Learning Outcomes based Curriculum Framework (LOCF)

For

B. Tech. (Electrical Engineering)

2nd year (Semester 3rd & 4th)

4-Year Regular Full-Time

Graduate Programme

Faculty of Engineering and Technology

Chaudhary Devi Lal University Sirsa-125055

Scheme of Examination

&

Detailed Syllabus

of

BTech (EE)

2^{nd} Yr. (3^{rd} & 4^{th} Sem)

Program Specific Outcomes (PSOs)

Sr. No.	Program Specific Outcomes
PSO1	Ability to utilize logical and technical skills to model, simulate and analyse electrical components and systems.
PSO2	Empowering to provide socially acceptable technical solutions to real time electrical engineering problems with the application of modern and appropriate techniques for sustainable development.
PSO3	Graduates will demonstrate their knowledge in effective implementation during their practice of profession of Electrical Engineering with due regard to environment and social concerns.

*****Programme Outcomes (POs) of Bachelor Programmes in Engineering and Technology have been specified in First year common curriculum of B.Tech. Programmes.

Course Code	Definition/ Category
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
MC	Mandatory Courses
PC	Program Core
PE	Program Elective Courses
OE	Open Elective Courses
EEC	Employability Enhancement Courses (Project work/ Summer Training/ Industrial Training/ Practical Training/ Internship/Seminar, etc.)

Credit Scheme for B.Tech. (Electrical Engg.) 2nd Year (3rd& 4th Sem)

Semester	Basic Science Courses BSC		Engineering Science Core/ Elective/ Open Elective Courses (PC/PE/OE)		Humanities, Social Sciences Courses (HSMC)		Mandatory Courses		Grand Total Credit
Sr. No.	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
3rd	01	03	07	19	00	00	01	00	22
4th	00	00	08	22	01	00	01	00	22

B. Tech. 2nd Year Semester-III

#	Course Code	Course Title	Workload/ Credit			
			Theory	Tutorial	Practical	Total
1.	PC/EE/1-T	Electrical Circuits and Networks	3/3	1/1	-	4/4
2.	PC/EE/2-T	Electronic Devices and Circuits	3/3	-	-	3/3
3.	PC/EE/3-T	Electrical Machines-I	3/3	1/1	-	4/4
4.	PC/EE/4-T	Generation of Electric Power	3/3	1/1	-	4/4
5.	BSC/7-T	Mathematics-III	3/3	-	-	3/3
6.	PC/EE/2-P	Electronic Devices and Circuits Laboratory	-	-	2/1	2/1
7.	PC/EE/3-P	Electrical Machines-I Laboratory	-	-	4/2	4/2
8.	PC/EE/5-P	Electrical Workshop	-	-	2/1	2/1
9.	*MC/3-T	Indian Constitution	3/-	-	-	3/-
TOTAL			18/15	3/3	7/4	29/22
					Total Credits	**22**

B. Tech. 2nd Year Semester-IV

#	Course Code	Course Title	Workload/ Credit			
			Theory	Tutorial	Practical	Total
1.	PC/EE/6-T	Power Electronics	3/3	0/0	0/0	3/3
2.	PC/EE/7-T	Electrical Machines-II	3/3	1/1	0/0	4/4
3.	PC/EE/8-T	Power Systems-I	3/3	1/1	0/0	4/4
4.	PC/EE/9-T	Fields and Waves	3/3	1/1	0/0	4/4
5.	PC/EE/10-T	Signals and Systems	3/3	0/0	0/0	3/3
6.	PC/EE/6-P	Power Electronics Laboratory	0/0	0/0	2/1	2/1
7.	PC/EE/7-P	Electrical Machines-II Laboratory	0/0	0/0	4/2	4/2
8.	PC/EE/8-P	Power Systems-I Laboratory	0/0	0/0	2/1	2/1
9.	*MC/4-T	Essence of Indian Traditional Knowledge	3/0	0/0	0/0	3/0
10.	*HSMC/2-T	Human Values and Personality Development	3/0	0/0	0/0	3/0
TOTAL			21/15	3/3	8/4	32/22
					Total Credits	**22**
1.	**EEC/EE/1	Industrial Training/ Internship-I	-/-	-/-	-/4	-/4

*Non-credit qualifying course. The assessment will be completely internal.

**The students will have to undergo Industrial/Practical Training/ Internship for 4-6 weeks during summer vacations after the examination of 4th semester which will be evaluated in 5th semester.

Note: Students will be allowed to use non-programmable scientific calculators only; however, sharing of calculator should not be permitted.

Detailed Syllabus of

B.Tech. (EE)

3rd Semester

ELECTRICAL CIRCUITS AND NETWORKS

General Course Information:

Course Code: PC/EE/1-T Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Recall the fundamental of network theorems	**L1(Remembering)**
CO2.	Understand and derive the response of electrical circuits and characteristics and parameters of two port networks	**L2(Understanding)**
CO3.	Apply the knowledge of network analysis in technical problem solving	**L3(Applying)**
CO4.	Perform analysis and synthesis of two port networks applicable in various engineering problems	**L4(Analyzing)**

***Revised Bloom's Taxonomy Action verbs/Levels**

Course Content

UNIT- I

Network topology and theorems: Classification of circuits, sources and signals, standard signals, source transformations, Network topology, graph matrices, formulation and solution of circuit equations based on graph theory using different analysis techniques- circuit, cut set and mixed. Concept of duality, Network theorems and their applications- Superposition, reciprocity, Thevenin, Norton, Maximum power transfer, Millman, Substitution, Compensation and Tellegen's theorem.

UNIT- II

Transient response: Introduction to non-linear circuits and their analysis, Analysis of circuits with dependent sources, Transient response under D.C. and A.C. excitation, Analysis of magnetically coupled circuits, Series and parallel resonance circuits, bandwidth and Q-factor, response with variation in parameters and frequency.

UNIT- III

Two-port networks and Parameters: Concept of one port, two-port networks, characteristics and parameters(impedance parameters, admittance parameters, transmission parameters and hybrid parameters), interrelationships of parameters, image & iterative impedance, concept of characteristic impedance, scattering parameters, insertion loss, interconnection of two-port networks, analysis of terminated two-port networks, extensions to multiport networks.

UNIT- IV

Network functions and Synthesis: Generalized network functions (Driving point and Transfer), concepts of poles and zeros, determination of free and forced response from poles and zeros, concept of minimum phase networks, analysis of ladder, lattice, T and bridged-T networks, Network synthesis-Synthesis problem formulation, properties of positive real functions, Hurwitz polynomials, properties of RC, LC and RL driving point functions, Foster and Cauer synthesis of LC and RC circuits.

REFERENCES:

1. M.E. Vanvalkenburg, "Network Analysis", PHI, 3rdEdition, 2014.
2. Franklin F. Kuo, "Network Analysis and Synthesis", 2ndEdition, Wiley India Ltd., 2006
3. S. P. Ghosh, A.K. Chakraborthy, "Network Analysis and Synthesis" McGraw Hill, 2010
4. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1988.
5. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", 9thEdition, McGraw Hill Education, 2018.

Course Articulation Matrix:															
Course/Course Code: Electrical Circuits and Networks (PCC-EE201-T),														Semester: III	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	3	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	2	1
CO3	3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	-	3	1

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

ELECTRONIC DEVICES AND CIRCUITS

General Course Information:

Course Code: **PC/EE/2-T** Course Credits: 3.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Outline semiconductors, diodes, transistors, operational amplifiers and digital circuits	**L1 (Remembering)**
CO2.	Explain about different power amplifier circuits, their design and use in electronics and communication circuits	**L2 (Understanding)**
CO3.	Demonstrate and interpret the working of analog and digital electronic devices and circuits	**L3 (Applying)**
CO4.	Distinguish between various logic families and their characteristics	**L4 (Analyzing)**
CO5.	Design and implement analog, combinational and sequential logic circuits applicable in various engineering problems	**L6 (Creating)**

***Revised Bloom's Taxonomy Action verbs/Levels**

Course Contents

UNIT-I

Diode and Transistor biasing circuits: P-N junction diode, I-V characteristics of a diode, Zener diodes, clamping and clipping circuits, Transistor biasing circuits: Base bias, Emitter-feedback bias, collector-feedback bias, Voltage divider bias, emitter bias, CE, CC and CB analysis, h-parameters, JFET: Gate bias, Self bias, Voltage-divider bias and source bias, current source bias, CS, CD and CG amplifier, MOSFET: Depletion type, Enhancement type and their biasing, Power Amplifiers: Class A, B, C, D and S power amplifiers, Push-pull operation.

UNIT-II

OP-AMP: Differential amplifier and its DC, AC analysis, OP-AMP characteristics, Non-Inverting/Inverting Voltage and Current feedback, Linear and Non-Linear OP-AMP circuits, Regulated power supplies**.**

Oscillators- Barkhausen criteria of oscillations, Wein-bridge, RC oscillator, 555 timer: its monostable and astable operation.

