University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B. Tech Admission Batch 2022

Electrical Engineering									
B.Tech. 2nd Year Course Structure									
4th Semester									
Sl No	**Type of Course**	**Course Code**	**Course Name**	**L**	**T**	**P**	**S**	**Total Contact Hours**	**Credit Points**
Theory									
1	Basic Science Courses	BSM401	Mathematics-IV	2	1	0		3	3
2	Basic Science Courses	MC401	Environmental Sciences	2	0	0		2	0
3	Professional Core Courses	PCCEE401	Electric Machine-I	3	0	0		3	3
4	Professional Core Courses	PCCEE402	Digital Electronics	3	0	0		3	3
5	Professional Core Courses	PCCEE403	Power Electronics	3	0	0		3	3
6	Professional Core Courses	PCCEE404	Signals & Systems	3	0	0		3	3
7	Humanities and social sciences including Management	ESP401	Essential Studies for Professionals IV	2	0	0		2	0.5

PRACTICAL									
8	Professional Core Courses	PCCEE491	Electric Machine Laboratory-I	0	0	2		2	1
9	Professional Core Courses	PCCEE492	Digital Electronics Laboratory	0	0	2		2	1
10	Professional Core Courses	PCCEE493	Power Electronics Laboratory	0	0	2		2	1
SESSIONAL									
11	Open Elective Courses	OECEE481	A. Object Oriented Programming & Java Lab B. Advance Python				2	2	1
12	Humanities and social sciences including Management	SDP481	Skill Development for Professionals IV				2	2	0.5
13	Project. Seminar and Industrial Training	PWEE481	Mini Project II				1	1	1
Value Added Courses									
14	Massive Open Online Courses (MOOCs)	MOOCs	Massive Open Online Courses (MOOCs)						
15	Industry and Foreign Certification (IFC)	IFC	Industry and Foreign Certification (IFC)						
16	Mandatory Additional Requirements (MAR)	MAR481	Mandatory Additional Requirements (MAR)						
Total Credit Points of Semester				**18**	**1**	**8**	**3**	**30**	**21**

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Mathematics-IV **Credit: 3** **Lecture Hours: 42**
Subject Code: BSCM401

Course Outcomes:

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

CO1. Identify different tools for differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.
CO2. Appraise the notions of Fourier Series and Transform to solve advanced engineering problems.
CO3. Apprehend the concept of Laplace Transform together with its applications in evaluating integrals and solving ordinary differential equations.
CO4. Relate the use of Z-Transform for discrete functions and solve difference equations using Z-Transform technique.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Calculus of Complex Functions**	Complex function, Limit, Continuity and Differentiation; Analytic functions, Cauchy-Riemann equations (statement only); Harmonic functions, Harmonic Conjugate; construction of Analytic functions; elementary Analytic functions (exponential, trigonometric, logarithm) and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series; zeros of analytic functions, singularities, poles; Laurent's series; Residues, Cauchy Residue theorem (without proof); Conformal mappings, Mobius transformations and their properties.	***International Academia:*** https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/pages/syllabus/ https://ocw.mit.edu/courses/18-112-functions-of-a-complex-variable-fall-2008/pages/syllabus/ ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE/EE/EEE/ME/BSC 104/pg 43.pdf) ***Industry Mapping:*** Analysis of AC circuit, physical problems involving ideal fluid flow, steady state heat and current flow can be solved using the theory.	14	**Associated Lab using MATLAB:** 1.Evaluation of contour integrals using **MATLAB** 2.Calculation of residues at the poles using **MATLAB**
2	**Fourier**	*Fourier Series*: Even function, Odd	**International Standards**	12	**Associated Lab using MATLAB:**

	Series & Transform	function. Periodic function, Euler's formula, Dirichlet's conditions; Sum of the Fourier series at the point of discontinuity and end points of an interval; Half Range Sine and Cosine Series; Parseval's Theorem. *Fourier Transforms*: Fourier Transform and its properties; Fourier Sine and Cosine Transforms, Fourier Transform of derivatives (statement only); Inverse Fourier Transform (statement only); Convolution theorem (statement only), related problems.	:) https://ocw.mit.edu/courses/18-085-computational-science-and-engineering-i-fall-2008/ ***Industry Mapping:*** 1.Designing and analysing electrical and electronic communication systems. 2. Fourier coefficients are used to analyse and predict signals and images. 3. In medical science,CT scan, ECG, EEG, X-ray are analysed using fourier transform.		1. Perform fourier sine and cosine transforms using **MATLAB** 2. Write fourier series for some elementary functions using **MATLAB**
3	**Laplace Transform**	Laplace Transform and its properties; First and Second Shifting theorems; Laplace Transform of Periodic functions; Inverse Laplace Transform by different methods, Convolution theorem; evaluation of integrals by Laplace Transform; solving ODEs by Laplace Transform method. .	***International Standards*** : https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/operations-on-fourier-series/ ***AICTE prescribed syllabus:***	10	**Associated Lab using MATLAB:** **1.** Perform Laplace transform of some elementary functions using **MATLAB** **2.**Perform inverse Laplace transform using **MATLAB**

			(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE/EE/EEE/ME/BSC 104/mOD 4/pg 211.pdf ***Industry Mapping:*** 1. In the circuit with inductor and capacitor connected to a generator, the charge and the supply voltage may be estimated. Differential-Difference equations, Intrigo-differential equations often obtained during solving non-linear problems which is difficult otherwise.		
4	**Z-Transform**	Sequence, representation of sequence, Z-Transform and its properties, Shifting theorems, Inverse Z-transform, Convolution theorem, region of convergence, concept of difference equation and their solution by Z-Transform method.	***International Standards:*** ***https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/*** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE/EE/EEE/ME/BSC 104/mOD 4/pg 211.pdf	6	**Associated Lab using MATLAB:** **1.** Compute z-transform of some elementary of some functions using **MATLAB** 2. Solve linear difference equation with constant coefficients using MATLAB

			Industry Mapping: *1. To find the current in the n-th loop for the ladder network.* *2. The principle of a controller design for process control.*		

Suggested Learning Resources:

Text Book:

1. **B. S. Grewal**, "Higher Engineering Mathematics", 44th Edition (2021), Khanna Publishers.

Reference Books:

1. **Biswadip Basu Mallik & Krishanu Deyasi,** "Engineering Mathematics" – Vol. 2B, 1st Edition (2020), Cengage Learning.
2. **B. K. Pal & K. Das,** "Engineering Mathematics" - Vol. IIB, 13th Edition (2019), Vol. IIIB, 8th Edition (2019), U. N. Dhur & Sons.
3. **Erwin Kreyszig,** "Advanced Engineering Mathematics", 10th Edition (2017), John Wiley & Sons.
4. **R. K. Jain and S. R. K. Iyengar,** "Advanced Engineering Mathematics", 5th Edition (2016), Narosa Publication House.
5. **B. V. Ramana,** "Higher Engineering Mathematics", 11th Reprint (2017), Tata McGraw Hill.

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Environmental Science **Credit: 0** **Lecture Hours: 40**

Subject Code: MC401

Course Outcomes:

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

CO1. To understand the natural environment and its relationships with human activities.

CO2. To apply the fundamental knowledge of science and engineering to assess environmental and health risk

CO3. To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations

CO4. Acquire skills for scientific problem-solving related to air, water, noise& land pollution

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
I	**Overview**	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. Importance, scope and principles of EIA.	***International Academia:*** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** https://cbs.umn.edu/populus/downloadplant(WWTP) .	6	There are no corresponding labs
II	**Ecology**	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L) Biodiversity- types, importance,	***International Academia:*** ***https://ocw.mit.edu/courses/1-020-ecology-ii-engineering-for-sustainability-spring-2008/*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf***	6	There are no corresponding labs

		Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	***Industry Mapping:*** ***https://vsni.co.uk/solutions/ecology*** ***https://www.helsinki.fi/en/researchgroups/statistical-ecology/software***		
III	**Air Pollution**	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants-	***International Academia:*** https://ocw.mit.edu/courses/1-84j-atmospheric-chemistry-fall-2013/pages/lecture-notes/ ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** https://www.who.int/europe/tools-and-toolkits/airq---software-tool-for-health-risk-assessment-of-air-pollution	11	There are no corresponding labs

		Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)			
IV	**Water Pollution**	Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds.DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenating, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Waste water standard [BOD, COD], Water Treatment system,primary and secondary treatments, tertiary treatment definition.Water pollution due to the toxic elements. USEPA and WHO guidelines for drinking water.	***International Academia:*** ***https://online.stanford.edu/courses/cee270m-aquatic-and-organic-chemistry-environmental-engineering*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** *Activated Sludge Simulation (ASIM), Sewage Treatment Operation and Analysis Over Time*	9	There are no corresponding labs

			(STOAT), and GPS-X are the common softwares used for waste water treatment plant(WWTP).		
V	**Lithosphere**	Lithosphere; Internal structure of earth, rock and soil (1L). Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method-Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)	***International Academia:*** ***https://ocw.mit.edu/courses/1-34-waste-containment-and-remediation-technology-spring-2004/*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** ***https://www.wasteworksonline.com/***	3	There are no corresponding labs
VI	**Noise pollution**	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. (1L)	***International Academia:*** ***No link found*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** No software found	3	There are no corresponding labs

VII	**Environmental Management**	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	***International Academia:*** ***https://ocw.mit.edu/courses/11-601-introduction-to-environmental-policy-and-planning-fall-2016/*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** ***https://www.intelex.com/products/environment/***	2	There are no corresponding labs

Suggested Learning Resources:

Text books/ reference books:

1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
3. De, A. K., "Environmental Chemistry", New Age International
4. Das Mohapatra Gourkrishna,. Basic Environmental Engineering and Elementary Biology, Vikas Publishing, (1 January 2017) .

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Electrical Machines I **Credit: 3** **Lecture Hours: 38**
Subject Code: PCCEE401

Course Outcomes:

CO1. To remember and understand the basic concept and laws pertaining to Magnetic field & circuits, E.M. forces & torque.

CO2. To appreciate the working principle, characteristics and different problems related to DC generator.

CO3. To understand the working principle, characteristics, testing and control mechanism of DC motor.

CO4. To develop the capability to analyze the operation, characteristics and testing of Transformers as per their usage in different sector.

Module Number	Topic	Sub-topics	Mapping with Industries, National and International Academia	Lecture Hours	Corresponding Lab assignments
1	Magnetic fields, Energy density and magnetic circuits; Electromagnetic force, torque and General theory of Rotating Electrical Machines	Review of magnetic circuits - MMF, flux, reluctance, inductance; Energy density, 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. 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	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus**: https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf **Industry Mapping:** IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines · **Simulation Software:** MATLAB	**7**	Introduction to IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines regarding: · Duty Type, · Rating and · Co-ordination of voltage and output

2	Construct-ion and Principle of working of 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.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus:** https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf **Industry Mapping:** IS Specification No. 9320: 1979 regarding Guide for testing of DC Machines **Simulation Software:** MATLAB	**8**	Testing of DC Generators and Motors as per IS Specification No. 9320: 1979 : a) Measurement of winding resistances b) Determination of open circuit characteristics c) Determination of regulation characteristics d) Determination of external characteristics (for generator only) e) Determination of efficiency of a machine · Assignments using Simulation Software
3	DC machine – Operation, Control and Efficiency	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.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus:** https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf · **Industry Mapping:** IS Specification No. 9320: 1979 regarding Guide for testing of DC Machines	**7**	Testing of DC motor to: a) Study Torque- Speed characteristics b) Different Methods of Speed Control · Assignments using Simulation Software

		Losses ,Efficiency, load testing and back-to-back testing of DC machines, Permanent Magnet DC (PMDC) motor, Brushless DC (BLDC) Motors	**Simulation Software:** MATLAB		
4	Transformers – Working principle, Construction, Operation, Control and Testing	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, Phasor groups 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, Dry type transformer.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus:** https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf · **Industry Mapping:** IS Specification No2026: 1981 (Part 1) for Power Transformer and IS Specification No. 11171: 1985 for Dry type transformer **Simulation Software:** MATLAB	**16**	Routine tests of transformer as per IS 2026: a) Transformer voltage ratio test and polarity b) Winding resistance test of transformer c) Transformer vector group test d) Measurement of impedance voltage/short circuit impedance (principal tap) and load loss (Short circuit test) e) Measurement of no-load loss and current (Open circuit test) f) Temperature rise test of transformer (Back to Back Test) g) Dielectric tests of transformer (in Power System) h) Measurement of insulation resistance (in Power System) · Assignments using Simulation Software

Suggested Learning Resources:

Text Books

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Reference Books

1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. 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. Kirtley Jr., James L. Electric Power Principles: Sources, Conversion, Distribution and Use. Wiley, 2010. ISBN: 9780470686362.

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Syllabus for B. Tech Electrical Engineering Batch 2022

Subject Name: Digital Electronics **Credit: 3** **Lecture Hours: 40**

Subject Code: PCCEE402

Course Outcomes:

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

CO1. Describe the function of different building blocks of digital electronics, semiconductor memories and programmable logic devices.

CO2. Explain the principle of operation of combinational and sequential digital circuits, A/D and D/A converter.

CO3. Solve numerical problems of Boolean algebra, number system, combinational & sequential digital circuits and A/D and D/A converter.

CO4. Specify applications of combinational and sequential digital circuits.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Number System and Codes**	Introduction to number systems, Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, gray codes and their conversions. Signed binary number representation with 1's and 2's complement methods, Radix and Radix conversions, Weighted and non-weighted codes, and BCD arithmetic	***International Academia:*** (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	8	1. Code conversion circuits:- BCD to Excess-3 & Excess-3 to BCD 2. To design and implement 4-bit Gray to binary code converter 3. Introduction to P-SPICE/ MATLAB/ SCILAB
2	**Boolean Algebra and Digital Logic Gates**	Basic definitions and features of Boolean algebra, Theorems of Boolean algebra, Basic logic functions, Standard and Canonical forms. Fundamental logic gates, derived	**International Standards**: (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-	10	4. To study about logic gates and verify their truth tables. 5. Realization of basic gates

		logic gates, logic diagrams, Converting logic diagrams to universal logic (NAND and NOR Implementation). Simplification of logic expressions using Karnaugh's maps. K-Map Method - Product of Sums (maxterms) and Sum of Products (minterms) Simplification.	1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB		using Universal logic gates

3	**Designing Combinational Logic Circuits**	Arithmetic circuits (ADDER and SUBTRACTOR), comparators, decoders, encoders, multiplexers, de- multiplexers, code converters and their use in logic synthesis; Potential hazards in combinational circuits.	***International Standards***: (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	8	6. Construction of simple decoder and multiplexer circuit using NAND gate. 7. Construction of simple arithmetic circuits – ADDER 8. Construction of simple arithmetic circuits – SUBTRACTOR 9. One bit and two bit comparator circuit.

4	**Designing Sequential Logic Circuits**	Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Design of Synchronous Sequential Circuits- State Table and State Diagrams, Design of Mealy and Moore FSM -Sequence Detection.	***International Standards:*** (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	8	10. Realization of RS-JK, T and D flip-flop using universal logic gates. 11. Realization of ring counter and Johnson's counter.

