DEPARTMENT OF ELECTRICAL ENGINEERING

Syllabus Scheme for Batch 2018 onwards (3rd - 8th semester)

BACHELOR OF TECHNOLOGY IN ELECTRICAL ENGINEERING

SEMESTER - 3RD											
S. No.	Course Type	Course Code	Course Title	Subject Type	Hours per week			Internal Marks	External Marks	Total	Credits
					L	T	P				
1.	Basic Science	BSEE-101	Engineering Mathematics-III (Probability and Statistics)	Theory	3	0	0	40	60	100	3
2.	Humanities/ Social Sciences/ Management	HSMEE-101	Education, Technology and Society	Theory	3	0	0	40	60	100	3
3.	Professional Core	PCEE-101	Electrical Circuit Analysis	Theory	3	1	0	40	60	100	4
4.	Professional Core	PCEE-102	Analog Electronics	Theory	3	1	0	40	60	100	4
5.	Professional Core	PCEE-103	Electrical Machines-I (Transformer & DC Machines)	Theory	3	1	0	40	60	100	4
6.	Professional Core	PCEE-104	Electromagnetic Fields	Theory	3	0	0	40	60	100	3
7.	Professional Core	LPCEE-101	Analog Electronics Laboratory	Practical	0	0	2	30	20	50	1
8.	Professional Core	LPCEE-102	Electrical Machines Laboratory-I	Practical	0	0	2	30	20	50	1
9.	Training*	TR-101	Training-I	Practical	-	-	-	60	40	100	1
TOTAL					**18**	**3**	**4+1#**	**360**	**440**	**800**	**24**

NOTE:

* Institutional/Industrial Training of Four weeks shall be held in summer vacation after 2nd semester and marks/credit shall be awarded in 3rd semester itself.

\# There will be one period per week for Mentoring and Professional Development, final evaluation of this course will be done based on the combined assessment of Odd and Even semester of respective year of study

SEMESTER - 4TH											
S. No.	**Course Type**	**Course Code**	**Course Title**	**Subject Type**	**Hours per week**			**Internal Marks**	**External Marks**	**Total**	**Credits**
					L	**T**	**P**				
1.	Professional Core	PCEE-105	Digital Electronics	Theory	3	1	0	40	60	100	4
2.	Professional Core	PCEE-106	Electrical Machines-II (Asynchronous & Synchronous Machines)	Theory	3	1	0	40	60	100	4
3.	Professional Core	PCEE-107	Power Electronics	Theory	3	1	0	40	60	100	4
4.	Professional Core	PCEE-108	Signals and Systems	Theory	3	1	0	40	60	100	4
5.	Professional Core	LPCEE-103	Digital Electronics Laboratory	Practical	0	0	2	30	20	50	1
6.	Professional Core	LPCEE-104	Electrical Machines Laboratory-II	Practical	0	0	2	30	20	50	1
7.	Professional Core	LPCEE-105	Power Electronics Laboratory	Practical	0	0	2	30	20	50	1
8.	Seminar	PREE-101	Seminar and Technical Report Writing	Practical	0	0	2	50	0	50	1
9.	Mandatory Course$	MCEE-101	Environmental Science	Theory	2	0	0	50	0	50	S/US
10.	Mentoring	MPD-102	Mentoring & Professional Development	Practical	0	0	1	100	0	100	1
TOTAL					**14**	**4**	**9**	**450**	**300**	**750**	**21**

NOTE:

$ Marks of non-credit courses are excluded from total and minimum 40% score required to pass.

SEMESTER - 5TH											
S. No.	**Course Type**	**Course Code**	**Course Title**	**Subject Type**	**Hours per week**			**Internal Marks**	**External Marks**	**Total**	**Credits**
					L	**T**	**P**				
1.	Professional Core	PCEE-109	Power Systems – I (Apparatus & Modelling)	Theory	3	1	0	40	60	100	4
2.	Professional Core	PCEE-110	Control Systems	Theory	3	1	0	40	60	100	4
3.	Professional Core	PCEE-111	Microprocessors & Microcontrollers	Theory	3	1	0	40	60	100	4
4.	Professional Core	PCEE-112	Measurements and Instrumentation	Theory	3	1	0	40	60	100	4
5.	Professional Core	PCEE-113	Electric Generation and Economics	Theory	3	1	0	40	60	100	4
6.	Professional Core	LPCEE-106	Power Systems Laboratory-I	Practical	0	0	2	30	20	50	1
7.	Professional Core	LPCEE-107	Control Systems Laboratory	Practical	0	0	2	30	20	50	1
8.	Professional Core	LPCEE-108	Microprocessors & Microcontrollers Laboratory	Practical	0	0	2	30	20	50	1
9.	Training*	TR-102	Training-II	Practical	-	-	-	60	40	100	1
10.	Mandatory Course$	MCI-102	Constitution of India	Theory	2	0	0	50	0	50	S/US
TOTAL					**17**	**5**	**6+1#**	**400**	**400**	**800**	**24**

NOTE:

* Industrial/Institutional Training of Four weeks shall be held in summer vacation after 4th semester and marks/credit shall be awarded in 5th semester itself.

$ Marks of non-credit courses are excluded from total and minimum 40% score required to pass.

There will be one period per week for Mentoring and Professional Development, final evaluation of this course will be done based on the combined assessment of Odd and Even semester of respective year of study.

SEMESTER - 6TH											
S. No.	**Course Type**	**Course Code**	**Course Title**	**Subject Type**	**Hours per week**			**Internal Marks**	**External Marks**	**Total**	**Credits**
					L	**T**	**P**				
1.	Professional Core	PCEE-114	Power Systems – II (Operation and Control)	Theory	3	1	0	40	60	100	4
2.	Professional Core	PCEE-115	Industrial Drives and Control	Theory	3	0	0	40	60	100	3
3.	Professional Elective	PEEE-XXX	Elective-I	Theory	3	1	0	40	60	100	4
4.	Professional Elective	PEEE-XXX	Elective-II	Theory	3	1	0	40	60	100	4
5.	Open Elective	OEXX-XXX	Open Elective-I	Theory	3	0	0	40	60	100	3
6.	Professional Core	LPCEE-109	Power Systems Laboratory-II	Practical	0	0	2	30	20	50	1
7.	Professional Core	LPCEE-110	Measurements and Instrumentation Laboratory	Practical	0	0	2	30	20	50	1
8.	Professional Core	LPCEE-111	Industrial Drives and Control Laboratory	Practical	0	0	2	30	20	50	1
9.	Project	PREE-102	Minor Project	Practical	0	0	2	50	50	100	1
10.	Mentoring	MPD-103	Mentoring & Professional Development	Practical	0	0	1	100	0	100	1
TOTAL					**15**	**3**	**9**	**440**	**410**	**850**	**23**

SEMESTER - 7TH											
S. No.	**Course Type**	**Course Code**	**Course Title**	**Subject Type**	**Hours per week**			**Internal Marks**	**External Marks**	**Total**	**Credits**
					L	**T**	**P**				
1.	Professional Elective	PEEE-XXX	Elective-III	Theory	3	1	0	40	60	100	4
2.	Professional Elective	PEEE-XXX	Elective-IV	Theory	3	1	0	40	60	100	4
3.	Open Elective	OEXX-XXX	Open Elective-II	Theory	3	0	0	40	60	100	3
4.	Project	PREE-103	Project-I	Practical	0	0	6	50	50	100	3
5.	Training*	TR-103	Training-III	Practical	-	-	-	100	50	150	2
6.	Mandatory Course$	MCI-103	Organisational Behavior	Theory	2	0	0	50	0	50	S/US
TOTAL					**11**	**2**	**6+1#**	**320**	**280**	**600**	**16**

NOTE:

* Institutional/Industrial Training of Six weeks shall be held in summer vacation after 6thsemester and marks/credit shall be awarded in 7thsemester itself.

