Course of Study New (Syllabus)
S. Y. B. TECH. (Electrical Engineering)
(Effective from Academic Year 2014-15)

Department of Electrical Engineering,
SGGS Institute of Engineering and Technology, Vishnupuri,
Nanded-431606 (MS), India
(An autonomous institute established by Govt. of Maharashtra)

COURSES OF STUDY (Syllabus)
S. Y. B. Tech. (Electrical Engineering)
(Effective from Academic Year 2014-15)

STRUCTURE

Course Code	Name of The Course	Total No. of Credits	Lectures /Week	Tutorials /Week	Practical's /Week
SEMESTER I					
MA201	Engineering Mathematics-III	4	3	1	
EE201	Analog and Digital Circuits	5	4	-	2
EE202	Electrical Machine-I	5	4		2
EE203	Electrical Measurement and Instrumentation	4	3	-	2
EE204	Numerical Method using MATLAB	3	2	-	2
HU202	Communication Skills	1	-	-	2
	Sub Total	22	16	1	10
SEMESTER-II					
MA202	Engineering Mathematics-IV	4	4	-	-
EE205	Electrical Machine-II	5	4	-	2
EE206	Power System Engineering	5	4	-	2
EE207	Network Analysis	4	3		2
EE208	Signals and System	4	3	1	-
EE209	Advanced Packages Lab	1	-	-	2
	Sub Total	23	18	1	08
	Total	45	34	2	18

Attendance Criteria:
Students have to maintain 75% attendance in all the registered courses in a semester to be eligible for appearing examinations.

SEMESTER-I

MA201 Engineering Mathematics-III
(4 credits L-3, T-1, P-0)

Syllabus:

1. Differential Second order equation (12 Hours)
Homogenous linear differential equations for real and complex roots. Modeling: free oscillations, Euler-Cauchy equation, Existence and Uniqueness theorem (without proof) and Wronskian, nonhomogenous equations, solutions by undetermined coefficients and variation of parameter methods. Modeling: forced oscillations, resonance and electrical circuits, system of differential equations.
2. Laplace Transform (LT) (12 Hours)
Definition, existence theorem, linearity property of Laplace transform, LT of standard functions, theorems on LT, Inverse Laplace transforms (ILT), convolution theorem, unit step function, impulse function, LT of periodic functions, applications to initial and boundary value problems.
3. Fourier Series (08 Hours)
Periodic functions, Fourier theorem, Fourier series, Euler's formulas for the Fourier coefficients, convergence of Fourier series, Change of interval, even and odd functions, half range Fourier series.
4. Partial Differential equations (08 Hours)
Separation of variables, Vibrations of string, one-dimensional heat equation.

Text/Reference books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley & Sons. 1999.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Second Edition, Narosa Publication House.
3. Boycs and DiPrima, Elementary Differential Equations and Boundary Value Problem, Seventh Edition, John Wiley & Sons.
4. Thomos and Finney, Calculus, Ninth edition, 1996.

EE201 Analog and Digital Circuits
(5 Credits, L-4, T-0, P-2)

Course objectives:

1. Introduce students to the concepts and use of feedback and feedback (amplifier) design.
2. Extend student knowledge of the theory and applications of operational amplifier integrated circuits.
3. The primary goal is to provide in depth understanding of logic and system synthesis.
4. Enable student to implement simple logical operations using combinational logic circuits.
5. Impart the concepts of sequential circuits enabling student to analyse sequential systems in terms of state machines.
6. Enable student to implement synchronous state machines using flip-flops.

Course outcomes:

After completing this course the student will be:

1. Able to identify, analyze op-amp circuit topologies and discuss the relative properties of op-amp circuits.
2. Able to demonstrate the operation of simple logic gates.
3. Able to combine simple gates into more complex circuit.

Syllabus:

Unit 01: (8 Hours)

BJT amplifier with reference to operational analysis of CE, CB and CC configuration, their input-output characteristics, biasing, frequency response and AC-DC load line analysis, Class A, B and AB push pull and complementary symmetry amplifier. Multistage BJT amplifier-direct, RC coupled and transformer coupled amplifier, Feedback amplifier, Darlington pair, FET-construction, Parameters, Characteristics.

Unit 02: (6 Hours)

Op- Amp: Block diagrams, ideal and practical parameters, open loop and close loop configuration of Op-Amp. Applications of Op-Amp:Integrator, differentiator, Comparator, Schmitt trigger, Instrumentation amplifier, Precision rectifiers, Zero crossing detectors, V-I and I-V converters.

Unit 03: (6 Hours)

Waveform generation using Op-amp - sine, square, saw-tooth and triangular generator, peak detector, IC 555– construction, working and modes of operation – astable, monostable, multi-vibrators, Sequence generator, voltage regulators using ICs Viz. 78xx, 79xx, LM 317, Active filters-Its configuration with frequency response, Analysis of first order low pass and high pass filters.

Unit 04: (8 Hours)

Numbering Systems and Boolean algebra- numbering systems-binary, octal, decimal and hexadecimal and their conversion, codes-BCD, Grey and excess3, Binary arithmetic:- addition and subtraction by 1’s and 2’s compliment. Revision of logic gates, Booleans algebra, De-

morgon's theory etc. K-map: - structure for two, three and four variables, SOP and POS form reduction of Boolean expressions by K-map 1-bit comparator analysis using K-map.