5	**Logic Families and Switching Circuits**	Diode, BJT, FET as switch. Different types of logic families: RTL, TTL, subfamilies, three state output logic, MOS, CMOS, ECL IIL. Their operations and specifications.	***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	6	12. Applications of P-SPICE/ MATLAB/ SCILAB

Suggested Learning Resources:

1. Digital Principles & Application, 5th Edition, Leach & Malvino, Mc Graw Hill Company.
2. Modern Digital Electronics, 4th Edition, R.P. Jain. Tata Mc Graw Hill Company Limited.
3. Fundamental of Digital Circuits, A. Anand Kumar, 4th Edition, PHI.
4. Digital Electronics, R. Anand, Khanna Publishing House (2018).
5. Digital Logic Design, Morries Mano, PHI.
6. Digital Integrated Electronics, H. Taub & D. Shilling, Mc Graw Hill Company.
7. Digital Electronics, James W. Bignell & Robert Donovan, Thomson Delman Learning.
8. Fundamental of logic Design, Charles H. Roth, Thomson Delman Learning.

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Power Electronics **Credit: 3** **Lecture Hours: 43**

Subject Code: PCCEE403

Course Outcomes:

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

CO1. Know the operation of different power electronics switches

CO2. Understand the basic operating principle of converters.

CO3. Evaluate the performance of different types of converter.

CO4. Design power electronic converter for specific application.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
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. EMB1412 - MOSFET Gate Driver	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** MATLAB	8	1. Study of the characteristics of an SCR. 2. Study of the characteristics of a Triac 3. Study of different triggering circuits of an SCR 4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
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. LM5045 Full-Bridge PWM Controller	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	7	5. Study of the operation of a single phase full controlled bridge converter with R and R-L load. 6. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters. 7. Study of performance of three phase controlled converter with R & R-L load.

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.	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	5	8. Study of performance of step down chopper with R and R-L load.
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. TPS631010-Buck-Boost Converters	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	5	9. Study of performance of buck-boost chopper with R load.
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	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed***	10	10. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.

		modulation and unipolar sinusoidal modulation, modulation index and output voltage	***syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB		
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. TIDA-010025 - Three-phase inverter	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	8	12. Study of performance 3phase bridge inverter using MOSFET as switch with lamp load.

Suggested Learning Resources:

Text Books

1. Power Electronics, P.S. Bimbhra, Khanna Publishers.
2. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.

Reference Books

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

University of Engineering and Management

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Syllabus for B.Tech Admission Batch 2023

Subject Name: Signals & Systems **Credit: 3** **Lecture Hours: 25**

Subject Code: PCCEE404

Course Outcomes:

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

CO1. Understand the concepts of continuous time and discrete time signals.

CO2. Evaluate the frequency spectra for different kind of signals.

CO3. Analyze different transformations for continuous and discrete signals.

CO4. Design sampling frequency and filters to recover the original signal.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
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.	***International Academia:*** (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:*** MATLAB,SCILAB	3	1. Simulation of different signals using MATLAB 2. Different operations on signals. 3. Introduction to programming using MATLAB
2	**Signal operation & state space models of LTI systems**	Behaviour of continuous and discrete-time LTI systems: Impulse response and step response, convolution, input-output behaviour with aperiodic convergentinputs, 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,	**International Standards** :(https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:***	8	1. Different operations on continuous time signals using MATLAB , Convolution, Correlation , Auto correlation.

		Multi-input, multi-output representation. State Transition Matrix andits Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	MATLAB, OCTAVE		
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, the solution to differential equations and system behaviour. The z-Transform for discrete-time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis	***International Standards*** : (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:*** Hardware Chipset (DSP KIT) Software: MATLAB, OCTAVE	10	1. Transformation of signals into time and frequency domain Using MATLAB 2. DTFT, DFT transformation using MATLAB.

4	**Introduction to Sampling and Reconstruction:**	The Sampling Theorem and its implications. Spectra of sample 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	***International Standards:*** (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:*** FPGA Kit Software: MATLAB, OCTAVE	4	1. Implementation of sampling using MATLAB. 2. Quantization implementation using MATLAB. 3. Reconstruction of signals using MATLAB

Suggested Learning Resources:

Text Books

1. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.

Reference Books

1. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
2. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
3. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
4. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
5. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Electrical Machines Laboratory - I **Credit: 1** **Lecture Hours: 24**

Subject Code: PCCEE491

Course Outcomes:

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

CO1. Identify appropriate equipment and instruments for the experiment.

CO2. Test the instrument for application to the experiment.

CO3. Construct circuits with appropriate instruments and safety precautions.

CO4. Validate different characteristics of DC machine, methods of speed control of DC motor and parallel operation of the transformer.

Laboratory Experiments

Module No	Description	Lecture Hours
1	Determination of the characteristics of a separately excited DC generator.	**2**
2	Determination of the characteristics of a DC motor.	**2**
3	Study of methods of speed control of DC motor.	**2**
4	Determination of the characteristics of a compound DC generator (short shunt).	**2**
5	Determination of speed of DC series motor as a function of load torque.	**2**
6	Polarity test on a single phase transformer.	**2**
7	Determination of equivalent circuit of a single phase transformer and efficiency.	**2**
8	Study of different connections of three phase transformer.	**2**
9	Study of Parallel operation of a single phase transformers	**2**
10	Determination of temperature rise and efficiency of the transformer (Back to back test).	**2**
Total		**20**

Virtual Lab. Details

Experiment Name	Web-Link/ Software Used
Determination of the characteristics of a separately excited DC generator.	https://ems-iitr.vlabs.ac.in/exp/magnetization-characteristics-dcshunt/ https://ems-iitr.vlabs.ac.in/exp/load-characteristics-dc-shunt/
Determination of the characteristics of a DC motor.	http://em-coep.vlabs.ac.in/Exp1/Theory.html?domain=Electrical%20Engineering&lab=Welcome%20to%20Electrical%20Machines!
Study of methods of speed control of DC motor.	https://ems-iitr.vlabs.ac.in/exp/dcmotor-field-resistance-control/ https://ems-iitr.vlabs.ac.in/exp/dcshunt-motor-armature-control/
Determination of equivalent circuit of a single phase transformer and efficiency.	https://ems-iitr.vlabs.ac.in/exp/circuit-parameters-oc-test/

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Digital Electronics Laboratory **Credit: 1** **Lecture Hours: 30**

Subject Code: PCCEE492

Course Outcomes:

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

CO1. Understand working of logic families and logic gates

CO2. Design and implement combinational and sequential logic circuits.

CO3. Design and implement arithmetic circuits.

CO4. Be able to use PLDs to implement the given logical problem

Laboratory Experiments

Module No	Description	Lecture Hours
1	Realization of basic gates using Universal logic gates.	**2**
2	Code conversion circuits- BCD to Excess-3 & vice-versa.	**2**
3	4-bit parity generator & comparator circuits.	**2**
4	Construction of simple Decoder & Multiplexer circuits using logic gates.	**2**
5	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display Using multiplexer	**2**
6	Construction of simple arithmetic circuits-Adder, Subtractor.	**2**
7	Realization of RS-JK & D flip-flops using Universal logic gates	**2**
8	Realization of Universal Register using JK flip-flops & logic gates	**2**
9	Realization of Universal Register using multiplexer & flip-flops.	**2**
10	Construction of Adder circuit using Shift Register & full Adder	**2**
11	Realization of Asynchronous Up/Down counter	**2**
12	Realization of Synchronous Up/Down counter	**2**
13	Design of Sequential Counter with irregular sequences.	**2**
14	Realization of Ring counter& Johnson's counter.	**2**
15	Familiarization with A/D and D/A circuits	**2**
TOTAL		**30**

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Power Electronics Laboratory **Credit: 1** **Lecture Hours: 26**

Subject Code: PCCEE493

Course Outcomes:

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

CO1. Identify the basic elements of the power electronics engineering.

CO2. Understand the basic operation of electronic switches.

CO3. Understand the operation of different types of power converter.

CO4. Design basic converter for various applications

Laboratory Experiments

Experiment No.	Description	Hrs.
1.	Study of the characteristics of an SCR.	2
2.	Study of the characteristics of a Triac.	2
3.	Study of the characteristics of an IGBT.	2
4.	Study of different triggering circuits of an SCR	2
5.	Study of firing circuits suitable for triggering SCR in a 1- phase full controlled bridge.	2
6.	Study of the operation of single phase full controlled converter with R and R-L load.	2
7.	Study of performance of single phase half controlled symmetrical bridge converters.	2
8.	Study of performance of single phase controlled converter with source inductance.	2
9.	Study of performance of three phase controlled converter with R & R-L load.	2
10.	Study of performance of step down chopper with R and R-L load.	2
11.	Study of performance of buck-boost chopper with R load.	2
12.	Study of performance of 1-phase PWM bridge inverter with R and R-L load.	2
13.	Study of performance of 3-phase bridge inverter with R load.	2
Total		**26**

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Syllabus for B.Tech Admission Batch 2022

Subject Name: Object Oriented Programming & Java Lab **Credit: 1** **Lecture Hours: 24**
Subject Code: OECEE481A **Semester: 4**

Prerequisite: Familiarity with data structures, and introduction to programming.

Course Outcomes

i.e., statements on students' understanding and skills at the end of the course the student shall have:

Essential:

1. Understanding the build system: IDE, tools for testing, debugging, profiling, and source code management.
2. Students are able to demonstrate proficiency in object-oriented programming.
3. Identify and abstract the programming task involved for a given programming problem.
4. Learning and using language libraries for building large programs.
5. Ability to apply defensive programming techniques (e.g., assertions, exceptions).

Desirable/Advanced:

1. Ability to implement basic event-driven programming.
2. Understanding of the fundamentals of parallel programming.
3. Understanding of the basics of cloud computing.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Corresponding Lab Assignment
1.	**Familiarity with the programming environment**	Understanding the build system, IDE, debugging, profiling and source code management. Introduction to various programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigm	**International Academia:** (https://drive.google.com/file/d/10z00dMd26WjiPThhCercGbsi6u3ciE62/view?usp=drive_link) (https://drive.google.com/file/d/1k3qrfDL9p5_IJR_iP2mt6c6AzwmByNtf/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Familiarity with terminal/command prompt, using git commands and github to pull/ commit/ push/ merge code, writing, compiling and running simple programs, debugging by setting breakpoints

2.	**Basic principles of the object-oriented development process**	Introduction to Object-Oriented Paradigm: Data encapsulation, modularity, code reuse, identifying classes, attributes, methods and objects, class relationships	**International Academia:** (https://drive.google.com/file/d/1Rc1KOzkVRHqLEWApFBplwz7s8IwsyFlf/view?usp=sharing) (https://drive.google.com/file/d/1e8g7D6nuMwEruToXtNDbh68vx2VKUrgS/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Importing pre-written classes using the this keyword, calling and defining methods, writing and instantiating classes, setter/getter methods, instance variables, returning values, debugging using print function, containment and association, scope and parameter passing

3.	**Advanced features of OOP**	Interfaces, inheritance, polymorphism, abstract classes, immutability, copying and cloning objects	**International Academia:** International Standards Mapping (MIT Open Courseware): String: immutability, BufferReader, StringBuilder (https://ocw.mit.edu/ans7870/6/6.005/s16/classes/09-immutability/) Polymorphism : Methods : Overloading and overriding Methods, overloading constructors (https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/67b1aec3f2867734ec0fb33034c8b5c8_MIT6_088IAP10_lec05.pdf) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Parameter polymorphism, method resolution, declared v/s actual type, partially and fully overriding methods, calling superclass constructor from child class constructor, protected fields and methods, using an abstract parent class v/s an interface with default and abstract methods, object equality check, object comparison (Comparable/Comparator interface), Cloneable interface/copy constructor

4.	**Using language APIs**	Language supported libraries for handling advanced data structures. Abstraction: abstract class, design debugging interface, multiple inheritance, packages Access control, class scope, packages, Java API	**International Academia:** (https://drive.google.com/file/d/1yFNf2IBXgy6ch47hR6TGHzddvCPfVm8p/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Big-O notation, Java collection framework (or Boost libraries), sorting objects, iterating over objects
5.	**Defensive programming**	Exception handling, assertions, Java Thread Programming	**International Academia:** (https://drive.google.com/file/d/1kbRGF396sQPdQbA4w-N81ElKU_bdGgFs/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Exception handling using try/catch block, nesting try/catch blocks, throw and throws keywords, rethrowing exceptions, handling checked exception, user defined exceptions. Thread Synchronization and Thread Communication

6.	**Modeling and Design patterns**	Basic modeling techniques – e.g. Class diagram, sequence diagram, use case diagrams, etc. Introduction to design patterns: iterator, singleton, flyweight, adapter, strategy, template, prototype, factory, façade, decorator, composite, proxy, chain of responsibility, observer, state) Model View Controller	**International Academia:** (https://drive.google.com/file/d/1DQVPfhmcyKog-PryPdZ-bxufUC7D0Cfl/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	UML modeling.
7.	**Basic Android Programming**	Android Components – Activity, Services, Content Provider, Broadcast Receiver; Simple UI Design,Applet and Swing	**International Academia:** (https://online.stanford.edu/courses/cs108-object-oriented-systems-design) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform,. Android Studio will be used.*	Android app making

Suggested Learning Resources:

Text Books

1. Herbert Schildt, Java: The Complete Reference, 11st edition
2. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston. Object-Oriented Analysis and Design with Applications.
3. E. Balaguruswami, Programming with Java, 6th edition
4. Barry A. Burd and John Mueller, Android Application Development All-in-One For Dummies

Reference Books:

1. J. Rumbaugh et al. The Unified Modeling Language Reference Manual.
2. P. Van Roy and S. Haridi. Concepts, Techniques, and Models of Computer Programming.
3. Horton, I. (2005). Ivor Horton's Beginning Java 2. John Wiley & Sons.
4. https://missing.csail.mit.edu/
5. https://www.baeldung.com/junit
6. https://www.tutorialspoint.com/junit/index.htm

For UML tools, open source tools may be used (e.g. www.starUML.io, argouml.tigris.org/)

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Syllabus for B.Tech Admission Batch 2022

Subject Name: Advance Python **Lecture Hours: 24** **Credit: 1**
Subject Code: OECEE481B

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Corresponding Lab Assignment
1	**Introduction to Python**	Data Types, Operators, Expression, Indexing & Slicing, Strings, Conditionals, Functions, Control Flow, Nested Loops, Sets &Dictionaries.	***International Academia:*** https://tinyurl.com/bdass3 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Jupyter Notebook	1. Experiments to understand all the basic datatypes in python. 2. Experiments to implement various arithmetical and logical operators. 3. Experiment to understand the indexing techniques in python. 4. Code using conditional statement, control flow and nested loops. 5. Code to implement sets and Dictionaries in python.
2	**Introduction to Machine Learning**	Machine Learning Vs Statistical Modelling, Supervised vs Unsupervised Learning, Supervised Learning Classification,	***International Academia:*** https://tinyurl.com/2jphac8c ***AICTE-prescribed syllabus:***	1. Experiments/ code that refresh Python, programming frameworks used for the course. 2. Experiments/Code that allows students to appreciate mathematics and data

		Unsupervised Learning, Reinforcement Learning, Applications, Python libraries suitable for Machine Learning: Pandas, Numpy, Scikit-learn, visualization libraries: matplotlib etc.	https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, SK Learn, Mat Plot Lib, NumPy, Pandas	manipulation. Appreciate (a) Features, Representation of the data/real-world phenomena (b) mathematical operations or transformations that manipulate the data (c) plot/visualise the data distributions (say in 2D) (d) Eigen values, eigen vectors, rank of matrices. 3. Lab/Experiments that appreciate the problem of Classification and problem of Regression 4. Lab/Experiments that appreciates the notions related to "Training" and "Testing" by considering algorithms like decision trees, nearest neighbour as black boxes.
3	**Regression Model using Python**	Simple Linear Regression, Multiple Linear Regression, Non-linear Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models	***International Academia:*** https://tinyurl.com/9d4brw22 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, Regression ML Algorithms	1. Experiments on dimensionality Reduction using Principal Component Analysis (PCA) and its applications in (a) removing irrelevant features (b) compression /compaction (c) efficient ML pipeline. 2. Experiment related to Linear Regression and Non-linear Regression. 3. Experiment to understand and implement the process of Model evolution in Regression Models. 4. Experiment related to Evaluation Metrics in Regression Models.
4	**Classification Model using Python**	Introduction to Classification, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Logistic regression vs Linear regression, Evaluation Metrics in Classification	***International Academia:*** https://tinyurl.com/9d4brw22 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, Classification ML Algorithms	1. Experiment related to Nearest neighbour classifier, (a) visualize the decision boundaries (b) appreciate the role of hyper parameter K. Role of validation data in choice of hyper parameters 2. Decision Tree as a classifier and see the overfitting with "deep" trees. How the overfitting can be controlled by seeing validation performance during the training. 3. Experiment that demonstrates how SVM can yield a solution better than a simple linear

				separating solution. Appreciate the role of support vectors. Appreciate how SVMs extend to problems even if data is not linearly separable.
5	**Unsupervised Learning using Python**	Introduction to Clustering, K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Content-based recommender systems, Collaborative Filtering	***International Academia:*** https://tinyurl.com/9d4brw22 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, Clustering ML Algorithms	1. Experiments on various techniques of plot under fitting and overfitting in a data set. 2. Experiment on the implementation of clustering using ML algorithms. 3. Experiments related to K-Means, by varying in "K", "initialization". How the "analysis of the algorithm" can be seen in the lab (e.g. change of objective across iterations). Try multiple datasets. Appreciate that "unsupervised discovery" makes sense in the problem under consideration.