$ Marks of non-credit courses are excluded from total and minimum 40% score required to pass.

\# There will be one period per week for Mentoring and Professional Development, final evaluation of this course will be done based on the combined assessment of Odd and Even semester of respective year of study.

SEMESTER - 8TH											
S. No.	**Course Type**	**Course Code**	**Course Title**	**Subject Type**	**Hours per week**			**Internal Marks**	**External Marks**	**Total**	**Credits**
					L	**T**	**P**				
1.	Professional Elective	PEEE-XXX	Elective-V	Theory	3	1	0	40	60	100	4
2.	Professional Elective	PEEE-XXX	Elective-VI	Theory	3	1	0	40	60	100	4
3.	Open Elective	OEXX-XXX	Open Elective-III	Theory	3	0	0	40	60	100	3
4.	Project	PREE-104	Project-II	Practical	0	0	6	50	50	100	3
5.	Mentoring	MPD-104	Mentoring & Professional Development	Practical	0	0	1	100	0	100	1
TOTAL					**9**	**2**	**7**	**270**	**230**	**500**	**15**

List of Professional Elective Courses (TRACK-I)

ENERGY CONVERSION & POWER SYSTEMS			
S. No.	**Professional Elective Course**	**Course code**	**Course Name**
1.	**Elective –I**	PEEE-101	Renewable Energy Sources
2.		PEEE-103	Solar and Wind Energy
3.	**Elective –II**	PEEE-105	Energy Efficient Machines
4.		PEEE-107	Computer Aided Electrical Machine Design
5.	**Elective –III**	PEEE-109	Power System Reliability
6.		PEEE-111	Power System Planning
7.	**Elective –IV**	PEEE-113	Sub-Station Automation
8.		PEEE-115	Smart Grids
9.	**Elective –V**	PEEE-117	High Voltage Engineering
10.		PEEE-119	High Voltage Transmission
11.	**Elective –VI**	PEEE-121	Power Quality Improvement
12.		PEEE-123	Digital Protection of Power system

List of Professional Elective Courses (TRACK-II)

INSTRUMENTATION & CONTROL SYSTEMS			
S. No.	**Professional Elective Course**	**Course code**	**Course Name**
1.	**Elective –I**	PEEE-102	Embedded Systems & PLC
2.		PEEE-104	Automatic Control & Robotics
3.	**Elective –II**	PEEE-106	Digital Control System
4.		PEEE-108	Process Dynamics and Control
5.	**Elective –III**	PEEE-110	Optimization Techniques
6.		PEEE-112	Artificial Intelligence Techniques
7.	**Elective –IV**	PEEE-114	Digital Signal Processing
8.		PEEE-116	Biomedical Signals & Instrumentation
9.	**Elective –V**	PEEE-118	SCADA & Distributed Control System
10.		PEEE-120	Data Communication and Networking
11.	**Elective –VI**	PEEE-122	Virtual Instrumentation
12.		PEEE-124	Fuzzy Expert Systems

List of Open Elective subject offered by Electrical Engineering department to all other departments.

S. No.	**Open Elective Course**	**Course code**	**Course Name**
1.	**Open Elective –I**	OPEE-101	Energy Auditing and Management
2.		OPEE-102	Elements of Power System
3.	**Open Elective –II**	OPEE-103	Non-Conventional Energy Sources
4.		OPEE-104	Automation Control and Robotics
5.	**Open Elective –III**	OPEE-105	Soft Optimization Techniques
6.		OPEE-106	Smart Electrical Machines

Minor specialization Course for Electrical Engineering

S. No.	**Course code**	**Course Name**	**Hours Per week**			**Internal awards**	**External Awards**	**Total**	**Credits**
			L	**T**	**P**				
1.	MnPCEE-101	Electrical Machines	3	0	0	40	60	100	3
2.	MnPCEE-102	Electrical Measurement & Instrumentation	3	0	0	40	60	100	3
3.	MnPCEE-103	Power Generation, Transmission & Utilization	3	0	0	40	60	100	3
4.	MnPEEE-104	Renewable Energy Systems	3	0	0	40	60	100	3

Subject Code: BSEE-101
Subject Name: *ENGINEERING MATHEMATICS-III (PROBABILITY AND STATISTICS)*

Programme: B.Tech (EE)	**L: 3 T: 0 P: 0**
Semester: 3	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 3
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:**80%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of Integration, Differential Calculus
Additional Material allowed in ESE: Scientific Calculator
On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Apply probability theory via Bayes' Rule.
2.	Formulate the marginal and conditional distributions of bivariate random variables.
3.	Verify the predicted data sets using Binomial, Poisson and normal distribution.
4.	Predict the linear regression parameters and correlation coefficient.
5.	Select a critical value from a normal and chi - square distribution.

DETAILED CONTENTS

PART-A

MODULE 1: BASIC PROBABILITY ***(12 Hours)***

Probability spaces, theorems of Probability, addition multiplication and Baye's theorem, conditional probability, independence; Discrete random variables, Independent random variables, Poisson approximation to the binomial distribution, sums of independent random variables; Expectation of Discrete Random Variables, Variance.

MODULE 2: CONTINUOUS PROBABILITY AND BIVARIATE DISTRIBUTIONS ***(8 Hours)***

Continuous random variables and their properties, distribution functions and densities, normal, exponential densities. Bivariate distributions and their properties, distribution of sums and quotients.

PART-B

MODULE 3: BASIC STATISTICS ***(8 Hours)***

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal-evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

MODULE 4: APPLIED STATISTICS ***(8 Hours)***

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations

MODULE 5: SMALL SAMPLES ***(4 Hours)***

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text / References:

1. E. Kreyszig, *"Advanced Engineering Mathematics",* John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, *"Introduction to Probability Theory"*, Universal Book Stall, 2003.
3. S. Ross, *"A First Course in Probability"*, Pearson Education India, 2002.
4. W. Feller, *"An Introduction to Probability Theory and its Applications"*, Vol. 1, Wiley, 1968.
5. N.P. Bali and M. Goyal, *"A text book of Engineering Mathematics",* Laxmi Publications, 2010.
6. B.S. Grewal, *"Higher Engineering Mathematics",* Khanna Publishers, 2000.
7. T. Veerarajan, *"Engineering Mathematics",* Tata McGraw-Hill, New Delhi, 2010.

