NOIDA INTERNATIONAL UNIVERSITY

EVALUATION SCHEME & SYLLABUS

For

UNDERGRADUATE DEGREE COURSE
IN

ELECTRICAL ENGINEERING

(Effective from the Session: 2018-19)

B. Tech in Electrical Engineering

Program Educational Objectives (PEOs)

The Department of Electrical Engineering has developed and maintained a well-defined set of educational objectives and desired program outcomes. Educational objectives of the program cater to the requirements of the stakeholders such as students, parents, employers, alumni, faculty etc. The program educational objectives are as follows:

- **PEO**1: Provide graduates with a strong foundation in mathematics, science and engineering fundamentals to enable them to devise and deliver efficient solutions to challenging problems in Electrical and allied disciplines.
- **PEO**2: Impart analytic and thinking skills to develop initiatives and innovative ideas for R&D, Industry and societal requirements.
- **PEO**3: Provide sound theoretical and practical knowledge of E&C Engineering, managerial and entrepreneurial skills to enable students to contribute to the well-being of society with a global outlook.
- **PEO**4: Inculcate qualities of teamwork as well as social, interpersonal and leadership skills and an ability to adapt to evolving professional environments in the domains of engineering and technology.
- **PEO**5: Motivate graduates to become good human beings and responsible citizens for the overall welfare of the society.

Program outcomes (POs)

Engineering Graduates will be able to:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12**. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Credit System-Credit requirement for award of B.Tech:

- Every semester shall offer a minimum of **12 credits**.
- Credits for the Project or Thesis can vary from 10 to 15.
- The total number of credits for the B. tech Degree Course could vary from a **minimum of 158** credits to a **maximum of 178** credits.
- All courses of study put together would engage the students for a **minimum of 26 periods** or hours of study a week and a **maximum of 30 periods** or hours a week.

Under the Choice based credit system, which is a student or learner centric system, the courses of study in the B.Tech Degree course shall be as under:

a) Professional Core (PC) Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
b) Basic Sciences and Engineering Science (BS and ES) Course: A course which informs the Professional core and should compulsorily be studied.
c) Elective Course: Generally a course which can be chosen from a pool of courses and are of two types:
    (i) Professional Elective (PE) which may be very specific or specialized or advanced or supportive to the discipline or subject of study or which provides an extended scope
    (ii) Open Elective (OE) which enables an exposure to some other discipline or subject or domain or nurtures the candidate's proficiency or skill

The Weightage in terms of Credits for each of the above in the prescribed curriculum of the institution shall be as follows:

S.no.	Credit Breakups	Credits	Percentage
1	Humanities and Social Sciences including Management courses	12	
2	Basic Science courses	26	
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	20	
4	Professional core courses	52	
5	Professional Elective courses relevant to chosen specialization/branch	18	
6	Open subjects – Electives from other technical and /or emerging subjects	18	
7	Project work, seminar and internship in industry or elsewhere	12	
8	Mandatory Courses	0	
		*158	

**Minor variation is allowed as per need of the respective disciplines.*

While calculating credits the following guidelines shall be adopted, namely: -

- 1 Hr. Lecture (L) per week 1 credit

- 1 Hr. Tutorial (T) per week 1 credit
- 1 Hr. Practical (P) per week 0.5
- 2 Hours Practical (Lab)/week 1 credit

Credit distribution in each semester (158 credits to 8 semesters)

Semester	**Credits**		
	Theory	Practical	Total
1st	15	5.5	20.5
2nd	12	5.5	17.5
3rd	25	2	27
4th	18	3	21
5th	18	3	21
6th	15	3	18
7th	12	4	16
8th	9	8	17
Total	110	48	158

Course coding system

Every course coded as follows:

BSC : Basic Science Courses
ESC : Engineering Science Course
MC : Mandatory Courses
HSMC : Humanities and Social Sciences including Management
EE : Program core courses
PEC : Program Elective courses
OEC : Open Elective courses