UNIT-III

Logic gates and Boolean Algebra: Logic gates, Universal gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic

Logic Families: transistor as a switching element, Tri-state switch, Bipolar logic Families: RTL, DTL, TTL, ECL, IIL, MOS Logic families: NMOS, CMOS families and characteristics, various logic functions and their implementation.

UNIT-IV

Combinational Circuits: Introduction to combinational circuits, arithmetic and logical operation, design of Half adder & full adder, subtractor circuits, decoders, multiplexers, demultiplexers, comparators, Sequential Circuits: Flip-flops, bistable circuits: RS, JK, D, T, Master/Slave Flip-flop, race around condition, latches, synchronous and asynchronous counters up & down counters, shift Registers.

REFERENCES:

1. J. Millman, C. Halkias and C. D. Parikh, "Integrated Electronics", McGraw Hill, 2nd edition 2017
2. R. Boylested and L. Nashelsky, "Electronics Devices and Circuit Theory", Pearson New International, 11th edition, 2013
3. J. Millman, C. Halkias and S. Jit, "Electronics Devices and Circuits", TMH 4th edition, 2015.
4. A. Malvino and D. Bates, "Electronic Principles", TMH 8th edition, 2016
5. D. Leach, A. Malvino, G. Saha, "Digital Principles and Applications", TMH education, 7th edition, 2010
6. C. H. Roth, L. L. Kinney, "Fundamentals of Logic Design", Cenegae learning, 7th edition, 2013
7. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 4th edition 2016.

Course Articulation Matrix:

Course/Course Code: Electronic Devices and Circuits (PCC-EE203-T), Semester: III

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	1	1	1	1
CO2	3	1	2	-	-	-	-	-	-	-	-	1	1	2	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1	1	1
CO4	2	1	1	-	-	-	-	-	-	-	-	1	1	1	1
CO5	3	2	3	-	-	-	-	-	-	-	-	1	1	1	1

Correlation level: 1- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ELECTRIC MACHINES-I

General Course Information:

Course Code: **PC/EE/3-T** Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Recall the basics of electric machines	**L1(Remembering)**
CO2.	Describe the performance of different types of electric machines.	**L2(Understanding)**
CO3.	Solve the problems related with electric machines.	**L3(Apply)**
CO4.	Compare the performance characteristics of electric machines.	**H1(Analysis)**
CO5.	Judge and use the machines on the basis of their utilization and performance.	**H2 (Evaluating)**

***Revised Bloom's Taxonomy Action verbs/Level**

Course Content

UNIT-I

Electromechanical Energy Conversion and Single Phase Transformer: Energy in a magnetic systems, field energy and mechanical force, energy in singly and multiply excited magnetic systems. Transformer construction, theory and operation, E.M.F. equation, Ideal and practical trans former, exact and approximate equivalent circuits, no load and on load operation, phasor diagrams, power and energy efficiency, open and short circuit tests, back to back test, voltage regulation, effect of load on power factor, Per Unit transformer values, excitation phenomenon in transformers, Auto transformers (construction, working & applications)

UNIT-II

Three Phase and Other Transformers: Constructional features of three phase transformers, Cooling methodology, parallel operation of single phase and three phase transformers, three phase transformer connections, phasor groups, three phase to two phase and six phase conversion. Three winding transformers and its equivalent circuit, Tap changing of transformers, tertiary winding, Applications. Variable frequency

transformer, voltage and current transformers, Grounding transformer, welding transformers, Pulse transformer and applications.

UNIT-III

DC Generators: Construction, working and types of dc generator, EMF equation, lap & wave winding, distributed & concentrated windings, armature reaction, commutation, interpoles and compensating windings, characteristics of dc generators, voltage build up, Parallel operation of DC generators, Applications.

UNIT-IV

D.C. Motors: Principles of working, Significance of back emf, Torque Equation, Types and Characteristics of DC Motors, Need of Starter, three point starter, four point starter, Speed Control (armature resistance, flux control, armature voltage, Thyristor), Ward-Leonard system, Swinburne's test, Hopkinson's test, braking of dc motor (regenerative, Dynamic, Plugging), Losses and Efficiency, Effect of saturation and armature reaction on losses; Applications.

REFERENCES:

1. I.J. Nagarath and D.P. Kothari, "Electric Machines", T.M.H. Publishing Co Ltd., New Delhi, 4th Edition 2010.
2. P.S. Bhimbra, 'Electrical Machinery', Khanna Publications.
3. J. B. Gupta., "Theory and Performance of Electrical Machines", Kataria and Sons, 14th edition 2009.
4. Fitzgerald Kingsley and Umans, "Electric Machinery" McGraw Hill Books co., New Delhi, 7th Edition, 2013.
5. A.S. Langsdorf, "Theory of AC Machinery", Tata McGraw Hill.
6. B. L. Thareja, "A Text Book of Electrical Technology", Volume II, S. Chand Publications.
7. Ashfaq Husain, "Electrical Machines", Dhanpat Rai Publications.

Course Articulation Matrix:

Course/Course Code: Electrical Machines-I (PCC-EE205-T)											Semester: III				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	3	-	1
CO2	2	2	-	2	-	-	-	-	-	-	-	1	2	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	1	2	3	1
CO4	2	-	2	2	-	-	-	-	-	-	-	1	2	1	-
CO5	2	-	-	2	-	1	-	-	-	-	-	1	2	-	2

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

GENERATION OF ELECTRIC POWER

General Course Information:

Course Code: **PC/EE/4-T** Course Credits: 4.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.	**L1(Remembering)**
CO2.	Summarize the working and layout of steam power plants and discuss about its economic and safety impacts.	**L2(Understanding)**
CO3.	Illustrate the working principle and basic components of the nuclear power plant, diesel engine and the economic and safety principles involved with it.	**L3(Apply)**
CO4.	Examine the mathematical and working principles of different electrical equipment's involved in the generation of power.	**L4(Analysis)**
CO5.	Evaluate the different power generating systems	**L5(Evaluating)**
CO6.	Construct the model on the applications basis of power plant	**L6(Creating)**

***Revised Bloom's Taxonomy Action verbs/Levels**

Course Content

UNIT- I

Load and loading forecasting: Load curves, maximum demand, load factor, diversity factor, capacity factor, utilization factor, types of loads, load forecasting.

Power plant economics: Choice of type of generation, size of generator and number of units, cost of electrical energy, depreciation of plant, effect of load factor on cost of electrical energy.

UNIT- II

Thermal power plants: Choice of site, main and auxiliary equipment fuel gas flow diagram, water stream flow diagram, working of power plants and their layout, characteristics of turbo generators.
Hydroelectric plants: Choice of site, classification of hydroelectric plants, main parts and working of plants and their layouts, characteristics of hydro electric generators.

UNIT- III

Nuclear power plants: Choice of site, classification of plants, main parts, layout and their working, associated problems.
Diesel power plants: Diesel plant equipment, diesel plant layout and its working, application of diesel plants.

UNIT- IV

Combined working of plants: Advantages of combined operation plant requirements for base load and peak load operation. Combined working of run off river plant and steam plant.
Tariffs and power factor improvement: Different types of tariffs and methods of power factor improvement.

REFERENCES:

1 P.K. Nag, “Power Plant Engineering”, Tata McGraw Hill.
2 F.T. Morse, “Power Plant Engineering”, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras.
3 Kothari & Nagrath, “Power System Engineering”, McGraw Hill.
4 Granger and Stevenson, “Power System Analysis”, McGraw Hill.
5 Electric Power Generation operation and control, Wood and Wollenberg, Willey.
6 R.K. Rajput, Power System Engineering, Laxmi Publication.

Course Articulation Matrix:

Course/Course Code: Generation of Electric Power (PCC-EE207-T),														Semester: III
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	-	-	-	1	-	-	-	-	1	2	-	-
CO2	3	-	3	-	-	2	-	-	-	-	-	1	1	-	-
CO3	3	-	1	-	-	3	-	-	-	-	-	1	3	-	-
CO4	3	3	1	-	-	-	-	-	-	-	-	1	2	2	-
CO5	2	-	-	-	-	1	3	-	-	-	-	1	2	1	-
CO6	3	-	3	1	-	-	-	-	-	-	-	1	2	1	-

Correlation level: 1- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

MATHEMATICS-III

General Course Information:

Course Code: **BSC/7-T** Course Credits: 3.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Define concepts and terminology of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing.	**L1(Remembering)**
CO2.	Solve problems using Fourier transforms in domains like digital electronics and image processing.	**L2 (Remembering)**
CO3.	Apply mathematical principles to solve computational problems	**L3(Apply)**
CO4.	Compare various probability distributions	**L4(Analysis)**
CO5.	Select suitable hypothesis testing methods for given problems and interpret the respective outcomes.	**L5(Evaluating)**
CO6.	Integrate the knowledge of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing for solving real world problems.	**L6(Creating)**

***Revised Bloom's Taxonomy Action verbs/Levels**

Course Content

UNIT- I

Fourier Series and Fourier Transforms: Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

UNIT-II

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac delta function.