Unit 05: (6 Hours)

Flip flops – R-S, Clocked S-R, D latches, Edge triggered D flip-flops, Edge triggered JK flip flops, JK Master - slave flip flop, Registers and Counters, Buffer registers, shift registers, controlled shift registers, asynchronous counters, synchronous counter, twisted ring counters, N - module counters.

Unit 06: (6 Hours)

Multiplexer, De-multiplexer using K-map, ADC, Dual slope SAR, DAC-binary weighted, ladder type, Memories: RAM-static& dynamic, ROM, PROMS and EPROMS, EEPROMS detailing.

Text/Reference Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Eighth edition, PHI publishers, 2004.
2. J. Millman and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw-Hill Publishing Company, 1988.
3. R.A. Gayakwad, Op-Amps & Linear Integrated Circuits, PHI, Fourth Edition, 2012
4. R.P.Jain, "Modern Digital Electronics" Tata McGraw Hill, Third Edition, 2003.

Term work:

It will consist of a record of at least eight experiments from the following list based on the prescribed syllabus.

1. Measurement of op-amp parameters and comparison with op-amp data sheets.
2. Assembling of op-amp inverting, non-inverting and differential circuit to measure an input in the range of mill volts to few volts.
3. Transistor amplifiers: frequency response of BJT, multistage BJT amplifier and FET amplifier.
4. Op-amp as square, sine and triangular wave generator.
5. Op-amp as ZCD, Comparator and Schmitt trigger.
6. Instrumentation amplifier using 3 - op amp CMR measurement and precision rectifier
7. IC-555 applications- astable, monostable, sequence counter.
8. Study and verify shift register operation (IC 7495) and application of 7495 as pseudo random no. generation
9. Voltage regulation of IC VR 78xx, 79xx and LM317
10. Study of counters, ring counter and twisted ring counter.
11. A to D and D to A converter using ADC 0809 and DAC 0808.
12. Study of up - down counters (IC 74192/74193) and N- modulo counter. (IC 7490/7493).
13. Study of various flip-flops and verification of truth table.
14. Study of Multiplexer and De-multiplexer.
15. Study of active filters- Low pass and high pass filters.

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

EE202 Electrical Machines-1
(5 Credits, L-4, T-0, P-2)

Course objective:

1. Introduce basic fundamentals of different electrical machines and transformers
2. Introduce the characteristics of different D.C. machines
3. Analysis and investigation of the major performance characteristics of different types of motors.
4. Investigation of motors' starting problems.
5. Allow the students to gain the proficiency to differentiate between the different types of motors, with the capability to select the proper motor for the proper application.
6. Provide the students with the proficiency to conduct and benefit from the testing procedures of electric motors with the ability to analyze data and to obtain the major characteristics.

Course outcome:

Upon successful completion of this course, a student should be able to:

1. Design and conduct experiments as well as analyse the parameter of DC machine & transformer.
2. Develop understanding of professional & ethical responsibility of DC machine & transformer.

Syllabus:

Unit 1: Single Phase Transformer (8 Hours)

Transformer construction and practical consideration, Transformer reactance's and equivalent circuits, Engineering aspects of transformer analysis, effect of load on power factor, phasor diagrams, per unit quantities, Excitation phenomenon in transformers-Switching transients, Testing-Polarity test, Open Circuit Test (O.C.) Short Circuit Test (S.C.), Sumpner's Test, Variable frequency transformer, Instrument Transformer-Current transformer, Potential transformer, Pulse transformer and applications.

Unit 2: Three Phase Transformers (6 Hours)

Special constructional features, three phase transformers connections, Labeling of transformers Terminals, Star/Star connection, Delta/Delta Connection, Star/Delta, Delta/Star connection, Delta/Zigzag Star, Star/Zigzag Star, Phase groups, Choice of transformers connections, Harmonics, Parallel operation of transformers, Three winding transformers and its equivalent circuits, Stabilization by Tertiary winding, Phase conversion/Open Delta connection, Three/Two phase conversion (Scott connection), Three/Six conversion, Three/One conversion, On-Off Load Tap changing transformers, cooling methodology, Types and Routing tests according to ISI.

Unit 3: Electromechanical Energy Conversion Principles (6 Hours)

Forces and torques in magnetic field systems Energy balance, Energy in Singly-Excited magnetic field systems, Determination of magnetic force and torque from energy, Determination

of magnetic force and torque from co-energy, Multiply-Excited magnetic field systems, Forces and torques in systems with permanent magnets, Energy Conversion via electrical field, Electric field energy, Dynamic equations of electromechanical systems and Analytical Techniques.

Unit 4: DC Generators (8 Hours)

Construction of armature and field systems, Basic Principle of working, Emf equation, Types, Armature windings, Characteristics and applications of different types of DC Generators, Building of Emf in DC Shunt Generator and causes of failure, Armature reaction-Demagnetizing and Cross magnetizing mmf's and their estimations; Remedies to overcome the armature reaction; Commutation Process, Straight line commutation, Commutation with variable current density, under and over commutation, Causes of bad commutation and remedies; interpoles, Compensating windings.