E-Books and online learning material:

1. Convex Optimization by Boyd and Vandenberghehttp://stanford.edu/~boyd/cvxbook/bv_cvxslides.pdf
2. Probability and Statistics by PrasannaSahoohttp://www.math.louisville.edu/~pksaho01/teaching/Math662TB-09S.pdf

Online Courses and Video Lectures:

1. Probability and Statistics bynptelhrdhttp://nptel.ac.in/courses/111105041/
2. Probability and statistics by nptelhrdhttp://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PLbMVogVj5nJQrzbAweTVynH6-vG5A4aN5

Subject Code: HSMEE-101
Subject Name: *EDUCATION, TECHNOLOGY AND SOCIETY*

Programme: B.Tech (EE)	**L: 3 T: 0 P: 0**
Semester: 3	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 3
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:** 0%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: NIL

Additional Material allowed in ESE: NIL

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Integrate Technical Education for betterment of Society as well get motivated to lead a good human life.
2.	Analyze different learning domains and Educational Transition.
3.	Acknowledge recent advancements in Electrical Technology.
4.	Use sustainable developments to address environmental issues.
5.	Estimate the Power scenario and ethics in the Urban and Rural sector.

DETAILED CONTENTS

PART-A

MODULE 1 INTRODUCTION TO EDUCATION AND SOCIETY ***(7Hours)***

Necessity of Education for Human Life, role of education in Technology advancement, Implications of Electrical engineering on Society and mankind, role of Central Electricity Authority(CEA).

MODULE 2 EDUCATIONAL TRANSITION-ICTDRIVEN ***(7Hours)***

Nature and scope of education (Gurukul to ICT driven), Emotional Intelligence Domains of learning, Approaches to learning, learning outcomes, Relevance of ICT (Information and communications technology) in Electrical Engineering education.

MODULE 3 ADVANCEMENT IN ELECTRICAL TECHNOLOGY ***(7 Hours)***

Introduction to the concept of Micro-grids, Energy Conservation Building Code, High Efficiency Photovoltaic Cells, Green Energy Electrical Power Converters, Hybrid energy Systems and Hybrid Vehicles.

PART B

MODULE 4 ENVIRONMENTAL ISSUES AND HEALTH HAZARDS ***(9Hours)***

Health hazards caused due to lack of awareness and education, promoting the use of Renewable Energy Resources for Sustainable development, Electrical Safety Precautions at commercial places, Safety Alerts, reduction of pollutants caused due to power generation.

MODULE 5 ETHICS IN POWER UTILITY ***(10Hours)***

Menace of power Theft, Technical and Commercial Losses, Power Scenario in Rural India, future of Indian Power sector. Anecdotes of Power Theft Detection, Tampering of security seals, Power Theft control methods. Power theft in Electro-mechanical Meters. Significance and planning structure of Indian Electricity Grid Code (IEGC).

Text / References:

1. Jan L Harrington, *"Technology and Society",* Jones and Bartlett Publishers, 2009
2. Bower and Hilgard, *"Theories of learning",* Prentice Hall Publisher, 1998
3. G. Sreenivasan, *"Power Theft"*, PHI Learning Pvt. Ltd Delhi, 2014
4. A.K Thereja, *"A textbook of Electrical Technology",* S.Chand, 1994
5. B H Khan,*"Non-Conventional energy Resources",* Tata McGraw-Hill Education Private Ltd. New Delhi, 2009.

E-books and online learning material:

1. Technology and Society By Jan L Harrington
   https://books.google.co.in/books?id=3y4LW3lAf9kC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. Non-Conventional energy Resources by B H Khan
   https://books.google.co.in/books?id=YVyv4WyA5QUC&printsec=frontcover&dq=Non-Conventional+energy+Resources+by+B+H+KHAN&hl=en&sa=X&ved=0ahUKEwin9_iHgebiAhVKfysKHVhtBQIQ6AEIKDAA#v=onepage&q&f=false

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=fTNnsZGlV28

Subject Code: PCEE-101
Subject Name: *ELECTRICAL CIRCUIT ANALYSIS*

Programme: B.Tech (EE)	**L: 3 T: 1 P: 0**
Semester: 3	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 4
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:** 50%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering.

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Apply network theorems for the analysis of electrical circuits.
2.	Obtain the steady-state and transient response of electrical circuits.
3.	Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
4.	Analyze electrical circuits using Laplace Transform
5.	Analyze various types of two port networks and their inter connection.

DETAILED CONTENTS

PART-A

MODULE 1: NETWORK THEOREMS ***(10 Hours)***

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources, Node and Mesh Analysis, .Concept of duality and dual networks.

MODULE 2: SOLUTION OF FIRST AND SECOND ORDER NETWORKS ***(10 Hours)***

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

PART-B

MODULE 3: SINUSOIDAL STEADY STATE ANALYSIS ***(7 Hours)***

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits, Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

MODULE 4: ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS ***(7 Hours)***

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

MODULE 5: TWO PORT NETWORK AND NETWORK FUNCTIONS ***(6 Hours)***

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks, synthesis of network using Foster and Cauer Forms.

Text / References:

1. M. E. Van Valkenburg, *"Network Analysis",* Prentice Hall, 2006.
2. D. Roy Choudhury, *"Networks and Systems",* New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, *"Engineering Circuit Analysis",* McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, *"Electric Circuits",* McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, *"Basic Circuit Analysis",* Jaico Publishers, 1999.

E-Books and online learning material:

1. Electrical Circuit Theory and Technology John Bird
   http://s1.nonlinear.ir/epublish/book/Electrical_Circuit_Theory_and_Technology_0415662869.pdf
2. Network Analysis and Synthesis by Smarajit Ghosh
   https://books.google.co.in/books?id=4P6tFSv7HswC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. Fundamentals of Electric Circuits Charles K. Alexander and Matthew N. O. Sadiku
   http://omega.altervista.org/extra/Fundamentals%20of%20Electric%20Circuits%20(Alexander%20and%20Sadiku),%204th%20Edition.pdf

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/108102042/9
2. https://nptel.ac.in/courses/108102042/10
3. https://nptel.ac.in/courses/108102042/21
4. https://nptel.ac.in/courses/108102042/24
5. https://nptel.ac.in/courses/108102042/26
6. https://nptel.ac.in/courses/108102042/42
7. https://nptel.ac.in/courses/108102042/43

Subject Code: PCEE-102
Subject Name: *ANALOG ELECTRONICS*

Programme: B.Tech (EE)	**L: 3 T: 1 P: 0**
Semester: 3	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 4
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:**40%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Analyze basic diode circuits.
2.	Understand the characteristics of transistors.
3.	Understand the characteristics of MOSFET.
4.	Design and analyze various rectifier and amplifier circuits.
5.	Understand the functioning of OP-AMP and design OP-AMP based circuits.

DETAILED CONTENTS

PART-A

MODULE 1: DIODE CIRCUITS ***(4 Hours)***

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

MODULE 2: BJT CIRCUITS ***(8 Hours)***

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

MODULE 3: MOSFET CIRCUITS ***(9 Hours)***

MOSFET structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

PART-B

MODULE 4: DIFFERENTIAL, MULTI-STAGE AND OPERATIONAL AMPLIFIERS ***(8 Hours)***

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

MODULE 5: LINEAR AND NONLINEAR APPLICATIONS OF OP-AMP ***(13 Hours)***

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector.

Text/References:

1. A.S. Sedra and K. C. Smith, *"Microelectronic Circuits",* New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, *"Introduction to Operational Amplifier theory and applications",* McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, *"Microelectronics",* McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, *"The Art of Electronics",* Cambridge University Press, 1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, *"Analysis and Design of Analog Integrated Circuits",* John Wiley & Sons, 2001.