Semester wise- course structure

Third-Semester

S.No	Course Code	Subject	Period			Evaluation Scheme					Total Credits
						Sessional Exam			End Exams	Subject Total	
			L	T	P	CA	TA	Total			
1	EE01	Electrical Circuit Analysis	3	1	0	20	20	40	60	100	4
2	EE02	Analog Electronics	3	0	0	20	20	40	60	100	3
3	EE04	Electrical Machines – I	3	0	0	20	20	40	60	100	3
4	EE06	Electromagnetic Field theory	3	1	0	20	20	40	60	100	4
5	BSC201	Mathematics -III	3	1	0	20	20	40	60	100	4
6	ESC201	Engineering mechanics	3	1	0	20	20	40	60	100	4
7	HSMC201	Human psychology	3	0	0	20	20	40	60	100	3
PRACTICALS											
1	EE03	Analog Electronics Lab	0	0	2	20	20	40	60	100	1
2	EE05	Electrical Machines – I Lab	0	0	2	20	20	40	60	100	1
Total											**27**

Fourth-Semester

S.No	Course Code	Subject	Period			Evaluation Scheme					Total Credits
						Sessional Exam			End Exams	Subject Total	
			L	T	P	CA	TA	Total			
THEORY											
1	EE07	Digital Electronics	3	0	0	20	20	40	60	100	3
2	EE09	Electrical Machines – II	3	0	0	20	20	40	60	100	3
3	EE11	Power Electronics	3	0	0	20	20	40	60	100	3
4	EE13	Signals and Systems	2	1	0	20	20	40	60	100	3
5	BSC202	Biology-I	3	0	0	20	20	40	60	100	3
6	HSMC202	Human values	3	0	0	20	20	40	60	100	3
7	MC-02	PYTHON	3	0	2	20	20	40	60	100	0
PRACTICALS											
1	EE08	Digital Electronics Lab	0	0	2	0	0	40	60	100	1
2	EE10	Electrical Machines – II Lab	0	0	2	0	0	40	60	100	1
3	EE12	Power Electronics Lab	0	0	2	0	0	40	60	100	1
Total											**21**

DETAILED 2-YEAR CURRICULUM CONTENTS

Undergraduate Degree in Engineering &Technology

BRANCH/COURSE: ELECTRICAL ENGINEERING

SEMESTER-III/IV

DETAILED CURRICULUM CONTENTS

Course Code: PCC-EE01 **Course Name:** Electrical Circuit Analysis

Course Credit: 4 **Total Contact Hour:** 40hr

Course Objective:

1. Fundamentals of Ohm's law, Kirchhoff's current and voltage laws and its practical implementation
2. Measurement of voltage, current, power and impedance of any circuit
3. Analysis of a given circuit depending on types of elements - DC analysis, Transient analysis and Frequency analysis
4. Measurement of frequency and amplitude of any signal using CRO
5. Designing of circuits (at least proto type models) for a given set of specifications weather in time domain or in frequency domain

Course Description:

This **course** introduces fundamental properties and methods for **analysis** of direct- current (DC) **electric circuits** including components such as resistors, capacitors, inductors, operational amplifiers, switches, and ideal and dependent voltage and current sources.

Course Contents:

Unit 1: Network Theorems

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.

Unit 2: Solution of First and Second order networks

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.

Unit 3: Sinusoidal steady state analysis

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.

Unit 4: Electrical Circuit Analysis Using Laplace Transforms

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

Unit 5: Two Port Network and Network Functions

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Course Learning Outcomes (CLOs):

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

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
- Analyze two port circuit behavior.

Text books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
3. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.

References books:

1. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.

Online links for study & reference materials:

https://nptel.ac.in/courses/117/106/117106086/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Midexam)	- 20%
Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	- 40%

Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

1. To give the idea about fundamental properties of semiconductors.
2. To prepare students to perform the analysis of any Analog electronics circuit.
3. To empower students to understand the design and working of BJT / FET amplifiers, oscillators and Operational Amplifier.
4. To prepare the students for advanced courses in Communication system Circuit Design

Course Description:

This course develops a basic understanding of the fundamentals and principles of analog circuits and electronic devices in electrical and electronic engineering. This understanding is a critical step towards being able to design new electronic circuits or use them appropriately as part of a larger engineering system.

