COURSE STRUCTURE(R20)
AND
DETAILED SYLLABUS
(II YEAR)

ELECTRICAL & ELCTRONICS ENGINEERING

For
B.Tech., Four Year Degree Course
(Applicable for the batches admitted from 2020-21)

LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (CSE, ECE,EEE & ME)
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B. Tech II-Year Course Structure and Syllabus –R20

II Year – I Semester							
S. No.	**Course code**	**Subjects**	**Category**	**L**	**T**	**P**	**Credits**
1	R20BSH-MA2102	Complex Variables, Probability and Statistics	BS	3	0	0	3
2	R20EEE-PC2101	Electrical Circuit Analysis – II	PC	3	0	0	3
3	R20EEE-PC2102	Electrical Machines-I	PC	3	0	0	3
4	R20ECE-PC2101	Electronics Devices and Circuits	ES	3	0	0	3
5	R20EEE-PC2103	Electro Magnetic Fields	PC	3	0	0	3
6	R20EEE-PC2104	Electronics Circuits & PSpice Lab	PC	0	0	3	1.5
7	R20EEE-PC2105	Electrical Circuits Laboratory	PC	0	0	3	1.5
8	R20MEC-ES2104	Thermal and Hydro Prime Movers Lab	ES	0	0	3	1.5
9	R20EEE-SC2101	Introduction to MATLAB (Skill Oriented Course)	SC	1	0	2	2
10	R20BSH-MC2102	Essence of Indian Traditional Knowledge	MC	2	0	0	0
11	R20BSH-MC1203	Community Service Project (Evaluation)	MC	0	0	0	0
Total				**18**	**0**	**11**	**21.5**

II Year – II Semester							
S. No.	**Course code**	**Subjects**	**Category**	**L**	**T**	**P**	**Credits**
1	R20EEE-PC2201	Power System-I	PC	3	0	0	3
2	R20EEE-PC2202	Electrical Machines-II	PC	3	0	0	3
3	R20ECE-ES2201	Digital Electronics	ES	3	0	0	3
4	R20EEE-PC2203	Control Systems	PC	3	0	0	3
5	R20BSH-HM2101	Managerial Economics & Financial Analysis	HM	3	0	0	3
6	R20EEE-PC2204	Electrical Machines Lab –I	PC	0	0	3	1.5
7	R20EEE-PC2205	Electrical Machines Lab –II	PC	0	0	3	1.5
8	R20EEE-PC2206	Control Systems Lab	PC	0	0	3	1.5
9	R20EEE-SC2201	Programmable Logic Control (Skill Oriented Course)	SC	1	0	2	2
10	R20BSH-MC2202	English for Competitive Exams	MC	1	0	2	0
Total				**17**	**0**	**13**	**21.5**
Honors Course -1/Minor Course-1							
Summer Internship-1(After Second Year & Evaluated in III-I Semester)							

**The Eligible students who opted the courses for B.Tech with Honors/Minor only*

Note:L-Lecture, T-Tutorial, P-Practical, C-Credits

II Year –I Semester Syllabus

Subject Code	Subject Name	Hrs./Week L: T: P	Credits
R20BSH-MA2102	Complex Variables, Probability and Statistics	3:0:0	3

Course Objectives:

- To familiarize the learners with concepts of complex variables.
- To impart knowledge in basic concepts and few techniques in probability and statistics in relation to the engineering applications.

Course Outcomes: At the end of the course, the student will be able to

1. Examine the analyticity of complex functions. (L3)
2. Evaluate complex integration using Cauchy's theorems and Cauchy's residue theorem. (L3)
3. Compute probabilities, theoretical frequencies using discrete and continuous probability distributions for real data. (L3)
4. Apply the concept of hypothesis test to large samples. (L3)
5. Apply statistical inferential methods to small samples. (L3)

UNIT I:

Complex Variables and Analytic Functions: Functions of a complex variable, continuity, differentiation, analytic functions, Cauchy-Riemann equations, Milne-Thompson method, harmonic functions, harmonic conjugate.

Applications: Flow problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Examine continuity and differentiability for complex functions. (L2)
- Determine the analyticity using Cauchy-Riemann equations to complex functions. (L3)
- Find the analytic function using Milne-Thompson method. (L3)

UNIT II:

Complex Integration (All theorems without proofs): Contour integrals, Cauchy theorem, Cauchy integral formula, Taylor's series, Laurent's series, zeros of analytic functions, singularities, residues, Cauchy residue theorem.

Applications: Evaluation of real integrals of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ and $\int_{-\infty}^{\infty} f(x)dx$

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate the Taylor and Laurent expansions of simple functions.(L2)
- determine the nature of the singularities of an analytic function. (L2)
- find the residues of an analytic function. (L2)
- apply Cauchy residue theorem to evaluate improper realintegrals. (L3)

UNIT III:

Probability Theory: Probability(Read only):introduction, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem,.

Probability Distribution: Random variable concept, distribution function, density function, Binomial distribution, Poisson distribution, Normal (Gaussian) distribution.

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate the probabilities of events on various random experiments. (L3)
- apply Baye's theorem to real time problems related to conditional probabilities.(L3)

- differentiate the properties in discrete and continuous probability distribution. (L2)
- apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies. (L3)
- interpret the properties of normal distribution and its applications. (L2)

Unit IV:

Estimation and Testing of Hypothesis, large sample tests:

Estimation and Testing of Hypothesis: Introduction to Sampling, parameters, statistics, sampling distribution, point and interval estimation, formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors.

Large sample tests: Test for single proportion, difference of proportions, test for single mean and difference of means, confidence interval for parameters in one sample and two sample problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concept of estimation, interval estimation and confidence intervals. (L2)
- apply the concept of hypothesis testing for large samples. (L3)

Unit V:

Small Sample Tests: Student t-distribution (single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for single variance, $\chi 2$ - test forgoodness of fit, ANOVA(1-way).

Learning Outcomes:

At the end of this unit, the student will be able to

- apply the concept of testing hypothesis for small samples to draw the inferences. (L3)
- estimate the goodness of fit.(L3)

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44/e, 2017.
2. Veerarajan T., Probability, Statistics and Random Processes, 3rd edition, Tata McGraw-Hill, New Delhi, 2008.

References:

1. Erwin kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.
4. Murray R. Spiegel,Seymour Lipschutz, John J. Schiller , Dennis Spellman,Schaum's Outline of Complex Variables, 2ed (Schaum's Outlines) 2nd Edition.
5. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye, Probability and Statistics for Engineers and Scientists, 9th Edition, Pearson.
6. Miller and Freunds, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
7. S. C. Guptha and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand and Sons Publications, 2012.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2101	Electrical Circuit Analysis-II	3:0:0	3

Course Objectives:

- To study the concept of balanced circuits.
- To study the concept of unbalanced three-phase circuits.
- To study the transient behavior of electrical networks with DC, pulse and AC excitations.
- To study the performance of a network based on input and output excitation/response.
- To know the realization of electrical network function into electrical equivalent passive elements.

Course Outcomes: At the end of this course, students will be able to

1. Solve three- phase circuits under balanced conditions (L3)
2. Solve three- phase circuits under unbalanced conditions (L3)
3. Apply the transient and steady state behavior of RL, RC & RLC circuits in time and Frequency domain (L3)
4. Explain the parameters for different types of two-port network (L2)
5. Analyze electrical equivalent network for a given transfer function (L4)

UNIT-I

Balanced Three-phase circuits: Phase sequence- star and delta connection - relation between line and phase voltages and currents in balanced systems - analysis of balanced three phase circuits - measurement of active and reactive power in balanced three phase systems.

Unit Outcomes: The students are able to

- Classify the relation between line and phase components of star and delta connected balanced systems (L2)
- Solve three- phase circuits under balanced Condition (L3)

UNIT-II

Unbalanced Three phase circuits: Analysis of three phase unbalanced circuits: Loop method, neutral shifting method and Star-Delta transformation technique.

Power Measurement by using Wattmeters: Two wattmeter method for measurement of three phase power, measurement of reactive power by using single wattmeter method.

Unit Outcomes: The students are able to

- Solve three- phase circuits under unbalanced Condition (L3)
- Make use of wattmeter's to measure three phase power of the three phase circuits (L3)

UNIT-III

Transient Analysis of DC and AC circuits :

DC Transient: Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in series and parallel R-L, R-C, R-L-C circuits and solution of first and second order differential equations for DC- excitation.

