter circuits or simulate the same using available software platforms. The work will involve appropriate literature survey and design calculations. The skill sets like PCB design, hands on fabrication, testing using available instruments and completion level of prototype will be considered for due weight age.

The student has to submit reports for T1, T2 and end sem. The evaluation will be based upon the overall group as well as individual performance.

(EE-17010)Control System Engineering

Teaching Scheme
Lectures : 3 Hrs/week
Tutorial : 1 Hrs/week

Examination Scheme
Assignments /Quiz-40 Marks
End sem exam -60 marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Appreciate role of control system.
2. Analyze mathematical model of control system.
3. Solve to get time domain response.
4. Analyze stability of the system.
5. Use bode plot for frequency domain analysis.
6. Analyze the control system in state space.

Unit I: Introduction to Control System **[6 Hrs]**

Introduction to control system block diagram. Importance of Control Systems. Components of control. Explanation with the help liquid level control system. Significance of actuators and sensors. Types of actuators, Types of sensors. Open loop control and closed loop control. Use of relays, switches and contactors for simple and sequential control system.

Unit II: Control system representation **[6 Hrs]**

Mathematical representation of simple mechanical, electrical, thermal, hydraulic system. Block diagram representation and reduction. Signal flow graph. Transfer function of these systems. Pole zero concepts.

Unit III: Time domain analysis **[8 Hrs]**

Time response of first order, second order systems. Analysis of steady state error, Type of system and steady state error, Time response specifications. Effect of parameter variation on open loop and closed loop system response, sensitivity. Effect of feedback on system response, stability and disturbance

Unit IV: Stability **[8 Hrs]**

Concept of stability, Effect of pole zero location on stability, Routh- Hurwitz criterian. Root Locus method for analysis of gain margin, phase margin and stability.

Unit V: Control system analysis in frequency domain **[8 Hrs]**

Concept of frequency domain behaviour, Bode Plot for analysing system in frequency domain. Frequency domain performance specifications. Correlation between time domain and frequency domain specification. Nyquist Analysis

Unit VI: State Space Approach **[8 Hrs]**

Representation of system in state space, Converting transfer function model in to state space model. Non uniqueness of state space model, Canonical representation, Eigen values, Solution of state equations, Concept of State feedback control, controllability, Observability.

Textbooks:

- Nagrath & M. Gopal "Control System Engineering", Anshan, 2008
- Norman S. Nice, "Control System Engineering", 2008, Wiley.

Reference Books:

- Smarajit Ghosh, "Control Systems Theory & Applications", Pearson Education 2007
- Katsuhiko Ogata," Modern Control Engineering", Prentice Hall, 2010.

(EE-17011)Power System Operation and Control

Teaching Scheme:
Lectures : 3 Hrs/week

Examination Scheme:
Assignments /Quiz- 40 Marks,
End-Sem Exam-60 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand basics of electrical power system operation and control.
2. Identify, formulate and solve power system problems for frequency and voltage control.
3. Analyze different control strategies for real and reactive power scheduling using control devices.
4. Get knowledge of electricity markets and demand side management.
5. Understand various power quality issues and concept of micro-grid.

Unit I: Power System Operation and Constraints [7 Hrs]

Operational objectives, Operating states of the power systems, Generator capability curve, Dielectric constraints, thermal constraints and stability (angle and voltage) constraints.

Unit II: Frequency Control [6 Hrs]

Load frequency control and economic load dispatch control (single area and two area), Speed governors, governor characteristics, Automatic generation control (AGC), frequency dependence of loads.

Unit III: Reactive power compensation and Voltage control [8 Hrs]

Reactive power characteristics of major equipment like generator, transformer, transmission line, cable, HVDC converter, Reactive Power compensation devices: shunt capacitors, reactors, tap changing transformers, static VAR compensators.

Unit IV: Power Flow Control and Real Power Scheduling [8 Hrs]

Power flow control: fixed and variable series reactance compensation, Phase shifter, TCSC, HVDC links, Real power scheduling: operational objectives and constraints, Formulation as optimization problem, Economical power system operation, Optimal power flow.