Unit 5: D.C. Motors (6 Hours)

Principles of working, Significance of Back Emf, Torque Equation, Types, methods of excitation- Steady State Motor Circuit equation, Characteristics and Selection of DC Motors for various applications, Starting of DC Motors, Speed Control of DC Shunt and Series Motors, Braking of DC Motors- Plugging, Dynamic Braking, Regenerative Braking; Losses and Efficiency, Condition for Maximum Efficiency, Effect of saturation and armature reaction on losses; Permanent Magnet DC Motors, Types and Routing tests according to ISI Specifications.

Unit 6: Variable-Reluctance Machines and Stepping Motors (6 Hours)

Basic VRM Analysis, Practical VRM analysis, Current waveform for torque production, Non-Linear Analysis, Stepping Motors.

Text/Reference Books :

1. B.L.Theraja, A.K. Theraja, A Textbook of Electrical Technology, Vol-II, S.Chand & Co., New Delhi, 2005.
2. I J Nagrath, D P Kothari; "Electric Machines," Tata McGraw Hill Publication. Second Edition (Reprint) 2003.
3. A.E.Fitzgerald, C.Kingsley, S.D.Umans. "Electrical Machinery" Tata McGraw Hill. Sixth Edition 2002.
4. Nasser Syed.A "Electrical Machines and Transformers," New York, Macmillon 1984.
5. Langsdorf "DC Machines".
6. J. B. Gupta, "Electrical Machines", SK Kataria and Sons, New Delhi
7. SK Bhattacharya, "Electrical Machines", Tata Mc Graw Hill, New Delhi.

Term work:

It will consist of a record of at least eight of the following experiments based on the prescribed syllabus.

1. To perform open circuit and short circuit test on single phase transformer to find its core loss, full load copper loss and constants of its equivalent circuit.
2. To operate two single-phase transformers in parallel and how they share a load under various conditions of their voltage ratios and leakage impedances.
3. To study V-connection of identical single-phase transformers for obtaining three phase transformation.

4. To study Scott-connection of single-phase transformer.
5. Sumpner's Test.
6. Study of no load current waveform of single-phase transformer.
7. Determination of magnetization, external and internal characteristics of a D.C. shunt generator,
8. Speed variation of a D.C. Shunt machine by- (i) armature voltage control & (ii) field current control method.
9. To study the performances of a D.C. shunt motor by Load/ Brake test.
10. To find efficiency of a D.C. shunt / compound machine by performing Swinburn's test.
11. To separate the losses in a D.C. shunt machines by performing the Retardation test.
12. Field test on two identical series machines to separate various losses and determine the efficiency of machines.
13. Hopkinsons Test.
14. Study of traditional and modern starters for DC motors

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

EE 203 Electrical Measurements and Instrumentation
(4-Credits, L-3, T-0, P-2)

Course objectives:

1. To expose the students to a broad knowledge of experimental methods and measurement techniques
2. To train the students in the skill of operation of instruments in the electrical & electronic engineering applications
3. To understand the basic working of instruments used for measurement
4. To understand the errors in measurements and their rectification
5. To gain proficiency in the use of common measuring instruments
6. To compare theoretical predictions with experimental results and to resolve any apparent differences.

Course outcome:

On completion of this course, students should be able to:

1. Discuss the operating principles of common electrical and electronic measuring instruments, devices and circuits, and their application to testing;
2. Measure the performance of equipment and circuits;
3. Identify and classify error sources, and explain how their effects can be minimized in particular measurement situations;
4. Discuss human and environmental implications of measurement systems;
5. Analyze single- and three-phase circuits to determine voltage and current values;
6. Analyze test measurements and circuit performance mathematically in both time and frequency domains;
7. Specify details of instrumentation and devices intended for a particular application;

8. Evaluate the results of tests and measurements taken from circuitry constructed by the student.

Syllabus:

Unit 1: Electrical measurement & Measuring Instrument (6 Hours)
Definition of measurement, classification of instruments. PMMC, moving iron, dynamometer & Induction type instruments. Ammeter, voltmeter, wattmeter and energy meter.

Unit 2: Measurement of resistance, Inductance & capacitance (6 Hours)
Measurement of low, medium and high resistance, insulation resistance, earth resistance. D.C. potentiometer, Kelvin double bridge, bridge megger. A.C bridges for measurement of inductance & capacitance.

Unit 3: Instrument transformers & special measuring instruments (8 Hours)
Instrument Transformers: Current Transformers, Potential Transformers, ratio & phase angle errors, design considerations & testing. Special Measuring Instruments: Single & Three-phase P.f. Meter, Frequency Meters, Synchroscopes, Tri-vector Meter, Maximum Demand Indicator, Permeability meter, Q meter, Flux meter.

Unit 4: Electronic Measurements (6 Hours)
Average, peak and true rms response instruments, Hall effect instruments, Electronic voltmeter, multimeter, wattmeter & energy meter. Storage Oscilloscope & its applications. Spectrum & Wave analyzer, Digital Counter, Harmonic & Distortion Analyzer, Logic Analyzer.

Unit 5: Introduction to Instrumentation (6 Hours)
Definition of instrumentation, purpose of instrumentation, Transducers: Definition, classification, selection of transducers, resistive transducers. Potentiometers, frequency counters and displays.