Course Contents:

Unit 1: Diode circuits

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

Unit 2: BJT circuits

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

Unit 3: MOSFET circuits

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.

Unit 4: Differential, multi-stage and operational amplifiers

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)

Unit 5: Linear applications of op-amp

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.

Unit 6: Nonlinear applications of op-amp (6 Hours)

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Course Learning Outcomes (CLOs):

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

- Understand the characteristics of transistors.
- Design and analyze various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

Text books:

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.

References books:

1. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
2. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

Online links for study & reference materials:
https://nptel.ac.in/courses/108/102/108102112/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Mid exam)	- 20%
Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	**- 40%**

Course Code: PCC-EE03P **Course Name:** Analog Electronic Circuits Laboratory
Course Credit: 1 **Total Contact Hour:** 20hr

1. To find the voltage gain of a CE amplifier and to find its frequency response.
2. Design a single stage RC coupled amplifier (BJT and FET).
3. Design a emitter follower circuit using darlington pair.
4. Design a two stage RC coupled amplifier and plot of frequency v/s gain, estimation of Q factor and bandwidth.
5. To design a Class A and Class B amplifier.
6. Design of inverting, non inverting and differential amplifier.
7. Measurement of common mode gain, Differential mode gain, CMRR, Slew Rate.
8. Application of Op-Amp as summing amplifier, Difference Amplifier, Integrator, Differentiator.
9. Oscillator Sinusoidal oscillator (i) Wein bridge (ii) Phase shift (iii) Colpitt's (iv) Hartley.
10. To design and obtain the frequency response of (i) First order low pass Filter,(ii) First order High Pass Filter , Band Pass Filter.
11. To construct a 3-bit R-2-R ladder type D/A converter using op-amp IC 741.

Course Code: PCC-EE04 **Course Name:** Electrical Machines-I

Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

To introduce the fundamentals of dc machines, transformer, 3-phase transformer and special purpose transformer.

Course Description:

This course examines the basic theory, characteristics, construction operation and application of rotating electrical machines.

Course Contents:

Unit 1: Magnetic fields and magnetic circuits

Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Unit 2: Electromagnetic force and torque

B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

Unit 3: DC machines

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Unit 4: DC machine - motoring and generation

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

Unit 5: Transformers

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses 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, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

Course Learning Outcomes (CLOs):

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

- Understand the concepts of magnetic circuits.
- Understand the operation of dc machines.
- Analyse the differences in operation of different dc machine configurations.
- Analyse single phase and three phase transformers circuits.

Text books:

1. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

3. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

References books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

Online links for study & reference materials:
https://nptel.ac.in/courses/108/105/108105155/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Mid exam)	- 20%
Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	**- 40%**

Course Code: *PCC-EE05* **Course Name:** *Electrical Machines Laboratory– I*
Course Credit: 1 **Total Contact Hour:** 20hr

Course Contents:

Hands-on experiments related to the course contents of EE04.

Course Code: PCC-EE06 **Course Name:** Electromagnetic Fields

Course Credit: 4 **Total Contact Hour:** 40hr

Course Objective:

To get familiarize with concepts of electrostatic fields, magneto statics. To provide the skills required to understand, develop, and design various engineering applications involving electromagnetic fields.

Course Description:

This course examines electric and magnetic quasi static forms of Maxwell's equations applied to dielectric, conduction, and magnetization boundary value problems.

Course Contents:

Unit 1: **Review of Vector Calculus**

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.

Unit 2: Static Electric Field (6 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.

Unit 3: Conductors, Dielectrics and Capacitance (6 Hours)

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.

Unit 4: Static Magnetic Fields (6 Hours)

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Unit 5: Magnetic Forces, Materials and Inductance (6 Hours)

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.