Unit V: Preventive emergency and restorative control: **[6 Hrs]**

Introduction to energy management system (load dispatch center), Introduction to state estimation, SCADA, Preventive control: Generation rescheduling, Load tripping, Emergency control: Under-frequency load tripping, generator tripping, system islanding, Restorative control

Unit VI: Power System Economics and Recent Developments **[6 Hrs]**

Basic pricing principles, Electricity pricing and markets: market models, Demand side management, Transmission and distribution pricing. Introduction to Power Quality, Integration of renewable energy sources, Concept of micro-grid.

Textbooks:

- I.J. Nagrath & D.P. Kothari, 'Modern Power System Analysis', Tata McGraw Hill, 3rd Edition
- Prabha Kundur, 'Power System Stability and Control', McGraw Hill, 1994

Reference Books:

- K.R. Padiyar,"Power System Dynamics Stability and Control", Edition 2, BS Publications, 2008.
- Grainger John J. and William D. Stevenson, McGraw Hill, 2nd Edition.
- Hadi Sadat, 'Power System Analysis', McGraw Hill, 1999.
- R.C. Dugan, "Electrical Power System Quality", 2nd Edition, Tata McGraw-Hill Education, 2012

EE-17012) Power Electronics

Teaching Scheme:
Lectures : 3 Hrs/week
Tutorial: 1 Hrs/week

Examination Scheme:
Quiz/Assignments– 40 marks,
End-Sem Exam - 60 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Knowledge of different types Power Semiconductor Switches and their characteristics.
2. Knowledge of different types of Power Converter systems with their operational and analytical details.
3. Knowledge of four quadrant operation for electric drive application.

Unit I: Thyristor and Transistor family Devices **[7 Hrs]**

Structure, Characteristics, Switching actions, Trigger requirements, Ratings, Protections and Are as of application of SCR, TRIAC and GTOs, IGBT, Power MOSFET and MCTs, Introduction to IPM.

Unit II: Uncontrolled Rectifiers **[7 Hrs]**

Single phase and three phase rectifiers, Performance parameters, comparison of diode rectifiers.

Unit III: AC-DC Converters **[7 Hrs]**

Single phase and three phase half (semi) and full converters: Quadrants of operation, circuit configurations, working, performance parameters and input-output waveforms for R, R-L and RLE loads. Dual converter in circulating and non-circulating current modes, PWM Converters.

Unit IV: AC Voltage Controllers **[7 Hrs]**

Principle of On-off and phase control, circuit configurations, Single and three phase AC voltage controllers with R and R-L loads.

Unit V: DC-AC Converters **[7 Hrs]**

Single phase and three-phase thyristorised bridge circuits, output waveforms for R and R-L loads. PWM techniques-Single, Multiple and Sinusoidal PWM. PWM Inverters: Principle of operation, Performance parameters, Working of single phase and three phase circuits, Current Source Inve

Unit VI: DC-DC Converters **[7 Hrs]**

Step-up and step-down configurations, CLC and TRC techniques, PWM and FM techniques. Practical transistorized chopper circuits: working, control, output waveforms, continuous and discontinuous current conduction.

Textbooks:

- M.H.Rashid, "PowerElectronics", PHIPub., 3rd Edition,2004.
- Mohan,Undeland,Robbins, "IntroductiontoPowerElectronics",JohnWilley&Sons.
- B.W.Williams, "PowerElectronics", JohnWilley,.

Reference Books:

- S.B.DewanandStraughan, "PowerSemiconductorCircuits", JohnWilley
- B.K.Bose, "PowerElectronicsandACDrives", Pearson
- M.H.Rashid, "SPICEforPowerElectronics", McGrawHillInternational.