Unit 6: Measurements of Non-electrical quantities (8 Hours)
Force measurement using strain gauges, displacement measurements using LVDT, temperature measurement using RTD, thermistor, thermocouple, bellows, and diaphragm. Flow measurement using rotameter, electromagnetic flow meter. Speed measurement using magnetic pick-up & photoelectric pick-up.

Text/Reference Books:

1. A.K. Sawhney, “A course in Electrical & Electronic Measurements & Instrumentation”, Publication- Dhanpat Rai & Sons, Edition 1995.
2. E.W Golding; “Electric Measurement & Measuring Instruments”, Publication - A. H. Wheeler & Co, Allahabad, Edition 1983.
3. Helfrick and cooper, “Modern Electronic Instrumentation & Measurement Techniques”, Publisher- Pearson, Edition 2007.

4. M. A. Baldwin, “Fundamentals of Electrical Measurements”, Publication - Lyall Book Depot, Ludhiyana, Edition 1985.
5. M.U. Reissland, “Electrical Measurements”, Publication - Wiely Eastern Ltd, New Delhi, Edition 1992.
6. V. Popov; “Electrical Measurements” Publication – Mir, Moscow, Edition 1970.
7. Jones B.E.; “Instrumentation Measurement & Feedback”, Publication – Tata McGraw Hill, New Delhi, Edition 1978.

Term work:

Term work shall consist of at least six to eight practical’s based on above syllabus. Some of the experiments may be from the following list.

1. Measurement of resistance (high, medium, low)
2. Measurement of inductance.
3. Measurement of capacitance.
4. Phase and frequency measurement on CRO using Lissajous pattern.
5. Study of digital voltmeter, digital multimeter.
6. Study of recorders.
7. Digital measurement of phase and frequency.
8. Study of AC and DC meters.
9. Measuring current and voltage.

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

EE204 Numerical Methods using MATLAB
(3 Credits, L-2, T-1, P-2)

Course objectives:

The following aspects are to be considered while dealing with topic from Numerical Methods.

1. Study of various methods of numerical analysis of linear and non linear problems
2. Use of method for solving the problems in engineering
3. Developing algorithm, flow-chart and computer program in any language

Course outcomes :

After completing this course student will be able to:

1. Solve various methods of numerical analysis of linear and non linear problems in MATLAB by writing program.
2. Develop algorithm, flow chart and computer program for solution of linear and non linaer problems

Syllabus:

Unit 1: Computer Arithmetic: (4 Hours)

Floating Point representation, Arithmetic operations with normalized floating point numbers, errors in numbers, Truncation error, round off error, inherent error, absolute and relative error.

Unit 2: Solution of Non linear equations: (6 Hours)
Bisection method, false position method, Newton-Raphson method, Method of successive approximation, rate of convergence.

Unit 3: Interpolation: (4 Hours)
Lagrange's interpolation, difference table, Newton's Interpolation, iterated linear interpolation technique.

Unit 4: Solution of simultaneous algebraic equations: (4 Hours)
Gauss elimination method, Iterative methods and their convergence. Ill-condition equation.

Unit 5: Numerical Integration: (6 Hours)
Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Romberg integration, Newton's cote's integration formula, error in these formulae.

Unit 6: Solution of Ordinary differential equation: (6 Hours)
Taylor series method, Picard's method, Euler method, Runge-Kutta method second and fourth order, predictor corrector method.

Unit 7: Numerical solution of partial differential equation: (6 Hours)
Finite difference, approximation to derivatives. Laplace equation, Iterative methods for the solution of equations.

Unit 8: Least square approximation of functions: (4 Hours)
Linear regression, Polynomial regression, fitting exponential and trigonometric functions.

Text/Reference Books:

1. V. Rajaraman - Computer Oriented Numerical Method- Prentice Hall of India.
2. S.S. Shastry- Introductory methods of numerical analysis., Prentice Hall of India
3. Thomas Richard Mecalla- Introduction to numerical Methods and FORTRAN programming- WilleyInternational Edition.
4. Steven C. Chapra and Raymond P. Canale, Numerical methods for Engineers, Mc-Graw-Hill Publication,2007.
5. B.S. Grewal- Numerical Methods in Engineering & Science, Khanna Publishers.
6. Steve Otto and James P. Denier - An Introduction to Programming and Numerical Methods in MATLAB- Springer
7. Rudra Pratap - Getting Started With Matlab 7 - Oxford University publications

Term work:

Practical examination shall be of 3 hours duration. The students have to write an algorithm, flow chart for the problem given by an examiner. He should develop program and execute it on the computer system and get its printout and face the oral based on above syllabus.

HU202 Communication Skills
(2 Credits, L-2, T-0, P-0)

Course objectives:

The main objective of this course is to prepare the engineering students for future career, further studies through development of listening, reading, writing and speaking skills.