AC Transient: Transient response in series R-L, R-C, R-L-C circuits for AC- excitation. Analysis of electrical circuits using Laplace transform for standard inputs.

Unit Outcomes: The students are able to

- Summarize initial and final conditions of circuit elements (L3)
- Identify the transient response of electrical networks for different types of excitations (L3)
- Apply the Laplace transform for steady state and transient analysis (L3)

UNIT-IV

Two Port Networks: Two port network parameters: Z, Y, ABCD and hybrid parameters and their relations, Cascaded networks - poles and zeros of network functions.

Unit Outcomes: The students are able to

- Find parameters for different types of networks (L1)
- Explain the concepts of Two-port Network parameters (L2)
- Analyze the stability of network functions using poles and zeros (L4)

UNIT-V

Network synthesis: Positive real function, basic synthesis procedure -LC immittance functions - RC impedance functions and RL admittance function - RL impedance function and RC admittance function - Foster and Cauer methods.

Unit Outcomes: The students are able to

- Analyze electrical equivalent network for a given network function (L4)
- Simplify the network using passive elements (L4)

Textbooks:

1. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India).
2. Ravish R. Singh "Network Analysis and Synthesis", McGraw Hill Education, 2013.

Reference Books:

1. Network synthesis: Van Valkenburg; Prentice-Hall of India Private Ltd.
2. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley, Mc Graw Hill Company, 6th edition
3. Circuits by A.Bruce Carlson , Cengage Learning Publications
4. Networks and Systems by D. Roy Choudhury, New Age International publishers
5. Electric Circuits by David A. Bell, Oxford publications
6. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthi, DhanpatRai&Co.

Web Links:

1. https://nptel.ac.in/courses/108/104/108104139
2. https://www.electrical4u.com/electrical-engineering-articles/circuit-theory

Course Code	Course title	Hrs./week L: T: P	Credits
R20EEE-PC2102	Electrical Machines–I (DC Machines and Transformers)	3:0:0	3

Course Objectives:

- To discuss the unifying principles of electromagnetic energy conversion.
- To understand the construction, principle of operation and performance of DC machines.
- To learn the characteristics, performance, methods of speed control and testing methods
- To predetermine the performance of single-phase transformers with its equivalent circuit.
- To analyze the three phase transformers and achieve three phase to two phase conversion.

Course Outcomes: At the end of this course, students will be able to

1. Understand the unifying principles of electromagnetic energy conversion(L2)
2. Analyze the operation & performance of DC Generators and Parallel Operation of DC Generators (L4)
3. Recognize the operation, performance of DC Motor , starting and speed control techniques (L2)
4. Understand operation & performance of single phase Transformer (L2)
5. Analyze the construction , classification of Three Phase Transformers & Autotransformers (L4)

UNIT-I

Electromechanical energy conversion: Principle of electromechanical energy conversion-forces and torque in magnetic field systems, energy balance in magnetic circuits, magnetic force, co-energy in singly excited and multi excited magnetic field system.

Unit Outcomes: The students are able to

- Understand the concept of energy, co-energy(L2)
- Appreciate the principles of electromagnetic energy conversion(L2)

UNIT-II

DC Generators: Principle of operation, constructional details, types of armature windings, EMF equation, armature reaction, commutation, Types of DC Generators, OCC, internal and external characteristics of DC Generators, applications of DC Generators.

Unit Outcomes: The students are able to

- Understand the reasons for the drop in terminal voltage when a DC Generator is loaded (L2)
- Analyze the conditions required to operate a DC Generator as a self-excited Generator (L4)

UNIT-III

DC Motors: Principle of operation, significance of back emf, torque equations, speed control of DC motors, 3-point starter & 4 point Starter, Types of DC Motors, losses and efficiency, condition for maximum efficiency. Brake test, Swinburne's test, Hopkinson's test, Retardation test & Separation of losses.

Unit Outcomes: The students are able to

- Analyze the Characteristics of DC Motor and its Performance (L4)
- Evaluate the performance of DC Motor by Direct and Indirect Tests (L5)

UNIT-IV

Single Phase Transformer: Construction and principle of operation, equivalent circuit, phasor diagrams, losses, open circuit and short circuit tests, voltage regulation- efficiency, Sumpner's test, separation of core losses, parallel operation of single-phase transformers, All day Efficiency.

Unit Outcomes: The students are able to

- Evaluate the Equivalent Circuit Parameters , Voltage Regulation & Predetermine Efficiency Transformer (L3)
- Understand the conditions required Parallel Operation of Transformers (L2)

UNIT-V

Autotransformer & Three Phase Transformers:

Autotransformer: Construction and working of auto transformer, comparison with two winding transformers, applications of autotransformer.

Three-Phase Transformer: Construction, types of connections and their comparative features, Scott connection, applications of Scott connection.

Unit Outcomes: The students are able to

- Understand the construction and working of Auto Transformer(L2)
- Distinguish between different types of connections of 3-Phase Transformer with respect to phasor diagram and connections (L3)

Textbooks:

1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011
3. Stephen J. Chapman, "Electric machinery fundamentals" McGraw Hill international edition, 2013

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. Theory and performance electrical machines by J.B.Gupta, S.K.Kataria & Sons

Web Links:

1. https://www.electrical4u.com
2. https://www.electronics-tutorials.ws
3. https://www.emworks.com

Course Code	Course title	Hrs./week L: T: P	Credits
R20ECE-PC2101	Electronic Devices and Circuits Common to EEE & ECE	3:0:0	3

Course Objectives:

- The principle of working and operation of BJT and FET and their characteristics are explained.
- Understand the concept of wave shaping circuits, switching characteristics of Diode and Transistor.
- Explain the need of Transistor Biasing and its significance.

Course Outcomes: At the end of the course, students will be able to:

1. Understand the working principle of various Diodes. (L1).
2. Understand the basic applications of Diodes as rectifier (L1).
3. Analyze the response of nonlinear wave shaping circuits for different signals (L4).
4. Study the working principle of transistors with different configurations(L1)
5. Identify the various stability parameters of a Bipolar Junction Transistor in different biasing methods (L3).

UNIT- I

Junction Diode Characteristics: Review of semiconductor physics: Fermi Dirac function, continuity equation. Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

Special Semiconductor Diodes -Zener Diode, Tunnel Diode, LED

Applications: Detection signals, Lighting systems, switching systems.

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the construction and operation of diode and special type of diodes (L2).
2. Draw characteristics of diode in different configurations (L1).
3. Understand the energy Band variations through energy band spectrum (L2).

UNIT- II

Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, comparison of various filter circuits in terms of ripple factors.

Applications: Power supplies for radio, television and computer equipment,

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the construction and operation of diode application (L2).
2. Understand the working procedure of different rectifiers with and without filters (L1).
3. Find the efficiency of rectifier (L2).

UNIT – III

Non-Linear Wave Shaping: Diode Clippers, Clipping at two independent levels, Transfer Characteristics of Clippers, Emitter Coupled Clipper, Clamping Operation, Clamping Circuits using diodes with different inputs, Clamping circuit theorem,

Applications: TV transmitter and receiver for processing picture signals, noise eliminations applications, and power supplies.

Learning Outcomes:

At the end of this unit the student will be able to

1. Explain the basic concepts of Non- linear wave shaping circuits (L2).
2. Plot the response of different Clipper and Clamper circuits using Diodes & Transistors (L1).

UNIT- IV

Transistor Characteristics: BJT: Junction transistor, transistor current components, transistor current equation, transistor configurations, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

Special transistors: UJT, SCR operations

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

Applications: regulators, switching devices, amplifiers and oscillators

Learning Outcomes:

At the end of this unit the student will be able to

1. Understand the construction and operation of BJT and FET (L2).
2. Draw the input and output characteristics of BJT and FET in different configurations (L1).
3. Compare the BJT, FET and MOSFET with respect to their parameters (L2).

UNIT- V

Transistor Biasing and Thermal Stabilization: Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic, and β, Stability factors, (S, S' , S''), Bias compensation, Thermal runaway, Thermal stability.

Applications: gain controller devices, thermal stability

Learning Outcomes:

At the end of this unit the student will be able to

1. Explain the need of the BJT and FET biasing (L2).
2. Know how to do the load line analysis of transistor (L1).
3. Compare different biasing techniques (L2).
4. Understand the need of Thermal Stability (L2).