E-books and online learning material:

1. Integrated Electronics: Analog and Digital circuits and systems by Jacob Milliman and Christos C Halkias http://www.introni.it/pdf/Millman%20Halkias%20-%20Integrated%20Electronics.pdf
2. Principles of Analog Electronics by Giovanni Saggio https://books.google.co.in/books?id=eosAAgAACAAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. Analog Electronics by Hayrettin Köymen http://www.electronics.teipir.gr/personalpages/papageorgas/download/2/shmeiwseis/ELECTRONIC_COMPONENTS/varistor/Analog_Electronics.pdf
4. Analog Electronics Raymond E. Frey Physics Department University of Oregon https://pages.uoregon.edu/rayfrey/AnalogNotes.pdf
5. Foundations of Analog and Digital Electronic Circuits anantagarwal and jeffrey h. lang https://neurophysics.ucsd.edu/courses/physics_120/Agarwal%20and%20Lang%20(2005)%20Foundations%20of%20Analog%20and%20Digital.pdf

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/108102095/1
2. https://nptel.ac.in/courses/108102095/2
3. https://nptel.ac.in/courses/108102095/3
4. https://nptel.ac.in/courses/108102095/5
5. https://nptel.ac.in/courses/108102095/10
6. https://nptel.ac.in/courses/108102095/20
7. https://nptel.ac.in/courses/108102095/41

Subject Code: PCEE-103
Subject Name: *ELECTRICAL MACHINES-I (TRANSFORMER AND DC MACHINES)*

Programme: B.Tech (EE)	**L: 3 T: 1 P: 0**
Semester: 3	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:**4
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:**40%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand the concepts of magnetic circuits.
2.	Understand the operation of dc generator.
3.	Analyze the performance characteristics of DC Generator and Motor for different operating conditions.
4.	Testing of single phase transformer and evaluate efficiency and voltage regulation.
5.	Understand the concept of three phase and auto transformers.

DETAILED CONTENTS

PART-A

MODULE 1: MAGNETIC FIELDS AND MAGNETIC CIRCUITS ***(6 Hours)***

Review of magnetic circuits - MMF, flux, reluctance, inductance; Flux-linkage vs current characteristic of magnetic circuits; choice of flux density in distribution and power transformers, and effect of saturation; harmonics in magnetization current, influence of highly permeable materials on the magnetic flux.

MODULE 2: DC GENERATOR ***(6 Hours)***

Working principle, construction of DC machines, armature windings, E.M.F. and torque equations, armature reaction: effect of brush shift and compensating winding. Commutation: causes of bad commutation, methods of improving commutation. D.C. generator characteristics.

MODULE 3: DC MOTOR ***(8 Hours)***

Working principle, characteristics, starters (3-point, 4-point and soft starters), speed control methods (field and armature control). Braking: plugging, dynamic and regenerative braking. Estimation of losses and efficiency by Swinburn's test and Hopkinson test. Introduction to brushless direct current (BLDC) machines.

PART-B

MODULE 4: SINGLE PHASE TRANSFORMERS ***(9 Hours)***

Working principle of transformer, constructional features and E.M.F equation, Phasor diagram on no-load and loaded conditions, Referred parameters equivalent circuit, In rush phenomenon, Voltage regulation and efficiency, All day efficiency. Testing: Open-circuit test, short-circuit test and back-to-back test

MODULE 5: THREE PHASE TRANSFORMERS AND AUTOTRANSFORMER ***(11 Hours)***

Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, No-load and on-load tap-changing of transformers, Different diagnostic techniques of transformers.

Text / References:

1. A. E. Fitzgerald and C. Kingsley, *"Electric Machinery",* New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, *"Performance and design of DC machines",* CBS Publishers, 2004.
3. M. G. Say, *"Performance and design of AC machines",* CBS Publishers, 2002.
4. P. S. Bimbhra, *"Electrical Machinery",* Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, *"Electric Machines",* McGraw Hill Education, 2010.

E-books and online learning material:

1. https://nptel.ac.in/courses/108106071/
2. https://drive.google.com/file/d/0B_jwSWRUH7bwbV83ZVpOd3dvdjA/view
3. https://drive.google.com/file/d/0B_jwSWRUH7bwZGxaREwyTWVzN1k/view
4. https://drive.google.com/file/d/0B_jwSWRUH7bwLUVRNk40X040RjQ/view
5. https://drive.google.com/file/d/0B_jwSWRUH7bwR0xHMFRKelRTZGs/view

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/108105017/2
2. https://nptel.ac.in/courses/108105017/4
3. https://nptel.ac.in/courses/108105017/10
4. https://nptel.ac.in/courses/108105017/11
5. https://nptel.ac.in/courses/108105017/17
6. https://nptel.ac.in/courses/108105017/21
7. https://nptel.ac.in/courses/108105017/24

Subject Code: PCEE-104
Subject Name: *ELECTROMAGNETIC FIELDS*

Programme: B.Tech (EE)	**L: 3 T: 0 P: 0**
Semester: 3	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:**3
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:**40%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic knowledge of Coordinate systems, Electric and Magnetic fields

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	To understand the basic laws of electromagnetism.
2.	To obtain the electric and magnetic fields for simple configurations under static conditions.
3.	To analyze time varying electric and magnetic fields.
4.	To understand Maxwell's equation in different forms and different media.
5.	To understand the propagation of EM waves.

DETAILED CONTENTS

PART-A

MODULE 1: REVIEW OF VECTOR CALCULUS ***(6 Hours)***

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl, integral theorems of vectors. Conversion of a vector from one coordinate system to another.

MODULE 2: STATIC ELECTRIC FIELD CONDUCTORS, DIELECTRICS AND CAPACITANCE ***(12 Hours)***

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density, Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

PART-B

MODULE 3: STATIC MAGNETIC FIELDs, FORCES, MATERIALS AND INDUCTANCE*(10Hours)*

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

MODULE 4: TIME VARYING FIELDS AND MAXWELL'S EQUATIONS ***(6 Hours)***

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces, Boundary Conditions.

MODULE 5: ELECTROMAGNETIC WAVES ***(6 Hours)***

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Text / References:

1. M. N. O. Sadiku, *"Elements of Electromagnetics",* Oxford University Publication, 2014.
2. A. Pramanik, *"Electromagnetism - Theory and applications",* PHI Learning Pvt. Ltd, New Delhi, 2009.

3. A. Pramanik, *"Electromagnetism-Problems with solution",* Prentice Hall India, 2012.
4. G.W. Carter, *"The electromagnetic field in its engineering aspects",* Longmans, 1954.
5. W.J. Duffin, *"Electricity and Magnetism",* McGraw Hill Publication, 1980.
6. W.J. Duffin, *"Advanced Electricity and Magnetism",* McGraw Hill, 1968.
7. E.G. Cullwick, *"The Fundamentals of Electromagnetism",* Cambridge University Press, 1966.
8. B. D. Popovic, *"Introductory Engineering Electromagnetics",* Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, *"Engineering Electromagnetics",* McGraw Hill Education, 2012.