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DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER WISE CURRICULAM

3rd YEAR- 6th SEMESTER

Semester VI [Third year]
Branch/Course: Electrical Engineering

Sl. No.	Course Code	Course Title	Hours per week			Total contact hours	Credits
			Lecture	Tutorial	Practical		
1	PCC-EE20	Power Systems – II (Operation and Control)	3	0	0	3	3
2	PCC-EE21	Power Systems Laboratory - II	0	0	2	2	1
3	PCC-EE22	Measurements and Instrumentation Laboratory	2	0	2	4	3
4	PCC-EE23	Electronics Design Laboratory	1	0	4	5	3
5	PEC-EE02	A. Digital Signal Processing B. Wind and Solar Power Energy System	3	0	0	3	2
6	PEC-EE92	A. Digital Signal Processing Laboratory B. Wind and Solar Power Energy System Laboratory	0	0	2	2	1
7	PEC-EE03	A. Digital Control System B. Electrical and Hybrid Vehicle	3	0	0	3	3
8	OEC-EE02	A. Internet of Things B. Image Processing	3	0	0	3	3
9	HSMC EE 302	Principles of Management	3	0	0	3	3
10	PROJ EE04	Project IV	0	0	0	0	1
11	HSMC (EE) 602	ESSENTIAL STUDIES FOR PROFESSIONAL- VI	2	0	0	2	0.5
12	HSMC 682	SKILL DEVELOPMENT FOR PROFESSIONALS- VI	0	0	2	2	0.5
						TOTAL CREDITS	**24**
13	MOOCS through NPTEL/SWAYAM Portal for Honours Degree						
14	IFC- Industry & Foreign Certification through different online portals						
15	MAR- Mandatory Additional Requirement						
Summer Internship of 3-week duration after 6th semester. Students will be assessed based on submission of report on internship and presentation in a seminar in 7th semester							

Name of the Course:	Power Systems–II (Operation and Control)	Subject Code:	PCC-EE20
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Power System I		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To utilize numerical methods for analyzing a power system in steady state.
2. To understand stability constraints in a synchronous grid.
3. To realize methods to control the voltage, frequency and power flow.
4. To understand the monitoring and control of a power system.
5. To understand the basics of power system economics.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Power Flow Analysis:** Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.	8
2	**Power System Stability:** Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.	10
3	**Automatic Generation Control: Frequency and Voltage Control** Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters.	8
4	**Monitoring and Control:** Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a	6

	Power System. Contingency Analysis. Preventive Control and Emergency Control.	
5	**Power System Economics and Management:** Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.	**8**
Total		**40**

Course Outcomes:

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

CO1. Understand the stability constraints in synchronous grid and numerical methods to analyze power flow in a power system.

CO2. Realize the control and methods to control the voltage, frequency and power flow in a power system.

CO3. Understand the measurement systems and assess the system through monitoring and control.

CO4. Appreciate the basics of power system economics and energy management.

Suggested Learning Resources:

Text Books

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
2. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

Reference Books

1. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
2. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

Name of the Course:	Digital Signal Processing	Subject Code:	PEC-EE02A
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Signal and System		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To understand sampling and reconstruction of signal
2. To understand the method of Z-transform and inverse Z- transform of signal and its properties
3. To understand Discrete Fourier Transform
4. To understand methods of design of Digital filters
5. To understand applications of Digital signal processing
6. To solve numerical problems on the topics studied

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Discrete-time signals and systems** Discrete time signals and systems: Sequences; representation of signals onorthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals -aliasing; Sampling theorem and Nyquistrate.	6
2	**Z-transform** z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.	8
3	**Discrete Fourier Transform** Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Connvolution of signals,Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems	6
4	**Design of Digital filters** Design of FIR Digital filters:Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.	12

5	**Applications of Digital Signal Processing** Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	6
Total		**38**

Course Outcomes:

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

CO1. Represent signals in continuous and discrete-time and in the frequency domain.
CO2. Analyze discrete-time systems using z-transform.
CO3. Explain the Discrete-Fourier Transform (DFT) and the FFT algorithms.
CO4. Design digital filters for various applications and apply digital signal processing for the analysis of real-life signals

Suggested Learning Resources:

Text Books

1. Digital Signal Processing-A computer based approach, S. Mitra, TMH
2. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis & M.G. Manslakis,PHI
3. Fundamental of Digital Signal Processing using MATLAB , Robert J. Schilling, S.L. Harris,Cengage Learning.

Reference Books

1. Digital Signal Processing, Johnson, PHI
2. Digital Signal Processing using MATLAB, Ingle, Vikas.

Name of the Course:	Digital Control System	Subject Code:	PEC-EE03A
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Control System		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To find Z-tranaform and inverse Z-transform of systems.
2. To carry out the analysis and design of digital control systems
3. To design compensators for digital control system to achieve desired specifications.
4. To represent digital control systems using state space models.
5. To analyze the effect sampling on stability, controllability and observability.
6. To design digital controllers for industrial applications.
7. To solve numerical problems on the topics studied.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Discrete Representation of Continuous Systems:** Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.	6
2	**Discrete System Analysis:** Z Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z-plane. Solution of Discrete time systems. Time response of discrete time system.	6
3	**Stability of Discrete Time System** Stability analysis by Jury test.Stability analysis using bilinear transformation. Design of digital control system with deadbeat response. Practical issues with deadbeat response design.	4
4	**State Space Approach for discrete time systems** State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.	10
5	**Design of Digital Control System** Design of Discrete PID Controller, Design of discrete statefeedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.	8

6	**Discrete output feedback control** Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems	**8**
Total		**42**

Course Outcomes:

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

CO1. Obtain discrete representation of LTI systems.
CO2. Analyse stability of open loop and closed loop discrete-time systems.
CO3. Design and analyse digital controllers.
CO4. Design state feedback and output feedback controllers.

Suggested Learning Resources:

Text Books

1. K.Ogata, "Digital Control Engineering",Prentice Hall,Englewood Cliffs,1995.
2. B.C.Kuo, "Digital Control System",Holt, Rinehart and Winston,1980.

Reference Books

1. M. Gopal, "Digital Control Engineering",Wiley Eastern,1988.
2. G. F. Franklin, J.D. Powell and M. L.Workman, "Digital Control of Dynamic Systems", Addison-Wesley,1998.

Name of the Course:	Wind and Solar Power Energy System	Subject Code:	PEC EE02B
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Power system-I, Electrical Machines I & II		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objective(s):

The purpose of learning this course is-

1. To understand the difference between Renewable and non-renewable energy sources
2. To understand methods of conversion of wind energy to other form of energy.
3. To understand methods of conversion of wind energy to other form of energy.
4. To solve numerical problems of Renewable and non-renewable energy sources

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Physics of Wind Power:** History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions	5
2	**Wind generator topologies:** Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, BDFRM, Power electronics converters. Generator-Converter configurations, Converter Control.	12
3	**The Solar Resource:** Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.	3
4	**Solar photovoltaic:** Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.	8

5	**Network Integration Issues:** Overview of grid code technical requirements. Fault ride-through for wind farms-real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.	**8**
6	**Solar thermal power generation:** Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.	**3**
Total		**39**

Course Outcomes:

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

CO1. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.

CO2. Understand the basic physics of wind and solar power generation.

CO3. Understand the power electronic interfaces for wind and solar generation.

CO4. Understand the issues related to the grid-integration of solar and wind energy systems.

Suggested Learning Resources:

Text Books

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. G.M. Masters, "Renewable and Efficient Electric Power Systems**",** John Wiley and Sons, 2004.
3. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill,1984.

Reference Books

1. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd.,2006.
2. G.N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications,2004.
3. J.A. Duffie and W.A. Beckman, "Solar Engineering of Thermal Processes", John Wiley&Sons,1991.

Name of the Course:	Electrical and Hybrid Vehicle	Subject Code:	PEC-EE03B
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Electric Machine-I, Electric Machine-II		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objectives:

The purpose of learning this course is-

1. To understand the basic difference between conventional and Hybrid vehicles.
2. To understand different configuration and control of Electric drives.
3. To understand energy storage system in Hybrid vehicles.
4. To understand different energy management strategies of Hybrid vehicles.
5. To solve numerical problems on the topics studied

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Introduction :** Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies,fuel efficiency analysis.	10
2	**Electric Trains :** Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives (BLDC, PMSM), Configuration and control of Switch Reluctance Motor drives, drive system efficiency.	10
3	**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power	10

	electronics, selecting the energy storage technology, Communications, supporting subsystems.	
4	**Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).	**10**
Total		**40**

Course Outcomes:

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

CO1. Understand the models to describe hybrid vehicles and their performance.
CO2. Understand the basic concept of electric traction.
CO3. Understand the different possible ways of energy storage.
CO4. Understand the different strategies related to energy storage systems.

Suggested Learning Resources:

Text Books

1. C. Mi, M. A. Masrurand D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.

Reference Books

1. M. Ehsani, Y. Gao, S. E. Gayand A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

Name of the Course:	Internet of Things	Subject Code:	OEC-EE02A
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Data Structure		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. Able to understand the application areas of IOT
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
3. Able to understand building blocks of Internet of Things and characteristics

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Environmental Parameters Measurement and Monitoring:** Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
2	**Sensors:** Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
3	**Important Characteristics of Sensors:** Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	9
4	**Architecture of Smart Sensors:** Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	8
5	**Sensor Interfacing:** Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
6	**Smart Sensor:** Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5
Total		44

Course Outcomes:

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

CO1. Determine the Market perspective of IoT.
CO2. Use of Devices, Gateways and Data Management in IoT.
CO3. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
CO4. Building state of the art architecture in IoT.

Suggested Learning Resources:

Text Books

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

Reference Books

1. Jeeva Jose, Internet of Things, Khanna Publishing House. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
2. Internet of Things, Arsheep Bahga and Vijay Madisetti

Name of the Course:	Image Processing	**Subject Code:**	OEC EE 02B
Semester:	6th	**Course Nature:**	Theory
Pre-Requisite(s):	Signal and Systems, Mathematics & Statistics -IV		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objective(s):

The purpose of learning this course is-

1. To learn digital image fundamentals.
2. To understand the filtering process of digital images.
3. To analyse the processed image for information retrieving.
4. To analyse redundancy in image compression.

Detailed Syllabus

Module No	**Description**	**Lecture Hours**
1	Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.	**8**
2	Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.	**9**
3	Color Image Processing-Color models – RGB, YUV, HSI; Color transformations – formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.	**8**
4	Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.	**3**
5	Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub band filter banks, wavelet packets.	**6**
6	Image Compression-Redundancy – inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG 2000.Image classification.	**6**
Total		**40**

Course Outcomes:

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

CO1. Mathematically represent the various types of images and analyze them
CO2. Process these images for the enhancement of certain properties
CO3. Process these images for optimized use of the resources.
CO4. Develop algorithms for image compression and coding.

Suggested Learning Resources:

Text Books

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004

Reference Books

1. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

Name of the Course:	Principles of Management	Subject Code:	HSMC EE 302
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	School history		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objectives:

1. Relate, discuss, understand, and present management principles, processes and procedures in consideration of their effort on individual actions.
2. Participate, summarize and/or lead class discussions, case problems and situations from both the text and student experience that relate to the text material.
3. Knowledge and understanding of the Principles of Management will enable the student manager and/ or employee and gain valuable insight into the workings of business and other organizations.

Detailed Syllabus

Module	Content	Hour
1	**Basic concepts of management**: Definition – Essence, Functions, Roles, Level. **Functions of Management**: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organization Structure –Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness.	5
2	**Management and Society** – Concept, External Environment, CSR, Corporate Governance, Ethical Standards. **People Management** – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. **Managerial Competencies** – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship	5
3	**Leadership:** Concept, Nature, Styles. **Decision making**: Concept, Nature, Process, Tools & techniques. **Economic, Financial & Quantitative Analysis** – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.	5

4	**Customer Management** – Market Planning & Research, Marketing Mix, Advertising & Brand Management. **Operations & Technology Management** – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.	5
	Total:	20

Course Outcome:

CO1: Recognize the role of a manager and how it relates to the organization's mission.
CO2: Know critical management theories and philosophies and how to apply them.
CO3: Explain the relationship between strategic, tactical, and operational plans
CO4: Recognize the part communication plays in the management function.

Suggested Learning Resources:

Text Books

1. Drucker, F. Peter - Management-Tasks, Responsibilities & Practices.
2. Koontz "O" Donnel Weihrich - Elements of Management.
3. Koontz H, "O" Donnel C - Management-A Book of Reading.

Reference Books

1. Drucker, F. Peter - The Practice of Management.
2. Terry and Franklin - Principles of Management
3. Stoner - Principles of Management
4. William H. Newman and - The Process of Management. E. Kirby Wassen

Name of the Course:	Power System Laboratory II	Subject Code:	PCC-EE 21
Semester:	6th	Course Nature:	Practical
Pre-Requisite(s):	Basic Electrical and Electronics Engineering Laboratory, Electric Circuit Theory Laboratory.		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
0	0	2	1

Course Objective(s):

The purpose of learning this course is-

1. To solve D.C. networks by different circuit analysis methods.
2. To understand the characteristics of different type of IDMT rely
3. To study the load flow by various method.
4. To simulate the different motor protection scheme.

Detailed Syllabus

Module No	Description	Hrs.
1	Study of the characteristics of on delay relay and off delay relay.	2
2	Test to find out polarity, ratio and magnetization characteristics of CT and PT.	2
3	Test to find out characteristics of under voltage relay	2
4	Study on AC load flow using Gauss-seidel method	2
5	Study on AC load flow using Newton Raphson method	2
6	Simulation of DC distribution by network analyzer.	2
7	Study of different transformer protection schemes by simulation.	2
8	Study of different generator protection schemes by simulation.	2
9	Study of different motor protection schemes by simulation.	2
10	Study of different characteristics of over current relay.	2
11.	Test to find out characteristics of earth fault relay.(hardware and simulation)	2
12.	Formation of bus admittance matrix of an interconnected system using matlab	2
13.	Simulation and analysis of different types of fault.	2
Total		26

Course Outcomes:

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

CO1. Explicate the function of various types of electromagnetic relays.