Methodology:

The course may be dealt with in following ways: -

1. Discussion by tutor about theoretical nature of different aspects of Communication Skill.
2. Practice of it by the students as pronunciation, public speaking and organizing meeting etc.
3. Intervention by the tutor for corrective measures.
4. Understanding and grasping and then reporting by the students.
5. Contents: What is communication- need, importance, types, and objectives. Communication process & barriers. Principles of effective communication, Personality Development, SWOT Analysis, Stress Management, Building Positive Attitude, etc
6. Modes of communication.
7. Practice of effective communication through eye contact, voice modulation, audience awareness, presentation plan and verbal & non-verbal Communication.
8. Face to face conversation with body language.
9. Understanding guidelines for telephonic conversation, making and receiving calls, telephonic messages.
10. Interviews Skills for employment – Preparing - Group Interview, Lunch / Dinner Interview, Telephonic Interview, self and reporting for sample questions on educational background, co-curricular activities, extracurricular activities, experience, and general knowledge, miscellaneous.
11. Technical Guidelines for Communication - Hyphenated words, Use of Apostrophe, Abbreviations, Units, etc.
12. Meetings: understanding role and importance of procedure, chairmanship, participation, and physical arrangements, rules for successful meeting- experience sharing and reporting.
13. Group Discussions, Seminars and Conferences- Understanding different aspects- experience sharing and reporting.
14. Practice of public speaking with use of audio – Visual and Graphic aids, experience sharing and reporting
15. Paragraph writing – Understanding principles, general hints writing and analyzing (practising paragraph writing on 3-5 topics)
16. Understanding the principles and practice of – office drafting, circular, notices, memos, and telex/telegraph/email messages. Application resumes, sales enquiry, reply order, complaint Reports, feasibility report, analytical report, progress report, project report, inspect of damage and losses etc. Preparation of notices, agenda, minutes etc.
17. Grammar – Articles, Tenses, The Preposition, Choice of Words and Phrases, Words commonly Misspell, Confusing words and Expressions, etc.

18. Phonetics – Pronunciation, Articulation of sounds structure of syllable stress, rhythm, connected speech, intonation, clarity and pitch.
19. Use of integrated skills of communication.

Term work and Reporting

Term work will be in the form of Report containing minimum 10-12 exercises based on separate topics as mentioned in the syllabus

The concerned teacher will make the assessment or an internal examiner appointed by the Principal of the College.

Text/Reference Books:

1. Developing Communication Skill by Krishna Mohan and Meera Banerjee, McMillan Publishers. Communication Skill – B.V. Pathak, Nirali Prakashan.
2. Writing Correct English – Readers Digest Publication.
3. Communication Skills for Engineers - Sunita Mishra, C. Murlikrishna.
4. Professional Communication Skills-- S. Chand.
5. Developing Communication Skills-- Krishna Mohan, Meera Banerji.
6. Communicative Grammar and Composition-- Rajesh K. Lidiya.

Note: Exercises on Chapter No. 1, 2, 3 and 7 are desirable and one each on other topic is essential.

SEMESTER-II

MA202 Engineering Mathematics- IV
(4 Credits, L-4, T-0, P-0)

Syllabus:

1. Vector Calculus:

Vector function, limit and continuity of vector function, derivative vector function, differential geometry (tangent normal and curvature), point function, directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

2. Complex variables:

Algebra of Complex Numbers: Polar form of Complex Number, De Moivre's Theorem and its applications to roots of the equations.

3. Complex Functions:

Circular function and Hyperbolic functions, Logarithmic of Complex Number, Limits and continuity of complex functions, derivative of Complex functions, Analytic functions, conformal

mappings, bilinear transformations, Complex integration, Cauchy's integral theorem and integral formula, Taylor's and Laurent' series, Residue theorem, solution integrals.

Text/Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India publication, Eighth Edition, 1999.
2. Monty J. Strauss, Gerald L. Bradley, Karl J. Smith, Calculus, Pearson Education, Third Edition,
3. R. K. Jain and SRK. Iyengar, Advanced Engineering Mathematics, Narosa Publication, Third Edition,
4. Michael D. Greenberg, Advanced Engineering Mathematics, Second Edition, Pearson Education

EE205 Electrical Machines- II
(5 Credits, L-4, T-0, P-2)

Course objectives:

1. To introduce fundamentals, physical concepts, and operating principles of AC machines and special machines.
2. This course aims at building a strong foundation of student in synchronous machines and Induction motors with their advantages and disadvantages.

Course outcome:

1. Student will be able to determine performance of the induction motor.
2. Student will be able to design rating of induction motor for a given application
3. Student will be able to evaluate parameters of single phase induction motor
4. Student will be able to evaluate performance of three phase synchronous machines
5. Student will be able to design a three phase winding of AC machines
6. Student will be able to design the ratings of synchronous machines for given application.
7. Student will develop good ethical practices in the society for the operation of AC machines.

Syllabus:

Unit 1: Synchronous Generators or Alternators (6 Hours)

Classification of A.C. Machines, Ferraris Principle, Production of 2- phase and 3-phase rotating magnetic fields, principle of operation and constructional (salient and non-salient pole) features of synchronous generators. Production of sinusoidal alternating EMF and its frequency, armature winding, winding factor, EMF equation.

Harmonics in voltage waveform, leakage reactance, armature reaction. Short circuit ratio, synchronous reactance, synchronous impedance, determination of voltage regulation (by Potier,

EMF, MMF methods), power developed by synchronous generators, phasor diagrams, transient conditions, losses and efficiency.