E-books and online learning material:

1. Engineering Electromagnetics Sixth Edition William H. Hayt, Jr. John A. Buck
   http://alumni.media.mit.edu/~aggelos/papers/EM_Hayt_6th.pdf
2. Electromagnetic Field Theory BO THIDE
   https://physics.bgu.ac.il/~gedalin/Teaching/Mater/EMFT_Book.pdf

Online Courses and Video Lectures:

Introduction to vector by Dr. Harishankar Ramchandran

1. https://nptel.ac.in/courses/108106073/
2. https://nptel.ac.in/courses/108106073/10
3. https://nptel.ac.in/courses/108106073/39
4. https://nptel.ac.in/courses/108106073/16

Subject Code: LPCEE-101
Subject Name: *ANALOG ELECTRONICS LABORATORY*

Programme: B.Tech (EE)	**L: 0 T: 0 P: 2**
Semester: 3	**Teaching Hours**: 26
Theory/Practical: Theory	**Credits:**1
Internal marks: 30	**Percentage of Numerical/Design/ Programming Problems:**100%
External Marks:20	**Duration of End Semester exam (ESE):**1.5hr
Total marks:50	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Ability to make circuits on bread-board and understand the use and importance of various types of equipment's used in the laboratory.
2.	Analyze, take measurements to understand circuit behavior and performance under different conditions.
3.	Troubleshoot, design and create electronic circuits meant for different applications.
4.	Acquire experience in creating and troubleshooting simple projects employing semiconductor devices.
5.	Evaluate the performance electronic circuits and working small projects employing semiconductor devices

Sr. No.	Name of Practical
1.	Design a full wave and half wave rectifier and observe the waveforms with and without filters (RC).
2.	To design a voltage regulator using Zener diode and also see the effect of line and load regulation
3.	To design various clippers and clampers using diodes.
4.	To study the transistor characteristics in common emitter characteristics and also determine the h-parameters from the characteristics.
5.	To design, study and compare various transistor biasing techniques and also see the effect on operating point (Q-point) when using various transistors at different temperatures.
6.	Design different transistor biasing circuits and compare them.
7.	Working of a transistor as current mirror and switch.
8.	To plot the VI characteristics of FET.
9.	Voltage follower circuit.
10.	Op-Amp as an inverting and non-inverting amplifier.
11.	Op-Amp as a summing and difference amplifier.
12.	Op-Amp as a zero crossing detector.
13.	Op-Amp as a Schmitt trigger.
14.	Op-Amp as an integrator and differentiator.
15.	RC phase shift oscillator using Op-Amp.
16.	Wein bridge oscillator using Op-Amp.
17.	To examine the operation of a PLL and to determine the free running frequency, the capture range and the lock in range of PLL.

Reference Material

Manual Available in lab

Subject Code: LPCEE-102
Subject Name: *ELECTRICAL MACHINES-I LABORATORY*

Programme: B.Tech (EE)	**L: 0 T: 0 P: 2**
Semester: 3	**Teaching Hours**: 26
Theory/Practical: Theory	**Credits:**1
Internal marks:30	**Percentage of Numerical/Design/ Programming Problems:**100%
External Marks:20	**Duration of End Semester exam (ESE):**1.5hr
Total marks:50	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Evaluation of equivalent circuit parameters, efficiency and voltage regulation by performing various tests on transformer.
2.	Analyze three-phase transformer connections and parallel operation of transformers
3.	Analyze performance characteristics of DC generators.
4.	Evaluate various speed controls and starting methods of DC motor.
5.	Construct and analyze torque slip characteristics of DC motor.

Sr. No.	Name of Practical
1.	To perform open circuit and short circuit tests on a single-phase transformer and hence find equivalent circuit parameters, voltage regulation and efficiency.
2.	To find the efficiency and voltage regulation of single-phase transformer under different loading conditions.
3.	To perform back-to-back test (Sumpner's Test) two single-phase transformers.
4.	To perform polarity test and parallel operation of two single-phase transformers.
5.	To make Scott connections on three-phase transformer to get two phase supply.
6.	To verify the outputs of various connections in three-phase transformer.
7.	To start the dc motor and study in detail the three-point and four-point starters.
8.	To measure armature and field resistance of direct current (d.c.) shunt generator and to obtain its open circuit characteristics.
9.	To perform speed control on dc shunt motor by field current and armature voltage.
10.	To draw speed-torque characteristics of dc shunt/series /compound motor.
11.	To perform Swinburne's test (no load test) to determine losses of dc shunt motor.
12.	Application of MATLAB for solution of problems regarding transformers and dc machines.

Reference Material

Manual Available in lab

Subject Code: PCEE-105
Subject Name: *DIGITAL ELECTRONICS*

Programme: B.Tech (EE)	**L: 3 T: 1 P: 0**
Semester: 4	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 4
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:** 40%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of Basic Electronics

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand working of logic families and logic gates.
2.	Design and implement Combinational logic circuits.
3.	Design and implement Sequential logic circuits.
4.	Understand the process of Analog to Digital conversion and Digital to Analog conversion.
5.	Be able to use PLDs to implement the given logical problem.

DETAILED CONTENTS

PART-A

MODULE 1: FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES*(7Hours)*

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

MODULE 2: COMBINATIONAL DIGITAL CIRCUITS *(7Hours)*

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

MODULE 3: SEQUENTIAL CIRCUITS AND SYSTEMS *(7Hours)*

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T andD-typesflipflops,applicationsofflipflops,shiftregisters,applicationsofshiftregisters,serialtoparallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

PART-B

MODULE 4: A/D AND D/A CONVERTERS *(10Hours)*

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

MODULE 5: SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES *(9Hours)*

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Text/References:

1. R. P. Jain, *"Modern Digital Electronics"*, McGraw Hill Education, 2009.
2. M. M. Mano, *"Digital logic and Computer design"*, Pearson Education India, 2016.
3. A. Kumar, *"Fundamentals of Digital Circuits"*, Prentice Hall India, 2016.

E-books and online learning material:

1. Digital electronics by Atul P. Godse & Deepali A. Godse
   https://books.google.co.in/books?id=bftp5ZG8v5kC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. Digital electronics by D. K. Kaushik
   https://www.researchgate.net/publication/264005171_Digital_Electronics
3. https://nptel.ac.in/courses/117103064/11

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/108105113/1
2. https://nptel.ac.in/courses/108105113/26
3. https://nptel.ac.in/courses/108105113/31
4. https://nptel.ac.in/courses/108105113/32

Subject Code: PCEE-106

Subject Name: *ELECTRICAL MACHINES – II* (ASYNCHRONOUS & SYNCHRONOUS MACHINES)

Programme: B.Tech (EE)	**L: 3 T: 1 P: 0**
Semester: 4	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 4
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:** 60%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering, Electrical Machines-I

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand the concepts of AC machine windings.
2.	Analyze performance characteristics of Three Phase Induction motor.
3.	Analyze performance characteristics of Induction Generator And Single Phase Induction Motor.
4.	Understand the concepts of Synchronous machines.
5.	Understand parallel operation of alternators with infinite bus with study of load sharing.

DETAILED CONTENTS

PART-A

MODULE 1:FUNDAMENTALS OF AC MACHINE WINDINGS ***(5 Hours)***

Introduction to salient pole and cylindrical Rotors, full-pitch windings, concentrated winding, distributed winding, sinusoidally distributed winding, winding distribution factor.

MODULE 2: THREE PHASE INDUCTION MOTORS ***(8 Hours)***

Analogy between induction motor and transformer, constructional features, concept of slip, rotor frequency, current and power, Development of circuit model (equivalent circuit), phasor diagram, torque-slip characteristics, effect of rotor circuit resistance, starting torque, crawling and cogging, High torque cage motors: double cage and deep bar motor.