Text books:

1. J. Millman, C.C.Halkias, "Millman's Integrated Electronics", Tata McGraw-Hill, 2nd Edition, 2001.
2. J. Millman, C.C.Halkias, SatyabrataJit, ―Millman's Electronic Devices and Circuits‖, Tata McGrawHill, 2nd Edition, 1998.

Reference Books:

1. Sedha.R.S, "A Text Book of Applied Electronics‖, Sultan Chand Publishers",1st Edition, 2008
2. "Electron Devices and Circuits‖, S.K.Kataria& Sons", 2 nd Edition,2012. Salivahanan, N. Suresh Kumar,A. Vallavaraj
3. R L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits‖, PEI/PHI", 9th edition, 2006.Gupta.J.B,
4. David A. Bell, ―Electronic Devices and Circuits‖, Oxford University Press ,5th Edition,2008.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2103	Electromagnetic Fields	3:0:0	3

Course Objectives:

- To discuss about the electric field intensity using coulombs law, gauss law and electric potentials for different types of charge distributions.
- To evaluate the capacitance of different configurations.
- To discuss the applications of Biot Savart's law, Ampere's Circuital law, Maxwell's second, third equations of static magnetic fields.
- To elaborate Lorentz force equation, enumerate magnetic force, self and mutual inductances in various configurations and its energy stored.
- To discuss about the time varying fields, Maxwell's equations – integral form, derivative form, Maxwell's fourth equation for the induced EMF.

Course Outcomes: At the end of this course, students will be able to

1. Understand the concepts of Coulomb's law, Gauss's law and their applications in electrostatics (L2)
2. Analyze capacitance and energy stored in dielectrics (L4)
3. Evaluate magneto static fields for simple configurations using Ampere's circuital law, magnetic forces, torque, magnetic dipole and dipole moment (L5)
4. Analyze the magnetic potential, self and mutual inductances in magnetostatics (L4)
5. Understand the time varying electromagnetic fields (L2)

UNIT-I

Electrostatics: Introduction to vector algebra, coordinate systems, Coulomb's law - electric field intensity due to line, surface and volume charges, work done on point charge - electric potential due to point charges, line charges and volume charges – Divergence- Gauss's law (Maxwell's first equation) and its applications - Laplace's equation and Poisson's equations - numerical problems

Unit Outcomes: The students are able to

- Determine electric field intensity and potentials using Coulomb's law and Gauss's law (L5)
- Understand Laplace's, Poisson's equations and their applications (L2)

UNIT- II

Conductors, Capacitance and Dielectrics: Electric dipole - dipole moment – potential, electric field intensity and torque due to electric dipole - boundary conditions - capacitance and its calculation in parallel plate, spherical, co-axial capacitors - energy stored, energy density in a static electric field - equation of continuity – numerical problems.

Unit Outcomes: The students are able to

- Evaluate the capacitance and energy stored in electrostatics (L5)
- Understand the concepts of electric dipole, dipole moment and energy density (L2)

UNIT-III

Magneto Statics: Static magnetic fields – Biot Savart's law, magnetic field intensity due to a straight, circular, solenoid current carrying wire – Maxwell's second equation. ampere's circuital law and its applications, magnetic field intensity due to an infinite sheet of current, long current carrying filament – point form of Ampere's circuital law – Maxwell's third equation – numerical problems.

Unit Outcomes: The students are able to

- Apply the concepts of magnetic field intensity using Biot-Savart law, Ampere law (L3)

- Evaluate magnetic field intensity due to an infinite sheet of current and a long filament carrying conductor in different loops (L5)

UNIT-IV:

Force in Magnetic fields , Self and Mutual Inductances: Lorentz force equation - force on current element - straight and long current carrying conductor in a magnetic field - force between two straight and parallel current carrying conductors – magnetic dipole, dipole moment and its torque in a magnetic field – numerical problems.

Self-inductance of a solenoid, toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and energy density in a magnetic field – numerical problems.

Unit Outcomes: The students are able to

- Determine magnetic forces and torque produced by current carrying elements in magnetic field (L5)
- Understand the concepts of self, mutual inductances and energy stored in the magnetic field (L2)

UNIT-V

Time varying fields: Maxwell's equations – integral form, derivative form, Maxwell's fourth equation, Modified Maxwell's equations for time varying fields.

Unit Outcomes: The students are able to

- Understand Maxwell's equations in different forms, Maxwell's fourth equation of electromagnetic induction. (L2)

Textbooks:

1. Principles of Electromagnetics, 6th Edition, Sadiku, Kulkarni, OXFORD University Press, 2015.
2. Engineering Electromagnetics, William.H.Hayt, Mc.Graw Hill, 2010.

Reference Books:

1. Electromagnetics 5th edition, J.D.Kraus,Mc.Graw – Hill Inc, 1999.
2. Field & Electromagnetic waves – 2nd edition, David K. Cheng.
3. Electromagnetics, Joseph Edminister, Tata McGraw Hill, 2006.

Web Links:

1. https://nptel.ac.in/courses/108/106/108106073
2. https://nptel.ac.in/courses/117/103/117103065
3. https://nptel.ac.in/courses/108/104/108104087

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2104	Electronic Circuits and PSpice Lab	0:0:3	1.5

Course Objectives:

- Familiarize the functional behavior of different diodes, BJTs and FETs.
- Demonstrate the characteristic features of BJT, FET
- Observe the response of linear wave –shaping circuits with square-wave input for different time constants
- Demonstrate the Non-Linear wave shaping circuits such as clippers, clampers and switching characteristics of transistor
- Demonstrate the working of various amplifiers based on different biasing techniques.
- Simulate the Simple electronic circuits using spice software.

Course Outcomes: At the end of the course, students will be able to:

1. Analyze the working principle of BJT and FET in different configurations (L4).
2. Analyze the response of linear wave shaping circuits for different signals (L4).
3. Sketch the response of nonlinear wave shaping circuits using nonlinear elements (L3).
4. Understand the switching characteristics of Diodes and Transistors applications (L2).
5. Identify the various stability parameters of a Bipolar Junction Transistor, Field Effect Transistor in different biasing methods (L3).

Part – A

1. PN Diode operation
2. Rectifier (Half And Full wave with and without filter)
3. BJT Characteristics (CE Configuration)
4. FET Characteristics(CS Configuration)
5. Linear Wave Shaping (LPF, HPF)
6. Non Linear Wave Shaping Clippers
7. Non Linear Wave Shaping Clampers
8. Transistor as a Switch
9. CE Amplifier
10. CC Amplifiers
11. FET Amplifier (Common Source Amplifier)

Part – B

Simulate any 4 experiments using spice software

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2105	Electrical Circuit Laboratory	0:0:3	1.5

Course Objectives:

- To verify the network theorems.
- To analyze the concepts of resonance and magnetic circuits.
- To evaluate two port networks parameters.
- To measure the powers of three phase network.
- To determine the parameters of a choke coil.

Course Outcomes: At the end of this course, students will be able to

1. Verify network theorems (L5)
2. Analyze the concepts of resonance and magnetic circuits (L4)
3. Examine two port networks parameters (L4)
4. Evaluate the powers in three phase networks (L5)
5. Determine the parameters of choke coil (L5)

List of the Laboratory Experiments:

1) Verification of Thevenin's and Norton's Theorems
2) Verification of Superposition and Maximum Power Transfer Theorems
3) Verification of Compensation Theorem
4) Verification of Reciprocity and Milliman's Theorems
5) Series and Parallel Resonance
6) Determination of Self, Mutual Inductances and Coefficient of Coupling
7) Determination of Z and Y Parameters
8) Determination of Transmission and Hybrid Parameters
9) Measurement the Parameters of a Choke Coil
10) Measurement of Three-Phase Power by Two Wattmeter Method for Unbalanced loads

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20MEC-ES2104	Thermal and Hydro Prime Movers Lab	0:0:3	1.5

Course Objectives:

- Understand basics for internal combustion engines
- Performance evaluation methods of various internal combustion engines
- Familiarize with the performance of turbines and pumps
- Gain knowledge in performance testing of hydraulic turbines at constantspeed and head
- Gain knowledge in performance testing of hydraulic pumps at differentworking conditions.
- Analyze experimental results using formulas of work done, discharge power,efficiency, data tables and graphs.