Unit 2 :Parallel Operation of Alternators (6 Hours)

Conditions for parallel operation , Load sharing between two alternators in parallel, Parallel-Generator theorem Process of synchronizing an alternator with infinite bus-bars by lamp methods & by use of synchroscope. Synchronizing torque, power and current.

Unit 3: Synchronous Motors (8 Hours)

Construction & principle of operation, various methods of starting, phenomenon of hunting or phase – swinging – its remedies. Operation of 3-phase Synchronous motor with constant excitation & variable load. Significance of torque angle, load characteristics Phasor diagram on the basis of synchronous impedance. Power flow chart, losses. Operation of 3-phase synchronous motor with a constant mechanical load on its shaft & variable excitation. 'V' Curves &'Inverted V' (pf) curves. Merits and demerits of synchronous motors & its application.

Unit 4 : Three Phase Induction Motors (8 Hours)

Construction & principle of operation, types of I.M, slip, frequency of rotor current, rotor EMF, current, pf and torque. Phasor diagrams, different torque equations and relation between them. Torque-Slip, current-speed and Torque- Speed Characteristics, Losses and efficiency. Circle diagrams, starters. I.M tests, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator. Applications, advantages and disadvantages of I.M.

Unit 5 : Single Phase Induction Motors (6 Hours)

Introduction, single phase induction motors, double revolving field theory, circuit model of single phase induction motor, determination of circuit parameters and types of single phase I.M. Torque-slip characteristics & applications. Comparison of 1-phase induction motor with 3-phase induction motor.

Unit 6 : Special Motors (6 Hours)

Construction, principle of working, characteristics, ratings & applications of Brushless DC motors, Permanent Magnet motor, linear induction motors, AC series motors, universal motors, repulsion type motors, Schrage motor, servo motors, hysteresis motor.

Text/Reference Books:

1. I J Nagrath, D P Kothari; "Electric Machines," Tata McGraw Hill Publication. Second Edition (Reprint) 2003.
2. A.E.Fitzgerald, C.Kingsley, S.D.Umans. "Electrical Machinery" Tata McGraw Hill. Sixth Edition 2002.
3. B.L.Theraja, A.K. Theraja, A Textbook of Electrical Technology, Vol-II, S.Chand & Co.New Delhi,2005.
4. Say.M.G - Performance & Design of Alternating Current Machine.(English Language Book Society), CBS Publisher (2002).
5. Ashfaq Hussein - Electrical Machines, Dhanpat Rai Publication (2012).
6. Bhimbra.P.S – Electrical Machines), Khanna Publication (2011).

7. J.B. Gupta – Electrical Machines, SK Kataria & Sons Publication (2010).

Term work:

It will consist of a record of at least eight experiments from the following list based on the Prescribed syllabus.

1. O.C. and S.C. test on Alternator: Determination of its regulation by the EMF method and MMF method.
2. 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
5. Synchronizing of alternators: Lamp Methods and use of synchroscope.
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. Load test on single phase induction motor.
11. Operation of induction motor as induction generator.
12. "V" and "inverse V" curves of synchronous motor at no load and constant load.
13. Load test on Synchronous motor at various voltages and frequency.
14. Load test on Induction motor at various voltages and frequency.
15. Study of induction motor starters..

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

EE206 Power System Engineering
(5 Credits, L-4, T-0, P-2)

Course objectives:

1. To introduce students to the basic structure and requirements of any electric power supply system
2. To develop knowledge about nature of power systems engineering and the profession
3. To develop an understanding of components in a power system and to understand the basic principles involved in these components.
4. To explore analysis and design principles for the complete power system

Course Outcomes:

After completing this course student will have-

1. Ability to model and represent power system components
2. Ability to use software development tools to simulate and analyze the system

3. Ability to implement corrective measure for immediate as well as long term solution to the system problems

Syllabus:

Unit 1: Fundamentals of Power Systems (6 Hours)

Introduction to modern power system: Generation, Transmission and sub-transmission, Distribution, Loads. Growth of power system in India, present Indian power industry, GRID formation, concept of National GRID.

Basic Principles: Power in single phase AC circuits, complex power, power factor correction, the complex power balance, complex power flow.

Unit 2: Transmission line Parameters (8 Hours)

Resistance, Inductance: Definition, Inductance due to internal flux of two wire single phase line of composite conductor line, Concept of GMD, Inductance of three phase line with equal & unequal spacing, vertical spacing.

Capacitance: Concept of electric field, Potential difference between two points in space, Effect of earth's surface on electric field, Computation of capacitance of single phase, three phase transmission lines with & without symmetrical spacing for solid & composite conductors. Concept of GMR and GMD, Skin effect, Proximity Effect, Ferranti effect.

Unit 3: Transmission line modeling and performance (6 Hours)

Single line diagram and impedance or reactance diagram, per unit system, per unit methods of representation of system and its components such as transformers (1 phase/3 phase) Two winding / Three winding) Synchronous machines (motors and generators) load.

Performance of Transmission Lines: Classification lines such as short, medium, long lines Voltages and currents at sending end and receiving end of the lines. Determination of generalized ABCD constants in them, Circle Diagrams.