Linear Programming Problem (LPP): Introduction, Formulation of linear programming problem (LPP); Graphical method for its solution; Standard form of LPP; Basic feasible solutions; Simplex Method and Dual Simplex Method for solving LPP.

UNIT-III

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions. Limit and Continuity of a function, Differentiability and Analyticity. Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions.

UNIT-IV

Complex integral, Cauchy Goursat theorem (without proof), Cauchy integral formula (without proof), Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi-circle only).

Text and Reference Books:

1. F. Kreyszig, Advanced Engineering Mathematics, 10th edition, Wiley, 2015.

2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th edition, 1965.

3. R. K. Jain, S.R.K. Iyenger. Advance Engineering. Mathematics, 4^{th} edition, Narosa Publishing House, 2012.

4. Michael D. Greenberg, Advanced Engineering Mathematics, 2^{nd} edition, Pearson Education, 2002.

5. Johnson and Miller Probability and statistics for Engineers, 8^{th} edition, Pearson Education India, 2015.

CO-PO Articulation Matrix

Course/Course Code: Mathematics-III (BSC201-T),												Semester: III			
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1: Define concepts and terminology of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing. **(LOTS L1: Remembering)**	1	-		-	-	-	-	-	-	-	-	0	2	2	2
CO2: Solve problems using Fourier transforms in domains like digital electronics and image processing. (**HOTS L2: Remembering)**	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO3: Apply mathematical principles to solve computational problems (**LOTS L3: Apply)**	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO4:Compare various probability distributions **(HOTS L4: Analyzing)**	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO5: Select suitable hypothesis testing method for given problems and interpret the respective outcomes.**(HOTS L5: Evaluating)**	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO6: Integrate the knowledge of Fourier series and Fourier transforms, Functions of complex variables, Power Series and, Probability distributions and hypothesis testing for solving real world problems. **(LOTS L6: Creating)**	3	3	2	3	-	-	-	-	-	-	-	-	2	2	3
Level of Attainments:															

Correlation level: 1- slight /Low **2-** Moderate/ Medium **3-** Substantial/High

INDIAN CONSITUTION

General Course Information:

Course Code: **MC/3-T** Course Credits: 0.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Content: Basic features and fundamental principles

1. Meaning of the Constitution law and Constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the fundamental duties and its legal status.
6. The directive principles of state policy- its importance and implementation.
7. Federal structure and distribution of legislative and financial power between the Union and the States.
8. Parliamentary form of government in India- the constitution power and status of the President of India.
9. Amendment of the constitutional powers and procedure.
10. The historical prospective of the constitutional amendments in India.
11. Emergency provisions: national emergency, President rule, financial emergency.
12. Local self-government: constitutional scheme in India.
13. Scheme of the fundamental rights of equality.
14. Scheme of the fundamental rights to certain freedom under Article 19.
15. Scope of the right to Life and personal liberty under Article 21.

Text and Reference Books:

1. M, Laxmikanth, Indian Polity for Civil Services Examination, 5th edition, McGraw Hill Education (India) Private Limited, 2017.

ELECTRONIC DEVICES AND CIRCUITS LABORATORY

General Course Information:

Course Code: **PC/EE/3-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination, the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Perform Experiments and acquire specific technical knowledge of operations of semiconductor devices and digital circuits.	**LOTS L3 (Applying)**
CO2.	Analyze various operations, characteristics and performance of various analog and digital devices.	**HOTS L4 (Analyzing)**
CO3.	Examine working of OP-AMP based amplifiers and arithmetic operational circuits.	**LOTS L3 (Applying)**
CO4.	Infer the applications of combinational and sequential circuits.	**HOTS L4 (Analyzing)**
CO5.	Organize reports based on experiments performed with effective demonstration and analysis of results.	**HOTS L4 (Analyzing)**
CO6.	Inculcate ethical practices while performing experiments individually and in groups.	**LOTS L3 (Applying)**

***Revised Bloom's Taxonomy Action verbs/Level**

LIST OF EXPERIMENTS:

1. To study and obtain the V-I characteristics of P-N Junction Diode and Zener Diode.
2. To study and obtain the characteristics of BJT (NPN, PNP).
3. To study and obtain the characteristics of JFET (N-channel, P-channel), MOSFET (N-channel, P-channel).
4. To observe the performance of Common emitter amplifier (b) Common base amplifier (c) common collector amplifiers
5. To obtain the characteristics of Wein-bridge, RC oscillator.
6. To study the following mathematical operations using Op-amps: -Addition (b) Subtraction (c) Multiplication (d) Division (e) Integration (f) Differentiation
7. To study the Op-amp as: a) stable multivibrator (b) Mono-stable multivibrator (c) Schmitt Trigger circuit
8. To study OP-AMP as non-inverting voltage amplifier, low pass filter, high-pass filter and band pass filter
9. To study NOT, AND, OR, NOR, XOR, XNOR gates.
10. To study and verify the truth table of R-S, D, J-K and T flip flop.
11. To study the operation of BCD to Decimal, BCD to Excess 3, BCD to Gey Code & BCD to 7 Segment and vice-versa.
12. To study the combinational circuit of half adder, full adder, subtractor, encoder, decoder, multiplexer, demultiplexer and 4-bit digital comparator.
13. To verify the operation of a 4 bit UP and DOWN counter, serial/parallel counter
14. To study the shift register SISO, SIPO, PISO, PIPO using shift register.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned course coordinator as per the scope of the syllabus.

CO-PO Articulation Matrix

Course/Course Code: Electronic Devices And Circuits Laboratory (PCC-EE203-P),															
												Semester: III			
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. Perform Experiments and acquire specific technical knowledge of operations of semiconductor devices and digital circuits. **(LOTS L3 :Applying)**	3	2		-	-	-	-	-	3	-	-	2	3	2	1
CO2. Analyze various operations, characteristics and performance of various analog and digital devices. (**HOTS L4: Analyzing)**	3	2		-	-	-	-	-	-	-	-	1	2	2	-
CO3. Examine working of OP-AMP based amplifiers and arithmetic operational circuits. **(LOTS L3: Applying)**	3	2		-	-	2	-	-	-	-	-	2	-	1	-
CO4. Infer the applications of combinational and sequential circuits. **(HOTS L4: Analyzing)**	3	3		-	-	-	-	-	-	-	2	3	-	1	-
CO5. Organize reports based on experiments performed with effective demonstration and analysis of results. **(HOTS L4: Analyzing)**	-	-		-	-	-	-	-	-	3	-	-	-	-	-
CO6. Inculcate ethical practices while performing experiments individually and in groups. **(LOTS L3: Applying)**	-	-		-	-	-	-	3	3	-	-	-	-	-	1
Level of Attainments:															

Correlation level: 1- slight /Low **2-** Moderate/ Medium **3-** Substantial/High

ELECTRICAL MACHINES-I LABORATORY

General Course Information

Course Code: **PC/EE/3-P** Course Credits: 1 Mode: Practical Type: Program Course Contact Hours: 4 hours/week. Examination Duration: 3 hours.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT*Level
CO1.	**Perform** experimental work to test and examine the performance of static and rotating electrical machines under different operating conditions.	**HOTS L4 (Analysis)**
CO2.	**Analyze** various performance characteristics with tabular and graphical representation of electric machines.	**HOTS L4 (Analysis)**
CO3.	**Compare** the performance of electrical machines with ratings on the basis of their utilization and efficiency.	**HOTS L5 (Evaluating)**
CO4.	**Design** electrical machine models for various engineering problems as per required specifications.	**HOTS L6 (Creating)**
CO5.	**Organize** reports based on experiments performed with effective demonstration and analysis of results.	**HOTS L4 (Analysis)**
CO6.	**Inculcate** ethical practices while performing experiments individually and in groups.	**LOTS L3 (Apply)**

***Revised Bloom's Taxonomy Action verbs/Level**

LIST OF EXPERIMENTS:

1. To find the turns ratio & polarity of a single phase transformer.
2. To perform the open & short circuit tests on a single phase transformer.
3. To perform Sumpner's Back to back test on single phase transformers.
4. To perform the parallel operation of two single phase transformers for load sharing.
5. To perform the various connections on three phase transformer.
6. To convert three phase to two phase by using Scott-connection
7. To perform load test on DC Shunt Generator and determine its performance characteristics.
8. To perform load test on DC Series Generator and determine its performance characteristics.
9. To obtain magnetization characteristics of separately excited DC Machine.
10. To obtain magnetization characteristics of self-excited DC Machine.
11. To perform speed control on a DC Shunt Motor using armature control and field control method.
12. To determine the efficiency of DC Shunt Motor using Swinburne's Test.
13. To determine the efficiency of a DC Machine using Hopkinson's Test.
14. To study and perform the field test on two identical D.C. series machines
15. To study the Ward Leonard method of speed control on DC Motor.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from the above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