Course Outcomes: At the end of this course, students will be able to

1. Construct valve and port timing diagrams. (L3)
2. Evaluate performance test on 4 -stroke Diesel engine and petrol engine. (L5)
3. Determine FHP by conducting morse and motoring tests on 4 -stroke petrol engineand prepare heat balance sheet and perform speed test of an IC engine . (L5)
4. Determine the efficiencies of pelton and francis turbines and single stage and multistage centrifugal pumps. (L5)
5. Determine coefficient discharge of venturi and orifice meters and impact of jet onvanes and also determine of loss of head due to sudden contraction . (L5)

Note: To conduct a minimum of 12 experiments by conducting a minimum of six from each section.

SECTION A – THERMAL ENGINEERING LAB

1. I.C. Engines valve / port timing diagrams.
2. I.C. Engines performance test on 4 -stroke Diesel engine.
3. I.C. Engines performance test on 2-stroke petrol engine.
4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrolengine
5. Determination of FHP by retardation and motoring test on IC engine
6. I.C. Engines heat balance on Diesel engine.
7. Economical speed test of an IC engine
8. Study of boilers

SECTION B – HYDRAULIC MACHINES LAB

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Reciprocating Pump.
7. Calibration of Venturimeter.
8. Calibration of Orifice meter.
9. Determination of loss of head due to sudden contraction in a pipeline.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-SC2101	Introduction to MATLAB (Skill Oriented Course)	1:0:2	2

Course Objective: The objectives of the course are to make the students learn about:

- To Understand the MATLAB environment.
- To do simple calculations using MATLAB
- To write simple programs in MATLAB to solve scientific and mathematical problems
- To use the MATLAB GUI effectively
- To get familiar with Simulink models.
- To understand image processing.

Course Outcomes: By the end of this course, the student will be able to

1. State the MATLAB environment and its applications(L1)
2. Illustrate file management and the use of arrays and strings(L2)
3. Develop program scripts and functions using MATLAB environment and to use basic flow controls (L6)
4. Create plots and to carryout numerical computations and analysis(L6)
5. Develop mathematical modelling of physical systems using Simulink(L6)

UNIT-I

Introduction to MATLAB: Historical Background, Applications, Scope of MATLAB, Importance of MATLAB for Engineers, Features, MATLAB Windows (Editor, Workspace, Command History, Command Window). Operations with Variables, Naming and Checking Existence, Clearing Operations, Commands, Data types, Operators-Applications

Learning Outcomes: The students are able to

- Know the history and applications of MATLAB.(L2)
- Understand the importance of MATLAB.(L2)
- Explain different data types.(L2)

UNIT-II

Data and Data Flow in MATLAB: Vectors, Matrix Operations & Operators, Reshaping Matrices, Arrays, Colon Notations, Numbers, Strings, Functions, File Input-Output, Importing and Exporting of data-Applications

Learning Outcomes: The students are able to

- Analyse matrix operations and operators.(L4)
- Make use of strings and functions.(L3)

UNIT-III

MATLAB PROGRAMMING: MATLAB Programming: Conditional Statements, Loops, Writing Script Files, Error Correction, Saving Files, Worked out Examples-applications

Learning Outcomes: The students are able to

- Write simple loop programs, script files etc.,(L3)
- Execute simple programs.(L3)

UNIT-IV

MATLAB Advanced: Plotting, Graphics, Creating Plot & Editing Plot, GUI (Graphical User Interface). MATLAB- Algebra, Calculus, Differential, Integration, Polynomials, solving a system of linear equations-Applications

Learning Outcomes: The students are able to

- Create and edit plots, graphics(L6)
- Use GUI effectively(L3)
- Perform different algebraic calculations using MATLAB.(L3)

UNIT-V

SIMULINK: Introduction, Importance, Model Based Design, Tools, Mathematical Modeling, Converting Mathematical Model into Simulink Model, Running Simulink Models, Importing Exporting Data, Solver Configuration, Masking Block/Model-Applications

Learning Outcomes: The students are able to

- Understand the tools in Simulink.(L2)
- Design mathematical models.(L6)
- Execute the models.(L3)

Textbooks:

1. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers (English) by Rudra Pratap, OXFORD University Press.
2. MATLAB Programming by Y. Kirani Singh, B.B. Chaudhuri, PHI Publication

Reference Books:

1. MATLAB Programming for Engineers Fourth edition by Stephen J. Chapman
2. Applied Numerical Methods Using MATLAB 1st Edition by Won Y. Yang ,Wenwu Cao, Tae-Sang Chung, John Morris.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20BSH-MC2102	Essence of Indian Traditional Knowledge Common to EEE,ECE,MEC	2:0:0	0

Course Objectives:

- Facilitate students with the concepts and roots of traditional knowledge system.(L2)
- Importing thought process reasoning and inference sustainability of Indian traditional knowledge system (L2)
- Comprehend the legal framework, traditional knowledge, biological diversity act 2002. (L3)
- Focus on traditional food and modern food. (L2)
- Facilitate traditional knowledge in various sectors. (L3)

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

1. Knowledge about the concept of traditional knowledge(L2)
2. Apply significance of traditional knowledge protection(L3)
3. Analyze various enactments related to the protecting facets of traditional knowledge. (L2)
4. Evaluate the significance Traditional Knowledge and modern food. (L2)
5. Compare the traditional knowledge in various sectors(L2)

Unit-I:

Introduction to Traditional Knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, Indigenous Knowledge(IK),characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge vis-à-vis formal knowledge.

Learning Outcomes:

At the end of the unit the student will able to:

- Recognize the social change in traditional knowledge(L2)
- Contrast and compare characteristics importance kinds of traditional knowledge.(L2)
- Analyze physical and social contexts of traditional knowledge. (L3)

Applications: Compare and contrast the traditional knowledge with formal knowledge.

Unit-II:

Protection of Traditional Knowledge: Need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Learning Outcomes:

At the end of the unit the student will able to:

- Identify the need of protecting traditional knowledge.(L2)
- Apply significance of TK protection.(L3)
- Analyze the value of TK in global economy. (L3)

Applications: Identify and implementation of traditional knowledge in present scenario.

Unit-III:

Legal framework and Traditional knowledge: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PVPFR Act), The Biological Diversity Act 2002and Rules 2004, Systems of traditional knowledge protection- Legal concepts for the protection of traditional knowledge-Certain non IPR mechanisms of traditional knowledge protection.

Learning Outcomes:
At the end of the unit the student will able to:

- Contrast and compare the Scheduled Tribes and other traditional forest dwellers. (L2)
- Analyze plant variant protections and evaluate farmers right act. (L4)
- Analyze legal concepts for the protection of Traditional Knowledge.(L4)

Applications: Case study to recognize legal concepts, protection of culture and Indian traditional knowledge.

Unit-IV:

Traditional knowledge in Food : Evolution of Indian cuisine, Importance of traditional food –Styles of traditional food- Modern Food-Harmful effects of modern food, Factors influencing food choice- Economic and Physical Determinants-Uniqueness of Culture in Food.

Learning Outcomes:
At the end of the unit the student will able to:

- Recognizing the significance of Traditional food (L2)
- Awareness about the harmful effects of modern food.(L3)

Applications: Distinguish between nutrition levels of traditional and modern food items

Unit-V:

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture.

Learning Outcomes:
At the end of the unit the student will able to:

- Compare traditional knowledge indifferent sectors. (L2)
- Apply traditional knowledge in engineering. (L3)

Applications: Comparative study of traditional knowledge with current practices in different sectors.

Text Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Knowledge Traditions and Practices of India "Kapil Kapoor, Michel Danino.

Reference Books:

1. TraditionalKnowledgeSystemandTechnologyinIndiabyBasantaKumarMohantaandVip in Kumar Singh, Pratibha Prakashan 2012.
2. TraditionalKnowledgeSystem in India by Amit Jha Atlantic publishers, 2002

E-Resources:

1 https://www.utrechtjournal.org/articles/10.5334/ujiel.283/
2 https://en.wikipedia.org/wiki/Traditional_knowledge
3 https://www.scconline.com/blog/post/2018/04/23/protecting-traditional-knowledge-the-india-story-till-date/
4 https://sciencebusiness.net/news/72773/India-leads-the-way-in-protecting-traditional-knowledge.