Unit 4: Mechanical design of overhead transmission line (8 Hours)

Main components of overhead line, conductor materials, line supports, Insulators: Type of insulators, potential distribution over suspension insulator string, string efficiency, methods of improving string efficiency. Corona: Phenomenon of corona, factors affecting corona, advantages and disadvantages of corona, methods of reducing corona. Sag: Sag in overhead line, calculation of sag, Effects of wind & ice coating on transmission line.

Unit 5: Distribution system and underground cables (6 Hours)

Distribution system: Classification of distribution, AC and DC distribution system, overhead versus underground system, connection scheme of distribution system. AC and DC distribution calculations. Underground cables for LT and HT systems, sub-stations.

Unit 6: Economic operation of power system (6 Hours)

Distribution of load between units within a plant, distribution of load between plants, The Transmission-loss equation, an interpretation of transformation coefficient. Numerical examples

Text/Reference Books:

1. C.L. Wadhwa, "Electrical Power Systems", 6th Edition, New Age International, 2010.
2. D.P.Kothari, I.J.Nagrath, "Power System Engineering" 2nd Edition, McGraw Hill Education(India) Pvt. Ltd, 2008.
3. Stevenson W.D. "Power System Analysis", TMH, 4th Edition 1989.
4. Hadi Saadat, Power System Analysis, TMH, 1st Edition, 2002
5. J.B. Gupta, "Electrical Power", SK Kataria & Sons(2012).

Term work:

The laboratory consists of minimum EIGHT experiments from following list.

1. Study of different equipments used in power station.
2. Study of transmission line inductance.
3. Study of transmission line capacitance.
4. Study of different components of power system. (e.g. different types of line conductors, insulators, pole structure)
5. Study of regulation and transmission efficiency for short, medium and long transmission lines.
6. Study of ABCD parameters of short, medium and long transmission lines.
7. Study of circle diagram of transmission lines.
8. Study of corona effect for transmission lines.
9. Study of different effects of power system. (e.g. skin effect, Ferranti effect, proximity effect, surge impedance loading)
10. Study of different types of substations.

Independent Learning Experiences:

Online NPTEL video lectures:

- Prof. A.K.Sinha, Department of Electrical Engineering, IIT Kharagpur.

Note:

The computational work is to be carried preferably by using software tools like MATLAB, Scilab.

Practical Examination:

The examination will be of three hours duration and will consist of an experiment based on term-work and followed by an oral based on above syllabus.

EE207 Network Analysis
(4 Credits, L-3, T-0, P-2)

Course objectives:

1. Study basic fundamentals, theorems used in circuit's analysis.
2. To study steady state analysis of different AC circuits, attenuators, filters and coupled circuits

Course outcomes:

1. Student will able to work with basic fundamentals, theorems used in circuits analysis.
2. Student will able to work with steady state analysis of different AC circuits, attenuators, filters and coupled circuit.

Syllabus

1. Development of Circuit Concepts:
Charge, Current, Voltage, Energy, introduction to basic passive circuit parameters.
2. Conventions for Describing Networks:
Reference direction for current and voltage, active element convention, source transformation, dot convention for coupled circuits, Topological description of networks.
3. Network Equations:
Kirchoff's laws, number of network equations, loop variable analysis, node variable analysis, duality, formation of network equation in matrix form, network solution by Laplace Transformation technique.
4. Initial Conditions in Networks:
Use and study of initial conditions in various elements, a procedure for evaluating initial conditions.
5. Transform of Other Signal Waveform:
The shifted unit step function, ramp and impulse function, waveform synthesis, initial and final valve theorem, convolution integral, convolution as a summation.
6. Impedance Functions and Network Theorems:
The concept of complex frequency, transform impedance and transform circuits, series and parallel combination of elements, Thevenin's, Superposition, Millman's, Tellegen's, Reciprocity, Norton and Maximum power transfer theorems.
7. Network Functions:
Network functions for one port and two-port network, calculation of network functions, Ladder networks, General networks. Poles and zeros of network functions, restriction on poles and zeros locations for driving point functions and transfer functions, Time domain behavior from pole and zero plot.
8. Two-Port Parameters:
Relationship of two port variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets, parallel connection of two port networks.
9. Sinusoidal Steady-State Analysis:
The sinusoidal steady-state, the sinusoid and solution using $e^{\pm j\omega t}$, phasors and phasor diagrams.

Term Work:

Term work shall consist of minimum 6 experiments from the list given below
1. Verification of Maximum power transfer theorem.
2. Verification of Thevenin's theorem.
3. Verification of Superposition theorem.
4. Plotting of behavior of RC circuit for step input.
5. Plotting of behavior of RL circuit for step input.
6. Plotting of behavior of RLC circuit for step input.

7. Determination of hybrid and impedance parameters of a given network.
8. Sinusoidal study of RC and RL series networks.

Practical Examination:

Practical examination shall consist of performance of the experiment carried out at the time of examination and viva- voce based on the term work submitted by the student for the subject.

Reference Books:

1. M. E. Van Valkenberg, Networtk analysis, Third Edition, Prentice Hall of India Publication, 1996.
2. C. P. Kuriakose, Circuit Theory: Continuous and Discrete Time Systems, Elements of Network Synthesis, Prentice Hall of India Publication, New Delhi, 2005.
3. L. P. Huelsman, Basic Circuit Theory, Third Edition, Prentice Hall of India, New Delhi, 2002.
4. W. H. Hayt. Jr. and J. E. Kemmerly, Engineering Circuit Analysis, Fifth Edition, Tata-McGraw Hill Edition, 2000.