(EE-17014)Power System Operation and Control Lab

Teaching Scheme:
Practical: 2 hr/week

Examination Scheme:
Term Work : 50 Marks
Oral/Practical : 50 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Model and simulate multi-machine power systems for steady state and transient studies.
2. Simulate the steady state and transient operations using MATLAB ATP and PSCAD.
3. Implement phasor estimation algorithms for protection studies.
4. Analyze and implement over current and other relaying philosophies.
5. Perform various contingencies on power system and compute sensitivity factors.

6. Analyze SIL and evaluate its effect on transmission line loading and stability.

List of Experiments:

1. Modeling and simulation of multi-machine power system
2. Evaluation of the effect of various contingencies and to compute sensitivity factors
3. Simulation of two generator system using ATP
4. To determine the effect of surge impedance loading
5. To determine the stability of cables for AC transmission system.
6. Determination of steady state power limit of a transmission line.
7. To test over current relay and under/over frequency relay.
8. To test differential relay.
9. To test distance relay.
10. To estimate phasor from given signal using full cycle and half cycle Fourier algorithm.

(EE-17015)Control System Engineering Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Develop the mathematical model of different components of linear feedback control system
2. using simulation and experiments
3. Analyze the transient characteristics of different first order and second order systems using simulation and experiments
4. Determine the performance of system using root locus
5. Carry out the stability analysis of linear feedback control system using Bode plot and Nyquist plot
6. Carry out the stability analysis of linear feedback control system using Modern control techniques
7. Analyze the different types of controllers like PI, PD, PID and tuning of these controllers using simulation and experiments
8. Describe various applications like temperature controller experimentally
9. Demonstrate an industrial application (like Bottle filling/ Pick and Place control) using PLC Write and present effectively technical reports.

List of Experiments:

1. To study input out characteristic of various control system components
2. To obtain step response and find time response specification of electrical system, hydraulic system, pneumatic system and thermal system.
3. To obtain transfer function and poles zeros of DC motor experimentally.
4. To obtain root locus experimentally.

5. Use Matlab to study effect of feedback gain on system response.
6. Use Matlab to study effect of damping factor zeta on time control performance specifications.
7. Use Matlab to obtain root locus for a given system and find performance specifications there from. Study effect of addition of zero and pole on root locus
8. Use Matlab to get bode plot and obtain gain margin and phase margin for various systems.
9. Use Matlab to obtain state space representation from transfer function, find Eigen values, Analyze controllability, observability and stability.

(EE-17016)Power Electronics LAB

Teaching Scheme:
Practical: 2 hr/week

Examination Scheme:
Term Work : 50Marks
Oral/Practical : 50 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Evaluation of the V-I characteristics, turn-on and turn-off methods for different power semiconductor switches.
2. Understanding operation and control techniques of power converters.
3. Analyzing waveforms exhibited at the input and output ports of the converters.
4. Measurement of input and outputs of converters and analyzing them in light of the respective theories.

List of Experiments:

Any three from 1 to 5

1. SCR/GTO Characteristics.
2. SCR Turn-on methods.
3. SCR Commutation methods.
4. IGBT/MOSFET Characteristics, Drivers.
5. TRIAC–Triggering modes and Phase Control.

Any three from 6 to 10

6. Single phase/three phase Converter
7. Dual Converter
8. D.C. Chopper
9. Single phase/three phase Thyristorised Inverter
10. PWM Inverter

Any two from 11 to 14

11. Simulation of Converter/Chopper
12. Simulation of PWM Inverter
13. Switched mode Converter/Rectifier
14. Uninterrupted Power Supply

[AS (ILE)-17008] English Proficiency-II

Teaching Scheme:
Lectures: 1 hr/week
Practical: 4 Hrs/week

Evaluation Scheme:
T1 & T2: 25 Marks each
End-Sem Exam: 50 Marks

Course Outcomes:

Students will be able to-

1. Communicate well using meaningful sentences for conversation or speech.
2. Reproduce their understanding of concepts of communicating using english language
3. Read and comprehend communication well and write an effectively and enhance formal communication
4. Better presentation skills and participate in healthy discussions both formal and informal among n peers
5. Be more confident in facing interviews, acquiring professional skills and will be industry ready