II Year –II Semester Syllabus

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2201	Power Systems – I	3:0:0	3

Course Objectives:

- To study the principle of operation of different components of a thermal power stations.
- To study the principle of operation of different components of a nuclear power stations.
- To study the constructional and operation of different components of an Air and Gas Insulated substations.
- To study the constructional details of different types of cables.
- To study different types of load curves and tariffs applicable to consumers.

Course Outcomes: At the end of this course, students will be able to

1. understand the generation of electrical power from thermal power station.(L2)
2. understand the generation of electrical power from nuclear power plant. (L2)
3. Classify the different components of air and gas insulated substations. (L2)
4. Identify single core and three core cables with different insulating materials. (L3)
5. Analyse the different economic factors of power generation and tariffs. (L4)

UNIT-I:

Generating Power Stations:

Thermal Power Stations- Selection of site, general layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system, Brief description of components: boilers, super heaters, economizers, electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

Learning outcomes: The students are able to

- Understand the components of Thermal power stations (L2).
- Analyse the principle of operation of Thermal power stations(L4).

UNIT -II

Nuclear Power Stations: Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

Learning outcomes: The students are able to

- Understand the components of nuclear power stations (L2).
- Analyze the principle of operation of nuclear power stations(L4).

UNIT-III

Substations: Classification of substations:

Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment.

Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS) – advantages of gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, constructional aspects of GIS, installation and maintenance of GIS, comparison of air insulated substations and gas insulated substations.

Learning outcomes: The students are able to

- Understand the principle and operation of Air insulated substations (L2)
- Understand the principle and operation Gas insulated substations (L2)

UNIT-IV

Underground Cables: Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable.

capacitance of single and 3-Core belted Cables: Grading of cables – capacitance grading and intersheath grading.

Learning outcomes: The students are able to

- Classify the types of cables (L2)
- Identify single core and multi core cables with different insulating materials (L3)
- Understand the importance of capacitance in single and multi-core belted cables (L2)

UNIT – V

Economic Aspects of Power Generation & Tariff : Economic Aspects –load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, power capacity factor and plant use factor, base and peak load plants.

Tariff Methods– costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three–part, and power factor tariff methods.

Learning outcomes: The students are able to

- Understand the concepts of factors relating to Loads (L2).
- Analyze the economic aspects of power system operation and different tariff methods used in power systems (L4).

Textbooks:

1. Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, DhanpatRai& Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.
3. Power Generation,operation and control by Allen J.Wood , Bruce F.Wollenberg ,Wiley-Interscience Publication

Reference Books:

1. A course in Power systems by J.B.Gupta S.K.Kataria & Sons Publishers
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems By V.K Mehta and Rohit Mehta S.Chand & Company Ltd., New Delhi 2004.

Web Links:

1. https://nptel.ac.in/courses/108/102/108102047
2. https://nptel.ac.in/courses/108/105/108105058
3. https://www.electricaleasy.com/p/power-system.html
4. http://www.electrical4u.com

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2202	Electrical Machines – II	3:0:0	3

Course Objectives:

- To understand the principle of operation and performance of three-phase induction motor.
- To analyze the relation between torque vs slip characteristics and performance of
- Induction motor.
- To discuss the principle of operation, voltage regulation of synchronous Generators.
- To understand the operation and performance of synchronous motor.
- To discuss the concept of double revolving field theory for single phase induction motor.

Course Outcomes: At the end of this course, students will be able to

1. Understand principle and operation of three phase induction motors (L2)
2. Discuss the performance characteristics of three phase induction motor (L3)
3. Analyze performance characteristics of synchronous generator (L4)
4. Assess the performance characteristics of synchronous motor (L2)
5. Understand the principle of operation of single-phase induction motors (L2)

UNIT-I

Three Phase Induction Motors: Principle of operation, constructional details, production of rotating magnetic field, slip, effect of rotor EMF, rotor frequency, rotor current and power factor at standstill and running conditions - rotor power input, rotor copper loss, mechanical power developed and their interrelationships, equivalent circuit, Phasor diagram.

Unit Outcomes: The students are able to

- Understand the construction, principle of operation of three phase induction motor (L2)
- Analyze the effect of rotor EMF, rotor frequency at standstill and running conditions (L4)

UNIT-II

Characteristics, Starting and Testing Methods of Three Phase Induction Motors: Torque equation, expressions for maximum torque and starting torque, torque-slip characteristics, applications of three phase induction motor- harmonics, effects of crawling and cogging, speed control of induction motor with v/f method, no load and blocked rotor tests, methods of starting, starting torque and starting current calculations, induction generator operation (qualitative treatment only).

Unit Outcomes: The students are able to

- Analyze the performance characteristics of induction motor (L4)
- Discuss the methods of starting, braking and speed control of induction motors (L3)

UNIT–III

Construction, Operation and Voltage Regulation of Synchronous Generator: Constructional features of non-salient and salient pole type, armature windings, distributed and concentrated windings, distribution and pitch factors, EMF equation, voltage regulation by synchronous impedance method, MMF method and Potier triangle method, phasor diagrams, two reaction theory of salient pole machine.

Parallel operation of Synchronous Generators: Synchronization, synchronization methods, two bright and one dark lamp, synchroscope method , parallel operation-with single alternator and infinite bus, load sharing, numerical problems.

Unit Outcomes: The students are able to

- Analyze the construction-operation-voltage regulation of synchronous generators (L4)
- Understand synchronization of synchronous generators (L2)
- estimate the load sharing of synchronous generator (L5)

UNIT–IV

Synchronous Motor – Operation, Starting and Performance: Principle of operation, variation of current and power factor with excitation, synchronous condenser, power equation, hunting and its suppression, methods of starting, applications of synchronous motor.

Unit Outcomes: The students are able to

- Understand the principle of operation of synchronous motor (L2)
- Analyze the performance characteristics of synchronous motor (L4)

UNIT – V

Single Phase Induction Motors: Single phase induction motors, constructional features and equivalent circuit, no load and block rotor tests, problem of starting, double revolving field theory, starting methods, application of single phase induction motor.

Unit Outcomes: The students are able to

- Understand the principle of operation of single phase induction motor (L2)
- Analyze the performance characteristics of single phase induction motor (L4)

Textbooks:

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publishers,2011.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. Stephen J. Chapman, Electric Machinery and Power System Fundamentals, McGraw-Hill Education, 2001.
4. Bhag S. Guru, Huseyin R.Hiziroglu, Electric Machinery and Transformers, Oxford University Press, 2012.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A. S. Leinsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Web Links:

1. www.electrical4u.com
2. www.electricaleaasy.com
3. www.learnengineering.org

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20ECE-ES2201	Digital Electronics	3:0:0	3

Course objectives:

- To teach significance of number systems, conversions, binary codes and functionality of logic gates
- To discuss different simplification methods for minimizing Boolean functions
- To outline procedures for the analysis and design of combinational circuits
- To outline procedures for the analysis and design of sequential logic circuits
- To introduce programmable logic devices

Course Outcomes: At the end of the course, the student will be able to

1. Describe various number systems, error detecting and correcting binary codes (L2)
2. Apply Boolean laws, k-map & Q-M methods to minimize switching functions (L3)
3. Design the combinational circuits (L5)
4. Design the sequential logic circuits (L5)
5. Compare different types of Programmable Logic Devices (L5)

Unit- 1

Number Systems and Codes: Decimal, Binary, Octal, and Hexa-decimal number systems and their conversions, sign magnitude representation , r's Complement and (r-1)'s Complement, Arithmetic addition, Subtraction of Binary Numbers complements, BCD code, Excess -3 code, BCD addition , Excess- 3 addition, Gray code, Error detection and correction – Parity generators and checkers, two-input logic gates, Universal building blocks, EX-OR, EX-NOR - Gates

Applications

1. Binary systems are widely used for electronic gates in electricity circuits and digital encoding.
2. Logic Gates are used in arithmetic logic units, microprocessors, computer memory and registers.
3. Gates are used to build square wave oscillators, as temperature heaters, parity generation and checking circuits.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Summarize advantages of using different number systems (L2)
2. Explain usefulness of different coding schemes and functionality of logic gates (L2)

Unit- 2

Boolean Algebra & Logic Gates: Boolean operations, Boolean functions, complements and dual of Boolean functions, min-terms and max-terms, sum-of-products and product-of-sum representations, NAND /NOR implementations.

Minimization of Boolean Functions: Karnaugh map, don't-care conditions, prime implicants, minimization of functions using Quine - McClusky method.