CO-PO Articulation Matrix

Course/Course Code: Electrical Machines-I Laboratory (PCC-EE205-P), Semester: III															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. **Perform** experimental work to test and examine the performance of static and rotating electrical machines under different operating conditions. **(HOTS L4: Analysis)**	3	3	-	-	-	-	-	-	3	-	-	2	3	-	-
CO2. **Analyze** various performance characteristics with tabular and graphical representation of electric machines. **(HOTS L4: Analysis)**	3	2	-	2	-	-	-	-	-	-	-	1	3	-	-
CO3. **Compare** the performance of electrical machines with ratings on the basis of their utilization and efficiency. **(HOTS L5: Evaluating)**	3	2	-	2	1	-	-	-	-	-	-	-	3	-	-
CO4. **Design** electrical machine models for various engineering problems as per required specifications. **(HOTS L6: Creating)**	3	-	3	-	-	-	-	-	3	-	-	-	3	2	-
CO5. **Organize** reports based on experiments performed with effective demonstration and analysis of results. **(HOTS L4: Creating)**	-		-	-	-	-	-	-	-	3	-	-	-	-	-
CO6. **Inculcate** ethical practices while performing experiments individually and in groups. **(LOTS L3: Apply)**	-		-	-	-	-	-	3	3	-	-	-	-	-	2
Level of Attainments:															

Correlation level: 1- slight /Low 2- Moderate/ Medium 3- Substantial/High

ELECTRICAL WORKSHOP

General Course Information:

Course Code: **PC/EE/5-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week. Examination Duration: 03 hours**.**	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	**Experimental** work and acquire basic technical knowledge to solve the installation problems of domestic and industrial field.	**HOTS L4 (Analyzing)**
CO2.	**Demonstrate** the applications of the various electrical tools.	**LOTS L3 (Applying)**
CO3.	**Judge** the suitability of lighting devices, protective devices and earthing.	**HOTS L5 (Evaluating)**
CO4.	**Design** of various types of wiring systems and assembling of small transformers.	**HOTS L6 (Creating)**
CO5.	**Organize** reports based on experiments performed with effective demonstration and analysis of results.	**HOTS L4 (Analyzing)**
CO6.	**Inculcate** ethical practices while performing experiments individually and in groups.	**LOTS L3 (Applying)**

***Revised Bloom's Taxonomy Action verbs/Level**

LIST OF EXPERIMENTS:

1. To study the use of different types of tools, electrical material, symbols and its abbreviations for electrical engineering workshop laboratory.
2. To study different types of wiring & practices for staircase, corridor & godown wiring.
3. To study & perform fluorescent lamp, tube light, CFL, LED & its series and parallel Connections.
4 To study operation and working of Sodium Vapour Lamp.
5. To study operation and working of high-Pressure Mercury Vapour Lamp
6. To study various types of wires/ cables and practices of switches.
7. To study the importance of earthing and measurement of earth resistance.
8. Familiarization and repairing practice of home appliances such as: mixer machine, electric iron, fan motor, pump motor, battery etc.
9. To study the different fuses, SFU, MCB, ELCB, MCCB.
10. To study moving iron, moving coil, electrodynamics and induction type meter.
11. To study & calibrate single phase energy meters.
12. To study different types of transformers and assembling practices of transformers.
13. To study the design of solar system for small houses.
14. To study the design of SMPS circuit.
15. To perform Soldering and De-soldering operation on circuit.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from the above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

CO-PO Articulation Matrix

Course/Course Code: Electrical Workshop (PCC-EE209-P),										Semester: III					
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. **Experimental** work and acquire basic technical knowledge to solve the installation problems of domestic and industrial field. **(HOTS L4: Analyzing)**	3	2	-	-	-	-	-	-	3	-	-	-	2	-	-
CO2. **Demonstrate** the applications of the various electrical tools. **(LOTS L3: Applying)**	2	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CO3. **Judge** the suitability of lighting devices, protective devices and earthing. **(HOTS L5: Evaluating)**	1	-	-	-	-	-	-	-	-	-	-	1	1	1	-
CO4. **Design** of various types of wiring systems and assembling of small transformers. **(HOTS L6 : Creating)**	3	1	3	-	-	-	-	-	-	-	2	3	3	2	-
CO5. **Organize** reports based on experiments performed with effective demonstration and analysis of results. **(HOTS L4: Analyzing)**	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO6. **Inculcate** ethical practices while performing experiments individually and in groups. **(LOTS L3: Applying)**	-	-	-	-	-	-	-	3	3	-	-	-	-	-	1
Level of Attainments:															

Correlation level: 1- slight /Low 2- Moderate/ Medium 3- Substantial/High

Detailed Syllabus of

B.Tech.(EE)

4th Semester

B. Tech. 2nd Year

Semester-IV

Sr. No.	Course Codde	Course Title	Workload/ Credit			
			Theory	Tutorial	Practical	Total
1.	PC/EE/6-T	Power Electronics	3/3	0/0	0/0	3/3
2.	PC/EE/7-T	Electrical Machines-II	3/3	1/1	0/0	4/4
3.	PC/EE/8-T	Power Systems-I	3/3	1/1	0/0	4/4
4.	PC/EE/9-T	Fields and Waves	3/3	1/1	0/0	4/4
5.	PC/EE/10-T	Signals and Systems	3/3	0/0	0/0	3/3
6.	PC/EE/6-P	Power Electronics Laboratory	0/0	0/0	2/1	2/1
7.	PC/EE/7-P	Electrical Machines-II Laboratory	0/0	0/0	4/2	4/2
8.	PC/EE/8-P	Power Systems-I Laboratory	0/0	0/0	2/1	2/1
9.	*MC/4-T	Essence of Indian Traditional Knowledge	3/0	0/0	0/0	3/0
10.	*HSMC/2-T	Human Values and Personality Development	3/0	0/0	0/0	3/0
					Total Credits	**22**

*** - Non credit qualifying course. The assessment will be completely internal.**

Important Notes:

1. The students will have to undergo Practical Training-I for 4-6 weeks during summer vacations at the end of 4th semester which will be evaluated in 5th semester.
2. Students will be allowed to use non-programmable scientific calculators only, however, sharing of calculator should not be permitted.

POWER ELECTRONICS

General Course Information:

Course Code: **PC/EE/6-T** Course Credits: 3.0 Mode: Lecture (L) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Recall the fundamental of electronics devices and circuit	**L1(Remembering)**
CO2.	Describe various power semiconductor devices, passive components and switching circuits.	**L2(Understanding)**
CO3.	Deploy power converter circuits design and learn to select suitable power electronic devices by assessing the requirements of application fields.	**L3(Apply)**
CO4.	Compare, formulate and analyze a power electronic circuit design and assess the performance.	**L4(Analysis)**
CO5.	Estimate the critical areas for improvement in an industries and derive typical alternative solution.	**L5(Evaluating)**
CO6.	Design a suitable power converters to control Electrical Motors and other industry grade apparatus	**L6(Creating)**

***Revised Bloom's Taxonomy Action verbs/Levels**

Course Content

UNIT- I

Modern Power Electronics Devices: Introduction to power Electronics, hierarchical study, advantages and applications**,** Principle of operation of SCR, dynamic characteristic of SCR during turn ON and turn OFF, Two transistor analogy, Protection of SCR, Commutation circuits, SCR ratings, Triggering Methods, Series and Parallel operation of SCR.

UNIT- II

Single-phase Converter: Single-phase Half wave converter, Single-phase 2-pulse midpoint converter, Single-phase half controlled and fully controlled bridge full-wave thyristor converters with R-load and inductive load, input current and output voltage waveforms, Effect of load and source impedance, expressions for output voltage, Effect of free-wheeling diode, triggering circuits, Dual converter.

Three-phase Converter: Three Phase Half wave, full wave, half controlled and fully controlled bridge converters, Three-phase full-bridge thyristor rectifier with R-load and inductive load, Effect of load and source impedance, Expressions for output voltage, Dual Converter.

UNIT- III

Inverters: Classification, basic series and improved series inverter, parallel inverter, single phase and three phase voltage source inverter, 120 degree mode and 180 degree mode conduction schemes, modified McMurray half bridge and full bridge inverters, McMurray -Bedford half bridge and full bridge inverters, brief description of parallel and series inverters, current source inverter (CSI), transistor and MOSFET based inverters

UNIT- IV

AC Voltage Controllers& Regulators: Single phase and three phase ac voltage controllers with R, RL and RLE loads, Single phase two SCR's in anti-parallel with R and RL loads, Voltage control, Operation waveforms, Types of voltage regulator, equation of load current, output voltage equation, synchronous tap changer, three phase regulator.