Unit I: **[3 Hrs]**
Linguistic Competence Building: Enhancement of Word Power, Formal and Group Discussions

Unit II: **[3 Hrs]**
Presentation Skills Development: Oral and Written Presentations

Unit III: **[4 Hrs]**
Business Writing: Business Reports, CV, Resume, Statement of Purpose

Unit IV: **[4 Hrs]**
Job Readiness: Interview Skills and Mock Interviews

Textbooks:

- Communication Skills for Technical Students by T. M. Farhathullah (Orient Longman)
- Communication for Business: A Practical Approach by Shirley Tailor (Longman)

Reference Books:

- Corporate Communication by Jaishri Jethwaney (Oxford University Press)
- Written Communication in English by Saran Freeman (Orient Longman)
- Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)

[AS (ILE)-17009] Finance for Engineers –II

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme:
T1 (Assignment): 20 marks
T2 (Written Test): 20 marks
End Semester Exam: 60 marks

Course Outcomes:
Students will be able to-

1. To understand the importance of financial literacy.
2. To understand the basics of accounting & accounting principles.
3. To analyze & solve the problems based on the above concepts.

Unit I: Introduction, Corporate Financial Objectives Ownership Structure and Control

Unit II: Financial Statement Analysis – Ratio Analysis

Unit III: Preparation of Cash Flow statement

Unit IV: Introduction to Break even analysis – Decision Making

Unit V: Return and Risk, Time Value of Money, Annuities and Accumulation, Discounted Payback period, Net Present Value, IRR

Textbooks:
Chandra, Prasanna (2004). Financial Management: Theory and Practice. New Delhi: TATA McGraw Hill

Reference Books:
Brearley, Richard A. and Myers, Stewart C. (1988). "Principles of Corporate Finance", New Delhi: McGraw-Hill

[AS (ILE)-17010] Engineering Economics-II

Teaching Scheme:
Lectures: 2Hrs/week

Examination Scheme:
Field Work/Assignment: 40
End Semester Exam: 60

Course Outcomes:
Students will be able to-

1. understand how managerial decisions are based on economics
2. learn about capital budgeting and planning
3. understand the importance balance trade, monetary policies and exchange rates
4. understand the importance of day to day budgeting and personal finances at early stage
5. learn about start-up culture and economics
6. get to know funding rounds which would help them to run their own start-ups

Unit I: Managerial Economic **[10 Hrs]**

Nature and scope of Managerial Decisions, Objectives of firms, Techniques of analyses with special reference to econometric method, Analysis of demand pattern, demand forecasting, Production function and production planning, cost and product relationships, cost function, Break-even-point analysis, Pricing and price related policies, Labour productivities and wages, Optimization problems,Introductory aspects of capital budgeting, Selected case studies under Indian conditions.

Unit II: International Economics **[7 Hrs]**

Balance of Trade and Balance of Payments, Barriers to Trade, Benefits of Trade/Comparative Advantage, Foreign Currency Markets/Exchange Rates, Monetary, Fiscal and Exchange rate policies, Economic Development.

Unit III: Personal Economics **[5 Hrs]**

Compound Interest and Credit, Financial Markets, Human Capital and Insurance, Money Management/ Budgeting, Risk and Return, Saving and Investing

Unit IV: **Start-up Economics** **[6 Hrs]**

Introduction to Start-up Finance, Introduction to Financial Terms, Financial Ratios, Capital Funding, VC's Funding Rounds, Series A, B.

Textbooks:

- Carton, D. and J.Perloff. Modern Industrial Organization (Reading, Massachusetts: Addison-Wesley), 1999.
- Hay, Donald A. and Derek J. Morris. Industrial Economics and Organization: Theory and Evidence, 2nd Edition (Oxford: Oxford University Press), 1991.
- Lall, Sanjaya. Competitiveness, Technology and Skills (Cheltenham: Edward Elgar), 2001.
- Scherer, F. M. and D. Ross. Industrial Market Structure and Economic Performance, 3rd Edition (Houghton: Mifflin), 1990.