CO2. Validate the concept of protection and pilot relaying schemes through simulation.

CO3. Apply various protective devices and its coordination techniques to distribution system.

CO4. Identify and analyze the real time power system problems and power flow techniques.

Suggested Learning Resources:

Text Books

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
2. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

Reference Books

1. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
2. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

Name of the Course:	Measurements and Instrumentation Laboratory	**Subject Code:**	PCC-EE22
Semester:	6th	**Course Nature:**	Laboratory
Pre-Requisite(s):	Electrical Circuit Analysis		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
2	**0**	**2**	**3**

Course Objective(s):

The purpose of learning this course is-

1. To design and validate DC and AC bridges.
2. To analyze the dynamic response and the calibration of few instruments.
3. To learn about various measurement devices, their characteristics, their operation and their limitations.
4. To understand statistical data analysis.

Detailed Syllabus

Lectures/Demonstrations:

Lectures/ Demonstrations:	Description	Class Hours
1	Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.	**3**
2	Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, C_p, $C_{pk.}$	**3**
3	Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.	**6**
4	Current and Voltage Measurements. Shunts, Potential Dividers. Instrument Transformers, Hall Sensors.	**3**
5	Measurements of R, L and C.	**3**
6	Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.	**3**
7	Digital Storage Oscilloscope.	**3**
Total		**24**

Experiments:

Experiment No	Description	Class Hours
1	Measurement of a batch of resistors and estimating statistical parameters	**2**
2	Measurement of L using a bridge technique as well as LCR meter.	**2**
3	Measurement of C using a bridge technique as well as LCR meter.	**2**
4	Measurement of Low Resistance using Kelvin's double bridge.	**2**

5	Measurement of High resistance and Insulation resistance using Megger.	**2**
6	Usage of DSO for steady state periodic waveforms produced by a function Generator. Selection of trigger source and trigger level, selection of time-scale And voltage scale. Bandwidth of measurement and sampling rate.	**2**
7	Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.	**2**
8	Usage of DSO to capture transients like a step change in R-L-C circuit.	**2**
9	Current Measurement using Shunt, CT, and Hall Sensor.	**2**
10	Study and calibration of LVDT transducer for displacement measurement.	**2**
11	Rotational speed measurement system by using photo magnetic pickup.	**2**
12	Study and calibration of force cell with force indicator.	**2**
13	Characteristics of LDR, photo diode and Phototransistor.	**2**
14	Angular displacement measurement using capacitive transducer.	**2**
15	Water level measurement by using capacitive transducer.	**2**
16	Light intensity measurement using Lux meter.	**2**
17	Measurement and calibrate unknown temperature using Thermocouple.	**2**
Total		**34**

Course Outcomes:

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

CO1. Design and validate DC and AC bridges.
CO2. Analyze the dynamic response and the calibration of few instruments.
CO3. Learn about various measurement devices, their characteristics, their operation and their limitations.
CO4. Understand statistical data analysis.

Suggested Learning Resources:

Text Books

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing

Reference Books

1. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication

Name of the Course:	ELECTRONICS DESIGN LABORATORY	Subject Code:	PCC-EE23
Semester:	6th	Course Nature:	Theory+Lab
Pre-Requisite(s):	Digital Electronics, Analog Electronics, Basic Electrical Engg		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
1	0	3	3

Course Objective(s):

The purpose of learning this course is-

1. To develop ideas of design problem solutions.
2. To build up better understanding of various subject areas of electrical engineering as well as fundamental science by common design problem solutions.

Detailed Syllabus

Module No	Description	Lecture Hours
1	Basic concepts on measurements.	4
2	Sensors and signal conditioning circuits	4
3	Introduction to electronic instrumentation and PC based data acquisition	4
4	Electronic system design, Analog system design.	4
5	Interfacing of analog and digital systems	4
6	Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout.	4
7	Group projects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application.	16
Total		40

Course Outcomes:

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

CO1. Understand the practical issues related to practical implementation of applications using electronic circuits.
CO2. Design a Printed Circuit Board, get it made and populate/solder it with components.
CO3. Choose appropriate components, software and hardware platforms for design and use them successfully to implement the design.
CO4. To build leadership quality working in a team with other students to implement an application.

Name of the Course/ Subject	Digital Signal Processing Laboratory	Subject Code:	PEC-EE-92A
Semester	6th	Course Nature	Practical
Prerequisite(s):	Signal & Systems		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
0	0	2	1

Course Objective(s):

The purpose of learning this course is to-

1. Implement Linear and Circular Convolution.
2. Implement FIR and IIR filters.
3. Study the architecture of DSP processor.
4. Demonstrate Finite word length effect.

Detailed Syllabus:

Module	Description	Number of Hours
Simulation Laboratory using standard Simulator	1. Sampled sinusoidal signal, various sequences and different arithmetic operations. 2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution. 3. Z-transform of various sequences – verification of the properties of Z-transform. 4. Twiddle factors – verification of the properties. 5. DFTs / IDFTs using matrix multiplication and also using commands. 6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions 7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods. 8. Butterworth filter design with different set of parameters. 9. FIR filter design using rectangular, Hamming and Blackman windows	18
Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA	1. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of	6

	MAC instruction. 2. Writing of small programs in VHDL and downloading onto Xilinx FPGA. 3. Mapping of some DSP algorithms onto FPGA. 4. Digital Filter design using Matlab & Simulink.	

Course Outcome(s) (COs):

After completion of this course, the learners will be able to

CO1. Carry out simulation of DSP systems.

CO2. Demonstrate their abilities towards DSP processor-based implementation of DSP systems.

CO3. Analyze Finite word length effect on DSP systems.

CO4. Demonstrate the applications of FFT to DSP and to implement adaptive filters for various applications of DSP.

Name of the Course/ Subject	Wind and Solar Power Energy System Laboratory	Subject Code:	PEC-EE-92B
Semester	6th	Course Nature	Practical
Prerequisite(s):	Electrical Machines, Power Electronics		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
0	0	2	1

Course objectives:

The purpose of learning this course is

1. To understand the different concepts of renewable sources like wind and solar
2. To understand the different operational behavior changes with different controlling parameters of renewable sources.
3. To understand the different controlling parameters for battery storage systems.
4. To understand the concept of developing a simulation model for renewable sources.

Detailed Syllabus

Experiment No	Experiment Name	No of period
1	To determine the I-V and P-V characteristics of different types of PV modules.	2
2	To determine the I-V and P-V characteristic of series and parallel combination of PV modules.	2
3	To show the effect of variation in tilt angle on PV module power.	2
4	To demonstrate the effect of shading on PV module output power.	2
5	To show the effect of the bypass diode on the PV module.	2
6	To determine the I-V and P-V characteristic of PV module by varying radiation and intensity.	2
7	To show the effect of wind speed on output power of a wind turbine.	2
8	To show the effect of different loads in a solar and grid-tie inverter system.	2
9	To monitor the health of EV battery systems.	2
10	To simulate the I-V and P-V characteristics of a PV module using MATLAB.	2

Course Outcome:

After completion of this course the learners will be able to

CO1. Remember the working principle of solar cell and wind turbine.
CO2. Apply the concept of charging and discharging to monitor the health of EV battery system.
CO3. Evaluate the effect of different loads in a solar and grid-tie inverter system.
CO4. Create a MATLAB simulation to draw the I-V and P-V characteristics of the PV module.

INSTITUTE OF ENGINEERING & MANAGEMENT

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DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER WISE CURRICULAM

4th YEAR- 8th SEMESTER

Semester VIII [Fourth year]

Branch/Course: Electrical Engineering

Sl. No.	Course Code	Course Title	Hours per week			Total contact hours	Credits
			Lecture	Tutorial	Practical		
1	PEC-EE06	A. Control System Design B. Electrical Energy Conservation and Audit C. Electrical Machine Design	3	0	0	3	3
2	OEC-EE05	A. Electrical Materials B. Electronic Devices	3	0	0	3	3
3	OEC-EE06	A. Power Plant Engineering B. Automobile Engineering	3	0	0	3	3
4	PROJ-EE08	Project Stage-II	0	0	16	16	4
5	HSMC 802	ESSENTIAL STUDIES FOR PROFESSIONAL- VIII	2	0	0	2	2
6	HSMC 882	SKILL DEVELOPMENT FOR PROFESSIONALS- VIII	0	0	2	2	1
						TOTAL CREDITS	**16**
MOOCS through NPTEL/SWAYAM Portal for Honours Degree							
IFC- Industry & Foreign Certification through different online portals							
MAR881- Mandatory Additional Requirement							

Name of the Course:	Control Systems Design	Subject Code:	PEC-EE06A
Semester:	8th	Course Nature:	Theory
Pre-Requisite(s):	Control system, Mathematics		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. At the end of this course, students will demonstrate the ability to understand the concepts of continuous time and discrete time systems.
2. Analyse systems in complex frequency domain.
3. Understand sampling theorem and its implications.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Design Specifications** Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.	6
2	**Design of Classical Control System in the time domain** Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.	8
3	**Design of Classical Control System in frequency domain :** Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.	8
4	**Design of PID controllers** Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.	6
5	**Control System Design in state space** Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design	8

	of Observer. Reduced order observer. Separation Principle.	
6	**Nonlinearities and its effect on system performance** Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.	**3**
Total		**39**

Course Outcomes:

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

CO1. Understand various design specifications.

CO2. Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).

CO3. Design controllers using the state-space approach.

Suggested Learning Resources:

Text Books

1. N. Nise, "Control system Engineering", John Wiley, 2000.
2. I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.

Reference Books

1. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
2. K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.
3. B. C. Kuo, "Automatic Control system", Prentice Hall, 1995.
4. J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill, 1995.
5. R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", Saunders College Pub, 1994.

Name of the Course:	Electrical Energy Conservation and Auditing	Subject Code:	PEC-EE06B
Semester:	8th	Course Nature:	Theory
Pre-Requisite(s):	Power system		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To understand the current energy scenario and importance of energy conservation.
2. To understand the concepts of energy management.
3. To understand the methods of improving energy efficiency in different electrical systems.
4. To understand the concepts of different energy efficient devices.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Energy Scenario:** Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.	6
2	**Basics of Energy and its various forms** Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	7
3	**Energy Management & Audit** Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.	6
4	**Energy Efficiency in Electrical Systems** Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction	7

	motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.	
5	**Energy Efficiency in Industrial Systems** Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.	**8**
6	**Energy Efficient Technologies in Electrical Systems** Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology	**8**
Total		**42**

Course Outcomes:

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

CO1. Understand the current energy scenario and importance of energy conservation.
CO2. Understand the concepts of energy management.
CO3. Understand the methods of improving energy efficiency in different electrical systems.
CO4. Understand the concepts of different energy efficient devices.

Suggested Learning Resources:

Text Books

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
2. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.

Reference Books

1. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)

Name of the Course:	Electrical Machine Design	Subject Code:	PECEE06C
Semester:	8th	Course Nature:	Theory
Pre-Requisite(s):	Electrical Machine I, Electrical Machine II		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Outcomes:

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

1. Understand the constructionand performance characteristics of electrical machines.
2. Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
3. Understand the principles of electrical machine design and carry out a basic design of an ac machine.
4. Use software tools to do design calculations.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Introduction** Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.	5
2	**Transformers** Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.	8
3	**Induction Motors** Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.	10
4	**Synchronous Machines** Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.	10

5	**Computer aided Design (CAD):** Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.	**7**
Total		**40**

Course Outcomes:

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

CO1: Design of Transformer
CO2: Design of Induction Motor
CO3: Design of Synchronous Machine
CO4: Design of Machines using AutoCAD software

Suggested Learning Resources:

Text Books

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
4. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.
5. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.
6. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
7. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

Name of the Course:	Electrical Materials	Subject Code:	OEC EE 05 A
Semester:	8th	Course Nature:	Theory
Pre-Requisite(s):	Physics-I, Chemistry-I		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. Select proper conducting material for a particular application
2. Select a proper insulating material for a particular application.
3. Select proper magnetic material for a particular application.
4. Make use of engineering material used for fabrication of particular electrical machine.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Conductivity of Metal:** Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.	10
2	**Dielectric Properties:** Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity.	10
3	**Magnetic properties of Materials:** Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.	10
4	**Semiconductors:** energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of	10

	semiconductors, electrical conductivity of doped materials.	
Total		**40**

Course Outcomes:

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

CO1. Identify electrical engineering materials/component

CO2. Select proper conducting material for a particular application.

CO3. Suggest an alternate material if proper material is not available

CO4. Procure various electrical engineering material available in the market.

Suggested Learning Resources:

Text Books

1. C.S. Indulkar and S. Thiruvengadam, S., "An Introduction to Electrical Engineering Materials", S.Chand & Company Limited
2. S K Bhattacharya , "Electrical and Electronic Engineering Materials", Khanna Publishers, New Delhi

Reference Books

1. Kenneth G. Budinski,, "Engineering Materials: Prentice Hall of India, New Delhi
2. Sahdev , "Electrical Engineering Materials", Uneek International Publications, Jalandhar

Name of the Course:	Electronic Devices	Subject Code:	OEC-EE05B
Semester:	8th	Course Nature:	Theory
Pre-Requisite(s):			
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To provide a comprehensive understanding of electronic devices and circuits and.
2. To understand the working diode and transistor.
3. To study basic circuits using diodes and transistors

Detailed Syllabus

Module No	Description	Lecture Hours
1	Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors	10
2	Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-Vcharacteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode	10
3	Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model,MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell;	10
4	Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.	6
Total		36

Course Outcomes:

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

CO1. Understand the principles of semiconductor Physics
CO2. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

Suggested Learning Resources:

Text Books

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education.

Reference Books

1. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2006.
2. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991.

Name of the Course:	Power Plant Engineering	Subject Code:	OEC-EE06A
Semester:	8th	Course Nature:	Theory
Pre-Requisite(s):	Electric Machine-I & Electric Machine-II		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To understand methods of selection of power plant and its economics.
2. To understand the principle of operation different types of power plants.
3. To understand methods of site selection of different power plants.
4. To solve numerical problems of load estimation, economics of power plants.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Introduction:** Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations. Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant. Power plant economics and selection: Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.	8
2	**Steam power plant:** General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.	8
3	**Diesel power plant** General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant. **Gas turbine power plant:** Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant.	8

4	**Nuclear power plant:** Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants. Hydro electric station Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems. **Non Conventional Power Plants:** Introduction to non-conventional power plants (Solar, wind, geothermal, tidal).	**9**
5	**Electrical system:** Generators and their cooling, transformers and their cooling. Instrumentation Purpose, classification, selection and application, recorders and their use, listing of various control rooms. Pollution due to power generation.	**7**
Total		**40**

Course Outcomes:

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

CO1. Explain the principle of operation of Steam, Hydroelectric, Diesel, Gas turbine, Nuclear power and non-conventional power plant.

CO2. Identify the cause of pollution for power generation and its remedy.

CO3. Suggest location to set up and methods of maintenance Steam, Hydroelectric, Diesel, Gas turbine and Nuclear power plant.

CO4. Solve numerical problems of load estimation and economics of power plants.

Suggested Learning Resources:

Text Books

1. P.K. Nag, “Power Plant Engineering”, Tata McGraw Hill.
2. F.T. Morse, “Power Plant Engineering”, Affiliated East-West Press Pvt. Ltd, New Delhi/Chennai.