MODULE 3: INDUCTION GENERATOR AND SINGLE PHASE INDUCTION MOTOR ***(7 Hours)***

Induction generator operation: Isolated and Grid mode, method of excitation, application of induction generator in wind mills and micro hydel power plants. Single Phase Induction Motor: Double revolving field theory, types of single phase motors, characteristics. Shaded pole motor: working principle and characteristics.

PART-B

MODULE 4: SYNCHRONOUS MACHINES ***(12 Hours)***

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation, EMF Method, MMF Method, Zero Power Factor (Z.P.F)Method, Operating characteristics of synchronous machines, V-curves. Salient pole machine-two reaction theory, power angle characteristics, Transients in Synchronous Machines.

MODULE 5:PARALLEL OPERATION OF ALTERNATORS ***(8 Hours)***

Conditions for Proper Synchronizing for Single Phase and Three Phase Alternators, Conditions for Parallel Operation, Synchronizing Power, Current and Torque, Effect of Increasing Excitation of one of the Alternators, Effect of Change of Speed of one of the Alternators, Effect of unequal Voltages, Load Sharing.

Text/References:

1. A. E. Fitzgerald and C. Kingsley, *"Electric Machinery",* McGraw Hill Education, 2013.
2. M. G. Say, *"Performance and design of AC machines",* CBS Publishers, 2002.
3. P. S. Bimbhra, *"Electrical Machinery",* Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, *"Electric Machines",* McGraw Hill Education, 2010.
5. A. S. Langsdorf, *"Alternating current machines",* McGraw Hill Education, 1984.
6. P. C. Sen, *"Principles of Electric Machines and Power Electronics",* John Wiley & Sons, 2007.

E-books and online learning material:

1. https://gndec.ac.in/~librarian/web%20courses/IIT-MADRAS/Elec_Mach2/SynchronousMachines.pdf
2. https://nptel.ac.in/courses/108106072/

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=fbwZkhaF0dk
2. https://www.youtube.com/watch?v=RX5Xj1keQIc&list=PLPpCFgQP7QKFrkYIYaZt0idq7ocZq9AYU

Subject Code: PCEE-107
Subject Name: *POWER ELECTRONICS*

Programme: B.Tech (EE)	**L: 3 T: 1 P: 0**
Semester: 4	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 4
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:**40%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic fundamentals of Analog and Semiconductor Electronics

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Analyze various thyristor family and its commutation techniques.
2.	Comprehend different single phase and three phase power converter circuits.
3.	Understand categorization of chopper as per necessity of industrial electronics application
4.	Develop skills to propose cycloconverter circuits for various applications
5.	Foster ability to understand the use of inverters in commercial and industrial applications.

DETAILED CONTENTS

PART-A

MODULE 1: THYRISTORS, CHARACTERISTICS AND COMMUTATION TECHNIQUES ***(11 Hours)***

Introduction to Thyristor Family, V-I Characteristics of SCR, SUS, GTO, LASCR, DIAC, TRIAC, Principle of Operation of SCR, Turn on Methods of a Thyristor, Switching Characteristics of Thyristors during Turn-on and Turn-off, Gate Characteristics, Firing of Thyristors, Series and Parallel Operation of SCR, Protection of SCR from Over Voltage and Over Current. Load Commutation (Class A), Resonant-Pulse Commutation (Class B), Complementary Commutation (Class C), Impulse Commutation (Class D), External Pulse Commutation (Class E), Line commutation (Class F).

MODULE 2: PHASE CONTROLLED TECHNIQUES ***(9 Hours)***

Introduction to Phase angle Control, Single Phase Half Wave Controlled Rectifiers, Single Phase Half Controlled and Full Controlled Bridge Rectifiers with RL Load, Three Phase Full Controlled Bridge Rectifiers with R and RL Load. Basic Circuit and Principle of Operation of Dual Converter with Circulating and Non-Circulating Current mode of operation, Applications of Rectifiers and Dual Converters to Control the Speed of DC Motors.

PART-B

MODULE 3: CHOPPERS ***(8 Hours)***

Introduction and Principle of Chopper Operations, Control strategies, Chopper Configurations, Regenerative Chopper, Voltage Commutated Chopper, Current Commutated Chopper, Load Commutated Chopper.

MODULE 4: CYCLOCONVERTERS ***(5 Hours)***

Basic Circuit and Operation of Single Phase Cycloconverter, Single Phase Bridge Cycloconverter, Three Phase to Single Phase Cycloconverter, Advantages and Disadvantages of Cycloconverter.

MODULE 5: INVERTERS ***(7 Hours)***

Introduction, Operating Principle of Single Phase Inverter, Three Phase Bridge Inverter, VSI, CSI, Voltage Control (PWM Control) and Reduction of Harmonics in the Inverter Output Voltage.

Text/References:

1. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
4. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.

E-books and online learning material:

1. Power Electronics Handbook By Muhammad H. Rashid
   http://site.iugaza.edu.ps/malramlawi/files/RASHID_Power_Electronics_Handbook.pdf
2. Power Electronics Principles & applications by Joseph vithayathil
   https://books.google.co.in/books?id=LX5GKpQz2CgC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. https://nptel.ac.in/courses/108105066/4
4. https://nptel.ac.in/courses/108105066/5

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/108108077/
2. https://nptel.ac.in/courses/108101038/

Subject Code: PCEE-108
Subject Name: *SIGNALS AND SYSTEMS*

Programme: B.Tech (EE)	**L: 3 T: 1 P: 0**
Semester: 4	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 4
Internal marks: 40	**Percentage of Numerical/Design/ Programming Problems:** 60%
External Marks: 60	**Duration of End Semester exam (ESE):** 3 hr
Total marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

Additional Material allowed in ESE: Scientific Calculator

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand the concepts of continuous time and discrete time systems.
2.	Understand the behavior of continuous and discrete-time LTI
3.	Understand the concept of Fourier Transforms
4.	Understand the concept of Laplace and z-Transforms
5.	Analyze Sampling and Reconstruction of control system

DETAILED CONTENTS

PART-A

MODULE 1: INTRODUCTION TO SIGNALS AND SYSTEMS ***(9 Hours)***

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

MODULE 2: BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS ***(10 Hours)***

Impulse response and step response, convolution, input-output behavior with a periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

PART-B

MODULE 3: FOURIER TRANSFORMS ***(7Hours)***

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

MODULE 4: LAPLACE AND Z-TRANSFORMS ***(6 Hours)***

Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

MODULE 5: SAMPLING AND RECONSTRUCTION ***(8 Hours)***

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, *"Signals and systems",* Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, *"Digital Signal Processing: Principles, Algorithms, and Applications",* Pearson, 2006.
3. H. P. Hsu, *"Signals and systems",* Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, *"Signals and Systems",* John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, *"Discrete-Time Signal Processing",* Prentice Hall, 2009.
6. M. J. Robert, *"Fundamentals of Signals and Systems",* McGraw Hill Education, 2007.
7. B. P. Lathi, *"Linear Systems and Signals",* Oxford University Press, 2009.