Cyclo-converter: Principle of operation of cyclo-converter, non-circulating and circulating types of cyclo-converters. Waveforms, control technique**.**

REFERENCES:

1. M. Ramamoorthy, "Thyristor and their applications", East West Publication, 1991.
2. P.S. Bimbhra, "Power Electronics", Khanna Publishers, 2015.
3. MD Singh and KB Khanchandani, "Power Electronics", TMH Edition, 2007.
4. AK Gupta and LP Singh, "Power Electronics", Dhanpat Rai Publishing Co.
5. G.K. Dubey, S. R. Doradla, A. Joshi, and R. M. K. Sinha, "Thyristorised Power Controllers", New Age International Private Ltd.
6. Mohan N., Undeland T. M. and Robbins W. P., "Power Electronics Converters, Applications and Design", 3rd ED, Wiley India.

Course Articulation Matrix:

Course/Course Code: Power Electronics (PCC-EE202-T),													Semester: IV		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	1	1	-	-	-	-	1	1	-	-
CO2	3	-	-	-	-	1	-	-	-	-	-	1	1	-	-
CO3	2	-	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-	1	2	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	3	1	-
CO6	3	3	3	-	-	-	-	-	-	-	-	1	1	1	-

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ELECTRICAL MACHINES-II

General Course Information:

Course Code: **PC/EE/7-T** Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Recall the basics of electric machines	**L1(Remembering)**
CO2.	Illustrate the performance of different types of rotating electric machines.	**L2(Understanding)**
CO3.	Solve the problems related with rotating electric machines.	**L3(Apply)**
CO4.	Compare the performance characteristics of rotating electric machines.	**H1(Analysis)**
CO5.	Judge and use the rotating electric machines on the basis of their utilization and performance.	**H2 (Evaluating)**

***Revised Bloom's Taxonomy Action verbs/Level**

Course Content

UNIT-I

Poly Phase Induction Motors: Construction details of three-phase induction motor, Rotating magnetic field, principle of operation, slip, Induction motor as generalized transformer-Equivalent circuit, expression for torque, full load torque, maximum torque, starting torque and output power, torque-slip and torque-speed characteristics, no load and blocked rotor test, circle diagram, introduction to deep bar cage and double cage induction motor, starting of induction motors, speed control of induction motor, cogging &crawling, Applications.

UNIT-II

Synchronous Generators: Alternators: Construction features and types, EMF equation of alternators, armature reaction in alternators, Alternator on load, Synchronous reactance, Synchronous Impedance, Voltage regulation, Determination of voltage regulation using EMF, MMF methods, ZPF, Ampere Turn methods and

Potier Triangle, Synchronizing and parallel operation of alternators, Salient pole synchronous machine, two-reaction theory, slip test, Applications.

UNIT-III

Synchronous Motor: Principle of operation, Methods of starting, Torque and power equations, Synchronous motor on load, Synchronous motor on constant excitation variable load, Synchronous motor on constant load variable excitation, 'V' and inverted 'V' curves, Synchronous condenser, Hunting and its suppression, Behaviors of synchronous machine on short circuit, capability curves, Applications.

UNIT-IV

Single Phase Induction & Special Motors: Single Phase Induction Motor,Double revolving field theory,Stepper Motor, Brushless DC motor, Servomotors, Shaded Pole Motor, Reluctance Motor, Hysteresis Motor, Single Phase Series Motor, Repulsion Motor, Schrage Motor, Linear Induction Motor.

REFERENCES:

1. I.J. Nagarath and D.P. Kothari, "Electric Machines", T.M.H. Publishing Co Ltd., New Delhi, 4th Edition 2010.
2. P.S. Bhimbra, 'Electrical Machinery', Khanna Publications.
3. J. B. Gupta., "Theory and Performance of Electrical Machines", Kataria and Sons, 14th edition 2009.
4. Fitzgerald Kingsley and Umans, "Electric Machinery" McGraw Hill Books co., New Delhi, 7th Edition, 2013.
5. A.S. Langsdorf, "Theory of AC Machinery", Tata McGraw Hill.
6. B. L. Thareja, "A Text Book of Electrical Technology", Volume II, S. Chand Publications
7. P.S. Bhimbra, "Generalized Theory of Electrical Machines", Khanna Publications.
8. Ashfaq Husain, "Electrical Machines", Dhanpat Rai Publications.

Course Articulation Matrix:

Course/Course Code: Electrical Machines-II (PCC-EE204-T)												Semester: IV			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	3	-	1
CO2	2	2	-	2	-	-	-	-	-	-	-	1	2	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	1	2	3	1
CO4	2	-	2	2	-	-	-	-	-	-	-	1	2	1	-
CO5	2	-	-	2	-	1	-	-	-	-	-	1	2	-	2

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

POWER SYSTEMS - I

General Course Information:

Course Code: **PC/EE/8-T** Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Draw the single line diagram and model the power system components for power system analysis	**L1(Remembering)**
CO2.	Understand the major components of Transmission and Distribution Systems, its modeling and important parameters	**L2(Understanding)**
CO3.	Investigate the performance of transmission lines by calculating voltage regulation and efficiency	**L3(Applying)**
CO4.	Analyze the mechanical and electrical design aspects of transmission system	**L4(Analyzing)**
CO5.	Compare between different supply systems, Overhead transmission lines and underground cables and select the appropriate according to the need.	**L5(Evaluating)**

***Revised Bloom's Taxonomy Action verbs/Levels**

Course Content

UNIT- I

Basic Concepts: Importance of electric power, single line diagram of power system, Modeling of power system components, Per unit system, Symmetrical and unsymmetrical components, Representation of generators, lines and transformers in sequence networks, Growth of power systems in India, power supply networks: effect of voltage on conductor size, comparison of conductor volume in typical supply systems, elementary high voltage DC transmission DC transmission and its advantages and disadvantages.

UNIT- II

Transmission line parameters: Calculations of resistance, inductance, and capacitance for single phase, three phase single circuit and double circuit lines, skin and proximity effect.

Performance of lines: Classification of lines as short, medium and long, representation and detailed performance analysis of these lines including ABCD parameters, Surge Impedance loading, Ferranti's effect, Power flow through a transmission line and power circle diagrams

UNIT- III

Mechanical considerations: Various types of line conductors, line supports, poles and towers, sag calculations, effect of wind, ice and temperature, stringing chart, sag template, line vibrations.
Insulators: various types of insulator, voltage distribution, string efficiency, methods of increasing string efficiency.
Corona: Phenomenon of corona, disruptive critical voltage, visual critical voltage, corona loss, radio interference.

UNIT- IV

Underground cables: Classification and construction, insulation resistance, capacitance, capacitance determination, power factor in cables, capacitance grading, use of inter sheaths, losses, heat dissipation and temperature rise in cables, current rating, Faults in cables, comparison with overhead lines
Distribution Systems: components – feeders, distributers, service mains, connections schemes of distribution, Introduction to distributed generation

REFERENCES:

1. C. L. Wadhwa, "Electrical Power Sytems", New Age Internationals, 7th edition, 2016.
2. I. J. Nagrath and D. P. Kothari "Power System Engineering". McGraw-Hill, 3rd Ed., 2019.
3. A. Chakrabarty, P. V. Gupta, M. L. Soni and U. S. Bhatnagar , "A Course in Electrical Power" Dhanpat Rai Pub. Co.(P) Ltd., 2008.
4. J.B.Gupta , "Power Systems", S.K.Kataria and sons, 2013.
5. B.R.Gupta , "Power System Analysis and Design", S. Chand, 7th edition, 2014.
6. B.M.Weedy, "Electric power system", John Wiley and sons.
7. S. N. Singh, "Electric Power Generation, Transmission and Distribution", PHI, 2nd edition, 2008.
8. L. M. Fualkenberry, W. Coffer, "Electrical Power Distribution and Transmission", Pearson Education, 1996.
9. S. K. Gupta, " Power System Engineering", Umesh Publications, 2009.