Applications

1. Boolean functions are used in designing Integrated circuits.
2. Karnaugh maps are used for easy generation of error correcting codes.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply basic laws & De Morgan's theorems to simplify Boolean expressions (L3)
2. Compare K- Map & Q-M methods of minimizing logic functions (L5)

Unit -3

Combinational Circuits: Introduction, Analysis of combinational circuits, Design Procedure- Half Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder - subtractor, Decimal Adder, Design of comparator, decoders, encoders, multiplexers, demultiplexers.

Applications

1. Combination logic is used in circuits to perform Boolean algebra on input signals and on stored data.
2. Combinational circuits are used in ALU's, data transmission, home alarm, car parking slot systems, multiple access techniques.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply Boolean algebra for describing combinational digital circuits (L3)
2. Analyze standard combinational circuits such as adders, subtractors, multipliers, comparators etc. (L4)
3. Design simple combinational logic circuits (L5)
4. Implement logic functions with decoders and multiplexers (L3)

Unit 4

Sequential Circuits: Introduction, Latches –RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops.

Registers and Counters: Registers, Shift registers, ripple counters, synchronous counters, Modulus-n Counter, Ring counter, Johnson counter, Up-Down counter.

Analysis and Design of Synchronous Sequential Circuits: Moore and Mealy machine models, State Equations, State Table, State diagram, State reduction & assignment.

Applications:

1. Flip flops are used in multi vibrators, triggering circuits, frequency divider circuits, data
storage and data transfer circuits.
2. Counters are used in Frequency counters, Digital clocks, Time measurement, A to D converters, Digital triangular wave generator.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Describe behaviour of Flip-Flops and Latches (L2)
2. Compare Moore and Mealy machine models (L2)
3. Design synchronous sequential circuits using flip flops (L5)
4. Construct complex digital systems using components such as registers and counters (L3)

Unit -5

Programmable Logic Devices (PLDs): PROM, Programmable Array Logic (PAL) and Programmable Logic Array (PLA), Realization of switching functions using PLDs.

Applications:

1. Programmable Logic devices provide specific functions, including device-to-device interfacing, data communication, signal processing, data display, timing and control operations

Learning Outcomes:

At the end of the unit, the student will be able to

1. Compare different types of Programmable Logic Devices (L5)
2. Design simple digital systems using PLDs (L5)

Textbooks:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, 4th Edition, Pearson Education, 2013.
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education (India Private Limited), 4th edition, 2012.

References:

1. Switching and Finite Automata Theory, Z. Kohavi, Tata McGraw Hill.
2. Wakerly J.F. "Digital Design: Principles and Practices," Pearson India, 2008, 4th Edition.
3. Charles H Roth (Jr), Larry L. Kinney, "Fundamentals of Logic Design", Cengage Learning India Edition, 5th Edition, 2010.
4. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2203	Control Systems Common to EEE &ECE	3:0:0	3

Course Objectives:

- To learn the fundamental concepts of control systems and write down the transfer functions for different types of electrical and mechanical systems.
- To study the characteristics and time response analysis for first and second order systems.
- To explain the absolute stability and relative stability of control system by RH criterion and Root locus techniques.
- To demonstrate the analysis of the system response in frequency domain using bode, polar and Nyquist plots.
- To introduce state variable analysis, concepts of controllability and observability.

Course Outcomes: At the end of this course, students will be able to

1. Develop the transfer function of physical systems using block diagram algebra and signal flow graphs (L3)
2. Apply the concepts of time response analysis on first and second order systems (L3)
3. Analyze the absolute stability and relative stability of control system by RH criterion and root locus techniques (L4)
4. Apply various frequency domain techniques to assess the system performance and stability (L3)
5. Analyze State space models of linear time invariant systems (L4)

UNIT-I

Mathematical Modeling of Control System: Classification of control systems, open loop and closed loop control systems and their differences-feedback characteristics, transfer function of linear systems, differential equations of electrical and mechanical systems, transfer function of AC and DC servo motors, synchro transmitter and receiver, block diagram algebra, representation by signal flow graph, reduction using mason's gain formula.

Unit outcomes: The students are able to

- Explain the open loop and closed loop systems (L2)
- Calculate the transfer function of a given system by using block diagram algebra and signal flow graph method (L3)

UNIT-II

Time Response Analysis: Standard test signals, time response of first order systems, characteristic equation of feedback control systems, transient response of second order systems, time domain specifications, steady state response, steady state errors and error constants, effects of proportional derivative and proportional integral systems.

Unit outcomes: The students are able to

- Understand the time response of first order and second order systems (L2)
- Derive the different time domain specifications for second order systems (L2)
- Determine time response specifications and steady state error for the second order system (L3)

UNIT-III

Stability Analysis: Concept of stability, absolute and relative stability analysis, Routh's stability criterion and its limitations. Root locus Technique- Root locus concept, construction of root loci, effects of adding poles and zeros to open loop transfer function [G(s) H(s)] on the root loci.

Unit Outcomes: The students are able to

- Find the stability of the given system by Routh's stability criterion (L1)
- Identify whether the system is stable or not by using root locus technique (L3)

UNIT–IV

Frequency Response Analysis: Frequency domain specifications -relationship between time and frequency response, bode diagrams, transfer function from the bode diagrams, phase margin and gain margin, stability analysis from bode plots, polar plots and nyquist plots, lag, lead, lag-lead and lead-lag compensators.

Unit outcomes: The students are able to

- Identify the stability of linear time invariant systems using frequency response methods (L3)
- Derive the different frequency domain specifications for second order systems (L2)
- Find the gain and phase margin from bode diagrams and Nyquist plots for understanding their implications in terms of stability (L2)
- Explain the concept of compensators (L2)

UNIT-V

State Space Analysis: Concepts of state, state variables and state model, derivation of state models from block diagrams, diagonalization, solving the time invariant state equations, state transition matrix and it's properties, concepts of controllability and observability.

Unit outcomes: The students are able to

- Analyze State space models of linear time invariant systems (L4)
- Determine state space model for the given system (L3)
- Understand the concepts of controllability and Observability (L2)

Textbooks:

1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International Limited Publishers, 2nd edition.
2. Automatic control system – B.C.Kuo , john wiley and son's 8th edition, 2003.

Reference Books:

1. Modern control engineering – K.Ogata , prentice Hall of India Pvt. Ltd., 5th Edition.
2. Control system – N.K.Sinha, New Age International (p) Limited Publishers, 3rd Edition, 1998.
3. A.Nagoor kani, "Control Systems", RBA Publications, 2nd Edition, 2006.
4. Control systems- A.Anand kumar, PHI learning pvt.ltd., 2nd Edition.
5. Control systems – K.Alice mary, P.Ramana.
6. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.

Web Links:

1. https://nptel.ac.in/courses/108101037
2. https://www.electrical4u.com/electrical-engineering-articles/control-system
3. https://www.tutorialspoint.com/control_systems/control_systems_quick_guide.htm

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20BSH-HM2201	Managerial Economics & Financial Analysis	3:0:0	3

Course Objectives:

- Inculcate the basic knowledge with the concepts of Economics & Demand and current business environment.(L2)
- Analyze various factors of production with proposed theories in relation to cost - volume profit analysis.(L4)
- Identify micro environment in which markets operate, how price determination is done under different kinds of competitions and know the different forms of Business organization. .(L4)
- Provide fundamental skills about accounting and explain the process of preparing accounting statements and analysis of financial statements. (L3)
- Apply the best investment decisions by means of time value of money.(L4)

Course Outcomes:

1. Equipped with the knowledge of fundamentals of economics, estimating the Demand for a product, Capable of analyzing Elasticity & Forecasting methods(L2)
2. Apply production concepts, assess the costs and Determine Break Even Point (BEP) of an enterprise for managerial decision making(L4)
3. Identify the influence and price determination of various markets structures and knowledge of the forms of business organization and Business cycles(L4)
4. Analyze and interpret the process & principles of accounting & apply financial statements for appropriate decisions to run the business profitably(L4)
5. Analyze how to invest adequate amount of capital in order to get maximum return from selected business activity.(L4)

Unit-I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Learning Outcomes:

At the end of this unit students will be able to:

- Awareness about basics of managerial economics(L1)
- Knowledge of the concepts of demand, elasticity of demand and methods of demand forecasting(L1)

Application:

1. Analyze the demand of a product by applying methods of the elasticity of demand.

Unit – II:

Theories of Production and Cost Analysis: Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Learning Outcomes:

At the end of this unit students will be able to:

- Examine various issues involved in production decision analysis (L1)
- Construct how production function is carried out to achieve least cost combination of inputs(L3)
- Apply Break – Even Analysis and its importance in managerial decision making(L4)

Application:

Compute contribution, revenue, Cost comparison, Margin of safety for making accurate decisions related to profitability of particular Enterprise

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies: Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Goods and services Tax, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company.