E-books and online learning material:

1. Signals and Systems by Richard Baraniuk
   http://www.eng.ucy.ac.cy/cpitris/courses/ece623/notes/SignalsAndSystems.pdf
2. Signals and Systems by Alan V. Oppenheim, S. Hamid Nawab
   https://web.itu.edu.tr/hulyayalcin/Signal_Processing_Books/Oppenheim_Signals_and_Systems.pdf

Online Courses and Video Lectures:

1. Review of Signal and system by S. C. Dutta Roy, EE Deptt IIT Delhi
   https://nptel.ac.in/courses/108102042/

Subject Code: LPCEE-103
Subject Name: *DIGITAL ELECTRONICS LABORATORY*

Programme: B.Tech (EE)	**L: 0 T: 0 P: 2**
Semester: 4	**Teaching Hours**: 26
Theory/Practical: Theory	**Credits:**1
Internal marks:30	**Percentage of Numerical/Design/ Programming Problems:**100%
External Marks:20	**Duration of End Semester exam (ESE):**1.5hr
Total marks: 50	**Elective Status:** Compulsory

Prerequisites:

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Identify different types of digital IC's, read their specification sheets and the way to handle these.
2.	Verify the truth tables of various gates and different laws and rules of Boolean Algebra.
3.	Design and test different types of combinational and sequential circuits.
4.	Analyze different types of DAC, ADC and memory devices.
5.	Create and troubleshoot working projects using digital logic.

Sr. No.	Name of Practical
1.	Verification of the truth tables of TTL gates viz: 7400, 7402, 7404, 7408, 7432, 7486.
2.	Design and realization of all gates using NAND/NOR gates.
3.	Verification of theorems and laws using gates.
4.	Design and verification of the truth tables of Half-Adder using different gates and Full Adder circuit using 7483 IC.
5.	Design and verification of the truth table of four bit subtractor using 7483 and 7486 IC's.
6.	Design and verification of binary to gray code converter or vice-versa.
7.	Verification of truth table of Multiplexer (74150)/Demultiplexer(74154).
8.	Design, fabrication and testing of Mon-stable multivibrator of t = 0.1ms approx. using 74121/123IC.Testing for both positive and negative edge triggering, variation in pulse width and retriggering.
9.	Design and test S-R flip-flop using NOR/NAND gates.
10.	Design, fabricate and test a switch debouncer using 7400.
11.	Verify the truth table of a JK flip flop using IC 7476.
12.	Verify the truth table of a D flip flop using IC 7474 and study its operation in the toggle and asynchronous mode.
13.	Operate the counters 7490, 7493 and 74193(Up/Down counting mode). Verify the frequency division at each stage. Using a frequency clock (say 1 Hz) display the count of LED's.
14.	Verify the truth table of decoder driver7447/7448. Hence operate a 7 segment LED display through a counter using a low frequency clock. Repeat the above with the BCD to Decimal decoder 7442.

Reference Material

Manual Available in lab

Subject Code: LPCEE-104

Subject Name: *ELECTRICAL MACHINES LABORATORY-II*

Programme: B.Tech (EE)	**L: 0 T: 0 P: 2**
Semester: 4	**Teaching Hours**: 26
Theory/Practical: Practical	**Credits:**1
Internal marks:30	**Percentage of Numerical/Design/ Programming Problems:**100%
External Marks:20	**Duration of End Semester exam (ESE):**1.5hr
Total marks:50	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Construct equivalent circuits for single phase and three phase induction motor by performing no-load and blocked rotor test.
2.	Comprehend the requirement of starting and speed control methods of induction motors in the various applications of industry.
3.	Construct equivalent circuits of synchronous generator and motor.
4.	Construct characteristic curves for induction motors and synchronous machines.
5.	Compare various methods of parallel operation of three phase alternators.

Sr. No.	Name of Practical
1.	To perform no-load and blocked–rotor test on three-phase induction motor and to obtain equivalent circuit parameters.
2.	To perform load-test on three-phase induction motor and to plot torque versus speed characteristics.
3.	To perform no-load and blocked–rotor test on single-phase induction motor and to determine the parameters of equivalent circuit.
4.	To perform load–test on single-phase induction motor and to plot torque–speed characteristics.
5.	To perform the speed control methods of three-phase induction motor by a) Kramer's method b) Cascading method.
6.	To start the three-phase induction motor using star- delta and DOL starters.
7.	To perform no load and short circuit test on three-phase alternator and to draw open circuit & short circuit characteristics.
8.	To analyze the effect of variation of field current on the stator current and power factor with synchronous motor running at no load and to draw V-curves & inverted Vcurves.
9.	To perform parallel operation of three phase alternators using dark lamp method, two-bright and one dark lamp method.
10.	To perform parallel operation of three-phase alternators using synchroscope.
11.	Application of MATLAB software for solution of problems regarding induction motors and synchronous machines.

Reference Material

Manual Available in lab

Subject Code: LPCEE-105
Subject Name: *POWER ELECTRONICS LABORATORY*

Programme: B.Tech (EE)	**L: 0 T: 0 P: 2**
Semester: 4	**Teaching Hours**: 26
Theory/Practical: Practical	**Credits:**1
Internal marks:30	**Percentage of Numerical/Design/ Programming Problems:** 100%
External Marks:20	**Duration of End Semester exam (ESE):** 1.5hr
Total marks: 50	**Elective Status:** Compulsory

Prerequisites: Basic Electrical Engineering

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand the properties and characteristics of thyristors.
2.	Evaluate and analyze the use of thyristors for different applications like phase control, speed control circuits.
3.	Acquire fault finding skills in thyristor based circuits.
4.	Develop thyristor based circuits for industrial use like understanding speed control of motors.
5.	Understand the different types of waveforms of inverter and chopper circuits.

Sr. No.	Name of Practical
1.	To plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2.	To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3.	To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
4.	To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
5.	To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
6.	Study of Jones chopper or any chopper circuit to check the performance.
7.	Thyristorised speed control of a D.C. Motor.
8.	Speed Control of induction motor using thyristors.
9.	Demonstration of series inverter circuit.
10.	Demonstration of commutation circuit.
11.	Study of a single-phase cycloconverter.

Reference Material

Manual Available in lab

Subject Code: PREE-101

Subject Name: *SEMINAR AND TECHNICAL REPORT WRITING*

Programme: B.Tech (EE)	**L: 0 T: 0 P: 2**
Semester: 4	**Teaching Hours**: 26
Theory/Practical: Practical	**Credits:**1
Internal marks:50	**Percentage of Numerical/Design/ Programming Problems:** 100%
External Marks: NIL	**Duration of End Semester exam (ESE):** NA
Total marks: 50	**Elective Status:** Compulsory

Prerequisites: Basic writing skills

Additional Material Allowed in ESE: NIL

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Define and agree the purpose of the report and needs of your readers
2.	Design a document structure to effectively get your message across.
3.	Identify the necessary content and have an appropriate layout.
4.	Use a number of readily available tools to assist with report writing.
5.	Reference and quote correctly, and not infringe

DETAILED CONTENTS

PART-A

MODULE-I: INTRODUCTION ***(4 Hours)***

Structure of technical Report, Presentation, Planning the report, Writing the first draft, Revising the first draft, Diagrams, graphs, tables and mathematics, The report layout, Headings, References to diagrams, graphs, tables and equations, Originality and plagiarism, Finalising the report and proofreading, The Summary, Proofreading.