Reference Books:

- Schmalensee, R., Inter-industry studies of Structure and Performance, in Schmalensee, R. and R. D. Willig (eds.): Handbook of Industrial Organization [Amsterdam: North-Holland] Vols. 2 Chapter 16, pp. 951-1009, 1989.
- Siddharthan, N. S. and Y.S. Rajan. Global Business, Technology and Knowledge Sharing: Lessons for Developing Country Enterprises (New Delhi: Macmillan), 2002.

[AS (ILE)-17011] Industrial Psychology-II

Teaching Scheme:
Lectures: 2Hrs/week

Examination Scheme:
Field Work/Assignment: 40
End Semester Exam: 60

Course Outcomes:

Students will be able to-

1. Learn about major psychological factors involved in the process of employment
2. Acquire psychological skills required to sustain employability
3. Understand the elements of organizational culture for enhancing group/team behavior
4. Understand the role of diversity in workforce and acknowledge the multicultural factors influencing workplace behaviour
5. Learn to apply the concepts of engineering psychology with respect to their disciplines
6. Learn about the impact of psychological factors in consumer behaviour and role of conscious efforts needed in designing products
7. Demonstrate the knowledge gained through practical implementation

Unit I: Managing People at Work: [8 Hrs]

Employee Selection- Techniques, Fair Employment Practices, Biographical Information, Interviews, References & Letters of Recommendation, Job Analysis- Types; Newer Developments, Performance Assessment: Evaluation & Appraisal- Objective & Subjective Techniques, Bias, Post Appraisal Interviews, Organizational Training- Types of Training, Psychological Issues; Career Development & Planning

Unit II: Groups at Work [6 Hrs]

Relationships- At workplace, Issues, Developing Effective Relationships, Groups & Teams- Stages of Group Development, Group Behaviour, Social Identity Theory, Leadership- New Approaches- Leader-Member Exchange, Transactional, Transformational & Charismatic Leaderships, Diversity at Workplace Cultural Differences (Multiculturalism, Psychometric Testing, Motivation, Work-related Attitude, Leadership, Team work, etc.)

Unit III: Engineering Psychology-II [8 Hrs]

Workspace Designs- General Principles, Design of Standing & Seating Work Areas; Human Anthropometry- Structural & Functional Data, Use of Anthropometric Data in Design, Human Computer Interaction- Software Design Cycle, System & User Characteristics, Principles & Guidelines for Design, Automation- Problems, Function Allocation; Transportation- Visibility, Hazards & Collisions, Characteristics of Impaired Driver, Safety Improvements, Industrial Robots

Unit IV: Consumer Psychology [6 Hrs]

Scope and Research Methods- Surveys, Public Opinion Polls, Focus Groups, Observations of Shopping Behavior, Neuromarketing , Advertising- Nature, Scope & Types, Consumer Behavior & Motivation- Buying Habits, Product Pricing, Targeted Advertising, Visual Merchandising- Psychological Perspective-

Techniques, Impulse Buying, Online Visual Merchandising .

Textbooks:

- Schultz, D. & Schultz, S. E. (2013). Psychology and Work Today: An Introduction to Industrial and Organizational Psychology. 7th Edition. Pearson Education: New Delhi.
- Matthewman, L., Rose, A. & Hetherington, A. (2009). Work Psychology. Oxford University Press: India.
- Wickens, C. D.; Lee, J. D., Liu, Y. & Gordon Becker, S. E. (2015). An Introduction to Human Factors Engineering. 2nd Edition. Pearson Education: New Delhi.

Reference Books:

- Landy, F. J. & Conte, J. M. (2010). Work in the 21st Century: An Introduction to Industrial and Organizational Psychology. 2nd Edition. Wiley India: New Delhi.
- Schultz, D. & Schultz, S. E. (2002). Psychology and Work Today. Pearson Education: New

[AS(ILE)-17012] Personnel Psychology-II

Teaching Scheme:
2 lectures/week

Examination Scheme:
3 Assignments for 60 marks
End-sem Exam of 40 marks

Course Outcomes:

Students will be able to-

1. Understand the importance of motivation.
2. Realize the importance of standards of behavior at work place.
3. Get guidelines to achieve workplace success.
4. Manage stress and conflict in their personal life and at a workplace.