EE208 Signals And System
(4 Credits, L-3, T-1, P-0)

Course objectives:

The course is designed to provide the fundamental concepts in signals and systems. The course objectives are listed below:
1. To obtain solid foundation in fundamentals of signals and systems,
2. To gain an understanding of some of the very important and basic applications of these fundamentals to problems in filtering, sampling, communications and feedback systems analysis,
3. To develop some appreciation for an extremely powerful and broadly applicable approach to formulating and solving complex problems.

Course outcome:

By the end of the course, students should
1. Know what different types of signals there are,
2. Be able to represent signals in different ways, and know main properties of signals useful to simplify their analysis,
3. Be able to determine systems characteristics: homogeneity, time-invariance, linearity and superposition, stability, etc. and know how to classify systems according to their properties,
4. Be able to obtain a system response to standard signals (impulse response, step response) and then the system response to any signal in terms of those,
5. Be able to represent systems in the time domain and the frequency domain and know how to pass from one representation to another,
6. Be able to analyze the system using ,Laplace transform , Z-transform , Fourier series representation and Fourier transform
7. Be able to find transfer function (continuous and discrete-time systems) frequency response (continuous and discrete-time systems) of the systems

Syllabus:

1. Continuous–Time and Discrete –Time Signals:

Various classifications; Mathematical Representation; Signal Energy and Power. Transformations of the Independent Variable; Periodic Signals; Even and Odd Signals; Arithmetic Operations on Sequences; Continuous-Time and Discrete-Time Complex Exponential. The continuous-Time Unit Step and Unit Impulse Functions. The Discrete-Time Unit Impulse and Unit Step Sequences; Representation of Direct-Time Signals in Terms of impulse.

2. Continuous-Time and Discrete-Time Systems:

Interconnections of Systems; Basic System Properties (Causality, Stability, Time-Invariance, Linearity, Invertibility, systems with and without, memory).

3. Linear Time –invariant systems:

The Discrete–Time and Continuous-Time LTI Systems; Unit Impulse Response; Convolution Sum and Convolution Integral Representation. Properties of LTI Systems (Commutative, Distributive, Associative Properties, Invertibility, Causality, Stability). The Unit Step Response of an LTI System; LTI Systems Described by Differential and the Difference Equations; Block Diagram Representations; Singularity Functions.

4. Fourier Series Representation of Periodic Signals:

The Response of LTI Systems to Complex Exponential; Fourier Series Representation of Continuous- Time and Discrete–Time periodic Signals; Convergence of the Fourier Series; Properties of Discrete- Time and Continuous-Time Fourier Series; Fourier Series and LTI Systems.

5. The Continuous-Time Fourier Transform:

Representation of Continuous-Time Aperiodic Signals and Continuous-Time Fourier Transform; the Fourier Transform for Periodic Signals; Properties of Continuous-Time Fourier Transform; Fourier Transform and LTI Systems.

6. The Discrete- Time Fourier Transform:

Representation of Discrete-Time Aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform.

7. Sampling:

Representation of a continuous–Time Signal by its Samples; The Sampling Theorem; Reconstruction of Signals form its Samples using Interpolation; Effect of Under Sampling (Frequency Domain Aliasing); Discrete Tim processing of Continuous–Time Signals.

8. The Laplace Transform:

The Laplace Transform; Region of Convergence for Laplace Transform; Properties of Laplace Transform; Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot; Properties of Laplace Transform; Analysis and Characterization of LTI Systems using the Laplace Transform; System Transfer Function; Block Diagram Representations; The Unilateral Laplace Transform; Solution of Differential Equations using the Unilateral Laplace Transform.

9. The Z Transform:

The Z Transform; The Region of Convergence for the Z- Transform; Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot; Properties of Z-Transform; Analysis and Characterization of Discrete-Time LTI Systems using Z-Transform; System Transfer Function; Block Diagram Representation; The Unilateral Z-Transform; Solution of Difference Equation using the Unilateral Z Transform

Reference Books:

1. A. V. Oppenheim, A. S. Willsky with S. H. Nawab, Signals and Systems, Prentice- Hall of India Private Limited, Second Edition, 1997.
2. S. Haykin and B. V. Veen, Signals and Systems, John Wiley and Sons, Inc., Second Edition, 1999.
3. M. J. Roberts, Signals and Systems: Analysis using , Transform Methods and MATLAB, Tata McGraw-Hill Publishing Company Limited, Second Edition, 2003.

EE209 Advanced Packages Lab
(1Credit, L-0, T-0, P-2)

Objectives:

1. To study the Simulink toolboxes and special toolboxes.
2. To get introduce with PSPICE software and simulation based on it.

List of Experiments

Minimum ten experiments to be performed from
1. Three Matlab experiments using Control System Toolbox.
2. Three Matlab programming experiments using Matlab m-file.
3. Four Matlab experiments using Power System Toolbox.
4. Four experiment on circuit analysis using P-spice software.

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