MODULE-II: PRESENTATION SKILLS ***(4 Hours)***

Different ways to fight anxiety, If you don't have anything to say, If something goes wrong, If you forget something, If you make a mistake. Voice: Voice and eye contact, Perfect vs Passionate, Tempo and Time, Gestures, Contact: Facial Expression, asking questions, Things not to do, Computer does not start, working with slides. Q&A: Recap, Filtering questions, Tough questions, you're uncomfortable with the answer, Difficult situations.

Module-III: LaTeX and Text Formatting ***(6 Hours)***

TeX, LaTeX, Terms regarding TeX, Custom installation with TeX Live, Tables and graphics tools, Automatic installation, Manual installation, Checking package status, External resources, The LaTeX syntax, Compilation. Spacing, Hyphenation, Quote-marks, Diacritics and accents, Margin misalignment and interword spacing, Ligatures, Slash marks, Fonts, Formatting macros, Text mode superscript and subscript, Text figures ("old style"numerals), Dashes and hyphens, Ellipsis (…), Readymade strings

PART B

MODULE-V: PARAGRAPH AND FONTS ***(6 Hours)***

Formatting Paragraph alignment, Paragraph indent and break, \paragraph line break, Line spacing, Manual breaks, Special paragraphs. Introduction to Font families, Available LaTeX Fonts, emphasizing text, Font encoding, Font styles, Local font selection, arbitrary font size, finding fonts, Using arbitrary system fonts, PDF fonts and properties, List Structures

MODULE-VII: TABLES, FLOATS, FIGURES AND CAPTIONS ***(6 Hours)***

The tabular environment, Row specification, Spanning, controlling table size, Colors, Width and stretching, Table across several pages, Partial vertical lines, vertically centered images, Footnotes in tables, Professional tables, Sideways tables, Table with legend, the eqparbox package, Floating with table, Floats, keeping floats in their place, Captions, lists of figures and tables, Labels and cross

referencing, Wrapping text around figures, Subfloats, Wide figures in two-column documents, Custom floats, Labels in the figures, Footnotes and Margin Notes

Text/References:

1. Van Emden J., *"Effective communication for Science and Technology",* Palgrave 2001.
2. Van Emden J., *"A Handbook of Writing for Engineers",* 2nd ed. Macmillan 1998.
3. Van Emden J. and Easteal J., *"Technical Writing and Speaking, an Introduction",* McGraw-Hill 1996.
4. Pfeiffer W.S., *"Pocket Guide to Technical Writing",* Prentice Hall 1998.
5. Eisenberg A., *"Effective Technical Communication",* McGraw-Hill 1992.
6. Presentation skills: Effective Presentation Delivery (Coursera).
7. Frank Mittelbach , Michel Goossens, Johannes Braams, David Carlisle, Chris Rowley, *"The LaTeX Companion (Tools and Techniques for Computer Typesetting)",* 2nd Edition, Addison-Wesley, 2005
8. Stefan Kottwitz, *"LaTeX Beginner's Guide"*, 1st Edition PACKT, 2011.
9. Davies J.W., *"Communication for Engineering Students",* Longman, 1996.
10. AH Basson & TW von Backström, *"Guide for Writing Technical Reports",* 3rd Edition, Stellenbosch University", 2007.

E-Books and online learning material:

1. http://www.sussex.ac.uk/ei/internal/forstudents/engineeringdesign/studyguides/techreport writing.
2. "Introduction to LaTex", http://home.iitk.ac.in/~kalpant/docs/intro_latex.pdf.
3. LaTeX, Wikibook , http://en.wikibooks.org/wiki/LaTeX ,en.wikibooks.org, 2016,

Online Courses and Video Lectures:

1. "Technical Report Writing for engineers", https://www.futurelearn.com/courses/technicalreport-writing-for-engineers
2. "Academic and Research Report Writing", https://swayam.gov.in/courses/4635-academic-andresearch-report-writing

Subject Code: MCEE-101

Subject Name: *ENVIRONMENTAL SCIENCE*

Programme: B.Tech (EE)	**L: 2 T: 0 P: 0**
Semester: 4	**Teaching Hours**: 26
Theory/Practical: Theory	**Credits:** NIL
Internal marks:50	**Percentage of Numerical/Design/ Programming Problems:** 100%
External Marks: NIL	**Duration of End Semester exam (ESE):** NA
Total marks: 50	**Elective Status:** Compulsory

Prerequisites: Basic of Environment

Additional Material Allowed in ESE: NIL

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Measure environmental variables and interpret results.
2.	Evaluate local, regional and global environmental topics related to resource use and management.
3.	Propose solutions to environmental problems related to resource use and management.
4.	Interpret the results of scientific studies of environmental problems.
5.	Describe threats to global biodiversity, their implications and potential solutions.

DETAILED CONTENTS

PART-A

MODULE-I: NATURAL RESOURCES AND RELATIONAL MODEL ***(6 Hours)***

Renewable and non renewable resources: Natural resources and associated problems: Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems, Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers-pesticides problems, water logging, salinity, case studies, Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.

MODULE-II: ECO SYSTEMS AND ENVIRONMENTAL POLLUTION ***(6 Hours)***

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers, decomposers, Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids. Definition, causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards.

PART-B

MODULE-III: IMPACT OF INFORMATION TECHNOLOGY ON ENVIRONMENT AND SUSTAINABLE DEVELOPMENT ***(4 Hours)***

Positive and Negative Impacts of IT for Environment, Mobile Phones and Cell Towers, SAR Levels, Effects of Mobile Radiations, Management and Control, IT Impact in Education-Health-Entertainment-Environment Business-Society, National Management Information System, Environmental Information System, Geographical Information System, Functions of Remote Sensing, Human Health and Safety.

MODULE-IV: SOCIAL ISSUES AND THE ENVIRONMENT ***(5 Hours)***

Form unsustainable to sustainable development, Water conservation, rain water harvesting, water shed management, Resettlement and rehabilitation of people; its problems and concerns, case studies, Environmental ethics: issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies, Environment protection Act, Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act, Wildlife protection act, Forest conservation act.

MODULE-V: E-WASTAGE AND GREEN COMPUTING ***(5 Hours)***

Impacts of E-Waste on the Environment, Harmful Effects caused by Improper Computer & Electronic Waste Recycling, Global Trade Issues, Information Security, Recycling, Repair, Electronic Waste Substances, Holistic Approaches and Techniques for Green Computing, Impacts of Green Computing, Green Awareness, Green Initiatives in Information Technology, Green Computing Certifications, Issues & Challenges Ahead.

Text / References:

1. Cunninghan, W.P, *"Principle of Environment Science",* Springer, 2009.
2. Joseph, *"Essentials of Environment Science",* W. H Freeman and Company, 2006.
3. Kaushik, A., *"Perspectives in Environmental Studies",* New Age International Publishers, 2008.
4. Meenakshi, "Elements of Environment Science & Engineering", PHI Publishers, 2012.
5. Duggal, *"Elements of Environment Engineering", S. Chand* 2007
6. Erach Bharucha,*"Textbook of Environmental studies",* UGC, 2017
   Weblink: https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf.
7. D D Mishra, *"Fundamental concepts in Environmental Studies",* S Chand & Co Ltd, 2018
8. Agarwal, K. c, *"Environment Biology",* Nidi Publ. Ltd. Bikaner, 2001