Learning Outcomes:

At the end of this unit students will be able to:

- Identify the various market structures like Monopoly, Monopolistic competition (L4)
- Determine the appropriate pricing strategies to be applied in each market(L2)
- Compare the suitability of various organizational and ownership structures like sole trading, partnership. (L2)

Application: Analyse the leaps and bounds faced by the service providers in estimation of pricing in Telecom sector**.**

Unit – IV:

Introduction to Accounting & Financial Analysis: Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements.

Learning Outcomes:

At the end of this unit students will be able to

- Knowledge about the framework for accounting process(L1)
- Analyze financial accounting decisions.(L3)

Application:

Prepare the financial accounting statements like Trading account, Profit and Loss account, Balance sheet of any organization.

Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (pay back period, accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Learning Outcomes:

At the end of this unit students will be able to

- Analyze how capital budgeting decisions are carried out(L4)
- Knowledge of the concepts and various methods of capital budgeting(L1)
- Apply traditional or modern methods of Capital budgeting in business decision making(L3)

Application:

1. Assess long term investments and funds required in small scale organization**.**

Text Books:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.
2. Varshney & Maheshwari, Managerial Economics, Sultan Chand& Sons, 2014.

References:

1. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
2. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
3. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
4. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
5. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

WEBLINKS

1. https://www.smartzworld.com/notes/managerial-economics-and-financial-analysis-mefa/
2. Production and cost analysis- https://slideplayer.com/slide/5708722/
3. Accounting analysis- https://www.readyratios.com/reference/accounting/accounting_analysis.html
4. https://nptel.ac.in/courses/110/101/110101131/

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2204	Electrical Machines Lab –I	0:0:3	1.5

Course Objectives:

- To plot the OCC characteristics of DC Shunt Generator and understand the mechanism of Self-Excitation.
- To control the speed of the DC Motors.
- To determine and pre-determine the Efficiency of DC Machines.
- To Predetermine the Efficiency, Regulation of Single Phase Transformer and assess their performance.

Course Outcomes: At the end of this course, students will be able to

1. Understand the performance of DC Shunt Generator (L3)
2. Analyze the performance of DC Shunt Motor (L4)
3. Understand the Speed Control Techniques of DC Shunt Motor (L2)
4. Evaluate the performance of single-phase Transformers (L4)
5. Achieve Three Phase to Two Phase Transformation (L3)

Any 10 of the following experiments are to be conducted

1. Magnetization characteristics of self-excited DC Shunt Generator. Determination of Critical Field Resistance and Critical Speed.
2. Brake test on DC shunt motor. Determination of performance curves.
3. Hopkinson's Test on DC Shunt Machines & Determination of Efficiency of DC Shunt Machines.
4. Swinburne's Test and Predetermination of Efficiencies as DC Generator and DC Motor.
5. Speed Control of DC shunt motor by Field and armature Control methods.
6. Retardation Test on DC Shunt Motor. Determination of losses at Rated Speed.
7. Separation of Losses in DC Shunts Motor.
8. OC & SC Test on Single Phase Transformer.
9. Sumpner's Test on Single Phase Transformer.
10. Scott Connection of Transformers.
11. Parallel Operation of Single Phase Transformers.
12. Separation of Core Losses of a Single Phase Transformer.
13. Heat Run Test on a Bank of 3 Nos. of Single Phase Delta Connected Transformers.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2205	Electrical Machines Lab –II	0:0:3	1.5

Course Objectives: To make the student to learn about

- To Determine the Performance of Three Phase Induction Motors.
- To improve the power factor of Single-Phase Induction Motor.
- To predetermine the regulation of Three–Phase Alternator by various methods.
- To Evaluate X_d / X_q ratio of Alternator and asses the Performance of Three–Phase Synchronous Motor.
- To Assess the V & Inverted V Curves of Three–Phase Synchronous Motor.

Course outcomes: At the end of this Course, the Student will be able to

1. Assess the Performance of Single-Phase and Three Phase Induction Motor. (L3)
2. Speed control of Three Phase Induction Motor. (L3)
3. Predetermine the Regulation of Three–Phase Alternator by various Methods. (L5)
4. Evaluate the X_d / Xq ratio of Alternator and asses the regulation of Three–Phase Synchronous Alternator (L5).
5. Determine V and Inverted V curves of a Three Phase Synchronous Motor (L5)

The following Experiments are required to be conducted as compulsory experiments:

1. Brake test on Three Phase Induction Motor.
2. No–load & Blocked Rotor Tests on Three Phase Induction Motor.
3. Speed Control of Induction Motor by V/f method.
4. Regulation of a Three –Phase Alternator by Synchronous Impedance method and MMF method.
5. Regulation of Three–Phase Alternator by Potier Triangle Method.
6. Determination of X_d , X_q and Regulation of a Salient Pole Synchronous Machine.
7. Synchronization of alternator by Dark Lamp method.
8. V and Inverted V Curves of a Three Phase Synchronous Motor.
9. Equivalent circuit parameters of Single-Phase Induction Motor
10. Power factor improvement of Single-Phase Induction motor by using Capacitor bank.

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-PC2206	Control Systems Lab	0:0:3	1.5

Course Objectives:

- To impart hands on experience to understand the performance of basic control system.
- To study the characteristics of Synchro's.
- To understand the working of magnetic amplifiers, D.C. servo motors, A.C. Servo motors, and potentiometer.
- To understand time and frequency responses of control system with and without controllers and compensators.

Course Outcomes: At the end of this course, students will be able to

1. Analyze the performance and working of Magnetic amplifier, D.C and A.C. servo motors (L4)
2. Design P, PI, PD and PID controllers. (L6)
3. Design lag, lead and lag–lead compensators (L6)
4. Determine the transfer function of D.C. motor (L5)
5. Test the performance of D.C servo motor using position control system.(L4)

The following Experiments are required to be conducted as compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchro's
3. Effect of P, PD, PI, PID Controller on a second order systems
4. Lag and lead compensation – Magnitude and phase plot
5. DC position control system
6. Transfer function of DC motor
7. Characteristics of magnetic amplifiers
8. Characteristics of AC servo motor
9. Characteristics of DC servo motor
10. Potentiometer as an error detector

Course Code	Course Title	Hrs./Week L: T: P	Credits
R20EEE-SC2201	Programmable Logic Controller (Skill Oriented Course)	1:0:2	2

Course Objectives:

- To study the Basics of Programmable Logic Controllers.
- To study Different Hardware Components of PLC
- To study the Basic programming techniques of PLC
- To study the different timers and Counters in PLC
- To study the different brands of PLC's and PLC networking

Course Outcomes: At the end of this course, students will be able to

1. Understand the Basics of Programmable Logic Controllers (L2)
2. Understand the Different Hardware Components of PLC . (L2)
3. Apply the knowledge of Basic programming techniques of PLC. (L3)
4. Understand different timers and Counters in PLC. (L2)
5. Design various application of PLC's (L2)

UNIT-I

Introduction: Definition, advantages and Importance of PLC, Evolution history of PLC, architecture and block diagram Types of PLC, CPU unit architecture, Memory classification, Input/output devices and its interfacing, Digital-Analog modules, Communication modules, Special function modules, PLC applications,

Learning outcomes: After completion of this unit the students are able to

- understand the Basics of Programmable Logic Controllers (L2)
- understand the Different Hardware Components of PLC (L2)

UNIT -II

Basics of PLC Programming– Processor Memory Organization, Program Scan, PLC Programming languages, Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, ladder diagram, PLC instructions

Learning outcomes: After completion of this unit the students are able to

- Apply the knowledge of Basic programming techniques of PLC. (L3)

UNIT-III

PLC: Programming Timers and Counters, PLC networking, introduction to various brands of PLC, industry based examples of counters & timers.