Unit I: Motivation **[4 Hrs]**

Self-motivation and motivating others in their job

Unit II: Emotional Intelligence & value **[4 Hrs]**

Emotional intelligence and Standards of conducts

Unit III: Work place success **[8 Hrs]**

Setting goals, performance appraisal and moving ahead

Unit IV: Stress & conflict management at a workplace: **[6 Hrs]**

Occupational stress and conflict, strategies for stress and conflict management

Textbooks:

- Khana S.S.- (2016) Organizational Behaviour(Text and Cases) Chand and company Pvt. Ltd. Delhi.

- Rae Andr'e :- (2008) organizational behavior. Dorling Kindersley(India) Pvt. Ltd.
- Wallace H.and Masters L.- (2008) Personality development..Cengage Learning India Pvt. Ltd.

Reference Books:

- Robbins S, Judge A, Vohra N:- (2013)Organizational behavior.(15th ed) Pearson Education, Inc.
- Singh Kavita:- (2010) Organizational behavior-Text and cases. Dorling Kindersley (India)

[AS(ILE)-17013] Japanese Language-II

Teaching Scheme:
2 Hrs/week

Evaluation Scheme:
Oral Exam: 20 Marks
Written Exam: 80 Marks

Course Outcomes:

Students will be able to-

1. Acquire target phrases and expressions
2. Master elementary Japanese grammar
3. Converse about professions at work
4. Get familiar with the customs, work culture & society of japan

Unit I: **[6 Hrs]**

Formation of requests, asking for permission/prohibition, speaking conversations of everyday life.

Unit II: **[6 Hrs]**

Rules and prohibitions, expressing potential and hobbies, sharing experiences.

Unit III: **[6 Hrs]**

Informal Conversations with friends, Expression of opinions, expectations, Utilization of modifying forms.

Unit IV: **[6 Hrs]**

Vocabulary of Machines, Directions, Forms of verbs (give/take/receive), Description of condition and coming to decision.

Textbooks:

- Minnano no Nihongo 1-2.Goyal Publishers& Distributors Pvt. Ltd. Delhi, India

[AS (ILE)-17014] German Language -II

Teaching Scheme:
2 Hrs/week

Evaluation Scheme:
Oral Exam: 20 Marks
Written Exam: 80 Marks

Course Outcomes:

Students will be able to-

1. Understand conversations of time and appointments
2. Get familiar with the place orientation and directions
3. Converse about professions and schedules at work
4. Get familiar with the tourism and culture of German

Unit I: Termine (Appointments) **[7 Hrs]**

Termine und Verabredungen,Pünktlichkeit interkulturell,Texte: Meldebestätigung Veranstaltungsangebote Arztchild, Gedicht, Wortfelder: UHrzeiten, Wochentage, Tageszeiten

Unit II: Orientierung: (Orientation): **[6 Hrs]**

Orientierung am Arbeitsplatz, Der Weg zur Arbeit, Die Stadt Leipzig/ Quiz online, Texte: Stadtplan, Etagenplan, Terminkalender, Prospekt, Wortfelder: Stadt, VerkeHrsmittel, Büro und Computer

Unit III: Berufe: (Professions): **[5 Hrs]**

Beruf und Alltag, Texte: Visitenkarten, Wörterbuchauszüge, Wortfelder: Berufe und Tätigkeiten

Unit IV: Berlin sehen: (To see Berlin): **[6 Hrs]**

Eine Exkursion durch Berlin, Orientierung in der Stadt, Projekt "Internetrally'', Texte: Busplan, Stadtplan, Postkarte, Exkursionsprogramm, Wortfelder: Tourismus, Kultur

Textbooks:

- Funk, Kuhn & Demme. Studio d A1. Deutsch als Fremdsprache. 2011. Goyal Publishers & Distributors Pvt. Ltd. Delhi, India

(EE(MI)-17003) Machines and Drives

Teaching Scheme
Lectures : 3 Hrs/week

Examination Scheme
Assignments /Quiz-40 Marks,
End –Sem Exam -60 Marks

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. To evaluate the steady state behavior and basic operating characteristics of A.C Machine
2. To demonstrate analytical skills to assess machine performance in steady state
3. To understand the basics of electric drives and fundamentals of drive dynamics
4. To analyze DC drive, Induction and Synchronous Motors Drives.