Reference Books

1. El-Vakil, “Power Plant Technology”, McGraw Hill.
2. R.Yadav , “Steam & Gas Turbines & Power Plant Engineering”, Central Publishing House.

Name of the Course:	Automobile Engineering	Subject Code:	OEC-EE06B
Semester:	8th	Course Nature:	Theory
Pre-Requisite(s):	Engineering Mechanics		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is to-

1. To understand basic of automobile engineering.
2. To get familiar with axels, steering systems, tyre & wheel assembly.
3. To understand suspension and brake system.
4. To understand vehicle performance and safety.
5. To understand automobile electrical system and latest advancement in vehicles.

Detailed Syllabus

Module No	Description	Lecture Hours
1	Module 1: Vehicle Structure and Engines-Types of Automobiles, Vehicle Construction – Chassis, Frame and Body ,Aerodynamics, Components of Engine – Their forms, Functions and Materials, Review of Cooling and Lubrication systems in Engine, Turbo Chargers, Engine Emission Control by 3–Way Catalytic Controller, Electronic Engine Management System.	8
2	Module 2: Engine Auxiliary Systems- Carburettor–working principle, Electronic fuel injection system – Mono-point and Multi - Point Injection Systems, Electrical systems – Battery generator –Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type)- Regulators-cut outs.	10
3	Module 3: Transmission Systems-Clutch – Types and Construction, Gear Boxes-Manual and Automatic, Simple Floor Mounted Shift Mechanism, Over Drives, Transfer Box Fluid flywheelTorque convertors, Propeller shaft – Slip Joint – Universal Joints, Differential and Rear Axle, Hotchkiss Drive and Torque Tube Drive.	6
4	Module 4: Steering, Brakes and Suspension- Wheels and Tires – Wheel Alignment Parameters , Steering Geometry and Types of steering gear box, Power Steering, Types of Front Axle – Suspension systems. Braking Systems – Types and Construction – Diagonal Braking System – Antilock Braking System.	10
5	Module 5: Alternative Energy Sources-Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles, Electric and Hybrid Vehicles, Fuel Cells.	6
Total		40

Course Outcomes:

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

CO1. Identify and description of different components and system of automobile
CO2. Explain working principle of various parts of automobile such as Axels, Wheels and Tyres, Steering systems
CO3. Explain working principle of various parts of automobile such as suspension and brake system.
CO4. Handle technical and management problems in automobile industry
CO5. Explain working principle of various of automobile electrical system.

Suggested Learning Resources:

Text Books

1. Crolla, D. Automotive Engineering: Powertrain, Chassis System and Vehicle Body: Butterworth-Heinemann.
2. Heisler, H. Advanced vehicle technology: Butterworth-Heinemann.
3. Happian-Smith, J. An introduction to modern vehicle design: Butterworth-Heinemann.

Reference Books

1. Newton, Steeds and Garet, Motor vehicles, Butterworth Publishers.
2. Crouse, W. H., & Anglin, D. L. Automotive Mechanics, Study Guide: McGraw-Hill

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DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER WISE CURRICULUM

2nd YEAR- 3rd SEMESTER

(Applicable for batch 2022-26)

B.Tech. 2nd Year Course Structure : 2023 – 3rd Semester									
Electrical Engineering									
Sl. No.	**Type of Course**	**Course Code**	**Course Name**	**L**	**T**	**P**	**S**	**Total Contact Hours**	**Credit Points**
THEORY									
1	Basic Science Course	BTHBSCEE301	Mathematics-III	2	1	0	0	3	3
2	Professional Core Course	BTHPCCEE301	Electrical Circuit Analysis	2	1	0	0	3	3
3	Professional Core Course	BTHPCCEE302	Analog Electronics	3	0	0	0	3	3
4	Professional Core Course	BTHPCCEE303	Electromagnetic Field theory	3	0	0	0	3	4
5	Professional Core Course	BTHPCCEE304	Data Structure and Algorithm	2	1	0	0	3	3
6	Mandatory Course	BTHMCEE301	Indian Constitution	2	0	0	0	2	0
7	Humanities and social sciences including Management	BTHESP301	Essential Studies for Professionals III	2	0	0	0	2	0.5
PRACTICAL									
8	Professional Core Course	BTHPCCEE391	Electrical Circuit Analysis Laboratory	0	0	2	0	2	1
9	Professional Core Course	BTHPCCEE392	Analog Electronics Lab	0	0	2	0	2	1
10	Professional Core Course	BTHPCCEE394	Data Structure and Algorithm Lab	0	0	2	0	2	1
SESSIONAL									
11	Humanities and social sciences including Management	BTHSDP381	Skill Development for Professionals III	0	0	0	2	2	0.5
12	Project, Seminar and Industrial Training	BTHPWEE381	Mini Project I	0	0	0	1	1	1
Mandatory Industry and Value Added Courses (IVC)									
13	Mandatory Course	MAR381	Mandatory Additional Requirement	0	0	0	0	0	0
14	MOOCs	MOOCs	Massive Open Online Courses through NPTEL/SWAYAM Portal for Honours Degree	0	0	0	0	0	0
15	IFC	IFC	Industry & Foreign Courses through different online portals	0	0	0	0	0	0
Total Credit Points of Semester				**16**	**3**	**6**	**3**	**28**	**21**

Name of the Course:	Mathematics- III	Subject Code:	BTHBSCEE301
Semester:	3rd	Course Nature:	Theory
Pre-Requisite(s):	BTHBSCBSH103 & BTHBSCBSH203		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
2	1	0	3

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Random Variables & Probability Distributions:** Discrete Random Variable; Discrete Probability Distribution, Expectation and Variance of random variables; Binomial and Poisson Distributions; Mean, Variance and Moment Generating Functions of Binomial and Poisson Variates; Convergence of Binomial to Poisson Variate. Continuous Random Variable; Continuous Probability Distributions, Expectation and Variance of random variables, Exponential, Normal and Gamma Distributions; Mean, Variance and Moment Generating Functions of the corresponding variates. Tchebycheff's Inequality and Weak Law of Large Numbers (Statement only)	12
2	**Method of Least Squares and Curve Fitting:** Principle of Least Squares, Curve fitting by the method of Least Squares - fitting of straight lines, second degree parabolas and exponential curves.	4
3	**Sampling and Sampling Distributions:** Population and Sample, Sampling With and Without Replacement (SRSWR and SRSWOR); Random Samples, Population Parameters, Sample Statistics, Sampling Distributions, Standard Error and Probable Error; Sample Mean, Sampling Distribution of Means; Sample Proportion, Sampling Distribution of Proportions, Sample Variances, Sampling Distribution of Variances; Case where Population Variance is unknown; Central Limit Theorem (Statement only); Degrees of freedom, Chi-square distribution, Mean & Variance of Chi-square variate.	8
4	**Estimation of Parameters:** Point and Interval estimations, Biased and Unbiased estimators, Minimum Variance Unbiased Estimator (MVUE), Consistent Estimator, Maximum Likelihood Estimation of Parameters, Applications in populations following theoretical distributions (Binomial, Poisson and Normal), Calculation of confidence limits for population mean and population proportions.	6
5	**Testing of Hypothesis:** Large Sample Test: Statistical Hypotheses, Test Statistic, Best Critical Region, Test for single mean, difference of means, single proportion, difference of proportions, and difference of standard deviations. Small Sample Test: 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.	12
Total		42

Course Outcomes:

CO No.	Course Outcomes
CO1	Illustrate the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
CO2	Apply the principle of least squares to curve fitting problems.
CO3	Appraise the notion of sampling and sampling distributions as well as estimation of population parameters.
CO4	Interpret the concept of testing of hypothesis for large and small samples with applications in physical and engineering environment.

Suggested Learning Resources:

Text Book:

1. Saktipada Nanda and Sibashis Nanda, "A Course on Probability & Statistics", 1st Edition (2022), Mindprobooks.

Reference Books:

1. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition (2020), Academic Press.
2. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", 7th Edition, (2018), John Wiley & Sons.
3. Richard A. Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", 9th Edition (2018), Pearson Education India.
4. Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, "Schaum's Outline of Probability & Statistics", 4th Edition (2012), McGraw Hill Education.
5. B. K. Pal & K. Das, "Engineering Mathematics" - Vol. IIA, 13th Edition (2021), U. N. Dhur & Sons.
6. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition (2020), S. Chand & Sons.
7. N. G. Das, "Statistical Methods", Combined Edition Vol. 1 & 2 (2017), McGraw Hill Education.

Name of the Course:	Electrical Circuit Analysis	Subject Code:	BTHPCCEE301
Semester:	3rd	Course Nature:	Theory
Pre-Requisite(s):	Basic Electrical Engineering		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
2	1	0	3

Course Objective(s):

The purpose of learning this course is-

1. To solve D.C. networks by different circuit analysis methods.
2. To understand the transient and steady-state response of electrical circuits.
3. To analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
4. To analyze two port circuit behavior.

Detailed Syllabus

Module No	Description	Lecture Hours
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.	10
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.	8
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.	8
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.	8
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.	6
Total		40

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	Apply the concept of network theorems and other network analysis methods to solve problems related with coupled circuits to develop simpler circuits for complex engineering problems.
CO2	Apply differential equations to analyze and solve series and parallel circuit and their sinusoidal steady state analysis
CO3	Apply powerful mathematical tools like Laplace transform to analyze and solve different circuit related problems.
CO4	Explain the concept of two port networks to formulate network equations and solving circuit related problems.

Suggested Learning Resources:

Text Books

1. A. Chakraborty, "Circuit Theory", Dhanpat Rai Publications, 2018.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.

Reference Books

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.

Name of the Course:	Analog Electronics	**Subject Code:**	BTHPCCEE302
Semester:	3rd	**Course Nature:**	Theory
Pre-Requisite(s):	Physics (10+2)		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objective(s):

The purpose of learning this course is-

1. The capability to know Diode circuits, BJT circuits, MOSFET circuits,
2. The ability to know the Differential, multi-stage and operational amplifiers
3. The ability to know the linear applications of op-amp.
4. The ability to know the nonlinear applications of op-amp.
5. The ability to know the Feedback amplifier & Oscillators.

Detailed Syllabus

Module No	Description	Lecture Hours
1	Zener diodes, clamping and clipping circuits	**2**
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.	**8**
3	MOSFET circuits (8 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.	**8**
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), Frequency Response of the amplifier. Hybrid parameters.	**8**
5	Linear applications of op-amp (12 Hours) Idealized analysis of op-amp circuits. Inverting a n d 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,	**8**

	Feedback amplifiers and Oscillators design (Wien bridge and phase shift). Analog to Digital Conversion. Nonlinear applications of op-amp Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector.	
6	Feedback amplifier & Oscillators (6 Hours): Concept of feedback, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit, Hartley's, Phase shift, Wien bridge, & Crystal oscillators.	**6**
Total		**40**

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	To appreciate the functioning of OP-AMP, oscillator and the characteristics of BJT and MOSFF.
CO2	Design of sinusoidal and non-sinusoidal oscillators using OP-AMP, design of single stage amplifier using BJT and MOSFET.
CO3	Analyze various rectifier and amplifier circuits based on diode, OP-AMP, BJT and MOSFET.
CO4	To design and construct requirement based multi-stage amplifier using BJT and MOSFET circuits.

Suggested Learning Resources:

Text Books

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press.
2. 2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S.

Reference Books

1. P.R. Gray, R.G. Meyer, and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons.
2. Robert Boylestad Louis Nashelsky "Electronic Devices and Circuit Theory", Pearson

Name of the Course:	Electromagnetic Field Theory	Subject Code:	BTHPCCEE303
Semester:	3rd	Course Nature:	Theory
Pre-Requisite(s):	Basic Electrical Engineering, Mathematics, Physics		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	4

Course Objective(s):

The purpose of learning this course is to-

1. To understand the basic mathematical tools to deal with Electromagnetic field Problem.
2. To understand properties and application of Electric and magnetic field.
3. To analyze electromagnetic wave propagation.
4. To solve problem related to Electromagnetic field

Detailed Syllabus

Chapter No.	Description	Lecture Hours
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.	6
2	**Static Electric Field** 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.	6
3	**Conductors, Dielectrics and Capacitance** 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.	6

4	**Static Magnetic Fields** Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.	**6**
5	**Magnetic Forces, Materials and Inductance** 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.	**6**
6	**Time Varying Fields and Maxwell's Equations** 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.	**6**
7	**Electromagnetic Waves** 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.	**6**
Total		**42**

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	To remember the basic laws of electromagnetism.
CO2	To understand the static and time varying electromagnetic field
CO3	To solve electric and magnetic field for different source distribution.
CO4	To analyze electromagnetic wave propagation in different medium..

Suggested Learning Resources:

Text Books

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.

Reference Books

1. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.
2. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. 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. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.

Name of the Course:	Data Structure & Algorithm	**Subject Code:**	BTHPCCEE304
Semester:	3rd	**Course Nature:**	Theory
Pre-Requisite(s):	Basic Computation and Principles of C, Engineering Mathematics.		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
2	**1**	**0**	**3**

Course Objective(s):

The purpose of learning this course is-

1. To know about linear and nonlinear data structure types and usage.
2. To understand the concept of stack, Queue and linked list in data operation.
3. To apply the concept of tree and graph for data scorching and sorting.
4. To analyse the complexity of different algorithms

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Introduction (2L):** Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, Basic idea of pseudo-code, Algorithm efficiency and analysis, time and space analysis of algorithms – order notations. **Array (2L):** Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. **Linked List (4L):** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list, Header nodes. Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.	08

2	**Stack (3L):** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. **Queue (3L):** ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis. Implementation of stack and queue- both linear and circular (using array, using linked list). **Recursion (2L):** Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.	**08**
3	**Trees (7L):** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Application of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis. **Graphs (7L):** Graph definitions and concepts. Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications. Minimal spanning tree – Prim's algorithm.	**14**
4	**Sorting Algorithms (5L):** Bubble sort, insertion sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort. **Searching (2L):** Sequential search, binary search, interpolation search. **Hashing (3L):** Hashing functions, collision resolution techniques.	**10**
Total		**40**

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	Acquire and remember the knowledge of fundamental data structures.

CO2	Understand any data structure properly and to have knowledge on basics of computers hardware and number systems.
CO3	Implement and analyze the algorithm for a given problem.
CO4	Use different data structures and create/update basic data files

Suggested Learning Resources:

Text books

1. "Classic Data Structures", 2/E by Debasis Samanta, PHI Learning Pvt. Ltd.

2. **"**Data Structures" by S. Lipschutz.

Reference books

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.

2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.

3. "Data Structures in C" by Aaron M. Tenenbaum.

Name of the Course:	Indian Constitution	**Subject Code:**	BTHMCEE301
Semester:	3rd	**Course Nature:**	Theory
Pre-Requisite(s):	School history		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
2	**0**	**0**	**0**

Course Objective(s):

The purpose of learning this course is-

1. Understand different features of Indian constitution. Power and functioning of Union, state and local self-government.
2. Understand basics of PIL and guideline for admission of PIL.
3. Analyze of local administration starting from block to Municipal Corporation.
4. Study the identification of authority to redress a problem in the profession and in the society.

Detailed Syllabus

Module	**Content**	**Hour**
1	**Indian Constitution:** Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	**5**
2	**Union government and its administration:** Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	**10**

3	**Supreme court:** Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lokadalats, family courts, gramnyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL	**10**
4	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	**10**
	Total	**35**

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	Recall the meaning and significance of the Indian Constitution as the fundamental law of the land.
CO2	Understand the Indian political system, the powers and functions of the Union, State and Local Governments in detail.
CO3	Exercise their fundamental rights in proper sense and analyze the outcomes of the Electoral Process, Emergency provisions, Amendment procedure and the basics of PIL and guideline for admission of PIL.
CO4	Access the Functioning of local administration starting from block to Municipal Corporation.