Learning outcomes: After completion of this unit the students are able to

- Apply the knowledge of Timers & counters used in PLC. (L3)

UNIT-IV

Applications of PLC 1: Introduction to ladder programming & to implement basic logic gates, Door Bell Operation, three phase motor in both direction, Motor starter application

Learning outcomes: After completion of this unit the students are able to

- Design various applications of PLC. (L5)

UNIT – V

Applications of PLC 2: Conveyor belt operation, Traffic Light Control System, Lift Mechanism, alarm annunciator system, Elevator system, stepper motor control in forward and reverse direction.

Learning outcomes: After completion of this unit the students are able to

- Design various applications of PLC. (L2)

Textbooks:

1. Programmable logic controller by Frank D. Petrusella, Tata McGraw-Hill publication
2. Programmable Logic Controllers: Principles and Applications by John W. Webb and Ronald A. Reis, Prentice – Hall India publication, 5th edition

Reference Books:

1. Introduction to programmable logic controller by Gary dunning, Thomson Asia Pte Ltd. Publication, Singapore
2. Programmable Controller by T. A. Huges, ISA publication, 2nd edition
3. Programmable Logic Controllers by W. Bolton, Elsevier Newnes publication, 4th edition.

Web Links:

1. http://coep.vlab.co.in/?sub=33&brch=97
2. http://www.plcdev.com/book/export/html/9
3. http://www.plcmanual.com/
4. http://literature.rockwellautomation.com
5. http://www.automation.siemens.com
6. http://nptel.ac.in/video.php

Subject Code	Subject Name	Hrs./Week L: T: P	Credits
R20BSH-MC2202	English for Competitive Exams	1:0:2	0

Course Objectives

- Aims to help learners develop their English language skills, particularly those planning to appear for Competitive Exams that test their English Language abilities.
- Gains the power of expression through rich Vocabulary.
- Imparts critical reading strategies for comprehension of complex texts
- Provides training and opportunities to develop fluency in English through participation in formal group discussions and Self Introductions.
- Demonstrates good writing skills for effective Paragraph Writing, Essay Writing and formal correspondence through Emails.
- Encourages use of a wide range of grammatical structures, Phrases, Clauses and Idioms in speech and writing.

Course Outcomes: At the end of this course, students will be able to

1. Enable students to identify Parts of Speech and use them flawlessly, write Emails in formal correspondence effectively, participate confidently by introducing oneself in any formal discussion.
2. Attain Language Proficiency & Accuracy through Contextualized Vocabulary, Verb forms, Tense and subject verb agreement, produce coherent expressions for professional writing, introduce themselves unhesitatingly with Task-Based Activities.
3. Develop the fluency and accuracy to write Technical Reports and Emails for professional communication by using appropriate vocabulary and participate confidently in any formal discussion.
4. Assimilate lifelong reading habit to comprehend a passage for its gist. Avoid the errors in both Speech & Writing and write Letters and Emails for official communication.
5. Realize the technical communicative competence and attainment of grammatically correct structures for formal communication.

Unit 1

Vocabulary: How to talk about actions. **Grammar: U**sing and Identifying Parts of Speech accurately**. Writing:** Paragraph Writing and formal correspondence through Emails**. Speaking:** Background to Group discussions & Self-introductions.

Unit Outcomes: The students are able to

- Acquire vocabulary and use it contextually(L2)
- identify parts of speech and use them flawlessly in both Speech and Writing (L3)
- write paragraphs and Emails in formal correspondence effectively (L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 2

Vocabulary: How to talk about various speech habits. **Grammar**: Learning Verb forms, Tenses and Subject-verb agreement and using them accurately in both Speaking and Writing contexts. **Writing:** Essay Writing and formal correspondence through Emails. **Speaking:** Four major areas-Subject Knowledge, Oral Communication Skills, Leadership Skills and Team Management-of GD; Real time GDs for Evaluation.

Unit Outcomes: The students are able to

- Acquire vocabulary and use it contextually (L2)
- use Verb forms, Tense and subject verb agreement for effective speaking and writing (L3)
- produce coherent expressions for professional writing (L4)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 3

Vocabulary: How to insult your enemies**. Grammar:** Sentence Analysis & Synthesis - Voice, Degrees of Comparison, Reported Speech and Types & Forms of sentences. **Writing:** Report writing and Emails for formal correspondence**. Speaking:** Roles in structured GDs; real time GDs for practicing the above roles.

Unit Outcomes: The students are able to

- Acquire vocabulary and use it contextually(L2)
- identify the complexity in the structure of a sentence (L2)
- write technical reports and emails for professional communication (L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 4

Vocabulary: How to flatter your friends**. Grammar**: Common errors and Correction of Sentences **Reading:** Reading Comprehension passages through Skimming and Scanning and understanding the gist or the specific purpose of them. **Writing:** Letter writing and Emails. **Speaking:** Advantages of GDs for hiring process ; real time GDs for evaluating.

Unit Outcomes: The students are able to

- Acquire vocabulary and use it contextually(L2)
- comprehend a passage and know its gist(L3)
- avoid the errors in both Speech and Writing (L2)
- write letters and emails for official communication(L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Unit 5

Vocabulary & Grammar: High-frequency words for all competitive exams, Clause, Phrase & Idioms**. Reading:** Reading for Comprehending **Writing:** Business Letters and Emails **Speaking:** Group Discussions for Evaluation

Unit Outcomes: The students are able to

- Acquire vocabulary and use it contextually(L2)
- use grammatically correct structures for formal communication (L3)
- write Business Letters effectively (L3)
- participate confidently in any formal discussion and introduce themselves unhesitatingly (L3)

Reference Books

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3. Skilful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)
5. Word Power Made Easy by Norman Lewis.

Assessment:

The learners will demonstrate their knowledge and abilities through completion of the following required assessments while or at the end of this course. —2 Quizzes, 1 Professional Certificate, 3 Activities on LSRW skills.

Quiz: Quiz is conducted on Grammar & Vocabulary. Each Quiz consists of 50 questions and will be scaled down to 5 Marks. Two quizzes are conducted. One after the 3rd unit, the other, after the last unit. Duration of any quiz is 1hr 30 Min only. These Quizzes are Computer Based Tests (CBT)

Professional Certificate: An International Language Assessment Certificate secured on B1 of Common European Framework for Reference (CEFR) scale.

Activities on LSRW skills:

Interviews: The candidate has to interview one celebrity of his/her own choice.

The recorded 5-7 min video of the candidate should be uploaded on the ELCS LAB Lendi YouTube Channel with the help of concerned English Teacher

The Evaluation Parameters:

Quality of the Questionnaire (3M)

Body Language & Confidence of the candidate (5M)

YouTube likes & Comments (2M)

E-mails:

Each student is required to submit 5 independently written Emails during the course. Specific Requirements for each one are accessed on the following Link:

https://docs.google.com/document/d/1IXuzjjmfiOLI23t8xlbLwNefRzIIXi9aOi3XkSHIK_Q/edit?usp=sharing

Listen to Speak:

Students are expected to watch and listen to any one of the 10 given educational video and audio clips to express their point of view. After watching, they will have the opportunity to share their points of view about some of the everyday issues that they can relate to. They have to explain and justify their reasoning to a team of three peers to explore their verbal expressions and their points of view before an External Examiner.

The following is the link to access those clippings:

https://docs.google.com/document/d/1tFuQ_43AVAHKJGVs9AeOODHJTnQMoydqcodSgENaZ3o/edit?usp=drivesdk

Details of Peer Evaluation & Assessment Parameters are available on the following Link: https://docs.google.com/document/d/16l_PUzaOONnjpvMYVzE3XAYUBNhqMK9PbdDOPGIef_8/edit?usp=sharing

Grading:

Assessment Model Points	Points
Quiz-1	**10**
Quiz- 2	**10**
Professional Certificate with B1 or above or Activity of Interview	**10**
E-Mails	**10**
Listen to Speak Activity	**10**
Total	**50**

Pass Criterion:

1. Student has to Secure 30 Marks to pass this examination
2. Student who is having a certificate of any International standard of English he/she has to secure a Minimum 20 Marks in this examination (Certificate+20 Marks) to pass the summative exam.
3. Student who is not having a certificate has to clear the exam with 30 marks mandatorily.
4. Clearing all categories is mandatory. Need to get 60% each category.
5. 20M +Certificate=Successful or 30M+No certificate=Successful