Unit 6: 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.

Unit 7: 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.

Course Learning Outcomes (CLOs):

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

- To understand the basic laws of electromagnetism.
- To obtain the electric and magnetic fields for simple configurations under static conditions.
- To analyse time varying electric and magnetic fields.
- To understand Maxwell's equation in different forms and different media.
- To understand the propagation of EM waves.

Text books:

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.

References books:

1. E. G. Cullwick, “The Fundamentals of Electromagnetism”, Cambridge University Press, 1966.
2. B. D. Popovic, “Introductory Engineering Electromagnetics”, Addison-Wesley Educational Publishers, International Edition, 1971.
3. W. Hayt, “Engineering Electromagnetics”, McGraw Hill Education, 2012.

Online links for study & reference materials:
https://nptel.ac.in/courses/108/104/108104087/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Mid exam)	- 20%
Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	**- 40%**

Course Code: PCC-EE07 **Course Name:** Digital Electronics
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:
To understand design concept of combinational and sequential digital circuits.
Course Description:

Study of electronic circuits that are used to process and control digital signals. In contrast to analog electronics, where information is represented by a continuously varying voltage, digital signals are represented by two discreet voltages or logic levels.

Course Contents:

Unit 1: Fundamentals of Digital Systems and logic families

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-state logic.

Unit 2: Combinational Digital Circuits

Standard representation for logic functions, K-map representation, and 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.

Unit 3: Sequential circuits and systems

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D-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.

Unit 4: A/D and D/A Converters

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.

Course Learning Outcomes (CLOs):

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

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

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.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/105/108105132/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Mid exam)	- 20%
Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	**- 40%**

Course Code: PCC-EE08 **Course Name:** Digital Electronics Laboratory

Course Credit: 1 **Total Contact Hour:** 20hr

1. Verification of NAND, NOR, Ex-OR,AND & OR Gates.
2. Implementation of half Adder & Full Adder
3. Implementation of half Subtractor & Full Subtractor.
4. Implementation of Demultiplexer / Decoder operation using IC-74138.

5. Implementation of Seven segment display.
6. Implementation of Binary to gray converter.
7. Implementation of Arithmetic algorithms.
8. Implementation of various flip-flops.
9. Implementation of Counters.
10. Implementation of shift register.
11.Verification of Transfer characteristics of TTL inverters & TTL Schmitt Trigger inverter.

Course Code: PCC-EE09 **Course Name:** Electrical Machines – II
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:
To introduce the concept of single phase and three phase AC machines, their construction and performance parameters.
Course Description:
This course examines the basic theory, characteristics, construction operation and application of rotating electrical machines. It includes the study of alternators, synchronous motors, polyphase induction motors and single phase motors.
Course Contents:

Unit 1: Fundamentals of AC machine windings

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single- turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoid ally distributed winding, winding distribution factor

Unit 2: Pulsating and revolving magnetic fields

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current

Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Unit 3: Induction Machines

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors.

Generator operation. Self-excitation. Doubly-Fed Induction Machines.

Unit 4: Single-phase induction motors

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications

Unit 5: Synchronous machines

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Course Learning Outcomes (CLOs):

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

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyse performance characteristics of ac machines.

Text books:

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

References books:

1. A. S. Langsdorf, " Alternating current machines", McGraw Hill Education, 1984.
2. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/105/108105131/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Mid exam)	- 20%

Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	**- 40%**

Course Code: PCC-EE10 **Course Name:** Electrical Machines Laboratory
Course Credit: 1 **Total Contact Hour:** 20hr

Hands-on experiments related to the course contents of EE09.

Course Code: PCC-EE11 **Course Name:** Power Electronics
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:
To review the operational aspects of power electronic devices and principle of conversion and control of AC and DC voltages for high power applications.

Course Description:
The course focuses on presenting concepts for conversion, control and monitoring of electric energy using power semiconductor devices.