Suggested Learning Resources:

Text Books

1. Introduction to the constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India

Reference Books

1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.

Name of the Course:	Electrical Circuit Analysis Laboratory	**Subject Code:**	BTHPCCEE391
Semester:	3rd	**Course Nature:**	Practical
Pre-Requisite(s):	Basic Electrical Laboratory		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
0	**0**	**2**	**1**

Experiment No	**Description**	**No of Hours**
1	Transient response of R-L and R-C network: simulation with software & hardware	**2**
2	Transient response of R-L-C series and parallel circuit: simulation with software & hardware	**2**
3	Determination of Impedance (Z) and Admittance (Y) parameter of two-port network: simulation & hardware.	**2**
4	Frequency response of LP and HP filters: simulation & hardware.	**2**
5	Frequency response of BP and BR filters: simulation & hardware.	**2**
6	Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.	**2**
7	Determination of Laplace transform and Inverse Laplace transform using MATLAB.	**2**
8	Amplitude and Phase spectrum analysis of different signals using MATLAB.	**2**
9	Verification of Network theorems using software & hardware	**2**

CO No.	**COURSE OUTCOME**
CO1	Determine transient response of different electrical circuit, parameters of two port network, frequency response of filters, Laplace transform and inverse Laplace transform
CO2	Generate different signals in both discrete and analog form. Analyze amplitude and phase spectrum of different signals.
CO3	Verify network theorems, construct circuits with appropriate instruments and safety precautions.

CO4	Simulate electrical circuit experiments using suitable software.

Name of the Course:	Analog Electronics Laboratory	**Subject Code:**	BTHPCCEE392
Semester:	3rd	**Course Nature:**	Laboratory
Pre-Requisite(s):	Basic Electrical Laboratory		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
0	**0**	**2**	**1**

Course Objective(s):

The purpose of learning this course is to-

1. To identify appropriate equipment and instruments for the experiment.
2. To study the various characteristic of different electronic components.
3. To work effectively in a team.

Laboratory Experiments

Module No	Description	Lecture Hours
1	(a)Study of Ripple And Regulation Characteristics of Full Wave Rectifier With And Without Capacitor Filter. (b)Study of Zener Diode As Voltage Regulator. (c) Study of Switched Mode Power Supply & Construction of a Linear Voltage Regulator Using Regulator IC Chip	**2**
2	Study of Characteristics Curves of B.J.T & F.E.T .	**2**
3	Construction of A Two-Stage R-C Coupled Amplifier & Study of its Gain & Bandwidth.	**2**
4	Study of Timer Circuit Using NE555 & Configuration For Monostable & Astable And Bistable Multivibrator	**2**
5	Realization of a V-To-I & I-To-V Converter Using Op-Amps.	**2**
6	Construction of a Simple Function Generator Using IC.	**2**
7	Realization of a Phase Locked Loop Using Voltage Controlled Oscillator (VCO).	**2**
8	Study of D.A.C & A.D.C.	**2**

Virtual Lab. Details

Experiment Name	Web-Link/ Software Used
Study of Ripple and Regulation Characteristics of Full Wave Rectifier with and without Capacitor Filter.	http://vlabs.iitkgp.ernet.in/be/exp6/index.html http://vlabs.iitkgp.ernet.in/be/exp7/index.html http://vlabs.iitkgp.ernet.in/be/exp8/index.html
Study of Zener Diode as Voltage Regulator.	http://vlabs.iitkgp.ernet.in/be/exp10/index.html#
Study of Characteristics Curves of B.J.T	http://vlabs.iitkgp.ernet.in/be/exp11/index.html http://vlabs.iitkgp.ernet.in/be/exp12/index.html http://vlabs.iitkgp.ernet.in/be/exp13/index.html
Study of Timer Circuit Using NE555 & Configuration For Monostable & Astable Multivibrator	http://he-coep.vlabs.ac.in/Experiment8/Aim.html?domain=ElectronicsandCommunications&lab=Hybrid%20Electronics%20Lab
Study of D.A.C & A.D.C.	http://he-coep.vlabs.ac.in/Experiment6/Aim.html?domain=ElectronicsandCommunications&lab=Hybrid%20Electronics%20Lab

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	Explain principle of operation of analog electronic components, filters, regulators and analog electronic circuits.
CO2	Compute parameters and operating points of analog electronic circuits.
CO3	Determine response of analog electronic circuits.
CO4	To design and construct requirement based multi-stage amplifier using BJT and MOSFET circuits.

Name of the Course:	Data Structure & Algorithm Laboratory	**Subject Code:**	BTHPCCEE394
Semester:	3rd	**Course Nature:**	Practical
Pre-Requisite(s):	Basic Computation and Principles of C, Engineering Mathematics.		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
0	**0**	**2**	**1**

Experiment No	Description	No of Hours
1	Implementation of array operation in Stacks and Queues: adding, deleting elements.	**2**
2	Implementation of array operation in Circular Queue: Adding & deleting elements.	**2**
3	Implementation of array operation in Merging Problem: Evaluation of expressions operations on multiple Stacks & queues.	**2**
4	Inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked lists.	**2**
5	Polynomial addition, Polynomial multiplication, Sparse Matrices: Multiplication, addition.	**2**
6	Recursive and Non recursive traversal of Trees, Threaded binary tree traversal, AVL tree implementation.	**2**
7	BFS, DFS application over graph.	**2**
8	Spanning tree by Prim's & Krushkal's algorithm application over graph	**2**
9	Searching, inserting and deleting, searching & sorting techniques.	**2**

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	Implement array operation using stack, Queue and linked list.
CO2	Formation of Threaded binary tree, AVL tree and tree traversal.
CO3	Verify Prim's and Kruskal's algorithm over graph.
CO4	Use different searching and sorting technique over structured data.

Actions taken as per the recommendations of the experts in the 8th BOS meeting held on 27.07.2023.

Proposal from the experts	Actions taken
Application of hashing, searching and complexity analysis are to be included in the course of Data structure.	Included in the syllabus of Data Structure.
Detailing of modes of operation of multivibrators, BJT characteristics and name of function generators are to be included in Analog Electronics laboratory.	Included in the syllabus of Analog Electronics laboratory.
Inclusion of detailing of hybrid parameters in Analog Electronics.	Included in the syllabus of Analog Electronics
A general recommendation of the external members to include courses on AI and ML in the curriculum.	Included a sessional based on 'Advance Python' in the 4th semester syllabus.

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B. Tech Admission Batch 2022

Electrical Engineering									
B.Tech. 2nd Year Course Structure									
4th Semester									
Sl No	**Type of Course**	**Course Code**	**Course Name**	**L**	**T**	**P**	**S**	**Total Contact Hours**	**Credit Points**
Theory									
1	Basic Science Courses	BSM401	Mathematics-IV	2	1	0		3	3
2	Basic Science Courses	MC401	Environmental Sciences	2	0	0		2	0
3	Professional Core Courses	PCCEE401	Electric Machine-I	3	0	0		3	3
4	Professional Core Courses	PCCEE402	Digital Electronics	3	0	0		3	3
5	Professional Core Courses	PCCEE403	Power Electronics	3	0	0		3	3
6	Professional Core Courses	PCCEE404	Signals & Systems	3	0	0		3	3
7	Humanities and social sciences including Management	ESP401	Essential Studies for Professionals IV	2	0	0		2	0.5

PRACTICAL									
8	Professional Core Courses	PCCEE491	Electric Machine Laboratory-I	0	0	2		2	1
9	Professional Core Courses	PCCEE492	Digital Electronics Laboratory	0	0	2		2	1
10	Professional Core Courses	PCCEE493	Power Electronics Laboratory	0	0	2		2	1
SESSIONAL									
11	Open Elective Courses	OECEE481	A. Object Oriented Programming & Java Lab B. Advance Python				2	2	1
12	Humanities and social sciences including Management	SDP481	Skill Development for Professionals IV				2	2	0.5
13	Project. Seminar and Industrial Training	PWEE481	Mini Project II				1	1	1
Value Added Courses									
14	Massive Open Online Courses (MOOCs)	MOOCs	Massive Open Online Courses (MOOCs)						
15	Industry and Foreign Certification (IFC)	IFC	Industry and Foreign Certification (IFC)						
16	Mandatory Additional Requirements (MAR)	MAR481	Mandatory Additional Requirements (MAR)						
Total Credit Points of Semester				**18**	**1**	**8**	**3**	**30**	**21**

University of Engineering & Management

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Mathematics-IV **Credit: 3** **Lecture Hours: 42**
Subject Code: BSCM401

Course Outcomes:

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

CO1. Identify different tools for differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.
CO2. Appraise the notions of Fourier Series and Transform to solve advanced engineering problems.
CO3. Apprehend the concept of Laplace Transform together with its applications in evaluating integrals and solving ordinary differential equations.
CO4. Relate the use of Z-Transform for discrete functions and solve difference equations using Z-Transform technique.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Calculus of Complex Functions**	Complex function, Limit, Continuity and Differentiation; Analytic functions, Cauchy-Riemann equations (statement only); Harmonic functions, Harmonic Conjugate; construction of Analytic functions; elementary Analytic functions (exponential, trigonometric, logarithm) and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series; zeros of analytic functions, singularities, poles; Laurent's series; Residues, Cauchy Residue theorem (without proof); Conformal mappings, Mobius transformations and their properties.	***International Academia:*** https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/pages/syllabus/ https://ocw.mit.edu/courses/18-112-functions-of-a-complex-variable-fall-2008/pages/syllabus/ ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE/EE/EEE/ME/BSC 104/pg 43.pdf) ***Industry Mapping:*** Analysis of AC circuit, physical problems involving ideal fluid flow, steady state heat and current flow can be solved using the theory.	14	**Associated Lab using MATLAB:** 1.Evaluation of contour integrals using **MATLAB** 2.Calculation of residues at the poles using **MATLAB**
2	**Fourier**	*Fourier Series*: Even function, Odd	**International Standards**	12	**Associated Lab using MATLAB:**

	Series & Transform	function. Periodic function, Euler's formula, Dirichlet's conditions; Sum of the Fourier series at the point of discontinuity and end points of an interval; Half Range Sine and Cosine Series; Parseval's Theorem. *Fourier Transforms*: Fourier Transform and its properties; Fourier Sine and Cosine Transforms, Fourier Transform of derivatives (statement only); Inverse Fourier Transform (statement only); Convolution theorem (statement only), related problems.	:) https://ocw.mit.edu/courses/18-085-computational-science-and-engineering-i-fall-2008/ ***Industry Mapping:*** 1.Designing and analysing electrical and electronic communication systems. 2. Fourier coefficients are used to analyse and predict signals and images. 3. In medical science,CT scan, ECG, EEG, X-ray are analysed using fourier transform.		1. Perform fourier sine and cosine transforms using **MATLAB** 2. Write fourier series for some elementary functions using **MATLAB**
3	**Laplace Transform**	Laplace Transform and its properties; First and Second Shifting theorems; Laplace Transform of Periodic functions; Inverse Laplace Transform by different methods, Convolution theorem; evaluation of integrals by Laplace Transform; solving ODEs by Laplace Transform method. .	***International Standards*** : https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/operations-on-fourier-series/ ***AICTE prescribed syllabus:***	10	**Associated Lab using MATLAB:** **1.** Perform Laplace transform of some elementary functions using **MATLAB** **2.**Perform inverse Laplace transform using **MATLAB**

			(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE/EE/EEE/ME/BSC 104/mOD 4/pg 211.pdf ***Industry Mapping:*** 1. In the circuit with inductor and capacitor connected to a generator, the charge and the supply voltage may be estimated. Differential-Difference equations, Intrigo-differential equations often obtained during solving non-linear problems which is difficult otherwise.		
4	**Z-Transform**	Sequence, representation of sequence, Z-Transform and its properties, Shifting theorems, Inverse Z-transform, Convolution theorem, region of convergence, concept of difference equation and their solution by Z-Transform method.	***International Standards:*** ***https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/*** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE/EE/EEE/ME/BSC 104/mOD 4/pg 211.pdf	6	**Associated Lab using MATLAB:** **1.** Compute z-transform of some elementary of some functions using **MATLAB** 2. Solve linear difference equation with constant coefficients using MATLAB

			Industry Mapping: *1. To find the current in the n-th loop for the ladder network.* *2. The principle of a controller design for process control.*		

Suggested Learning Resources:

Text Book:

1. **B. S. Grewal**, "Higher Engineering Mathematics", 44th Edition (2021), Khanna Publishers.

Reference Books:

1. **Biswadip Basu Mallik & Krishanu Deyasi,** "Engineering Mathematics" – Vol. 2B, 1st Edition (2020), Cengage Learning.
2. **B. K. Pal & K. Das,** "Engineering Mathematics" - Vol. IIB, 13th Edition (2019), Vol. IIIB, 8th Edition (2019), U. N. Dhur & Sons.
3. **Erwin Kreyszig,** "Advanced Engineering Mathematics", 10th Edition (2017), John Wiley & Sons.
4. **R. K. Jain and S. R. K. Iyengar,** "Advanced Engineering Mathematics", 5th Edition (2016), Narosa Publication House.
5. **B. V. Ramana,** "Higher Engineering Mathematics", 11th Reprint (2017), Tata McGraw Hill.

University of Engineering & Management

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Environmental Science **Credit: 0** **Lecture Hours: 40**

Subject Code: MC401

Course Outcomes:

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

CO1. To understand the natural environment and its relationships with human activities.

CO2. To apply the fundamental knowledge of science and engineering to assess environmental and health risk

CO3. To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations

CO4. Acquire skills for scientific problem-solving related to air, water, noise& land pollution

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
I	**Overview**	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. Importance, scope and principles of EIA.	***International Academia:*** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** https://cbs.umn.edu/populus/downloadplant(WWTP) .	6	There are no corresponding labs
II	**Ecology**	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L) Biodiversity- types, importance,	***International Academia:*** ***https://ocw.mit.edu/courses/1-020-ecology-ii-engineering-for-sustainability-spring-2008/*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf***	6	There are no corresponding labs

		Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	***Industry Mapping:*** ***https://vsni.co.uk/solutions/ecology*** ***https://www.helsinki.fi/en/researchgroups/statistical-ecology/software***		
III	**Air Pollution**	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants-	***International Academia:*** https://ocw.mit.edu/courses/1-84j-atmospheric-chemistry-fall-2013/pages/lecture-notes/ ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** https://www.who.int/europe/tools-and-toolkits/airq---software-tool-for-health-risk-assessment-of-air-pollution	11	There are no corresponding labs

		Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)			
IV	**Water Pollution**	Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds.DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenating, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Waste water standard [BOD, COD], Water Treatment system,primary and secondary treatments, tertiary treatment definition.Water pollution due to the toxic elements. USEPA and WHO guidelines for drinking water.	***International Academia:*** ***https://online.stanford.edu/courses/cee270m-aquatic-and-organic-chemistry-environmental-engineering*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** *Activated Sludge Simulation (ASIM), Sewage Treatment Operation and Analysis Over Time*	9	There are no corresponding labs

			(STOAT), and GPS-X are the common softwares used for waste water treatment plant(WWTP).		
V	**Lithosphere**	Lithosphere; Internal structure of earth, rock and soil (1L). Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method-Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)	***International Academia:*** ***https://ocw.mit.edu/courses/1-34-waste-containment-and-remediation-technology-spring-2004/*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** ***https://www.wasteworksonline.com/***	3	There are no corresponding labs
VI	**Noise pollution**	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. (1L)	***International Academia:*** ***No link found*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** No software found	3	There are no corresponding labs

VII	**Environmental Management**	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	***International Academia:*** ***https://ocw.mit.edu/courses/11-601-introduction-to-environmental-policy-and-planning-fall-2016/*** ***AICTE-prescribed syllabus:*** ***https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf*** ***Industry Mapping:*** ***https://www.intelex.com/products/environment/***	2	There are no corresponding labs

Suggested Learning Resources:

Text books/ reference books:

1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
3. De, A. K., "Environmental Chemistry", New Age International
4. Das Mohapatra Gourkrishna,. Basic Environmental Engineering and Elementary Biology, Vikas Publishing, (1 January 2017) .