Unit I: D.C. Motors: **[6 Hrs]**

Principles of working, Significance of back emf, Torque Equation, Types, Characteristics and Selection of DC Motors, Starting of DC Motors, Speed Control, Losses and Efficiency, Condition for Maximum Efficiency, Braking of DC Motors, Effect of saturation and armature reaction on losses; Applications, Permanent Magnet DC Motors, Type and Routine tests.

Unit II: Three phase Induction (Asynchronous) Motor **[8 Hrs]**

Types of induction motor, flux and mmf waves, development of circuit model, power across air gap, torque and power output, starting methods, speed control, induction generator, induction machine dynamics, high efficiency induction motors, Single phase IM, Modeling of induction machine.

Unit III: Synchronous Machines **[9 Hrs]**

Construction, types, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle characteristics, parallel operation of synchronous generators, synchronizing to infinite bus bars, two axis theory, synchronous motor operation, dynamics, modeling of synchronous machine, PM synchronous machines.

Unit IV: Electric Drives, Dynamics and Control: **[6 Hrs]**

Definition, Advantages of electrical drives, Components of Electric drive system, Selection Factors, speed control and drive classifications, Motor-Load Dynamics, Speed Torque conventions and multi quadrant operation, Equivalent values of drive parameters. Load Torque Components, Nature and classification of Load Torques, Constant Torque and Constant Power operation of a Drive, Steady state stability, Load epilation and selection motors. .

Unit IV: DC Motor Drives **[6 Hrs]**

Dc motors and their performance starting, transient analysis, speed control, ward Leonard drives, Controlled rectifier fed drives, [full controlled3 phase rectifier control of dc separately excited motor], multi-quadrant operation, Chopper controlled drives Closed loop speed control of DC motor.

Unit VI: Induction and Synchronous Motor Drives **[6 Hrs]**

Induction motor analysis, starting and speed control methods- voltage and frequency control, current control, closed loop control of induction motor drives, rotor resistance control, Slip power recovery – Static Kramer and Scherbius Drive, Single phase induction motor starting, braking and speed control. Synchronous motor operation with fixed frequency, variable speed drives, PMAC and BLDC motor drives, Stepper motor drives, switch reluctance motor drives.

Textbooks:

- D. P. Kothari, I. J. Nagrath, “Electric Machines “, Tata McGraw Hill Publication, Fourth edition, reprint 2012.
- A.E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans ,”Electric Machinery”, Tata McGraw Hill Publication, sixth edition 2002.

- G. K. Dubey, “Fundamentals of Electrical Drives”, Second edition (sixth reprint), Narosa Publishing house, 2001

Reference Books:

- M. G. Say,” Alternating current machines”, fifth edition, E.L.B.S. Publication.
- A. F. Puchstein, T.C. Lloyd, A.G. Conrad, “Alternating current machines”, John Wiley and Sons, New York 1954.
- P. C. Sen, “Principles of Electric Machines and Power Electronics “, John Wiley and Sons Publication, second edition 1997.
- M. H. Rashid, “Power Electronics -Circuits, devices and Applications”, 3rdEdition, PHI Pub. 2004.
- B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.