Course Articulation Matrix:

Course/Course Code: Power Systems- I (PCC-EE206-T),												Semester: IV			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	2	-	1
CO3	3	3	3	2	-	-	-	-	-	-	-	1	2	2	-
CO4	3	1	1	2	-	1	-	-	-	-	-	1	3	2	1
CO5	3	2	1	1	-	-	-	-	-	-	-	1	3	2	2

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3-** Substantial/High

FIELDS AND WAVES

General Course Information:

Course Code: **PC/EE/9-T** Course Credits: 4.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 1 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Recall the basics of coordinates(2 D & 3D)	**L1(Remembering)**
CO2.	Describe the electromagnetic waves and theory.	**L2(Understanding)**
CO3.	Solve the problems related with electromagnetic waves and theory.	**L3(Apply)**
CO4.	Compare the performance of electromagnetic waves on the basis of different theories.	**H1(Analysis)**
CO5.	Judge the characteristics of electromagnetic waves and utilize them as per their requirements.	**H2 (Evaluating)**

***Revised Bloom's Taxonomy Action verbs/Level**

Course Content

UNIT-I

Introduction of Coordinates: Cartesian coordinates, cylindrical coordinates, spherical coordinates, Vector calculus: Differential length, area and volume, line surface and volume integrals and their significance, Del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stoke's theorem

UNIT-II

Electrostatics: Electrostatic fields, Field intensity, Electric flux density, Coulomb's Law, Electric field and potential due to point, line, plane and charge distribution, Gausses's Law and application, Electric field in material space: Properties of materials, conductors, dielectric constants, Effect of dielectric medium, continuity equation, boundary condition. Poisson's and Laplace's equations, Equipotential Surfaces, Uniqueness Theorem, capacitance, method of images.

UNIT-III

Magnetostatics: Magneto-static fields, Magnetic flux density, Magnetic field Intensity, Biot-Savart's Law, Ampere's circuit law ,Faraday Law of Induction, application of ampere's law, - Maxwell's equation, Maxwell's equation for static fields, for harmonically varying fields, for free space, magnetic vector potential. Lorentz Force, magnetization in materials, magnetic boundary conditions, Self and mutual inductances, Relation between E and H.

UNIT-IV

Electromagnetic Waves: Polarization, Reflection of plane wave for perfect conductor, perfect dielectric at normal incidence as well as oblique incidence, Electromagnetic wave propagation, Depth of Penetration, Brewester's Angle Poynting Theorem and interpretation of Poynting vector.

Transmission lines: Transmission line parameters, Transmission line equations, input impedance, Characteristic Impedance, Reflection Coefficient, Standing wave ratio, Smith chart and its application.

REFERENCES:

1. M. N. O. Sadiku, "Elements of Electromagnetic", 4th Ed, Oxford University Press.
2. K.D. Prasad, "Electromagnetic Fields and Waves", Satya Prakashan, New Delhi.
3. Balmein and Jordan, "Electromagnetic Waves and Radiating System", PHI Publication.
4. W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th edition TMH Publications.
5. R. Gowri, "Electromagnetic Field and Waves", Katson Publications.
6. J.D.F. Krauss, "Electromagnetics", McGraw Hill Publications.

Course Articulation Matrix:

Course/Course Code: Fields and Waves (PCC-EE208-T)															Semester: IV
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	3	-	-	-	-	-	-	-	2	1	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO3	1	2	2	3	-	-	-	-	-	-	-	1	-	1	1
CO4	1	2	1	2	-	-	-	-	-	-	-	1	-	1	-
CO5	1	3	-	1	-	-	-	-	-	-	-	1	-	1	-

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

SIGNALS AND SYSTEMS

General Course Information:

Course Code: **PC/EE/10-T** Course Credits: 3.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes:

Sr.No.	Course Outcomes At the end of the semester, students will be able to:	RBT* Level
CO 1	Describe various signals and their behaviour involved in processing.	**L1 (Remembering)**
CO 2	Classify different systems used for signal processing and operation and Conceptualize the effects of sampling a CT signal	**L2 (Understanding)**
CO 3	Demonstrate the Conversion of signals in analog domain to digital domain using various transforms	**L3 (Applying)**
CO 4	Analyze CT and DT systems using Laplace transforms and Z-Transforms.	**L4(Analyzing)**
CO 5	Modeling different systems with detailed analysis of LTI systems according to different types of applications	**L6 (Creating)**

***Revised Bloom's Taxonomy Action verbs/Levels**

Course Content

UNIT-I

Introduction to Signals: Signal Definition, Classification of Signals, Basic/Singularity Continuous and Discrete-Time Signals, Basic operations: Time Shifting, Time Reversal, Time Scaling on signals, Signal representation in terms of singular functions, Correlation of Signals and its Properties, Representation of a Continuous-Time Signal by its Samples: The Sampling Theorem, Reconstruction, Aliasing.

UNIT-II

Types of Systems: System, classification of Systems: Linear & Nonlinear Systems; Static & Dynamic Systems, Causal & Non-causal System, Invertible & Noninvertible, Stable & Unstable System, Time variant & Time Invariant Systems with examples.

Linear Time-Invariant Systems: Definition and Properties, Impulse Response, Convolution Sum/Integral and its Properties, Representation of LTI systems using Differential and Difference equations.

UNIT- III

Fourier Series & Fourier Transform: Introduction to Frequency domain Representation, Fourier Series Representation of Periodic Signals, Convergence of Fourier Series, Properties of Fourier Series, Fourier Transform for periodic and aperiodic signals, Convergence of Fourier Transform, Properties of Fourier Transform, Applications of Fourier Transform.

Discrete-Time Fourier Transform: Fourier Transform representation for Discrete –Time Aperiodic & Periodic Signals, Properties of Discrete-Time Fourier Transform, Basic Fourier Transform Pairs**.**

UNIT-IV

Laplace Transform: Introduction to Laplace transform, Region of convergence**(**ROC**)**, relation with Fourier transform, Properties, Inverse of Laplace transform, Application to LTI systems, their interconnections and block diagram

Z-Transform: Introduction to Z-Transform, Region of convergence (ROC), Z-Transform Properties, Inverse Z-Transform, Analysis of LTI Systems using Z-Transform, Application of Z- transform, Introduction to Hilbert Transform.

REFERENCES:

1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab "Signals & Systems", Prentice –Hall India.
2. T. K. Rawat, "Signal & Systems", Oxford University Press.
3. S. Salivahanan, A. Vallavraj, C. Gnanapriya, "Digital Signal Processing", Tata McGraw Hill.
4. A. Papoulis, "Circuits and Systems: A Modern Approach", Oxford Univ. Press.
5. B. Kumar, "Signals and Systems", New Age International Publishers.
6. H. P. Hsu, "Signals and Systems", Schaum's Outlines, TMH
7. Fred J. Taylor, "Principles of Signals and System"s, TMH
8. S. Haykins and B.V. Veen, "Signals and Systems", Wiley

Course Articulation Matrix:

Course/Course Code: Signals and Systems (PCC-EE210-T),												Semester: IV			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	-	2	2	-	-	-	-	-	-	-	1	2	2	-
CO4	3	-	-	2	2	-	-	-	-	-	-	1	2	2	-
CO5	3	-	2	-	2	-	-	-	-	-	-	1	2	-	1

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

General Course Information:

Course Code: **MC/4-T** Course Credits: 0.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: 3 hours	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

About the Course and its Outcomes:

This course is designed to acquaint the students with Indian Knowledge traditions. It introduces the students to Vedic Period, Post-Vedic period, Sufi and Bhakti Movement in India and social reform movements of 19th Century.

Course outcomes:

Sr.No.	Course Outcomes At the end of the semester, students will be able to:	RBT* Level
CO 1	Recognize the forms and sources of Indian Traditional Knowledge	**L1 (Remembering)**
CO 2	Identify the contribution of great ancient Indian Scientists and spiritual leaders to the World of Knowledge	**L2 (Understanding)**
CO 3	Apply the reasoning based on the objectivity and contextual knowledge to address the social and cultural issues prevalent in the Indian Society.	**L3 (Applying)**
CO 4	Differentiate the myths, superstitions form the reality in context of traditional knowledge to protect the physical and social environment.	**L4(Analyzing)**
CO 5	Suggest means of creating just a fair and social environment that is free from any prejudices and intolerance for different opinions and cultures.	**L5 (Evaluating)**

Course Content

UNIT-I

Introduction to Indian Traditional Knowledge: Definition traditional knowledge, forms, resources and dissemination of traditional knowledge.

Vedic Period: Vedas and Upnishads, Yogsutras of Patanjali.

Post Vedic Period: Budhism, Jainism and Indian Materialism, Charvak Schools of Thoughts.

UNIT-II

Sufi and Bhakti Movement (14th to 17th Century):सगुण-निर्गुण भक्ति, Sufism and Sufi Saints, Sant Kabir Ji, Guru Nanak Dev Ji and Guru Jambheshwar Ji Maharaj, composite cultural of Indian sub-continent.

UNIT- III

Jyotirao Phule and Savitri Bai Phule & Other 19th Century Social Reform Movements: India's Cultural Heritage.

UNIT-IV

India's Contribution to the World of Knowledge:प्राचीन भारत के महान विज्ञानिक, बोधायन, चरक,कोमारभरित्य, जीवन,सुश्रुत, आर्यभट्ट, बारहमिहिर,ब्रह्मगुप्त, नागार्जुन,वाग्भट्ट, Astrology and Astronomy, Myths and Realities.