Course Contents:
Unit 1: Power switching devices

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

Unit 2: Thyristor rectifiers

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

Unit 3: DC-DC buck converter

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

Unit 4: DC-DC boost converter

Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

Unit 5: Single-phase voltage source inverter

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage

Unit 6: Three-phase voltage source inverter

Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation

Course Learning Outcomes (CLOs):

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

- Understand the differences between signal level and power level devices.
- Analyse controlled rectifier circuits.
- Analyse the operation of DC-DC choppers.
- Analyse the operation of voltage source inverters.

Text books:

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.

References books:

1. L. Umanand, " Power Electronics: Essentials and Applications" , Wiley India, 2009.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/102/108102145/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Mid exam)	- 20%
Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	**- 40%**

Course Code: PCC-EE12 **Course Name:** Power Electronics Laboratory
Course Credit: 1 **Total Contact Hour:** 20hr

Hands-on experiments related to the course contents of EE11.

Course Code: PCC-EE13 **Course Name:** Signals and Systems
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective: Understanding the fundamental characteristics of signals and systems. Understanding the concepts of vector space, inner product space and orthogonal series.

Course Description:

Signals and Systems is an introduction to analog and digital signal processing, a topic that forms an integral part of engineering systems in many diverse areas, including seismic data processing, communications, speech processing, image processing, defense electronics, consumer electronics, and consumer products.

Course Contents:

Unit 1: Introduction to Signals and Systems

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.

Unit 2: Behavior of continuous and discrete-time LTI systems

Impulse response and step response, convolution, input-output behavior with aperiodic 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.

Unit 3: Fourier, Laplace and z- Transforms

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. 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.

Unit 4: Sampling and Reconstruction

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.

Course Learning Outcomes (CLOs):

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

- Understand the concepts of continuous time and discrete time systems.
- Analyse systems in complex frequency domain.
- Understand sampling theorem and its implications.

Text books:

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.

References books:

1. A. V. Oppenheim and R. W. Schafer, " Discrete-Time Signal Processing", Prentice Hall, 2009.
2. M. J. Robert " Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
3. B. P. Lathi, " Linear Systems and Signals", Oxford University Press, 2009.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/104/108104100/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assessment -1	- 05%
Assessment -2	- 05%
Assessment -3 (Mid exam)	- 20%
Assessment -3	- 05%
Assessment -4	- 05%
Total Internal Assessment	**- 40%**

Course Code: HSMC 201 **Course Name:** Human Psychology

Course Credit Hour: 3 **Total Contact Hour:** 30hr

Course Objective:

- The student will acquire knowledge of human psychology including workplace environment, Motivation and perception.

Course Description:

- This course introduces the fundamental of human psychology includes important insights about motivation, leadership, perception and work environment.

Course Contents:

Unit 1: Introduction to Psychology (8 lectures)

Definitions & Scope. Types and branches of psychology Major influence on Psychology- Scientific Management and Human relations -Hawthorne Experiments. Taylor Principles, Implications of Psychology on Modern Industries and behavior

Unit 2: Individual at workplace (8 lectures)

Attention and Perception, Individual at Workplace-Attitude, Motivation and Job satisfaction. Stress management. Leadership and Group dynamics.

Unit 3: Work Environment & Engineering Psychology- (7 lectures)

Engineering psychology: fatigue, Monotony, Boredom. Accidents and Safety. Emotional and social development, Cognitive development. Consumer behavior analysis.

Unit 4: Job Analysis (7 lectures)

Job Analysis, Recruitment, Selection and Interview– Reliability & Validity of recruitment tests. Performance Management: Training & Development, Appraisals.

Course Learning Outcomes (CLOs):

CLO-1: Develop the basic concept of human psychology.
CLO-2: Inculcate leadership and motivational skills.
CLO-3: To understand consumer behavior and emotional development.
CLO-4: To understand about job recruitment process and interviews methods.