Minor Course Syllabus for Electrical and Renewable

(EE(MI)-17004) Wind Energy Systems

Teaching Scheme:
Lectures: 3 Hrs/week
Field Visit: As necessary

Examination Scheme:
MCQ-1 and 2: 20 Marks each
End-Semester Exam: 60 Marks

Course Outcomes:

Students will be able to:

1. Understand the basics of wind energy, availability, applications, various types of wind energy systems, introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics.
2. A field visits will be designed for firsthand experience and demonstration of the system elements.
3. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of multiple choice type or of the type-define, identify, state, match, list, name etc.).
4. Understand basic concepts. (To measure this outcome, questions may be of the type explain, describe, illustrate, evaluate, give examples, compute etc.).

Unit I: Physics of Wind Power **[6 Hrs]**

History of wind power, Indian and global statistics, wind physics, Betz limit, tip speed ratio, stall and pitch control, wind speed statistics and probability distribution, wind speed and power.

Unit II: Introduction to Wind Energy Technologies **[8 Hrs]**

Introduction to wind turbines, types of wind energy systems, typical construction of various wind energy systems, wind electricity generation, environmental impact of wind electricity generators.

Unit III: Introduction to Small Scale Wind Electricity Generators [8 Hrs]

Small scale Wind Electricity Generation (WEG) systems, wind turbine basics, generator designs for small scale WEG, site requirements for small scale WEG, controllers for small scale WEG, grid integration, operation and maintenance of WEG, manufacturing, quality assurance, certification.

Unit IV: Large Scale Wind Power Plants [8 Hrs]

Large scale wind turbine basics, turbine design basics, generator design, control systems, safety, grid integration, power evacuation, site selection, state of the art wind turbine manufacturers, applicable standards, certification, power generation forecasting, design of wind farms, operation and maintenance, life.

Unit V: Economics of Wind Energy Systems [4 Hrs]

Life cycle costing, payback, return on investment; calculations for selection, costing and payback for WEG system, fiscal incentives, tariff calculations.

Unit VI: Field Visits [6 Hrs]

One or more of the following visits may be undertaken.

- Small scale wind electricity generator system manufacturer
- Large scale wind farm
- Manufacturer of electronics and control systems for WEG

Reference Books:

- Wind Energy Handbook, Tony Burton et al, John Wiley & Sons Ltd., New York, USA
- Wind Turbine technology, Ahmad Hemami, Cengage Learning, Clifton Park, New York, USA
- Research papers and publications from various manufacturers
- Government and Electricity Board documents
- ASTM, DIN and BIS standards

Honors Course Syllabus for Electrical and Renewable

(ECS-16008) Embedded System Design

Teaching Scheme:
Lectures: 3 Hrs/week

Examination Scheme:
T1, T2 – 20 Marks each
End-Sem Exam – 60 Marks

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Deploy low end applications using low and high level languages on microcontroller platform.
2. Test and debug peripherals in embedded system.
3. Identify, design and implement applications on embedded platform.

Syllabus contents:

Introduction to embedded system design and embedded system design flow. Signal conditioning and various signal chain elements, their operations, critical specifications, how to smartly choose elements from wide choice available in market. Various elements include operational amplifier, comparators, instrumentation op amp, ADCs, DACs, DC-DC Converters, isolators, level shifters and ESD protection devices. Use case analysis. Systems on chop, memory subsystem, Bus structure, Interfacing protocol, Peripheral Interfacing, testing and debugging, Power management, Software for embedded systems, design of analog signal chain from sensor to processor with noise, power signal bandwidth, accuracy considerations. Software programming optimization, concurrent programming. Real time Scheduling, I/O management, embedded operating systems. Developing embedded systems, Building dependable embedded systems.

Reference Books:

- "Embedded Systems Design" by Steve Heath. Publisher: Butterworth-Heinemann.
- Principles of embedded computing system design, Wyne Woff Morgan Koffman Publications 2000
- Embedded Systems Architecture Programming and design by Rajkamal, 2007, TMH
- Real Time Concepts for Embedded Systems – Qing Li, Elsvier, 2011.
- Introduction to Embedded Systems – Shibu K. V. Mc Graw Hill.
- Embedded System Design – Frank Vahid, Tony Givargis, John Wiley.
- Embedded Systems – Lyla, Pearson, 2013