University of Engineering and Management

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Electrical Machines I **Credit: 3** **Lecture Hours: 38**
Subject Code: PCCEE401

Course Outcomes:

CO1. To remember and understand the basic concept and laws pertaining to Magnetic field & circuits, E.M. forces & torque.

CO2. To appreciate the working principle, characteristics and different problems related to DC generator.

CO3. To understand the working principle, characteristics, testing and control mechanism of DC motor.

CO4. To develop the capability to analyze the operation, characteristics and testing of Transformers as per their usage in different sector.

Module Number	Topic	Sub-topics	Mapping with Industries, National and International Academia	Lecture Hours	Corresponding Lab assignments
1	Magnetic fields, Energy density and magnetic circuits; Electromagnetic force, torque and General theory of Rotating Electrical Machines	Review of magnetic circuits - MMF, flux, reluctance, inductance; Energy density, 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. 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	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus**: https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf **Industry Mapping:** IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines · **Simulation Software:** MATLAB	**7**	Introduction to IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines regarding: · Duty Type, · Rating and · Co-ordination of voltage and output

2	Construct-ion and Principle of working of 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.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus:** https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf **Industry Mapping:** IS Specification No. 9320: 1979 regarding Guide for testing of DC Machines **Simulation Software:** MATLAB	**8**	Testing of DC Generators and Motors as per IS Specification No. 9320: 1979 : a) Measurement of winding resistances b) Determination of open circuit characteristics c) Determination of regulation characteristics d) Determination of external characteristics (for generator only) e) Determination of efficiency of a machine · Assignments using Simulation Software
3	DC machine – Operation, Control and Efficiency	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.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus:** https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf · **Industry Mapping:** IS Specification No. 9320: 1979 regarding Guide for testing of DC Machines	**7**	Testing of DC motor to: a) Study Torque- Speed characteristics b) Different Methods of Speed Control · Assignments using Simulation Software

		Losses ,Efficiency, load testing and back-to-back testing of DC machines, Permanent Magnet DC (PMDC) motor, Brushless DC (BLDC) Motors	**Simulation Software:** MATLAB		
4	Transformers – Working principle, Construction, Operation, Control and Testing	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, Phasor groups 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, Dry type transformer.	**International Academia:** https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ **AICTE-prescribed syllabus:** https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf · **Industry Mapping:** IS Specification No2026: 1981 (Part 1) for Power Transformer and IS Specification No. 11171: 1985 for Dry type transformer **Simulation Software:** MATLAB	**16**	Routine tests of transformer as per IS 2026: a) Transformer voltage ratio test and polarity b) Winding resistance test of transformer c) Transformer vector group test d) Measurement of impedance voltage/short circuit impedance (principal tap) and load loss (Short circuit test) e) Measurement of no-load loss and current (Open circuit test) f) Temperature rise test of transformer (Back to Back Test) g) Dielectric tests of transformer (in Power System) h) Measurement of insulation resistance (in Power System) · Assignments using Simulation Software

Suggested Learning Resources:

Text Books

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

Reference Books

1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
2. 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. Kirtley Jr., James L. Electric Power Principles: Sources, Conversion, Distribution and Use. Wiley, 2010. ISBN: 9780470686362.

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Syllabus for B. Tech Electrical Engineering Batch 2022

Subject Name: Digital Electronics **Credit: 3** **Lecture Hours: 40**

Subject Code: PCCEE402

Course Outcomes:

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

CO1. Describe the function of different building blocks of digital electronics, semiconductor memories and programmable logic devices.

CO2. Explain the principle of operation of combinational and sequential digital circuits, A/D and D/A converter.

CO3. Solve numerical problems of Boolean algebra, number system, combinational & sequential digital circuits and A/D and D/A converter.

CO4. Specify applications of combinational and sequential digital circuits.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Number System and Codes**	Introduction to number systems, Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, gray codes and their conversions. Signed binary number representation with 1's and 2's complement methods, Radix and Radix conversions, Weighted and non-weighted codes, and BCD arithmetic	***International Academia:*** (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	8	1. Code conversion circuits:- BCD to Excess-3 & Excess-3 to BCD 2. To design and implement 4-bit Gray to binary code converter 3. Introduction to P-SPICE/ MATLAB/ SCILAB
2	**Boolean Algebra and Digital Logic Gates**	Basic definitions and features of Boolean algebra, Theorems of Boolean algebra, Basic logic functions, Standard and Canonical forms. Fundamental logic gates, derived	**International Standards**: (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-	10	4. To study about logic gates and verify their truth tables. 5. Realization of basic gates

		logic gates, logic diagrams, Converting logic diagrams to universal logic (NAND and NOR Implementation). Simplification of logic expressions using Karnaugh's maps. K-Map Method - Product of Sums (maxterms) and Sum of Products (minterms) Simplification.	1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB		using Universal logic gates

3	**Designing Combinational Logic Circuits**	Arithmetic circuits (ADDER and SUBTRACTOR), comparators, decoders, encoders, multiplexers, de- multiplexers, code converters and their use in logic synthesis; Potential hazards in combinational circuits.	***International Standards***: (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	8	6. Construction of simple decoder and multiplexer circuit using NAND gate. 7. Construction of simple arithmetic circuits – ADDER 8. Construction of simple arithmetic circuits – SUBTRACTOR 9. One bit and two bit comparator circuit.

4	**Designing Sequential Logic Circuits**	Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Design of Synchronous Sequential Circuits- State Table and State Diagrams, Design of Mealy and Moore FSM -Sequence Detection.	***International Standards:*** (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	8	10. Realization of RS-JK, T and D flip-flop using universal logic gates. 11. Realization of ring counter and Johnson's counter.

5	**Logic Families and Switching Circuits**	Diode, BJT, FET as switch. Different types of logic families: RTL, TTL, subfamilies, three state output logic, MOS, CMOS, ECL IIL. Their operations and specifications.	***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: P-Spice/ MATLAB/SCILAB	6	12. Applications of P-SPICE/ MATLAB/ SCILAB

Suggested Learning Resources:

1. Digital Principles & Application, 5th Edition, Leach & Malvino, Mc Graw Hill Company.
2. Modern Digital Electronics, 4th Edition, R.P. Jain. Tata Mc Graw Hill Company Limited.
3. Fundamental of Digital Circuits, A. Anand Kumar, 4th Edition, PHI.
4. Digital Electronics, R. Anand, Khanna Publishing House (2018).
5. Digital Logic Design, Morries Mano, PHI.
6. Digital Integrated Electronics, H. Taub & D. Shilling, Mc Graw Hill Company.
7. Digital Electronics, James W. Bignell & Robert Donovan, Thomson Delman Learning.
8. Fundamental of logic Design, Charles H. Roth, Thomson Delman Learning.

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Power Electronics **Credit: 3** **Lecture Hours: 43**

Subject Code: PCCEE403

Course Outcomes:

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

CO1. Know the operation of different power electronics switches

CO2. Understand the basic operating principle of converters.

CO3. Evaluate the performance of different types of converter.

CO4. Design power electronic converter for specific application.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
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. EMB1412 - MOSFET Gate Driver	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** MATLAB	8	1. Study of the characteristics of an SCR. 2. Study of the characteristics of a Triac 3. Study of different triggering circuits of an SCR 4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
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. LM5045 Full-Bridge PWM Controller	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	7	5. Study of the operation of a single phase full controlled bridge converter with R and R-L load. 6. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters. 7. Study of performance of three phase controlled converter with R & R-L load.

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.	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	5	8. Study of performance of step down chopper with R and R-L load.
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. TPS631010-Buck-Boost Converters	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	5	9. Study of performance of buck-boost chopper with R load.
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	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed***	10	10. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.

		modulation and unipolar sinusoidal modulation, modulation index and output voltage	***syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB		
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. TIDA-010025 - Three-phase inverter	***International Academia:*** (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** PSIM, MATLAB	8	12. Study of performance 3phase bridge inverter using MOSFET as switch with lamp load.

Suggested Learning Resources:

Text Books

1. Power Electronics, P.S. Bimbhra, Khanna Publishers.
2. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.

Reference Books

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

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
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University of Engineering & Management, Jaipur

Syllabus for B.Tech Admission Batch 2023

Subject Name: Signals & Systems **Credit: 3** **Lecture Hours: 25**

Subject Code: PCCEE404

Course Outcomes:

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

CO1. Understand the concepts of continuous time and discrete time signals.

CO2. Evaluate the frequency spectra for different kind of signals.

CO3. Analyze different transformations for continuous and discrete signals.

CO4. Design sampling frequency and filters to recover the original signal.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
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.	***International Academia:*** (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:*** MATLAB,SCILAB	3	1. Simulation of different signals using MATLAB 2. Different operations on signals. 3. Introduction to programming using MATLAB
2	**Signal operation & state space models of LTI systems**	Behaviour of continuous and discrete-time LTI systems: Impulse response and step response, convolution, input-output behaviour with aperiodic convergentinputs, 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,	**International Standards** :(https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:***	8	1. Different operations on continuous time signals using MATLAB , Convolution, Correlation , Auto correlation.

		Multi-input, multi-output representation. State Transition Matrix andits Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	MATLAB, OCTAVE		
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, the solution to differential equations and system behaviour. The z-Transform for discrete-time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis	***International Standards*** : (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:*** Hardware Chipset (DSP KIT) Software: MATLAB, OCTAVE	10	1. Transformation of signals into time and frequency domain Using MATLAB 2. DTFT, DFT transformation using MATLAB.

4	**Introduction to Sampling and Reconstruction:**	The Sampling Theorem and its implications. Spectra of sample 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	***International Standards:*** (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) ***Industry Mapping:*** FPGA Kit Software: MATLAB, OCTAVE	4	1. Implementation of sampling using MATLAB. 2. Quantization implementation using MATLAB. 3. Reconstruction of signals using MATLAB

Suggested Learning Resources:

Text Books

1. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.

Reference Books

1. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
2. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
3. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
4. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
5. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

University of Engineering and Management

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University of Engineering & Management, Jaipur

Syllabus for B. Tech Admission Batch 2022

Subject Name: Electrical Machines Laboratory - I **Credit: 1** **Lecture Hours: 24**

Subject Code: PCCEE491

Course Outcomes:

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

CO1. Identify appropriate equipment and instruments for the experiment.

CO2. Test the instrument for application to the experiment.

CO3. Construct circuits with appropriate instruments and safety precautions.

CO4. Validate different characteristics of DC machine, methods of speed control of DC motor and parallel operation of the transformer.

Laboratory Experiments

Module No	Description	Lecture Hours
1	Determination of the characteristics of a separately excited DC generator.	**2**
2	Determination of the characteristics of a DC motor.	**2**
3	Study of methods of speed control of DC motor.	**2**
4	Determination of the characteristics of a compound DC generator (short shunt).	**2**
5	Determination of speed of DC series motor as a function of load torque.	**2**
6	Polarity test on a single phase transformer.	**2**
7	Determination of equivalent circuit of a single phase transformer and efficiency.	**2**
8	Study of different connections of three phase transformer.	**2**
9	Study of Parallel operation of a single phase transformers	**2**
10	Determination of temperature rise and efficiency of the transformer (Back to back test).	**2**
Total		**20**

Virtual Lab. Details

Experiment Name	Web-Link/ Software Used
Determination of the characteristics of a separately excited DC generator.	https://ems-iitr.vlabs.ac.in/exp/magnetization-characteristics-dcshunt/ https://ems-iitr.vlabs.ac.in/exp/load-characteristics-dc-shunt/
Determination of the characteristics of a DC motor.	http://em-coep.vlabs.ac.in/Exp1/Theory.html?domain=Electrical%20Engineering&lab=Welcome%20to%20Electrical%20Machines!
Study of methods of speed control of DC motor.	https://ems-iitr.vlabs.ac.in/exp/dcmotor-field-resistance-control/ https://ems-iitr.vlabs.ac.in/exp/dcshunt-motor-armature-control/
Determination of equivalent circuit of a single phase transformer and efficiency.	https://ems-iitr.vlabs.ac.in/exp/circuit-parameters-oc-test/

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Digital Electronics Laboratory **Credit: 1** **Lecture Hours: 30**

Subject Code: PCCEE492

Course Outcomes:

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

CO1. Understand working of logic families and logic gates

CO2. Design and implement combinational and sequential logic circuits.

CO3. Design and implement arithmetic circuits.

CO4. Be able to use PLDs to implement the given logical problem

Laboratory Experiments

Module No	Description	Lecture Hours
1	Realization of basic gates using Universal logic gates.	**2**
2	Code conversion circuits- BCD to Excess-3 & vice-versa.	**2**
3	4-bit parity generator & comparator circuits.	**2**
4	Construction of simple Decoder & Multiplexer circuits using logic gates.	**2**
5	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display Using multiplexer	**2**
6	Construction of simple arithmetic circuits-Adder, Subtractor.	**2**
7	Realization of RS-JK & D flip-flops using Universal logic gates	**2**
8	Realization of Universal Register using JK flip-flops & logic gates	**2**
9	Realization of Universal Register using multiplexer & flip-flops.	**2**
10	Construction of Adder circuit using Shift Register & full Adder	**2**
11	Realization of Asynchronous Up/Down counter	**2**
12	Realization of Synchronous Up/Down counter	**2**
13	Design of Sequential Counter with irregular sequences.	**2**
14	Realization of Ring counter& Johnson's counter.	**2**
15	Familiarization with A/D and D/A circuits	**2**
TOTAL		**30**

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Syllabus for B. Tech Admission Batch 2022

Subject Name: Power Electronics Laboratory **Credit: 1** **Lecture Hours: 26**

Subject Code: PCCEE493

Course Outcomes:

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

CO1. Identify the basic elements of the power electronics engineering.

CO2. Understand the basic operation of electronic switches.

CO3. Understand the operation of different types of power converter.

CO4. Design basic converter for various applications

Laboratory Experiments

Experiment No.	Description	Hrs.
1.	Study of the characteristics of an SCR.	2
2.	Study of the characteristics of a Triac.	2
3.	Study of the characteristics of an IGBT.	2
4.	Study of different triggering circuits of an SCR	2
5.	Study of firing circuits suitable for triggering SCR in a 1- phase full controlled bridge.	2
6.	Study of the operation of single phase full controlled converter with R and R-L load.	2
7.	Study of performance of single phase half controlled symmetrical bridge converters.	2
8.	Study of performance of single phase controlled converter with source inductance.	2
9.	Study of performance of three phase controlled converter with R & R-L load.	2
10.	Study of performance of step down chopper with R and R-L load.	2
11.	Study of performance of buck-boost chopper with R load.	2
12.	Study of performance of 1-phase PWM bridge inverter with R and R-L load.	2
13.	Study of performance of 3-phase bridge inverter with R load.	2
Total		**26**

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Syllabus for B.Tech Admission Batch 2022

Subject Name: Object Oriented Programming & Java Lab **Credit: 1** **Lecture Hours: 24**
Subject Code: OECEE481A **Semester: 4**

Prerequisite: Familiarity with data structures, and introduction to programming.