Text books:

(i) Aamodt, M.G. (2007) Human/Organizational Psychology: An Applied Approach (5th edition) Wadsworth/Thompson: Belmont, C.A.
(ii) Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi: Tata McGraw Hill.

Reference books:

(i) Miner J.B. (1992) Organizational Psychology. N Y: McGraw Hill.
(ii) Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: **HSMC 202** **Course Name:** Human Values
Course Credit Hour: 3 **Total Contact Hour:** 30hr

Course Objective:

- Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Description:

- This course introduces the fundamental of human values. It includes important insights about self-exploration, right conduct, ethics and harmony.

Course Contents:

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4.Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
5.Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself!

1.Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. 2.Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
3.Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
4.Understanding the characteristics and activities of 'I' and harmony in 'I'.
5.Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Health.

Unit 3: Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

2. Understanding the meaning of Trust; Difference between intention and competence

3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

4.Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. 3.Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. 4.Holistic perception of harmony at all levels of existence.

Unit 5 : Implications of the above Holistic Understanding of Harmony on Professional Ethics

1.Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and

develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems

Course Learning Outcomes (CLOs):

CLO-1: Develop the basic concept of human values
CLO-2: To understand the importance of self-exploration process
CLO-3: To understand harmony at individual levels
CLO-4: To understand harmony at nature level
CLO-5: Develop professional ethics

Textbooks:

(i) Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 Reference Books 1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
(ii) Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Reference books:

Human Values and Professional Ethics: Values and Ethics of Profession, Jay Shree Suresh and B.S Bahgvan, S.Chand

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: MC-02 **Course Name:** Python
Course Credit Hour: 3 **Total Contact Hour:** 34hr

Course Objective:

- Master the fundamentals of writing Python programs
- Learn basic Python coding elements such as variables, identifiers and flow control structures.
- Discover how to work with lists and sequence data.
- Write Python functions to facilitate code reuse.
- Work with the Python standard library
- Explore Python's object-oriented features

Course Description:

- This is an introductory course designed for any student interested in using computation to enhance their problem solving abilities. No prior experience in programming is necessary. Students will use their problem solving abilities to implement programs in Python. This course will develop a basic understanding the Python programming language

Course Contents:

UNIT 1

Introduction to Python: - History of python programming language, thrust areas of python, overview of programming in Python, identifiers, variables, Expressions and statements, Operators and Operands, data types, indentation, comments, reading input.

UNIT 2

Control flow Statements:-if statement, if-else statement, if-else-elif control flow statement, nested if statement, the while loops, the for loop, Strings: Creating and storing strings, basic string operations, formatting strings and string operations.

UNIT 3

Functions: Built in functions, function definition and calling the function, default parameters, Lists: Creating list, basic list operations, build in functions used in list, list methods, Dictionaries: Creating dictionaries, built on functions used in dictionaries, dictionary methods.

UNIT 4

Tuples: Creates tuples, basic tuple operations, tuple methods, Sets: set methods, Basics Object –oriented Programming: classes and objects, creating classes and objects in python, classes with multiple objects, class attributes vs. data attributes .

Course Learning Outcomes (CLOs):

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

- Understand python identifiers, variables, Expressions, statements, Operators, operand and data types.
- Implement Conditionals and Loops for Python Programs.
- Use functions and represent Compound data using Lists, Tuples, Dictionaries and strings.
- Implement basics object –oriented components.

Text books:

- Bill Lubanovic, Introducing Python- Modern Computing in Simple Packages, O'Reilly Publication.
- Wesley J. Chun, Core Python Programming, 2nd Edition, Pearson Education.

Reference books:

- Guido Van Russom, Fred L. Drake, An Introduction to Python, Network Theory Limited.
- Magnus Lie Hetland, Beginning Python: From Novice To Professional, Pearson Education.

Online links for study & reference materials:

https://nptel.ac.in/courses/106/106/106106212/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	-05%
Assignment -2	- 05%
Assessment -3(Mid Term-exam)-20%	
Assignment -3	- 05%
Assessment-4/ Quiz	- 05%
Total Internal Assessment	**- 40%**