TEXT AND REFERENCES BOOKS:

1. A.L. Bansham, The Wonder That was India, A Survey of the culture of the, Indian Sub-Continent before, the Coming of the Muslims, Vol 1, Groove Press, New York,1959.
2. S. A.A Rizvi, Wonder That was India, A survey of the history and culture of the Indian sub-continent from the coming of the Muslims to the British conquest 1200-1700, Vol-II, Rupa and Co.2001.
3. Jambhavani Mool Sanjivini Vyakhya
4. प्रतियोगिता दर्पण अतिरिक्तांक सीरीज–5 भारतीय कला एवं संस्कृति
5. B. V. Subbarayappa, *A Historical Perspective: Science in India:*, Rupa Publications, New Delhi 2013.
6. Bishnoi, K.R. and N.R. Bishnoi (eds). Religion and Environment. Vol. II, New Delhi: Arihant Prakashan Pvt. Ltd., 2002.

Course Articulation Matrix:

Course/Course Code: Essence of Indian Traditional Knowledge (MC104-T),											Semester: IV	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	1
CO2	-	2	1	-	-	-	-	-	-	-	-	1
CO3	-	3	3	2	-	3	-	-	-	-	-	3
CO4	-	2	3	3	-	3	1	-	-	-	-	3
CO5	-	3	3	3	-	3	-	-	-	-	-	3

Correlation level: **1**- Slight /Low **2-** Moderate/ Medium **3**- Substantial/High

HUMAN VALUES AND PERSONALITY DEVELOPMENT

General Course Information:

Course Code: **HSMC/2-T** Course Credits: 0.0 Mode: Lecture (L) and Tutorial (T) Type: Program Core Teaching Schedule L T P: 3 0 0 Examination Duration: **Internal Examination**	**Course Assessment Methods: Total Marks: 100** **(Internal Examination only)** The internal assessment of 30 marks will be on the minor tests, class attendance, assignments, and class performance. Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The assessment of 70 marks will be at the end of Semester through Interview/ VIVA-VOCE only by a committee of Two Faculty Members including course coordinator and a faculty member appointed by Chairperson/Head of concerned Department.

Pre-Requisites: None

About the Course and its Outcomes:

The course is designed to develop the Holistic perspective based on self-exploration and co-existence in society and nature. The focus is on to understand the harmony and being in harmony with the society and the environment around us. The students will nurture a habit of self-reflection and courage to act. This course includes the practice sessions to discuss natural acceptance in human-being as the innate acceptance for living with the responsibility (living in relationship, harmony and co-existence) rather than an arbitrariness in choice based on liking-disliking).

Course outcomes:

Sr. No.	Course Outcomes At the end of the semester, students will be able to:
CO 1	Exhibit awareness about oneself, one's surroundings and goals in one's life.
CO 2	Stay in harmony with society and nature.
CO 3	Develop healthy and harmonious relationships.
CO 4	Understand groups and develop team spirit
CO 5	Manage stress effectively.
CO6	Exhibit leadership qualities.
CO7	Excel in Personal and Professional Life.

Course Content

UNIT-I

Understanding the Concept of self exploration of self with JOHARI – Window. Self –Esteem, Characteristics of individuals with low and high Self- Esteem. Self Confidence, Strategies of Building Self- Confidence.

Personality: Definition, Types and Traits; Relevance and importance of nature and nurture in the development of the personality.

UNIT-II

Nature of Socialization: Socialization process, contributing to the society and nation.
Importance of discipline and hard work, Ecological responsibility of Engineers.
Professional Ethics: Competence in Professional values and ethics.
Personal and Professional Excellence: Identifying long-term choices and goals.

UNIT- III

Meaning and nature of teams, External and internal factors affecting team building.
Leadership Meaning, Nature and Functions, leadership styles in organization.
Meaning and nature of stress, causes, effects and management.

UNIT-IV

Meaning and importance of human rights, Human rights awareness.
Harmony in nature, understanding co-existence, harmony at all levels of existence.
Understanding the concept of happiness and well – being. Role and importance of positive emotions: Gratitude, hope and optimism.

TEXT AND REFERENCES BOOKS:

1. Bates, A.P. and Julian, J.: Sociology – Understanding Social Behaviour.
2. Dressler, David and Cans, Donald: The Study of Human Interaction.
3. Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
4. Organizational Behaviour, Davis K.
5. Hoover, Judhith D. Effective small group and Team Communication, 2001, Harcourt College Publishers.
6. Dick, McCann and Margerison, Charles: Team Management , 1992 Edition, via books.
7. Pestonjee, D.M.; Stress and Coping: the Indian Experience
8. Clegg, Britain; Instant Stress Management – Bring calm to your life now.

POWER ELECTRONICS LABORATORY

General Course Information:

Course Code: **PC/EE/6-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	**Experimental** work and acquire thorough knowledge of various power converters for electric drives control applications.	**HOTS L4 (Analyzing)**
CO2.	**Analyze** the performance characteristics of power electronics devices.	**HOTS L4 Analyzing**
CO3.	**Judge** the suitability of power converter for speed control of various rotating electrical machines.	**HOTS L5 (Evaluating)**
CO4.	**Demonstrate** operation of various power inverters and rectifiers with different Load conditions.	**LOTS L3 (Applying)**
CO5.	**Organize** reports based on experiments performed with effective demonstration and analysis of results.	**HOTS L6 (Creating)**
CO6.	**Inculcate** ethical practices while performing experiments individually and in groups.	**LOTS L3 (Applying)**

***Revised Bloom's Taxonomy Action verbs/Level**

LIST OF EXPERIMENTS:

1. To study performance and draw the V-I characteristics of Silicon Controlled Rectifier.
2. To study performance and draw the V-I characteristics of TRIAC.
3. **(a)**To study operation and performance of various types of Firing Circuits of turning on of a Silicon Controlled Rectifier.
   (b) To study operation and performance of various types of Commutation techniques of commutating/ turning off of a Silicon Controlled Rectifier.
4. To study the light intensity control using SCR and TRIAC and understand the operation of control of intensity of light.
5. To obtain and plot the output (Voltage & Current) wave form of single-phase half-wave & full-wave uncontrolled rectifiers for R and R-L load.
6. To analyse and plot the output wave form of single-phase half-controlled and fully-controlled full-wave rectifier for R and R-L load.
7. To analyse the performance characteristics of three-phase half controlled & fully controlled bridge converters for R load and sketch its output wave form.
8. To observe and analyse the output (Voltage & Current) wave form of Three-phase six pulses fully controlled rectifier feeding R and RL loads.
9. To study performance and operation of single-phase Dual Converters.
10. To study performance and operation of single-phase AC voltage regulators for R and R-L load.
11. To study performance and operation of single-phase Bridge inverter.
12. **(a)**To study performance and operation of single-phase Series inverter.
    (b) To study performance and operation of single-phase Parallel inverter.
13. .To study performance and operation of single phase AC voltage regulators for R and R-L load.

14. To study performance and operation of Single-phase PWM inverters using IGBT.
15. To sketch the output (Voltage & Current) wave form of a single phase cycloconverter.
16. To study performance and operation of three phase cyclo-converter.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from the above list. Remaining experiments may either be performed from the above list or designed & set by the concerned course coordinator as per the scope of the syllabus.

CO-PO Articulation Matrix

Course/Course Code: Power Electronics Laboratory (PCC-EE202-P),										Semester: IV					
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. **Experimental** work and acquire thorough knowledge of various power converters for electric drives control applications. **(HOTS L4: Analyzing)**	3	-	-	2	-	-	-	-	3	-	-	2	3	2	-
CO2. **Analyze** the performance characteristics of power electronics devices. **(HOTS L4: Analyzing)**	3	-	1	2	-	-	-	-	-	-	-	2	3	-	-
CO3. **Judge** the suitability of power converter for speed control of various rotating electrical machines. **(HOTS L5: Evaluating)**	3	-	1	-	-	-	-	-	-	-	-	2	3	1	-
CO4. **Demonstrate** operation of various power inverters and rectifiers with different Load conditions. **(HOTS L6: Creating)**	2	-	1	-	-	-	-	-	-	-	-	2	3	2	-
CO5. **Organize** the basic requirements reports based on experiments for the controlling of electric drive. **(HOTS L6: Creating)**	-	-	-	-	-	-	-	-	-	3	-	-	1	-	-
CO6. **Inculcate** ethical practices while performing experiments individually and in groups. **(LOTS L3:Applying)**	-	-	-	-	-	-	-	3	3	-	-	-	-	-	1
Level of Attainments:															

Correlation level: 1- slight /Low 2- Moderate/ Medium 3- Substantial/High

ELECTRICAL MACHINES-II LABORATORY

General Course Information:

Course Code: **PC/EE/7-P** Course Credits: 1 Mode: Practical Type: Program Course Contact Hours: 4 hours/week. Examination Duration: 3 hours.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Perform experimental work to test and examine the performance of static and rotating electrical machines under different operating conditions.	HOTS L4 (Analysis)
CO2.	Analyze various performance characteristics with tabular and graphical representation of electric machines.	HOTS L4 (Analysis)
CO3.	Compare the performance of electrical machines with ratings on the basis of their utilization and efficiency.	HOTS L5 (Evaluating)
CO4.	Design machine models for various engineering problems as per required specifications.	HOTS L6 (Creating)
CO5.	Organize reports based on experiments performed with effective demonstration and analysis of results.	HOTS L4 (Analysis)
CO6.	Inculcate ethical practices while performing experiments individually and in groups.	LOTS L3 (Apply)

***Revised Bloom's Taxonomy Action verbs/Level**

LIST OF EXPERIMENTS:

1. To conduct starting and reversing the direction of rotation for 1-Phase and 3-Phase induction motor.
2. To conduct the load test to determine the performance characteristics of three phase induction motor.
3. To perform Load test on a 3-phase induction motor & DC generator set and to determine the efficiency of induction motor.
4. To perform light running and block rotor test to determine the parameters of the equivalent circuit of single phase induction motor.
5. To perform the open circuit test and block rotor test on three phase induction motor, draw the circle diagram and find out the rotor resistance.
6. To calculate the voltage regulation of three phase alternator by using synchronous impedance method:-
    - **a.** Conduct open and short circuit test.
    - **b.** Determine and plot variation of synchronous impedance with field current.
    - **c.** Determine synchronous reactance.
    - **d.** Determine voltage regulation for lagging, leading and unity power factors.
7. To plot the V-Curves of a synchronous machine.
    - **a.** Determination of Zero Sequence reactance of a synchronous machine.
    - **b.** Measurement of direct and quadrature axis reactance.
8. To measure negative sequence reactance of synchronous machine.
9. To calculate voltage regulation of synchronous machine by Zero Power Factor method.
10. To study the parallel operation of synchronous generators for load sharing.
11. To perform the synchronization for the parallel operations of alternators.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

CO-PO Articulation Matrix

Course/Course Code: Electrical Machines-II Laboratory (PCC-EE204-P), Semester: IV															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. **Perform** experimental work to test and examine the performance of static and rotating electrical machines under different operating conditions. **(HOTS: L4 Analysis)**	3	3	-	-	-	-	-	-	3	-	-	2	3	-	-
CO2. **Analyze** various performance characteristics with tabular and graphical representation of electric machines. **(HOTS: L4 Analysis)**	3	2	-	2	-	-	-	-	-	-	-	1	3	-	-
CO3. **Compare** the performance of electrical machines with ratings on the basis of their utilization and efficiency. **(HOTS: L5 Evaluating)**	3	2	-	2	-	-	-	-	-	-	-	1	3	-	-
CO4. **Design** machine models for various engineering problems as per required specifications. **(HOTS: L6 Creating)**	3	2	3	-	-	-	-	-	3	-	-	-	3	2	-
CO5. **Organize** reports based on experiments performed with effective demonstration and analysis of results. **(HOTS: L 4 Analysis)**	-		-	-	-	-	-	-	-	3	-	-	-	-	-
CO6. **Inculcate** ethical practices while performing experiments individually and in groups. **(LOTS: L3 Apply)**	-		-	-	-	-	-	3	3	-	-	-	-	-	2
Level of Attainments:															

Correlation level: **1**- slight /Low **2-** Moderate/ Medium **3-** Substantial/High

POWER SYSTEMS - I LABORATORY

General Course Information:

Course Code: **PC/EE/8-P** Course Credits: 1 Mode: Practical Type: Program Core Contact Hours: 2 hours per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 50; External: 50)** Internal continuous assessment of 50 marks by course coordinator as per the course assessment method (Annexure I). For the end semester practical examination the assessment will be done out of 50 marks by the external and internal examiners as per the course assessment method (Annexure I).

Course Outcomes:

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	**Perform** Experimental work and acquire sound technical knowledge to solve field problems of Power Systems- transmission & distribution	**HOTS L4 (Analyzing)**
CO2.	**Analyse** parameters, characteristics and performance of the given transmission line model	**HOTS L4 (Analyzing)**
CO3.	**Judge** the suitability of cables and insulating materials in various practical applications.	**LOTS L3 (Applying)**
CO4.	**Modelling** of 3 winding transformer and synchronous machines by determining the sequence impedances	**HOTS L6 (Creating)**
CO5.	**Organize** reports based on experiments performed with effective demonstration and analysis of results.	**HOTS L4 (Analyzing)**
CO6.	**Inculcate** ethical practices while performing experiments individually and in groups.	**LOTS L3 (Applying)**

***Revised Bloom's Taxonomy Action verbs/Level**

LIST OF EXPERIMENTS:

1. To draw and illustrate single line diagram of distribution system of nearby area.
2. To study the operation of short, medium and long transmission line.
3. To plot power angle characteristics of transmission line.
4. To find ABCD Parameters of a model of loaded transmission line.
5. To find efficiency and voltage regulation of transmission line
6. To observe Ferranti effect in a model of transmission line.
7. To determine positive, negative and zero sequence impedances of a 3 winding transformer.
8. To determine sequence impedances of a cylindrical rotor Synchronous Machine.
9. To measure the dielectric strength of transformer oil.
10. To study and compare different types of power cables and methods of laying underground cables
11. To Study different types of Insulators and find string efficiency of string insulator:
    - **a.** Without guard ring
    - **b.** With guard ring.
12. To locate cable fault using cable fault locator.
13. To Study the performance of wind turbine generator system under variable load, wind speed and pitch angle.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned course coordinator as per the scope of the syllabus.

CO-PO Articulation Matrix

Course/Course Code: Power Systems- I Laboratory (PCC-EE206-P),															
List of Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. **Perform** Experimental work and acquire sound technical knowledge to solve field problems of Power Systems- transmission & distribution **(HOTS L4: Analyzing)**	3	1	-	-	-	-	-	-	3	-	-	2	3	2	1
CO2. **Analyze** parameters, characteristics and performance of the given transmission line model **(LOTS L3:Applying)**	3	2	-	2	-	-	-	-	-	-	-	1	3	-	-
CO3. **Judge** the suitability of cables and insulating materials in various practical applications. **(LOTS L3:Applying)**	3	-	1	-	-	-	-	-	-	-	-	1	3	-	-
CO4. **Modeling** of 3 winding transformer and synchronous machines by determining the sequence impedances **(HOTS L6: Creating)**	3	2	2	1	-	-	-	-	-	-	-	1	3	2	-
CO5. **Organize** reports based on experiments performed with effective demonstration and analysis of results. **(HOTS L4: Analyzing)**	-	-	-	-	-	-	-	-	-	3	-	-	-	-	2
CO6. **Inculcate** ethical practices while performing experiments individually and in groups. **(LOTS L3:Applying)**	-	-	-	-	-	-	-	3	3	-	-	-	-	-	1
Level of Attainments:															

Correlation level: **1**- slight /Low **2-** Moderate/ Medium **3**- Substantial/High

Annexure - I

Course Assessment Methods (Internal: 50; External: 50)

The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed.

There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations.

The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students.

The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the Performa (attached herewith as Annexure II and III) to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Annexure - II

Chaudhary Devi Lal University
Sirsa, Haryana (India) – NAAC Accredited Univesity
(Established by the State Legislature Act 9 of 2003)

CHUADHARY DEVI LAL UNIVERSITY, SIRSA

Internal Laboratory Course Evaluation Performa

Minor Laboratory Course Evaluation-I (MLE-I) / Minor Laboratory Course Evaluation-II (MLE-II)

Name of the Programme :
Semester :
Nomenclature of the Course :
Course Code :

SR. No.	Roll. No.	Conduct of Experiments and /or Written work	(VIVA-VOCE) based on laboratory Course Outcomes (CO-2 to CO-4)			Laboratory Record/ Reports/ File	Class Performance (Attendance/Ethical practices followed, Self-Learning and Team Spirit)	Total Marks
		CO-1 (15)	CO-2 (5)	CO-3 (5)	CO-4 (5)	CO-5 (10)	CO-6 (10)	50

Total No. of Students:	Present:	Absent

Name of the Course Coordinator	Signature of the Course Coordinator

Annexure - III

Chaudhary Devi Lal University
Sirsa, Haryana (India) – NAAC Accredited Univesity
(Established by the State Legislature Act 9 of 2003)

CHUADHARY DEVI LAL UNIVERSITY, SIRSA

External Laboratory Course Evaluation Performa

Name of the Programme:
Semester:
Nomenclature of the Course:
Course Code:

SR. No.	Roll. No.	Conduct of Experiment(s)	VIVA-VOCE	Written Work	Total Marks (50)
		CO1, CO6 (20)	CO2-CO4 (15)	CO5 (15)	

Total No. of Students:	Present:	Absent:
Signature of the Internal Examiner Name of the Internal Examiner	Signature of the External Examiner Name of the External Examiner	