Course Outcomes

i.e., statements on students' understanding and skills at the end of the course the student shall have:

Essential:

1. Understanding the build system: IDE, tools for testing, debugging, profiling, and source code management.
2. Students are able to demonstrate proficiency in object-oriented programming.
3. Identify and abstract the programming task involved for a given programming problem.
4. Learning and using language libraries for building large programs.
5. Ability to apply defensive programming techniques (e.g., assertions, exceptions).

Desirable/Advanced:

1. Ability to implement basic event-driven programming.
2. Understanding of the fundamentals of parallel programming.
3. Understanding of the basics of cloud computing.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Corresponding Lab Assignment
1.	**Familiarity with the programming environment**	Understanding the build system, IDE, debugging, profiling and source code management. Introduction to various programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigm	**International Academia:** (https://drive.google.com/file/d/10z00dMd26WjiPThhCercGbsi6u3ciE62/view?usp=drive_link) (https://drive.google.com/file/d/1k3qrfDL9p5_IJR_iP2mt6c6AzwmByNtf/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Familiarity with terminal/command prompt, using git commands and github to pull/ commit/ push/ merge code, writing, compiling and running simple programs, debugging by setting breakpoints

2.	**Basic principles of the object-oriented development process**	Introduction to Object-Oriented Paradigm: Data encapsulation, modularity, code reuse, identifying classes, attributes, methods and objects, class relationships	**International Academia:** (https://drive.google.com/file/d/1Rc1KOzkVRHqLEWApFBplwz7s8IwsyFlf/view?usp=sharing) (https://drive.google.com/file/d/1e8g7D6nuMwEruToXtNDbh68vx2VKUrgS/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Importing pre-written classes using the this keyword, calling and defining methods, writing and instantiating classes, setter/getter methods, instance variables, returning values, debugging using print function, containment and association, scope and parameter passing

3.	**Advanced features of OOP**	Interfaces, inheritance, polymorphism, abstract classes, immutability, copying and cloning objects	**International Academia:** International Standards Mapping (MIT Open Courseware): String: immutability, BufferReader, StringBuilder (https://ocw.mit.edu/ans7870/6/6.005/s16/classes/09-immutability/) Polymorphism : Methods : Overloading and overriding Methods, overloading constructors (https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/67b1aec3f2867734ec0fb33034c8b5c8_MIT6_088IAP10_lec05.pdf) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Parameter polymorphism, method resolution, declared v/s actual type, partially and fully overriding methods, calling superclass constructor from child class constructor, protected fields and methods, using an abstract parent class v/s an interface with default and abstract methods, object equality check, object comparison (Comparable/Comparator interface), Cloneable interface/copy constructor

4.	**Using language APIs**	Language supported libraries for handling advanced data structures. Abstraction: abstract class, design debugging interface, multiple inheritance, packages Access control, class scope, packages, Java API	**International Academia:** (https://drive.google.com/file/d/1yFNf2IBXgy6ch47hR6TGHzddvCPfVm8p/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Big-O notation, Java collection framework (or Boost libraries), sorting objects, iterating over objects
5.	**Defensive programming**	Exception handling, assertions, Java Thread Programming	**International Academia:** (https://drive.google.com/file/d/1kbRGF396sQPdQbA4w-N81ElKU_bdGgFs/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	Exception handling using try/catch block, nesting try/catch blocks, throw and throws keywords, rethrowing exceptions, handling checked exception, user defined exceptions. Thread Synchronization and Thread Communication

6.	**Modeling and Design patterns**	Basic modeling techniques – e.g. Class diagram, sequence diagram, use case diagrams, etc. Introduction to design patterns: iterator, singleton, flyweight, adapter, strategy, template, prototype, factory, façade, decorator, composite, proxy, chain of responsibility, observer, state) Model View Controller	**International Academia:** (https://drive.google.com/file/d/1DQVPfhmcyKog-PryPdZ-bxufUC7D0Cfl/view?usp=sharing) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.*	UML modeling.
7.	**Basic Android Programming**	Android Components – Activity, Services, Content Provider, Broadcast Receiver; Simple UI Design,Applet and Swing	**International Academia:** (https://online.stanford.edu/courses/cs108-object-oriented-systems-design) **AICTE-prescribed syllabus:** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) ***Industry Mapping:*** *Hackerrank,TCS Codevita projects, GitHub platform,. Android Studio will be used.*	Android app making

Suggested Learning Resources:

Text Books

1. Herbert Schildt, Java: The Complete Reference, 11st edition
2. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston. Object-Oriented Analysis and Design with Applications.
3. E. Balaguruswami, Programming with Java, 6th edition
4. Barry A. Burd and John Mueller, Android Application Development All-in-One For Dummies

Reference Books:

1. J. Rumbaugh et al. The Unified Modeling Language Reference Manual.
2. P. Van Roy and S. Haridi. Concepts, Techniques, and Models of Computer Programming.
3. Horton, I. (2005). Ivor Horton's Beginning Java 2. John Wiley & Sons.
4. https://missing.csail.mit.edu/
5. https://www.baeldung.com/junit
6. https://www.tutorialspoint.com/junit/index.htm

For UML tools, open source tools may be used (e.g. www.starUML.io, argouml.tigris.org/)

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Syllabus for B.Tech Admission Batch 2022

Subject Name: Advance Python **Lecture Hours: 24** **Credit: 1**
Subject Code: OECEE481B

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Corresponding Lab Assignment
1	**Introduction to Python**	Data Types, Operators, Expression, Indexing & Slicing, Strings, Conditionals, Functions, Control Flow, Nested Loops, Sets &Dictionaries.	***International Academia:*** https://tinyurl.com/bdass3 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Jupyter Notebook	1. Experiments to understand all the basic datatypes in python. 2. Experiments to implement various arithmetical and logical operators. 3. Experiment to understand the indexing techniques in python. 4. Code using conditional statement, control flow and nested loops. 5. Code to implement sets and Dictionaries in python.
2	**Introduction to Machine Learning**	Machine Learning Vs Statistical Modelling, Supervised vs Unsupervised Learning, Supervised Learning Classification,	***International Academia:*** https://tinyurl.com/2jphac8c ***AICTE-prescribed syllabus:***	1. Experiments/ code that refresh Python, programming frameworks used for the course. 2. Experiments/Code that allows students to appreciate mathematics and data

		Unsupervised Learning, Reinforcement Learning, Applications, Python libraries suitable for Machine Learning: Pandas, Numpy, Scikit-learn, visualization libraries: matplotlib etc.	https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, SK Learn, Mat Plot Lib, NumPy, Pandas	manipulation. Appreciate (a) Features, Representation of the data/real-world phenomena (b) mathematical operations or transformations that manipulate the data (c) plot/visualise the data distributions (say in 2D) (d) Eigen values, eigen vectors, rank of matrices. 3. Lab/Experiments that appreciate the problem of Classification and problem of Regression 4. Lab/Experiments that appreciates the notions related to "Training" and "Testing" by considering algorithms like decision trees, nearest neighbour as black boxes.
3	**Regression Model using Python**	Simple Linear Regression, Multiple Linear Regression, Non-linear Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models	***International Academia:*** https://tinyurl.com/9d4brw22 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, Regression ML Algorithms	1. Experiments on dimensionality Reduction using Principal Component Analysis (PCA) and its applications in (a) removing irrelevant features (b) compression /compaction (c) efficient ML pipeline. 2. Experiment related to Linear Regression and Non-linear Regression. 3. Experiment to understand and implement the process of Model evolution in Regression Models. 4. Experiment related to Evaluation Metrics in Regression Models.
4	**Classification Model using Python**	Introduction to Classification, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Logistic regression vs Linear regression, Evaluation Metrics in Classification	***International Academia:*** https://tinyurl.com/9d4brw22 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, Classification ML Algorithms	1. Experiment related to Nearest neighbour classifier, (a) visualize the decision boundaries (b) appreciate the role of hyper parameter K. Role of validation data in choice of hyper parameters 2. Decision Tree as a classifier and see the overfitting with "deep" trees. How the overfitting can be controlled by seeing validation performance during the training. 3. Experiment that demonstrates how SVM can yield a solution better than a simple linear

				separating solution. Appreciate the role of support vectors. Appreciate how SVMs extend to problems even if data is not linearly separable.
5	**Unsupervised Learning using Python**	Introduction to Clustering, K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Content-based recommender systems, Collaborative Filtering	***International Academia:*** https://tinyurl.com/9d4brw22 ***AICTE-prescribed syllabus:*** https://tinyurl.com/32a8mp5t ***Industry Mapping:*** Spyder, Clustering ML Algorithms	1. Experiments on various techniques of plot under fitting and overfitting in a data set. 2. Experiment on the implementation of clustering using ML algorithms. 3. Experiments related to K-Means, by varying in "K", "initialization". How the "analysis of the algorithm" can be seen in the lab (e.g. change of objective across iterations). Try multiple datasets. Appreciate that "unsupervised discovery" makes sense in the problem under consideration.

INSTITUTE OF ENGINEERING & MANAGEMENT

An Autonomous Institution, Affiliated to MAKAUT

DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER WISE CURRICULAM

3rd YEAR- 6th SEMESTER

Semester VI [Third year]
Branch/Course: Electrical Engineering

Sl. No.	Course Code	Course Title	Hours per week			Total contact hours	Credits
			Lecture	Tutorial	Practical		
1	PCC-EE20	Power Systems – II (Operation and Control)	3	0	0	3	3
2	PCC-EE21	Power Systems Laboratory - II	0	0	2	2	1
3	PCC-EE22	Measurements and Instrumentation Laboratory	2	0	2	4	3
4	PCC-EE23	Electronics Design Laboratory	1	0	4	5	3
5	PEC-EE02	A. Digital Signal Processing B. Wind and Solar Power Energy System	3	0	0	3	2
6	PEC-EE92	A. Digital Signal Processing Laboratory B. Wind and Solar Power Energy System Laboratory	0	0	2	2	1
7	PEC-EE03	A. Digital Control System B. Electrical and Hybrid Vehicle	3	0	0	3	3
8	OEC-EE02	A. Internet of Things B. Image Processing	3	0	0	3	3
9	HSMC EE 302	Principles of Management	3	0	0	3	3
10	PROJ EE04	Project IV	0	0	0	0	1
11	HSMC (EE) 602	ESSENTIAL STUDIES FOR PROFESSIONAL- VI	2	0	0	2	0.5
12	HSMC 682	SKILL DEVELOPMENT FOR PROFESSIONALS- VI	0	0	2	2	0.5
						TOTAL CREDITS	**24**
13	MOOCS through NPTEL/SWAYAM Portal for Honours Degree						
14	IFC- Industry & Foreign Certification through different online portals						
15	MAR- Mandatory Additional Requirement						
Summer Internship of 3-week duration after 6th semester. Students will be assessed based on submission of report on internship and presentation in a seminar in 7th semester							

Name of the Course:	Power Systems–II (Operation and Control)	Subject Code:	PCC-EE20
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Power System I		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To utilize numerical methods for analyzing a power system in steady state.
2. To understand stability constraints in a synchronous grid.
3. To realize methods to control the voltage, frequency and power flow.
4. To understand the monitoring and control of a power system.
5. To understand the basics of power system economics.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Power Flow Analysis:** Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.	8
2	**Power System Stability:** Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.	10
3	**Automatic Generation Control: Frequency and Voltage Control** Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters.	8
4	**Monitoring and Control:** Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a	6

	Power System. Contingency Analysis. Preventive Control and Emergency Control.	
5	**Power System Economics and Management:** Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.	**8**
Total		**40**

Course Outcomes:

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

CO1. Understand the stability constraints in synchronous grid and numerical methods to analyze power flow in a power system.

CO2. Realize the control and methods to control the voltage, frequency and power flow in a power system.

CO3. Understand the measurement systems and assess the system through monitoring and control.

CO4. Appreciate the basics of power system economics and energy management.

Suggested Learning Resources:

Text Books

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
2. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

Reference Books

1. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
2. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

Name of the Course:	Digital Signal Processing	Subject Code:	PEC-EE02A
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Signal and System		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To understand sampling and reconstruction of signal
2. To understand the method of Z-transform and inverse Z- transform of signal and its properties
3. To understand Discrete Fourier Transform
4. To understand methods of design of Digital filters
5. To understand applications of Digital signal processing
6. To solve numerical problems on the topics studied

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Discrete-time signals and systems** Discrete time signals and systems: Sequences; representation of signals onorthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals -aliasing; Sampling theorem and Nyquistrate.	6
2	**Z-transform** z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.	8
3	**Discrete Fourier Transform** Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Connvolution of signals,Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems	6
4	**Design of Digital filters** Design of FIR Digital filters:Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.	12

5	**Applications of Digital Signal Processing** Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	6
Total		**38**

Course Outcomes:

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

CO1. Represent signals in continuous and discrete-time and in the frequency domain.
CO2. Analyze discrete-time systems using z-transform.
CO3. Explain the Discrete-Fourier Transform (DFT) and the FFT algorithms.
CO4. Design digital filters for various applications and apply digital signal processing for the analysis of real-life signals

Suggested Learning Resources:

Text Books

1. Digital Signal Processing-A computer based approach, S. Mitra, TMH
2. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis & M.G. Manslakis,PHI
3. Fundamental of Digital Signal Processing using MATLAB , Robert J. Schilling, S.L. Harris,Cengage Learning.

Reference Books

1. Digital Signal Processing, Johnson, PHI
2. Digital Signal Processing using MATLAB, Ingle, Vikas.

Name of the Course:	Digital Control System	Subject Code:	PEC-EE03A
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Control System		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. To find Z-tranaform and inverse Z-transform of systems.
2. To carry out the analysis and design of digital control systems
3. To design compensators for digital control system to achieve desired specifications.
4. To represent digital control systems using state space models.
5. To analyze the effect sampling on stability, controllability and observability.
6. To design digital controllers for industrial applications.
7. To solve numerical problems on the topics studied.

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Discrete Representation of Continuous Systems:** Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.	6
2	**Discrete System Analysis:** Z Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z-plane. Solution of Discrete time systems. Time response of discrete time system.	6
3	**Stability of Discrete Time System** Stability analysis by Jury test.Stability analysis using bilinear transformation. Design of digital control system with deadbeat response. Practical issues with deadbeat response design.	4
4	**State Space Approach for discrete time systems** State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.	10
5	**Design of Digital Control System** Design of Discrete PID Controller, Design of discrete statefeedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.	8

6	**Discrete output feedback control** Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems	**8**
Total		**42**

Course Outcomes:

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

CO1. Obtain discrete representation of LTI systems.
CO2. Analyse stability of open loop and closed loop discrete-time systems.
CO3. Design and analyse digital controllers.
CO4. Design state feedback and output feedback controllers.

Suggested Learning Resources:

Text Books

1. K.Ogata, "Digital Control Engineering",Prentice Hall,Englewood Cliffs,1995.
2. B.C.Kuo, "Digital Control System",Holt, Rinehart and Winston,1980.

Reference Books

1. M. Gopal, "Digital Control Engineering",Wiley Eastern,1988.
2. G. F. Franklin, J.D. Powell and M. L.Workman, "Digital Control of Dynamic Systems", Addison-Wesley,1998.

Name of the Course:	Wind and Solar Power Energy System	Subject Code:	PEC EE02B
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Power system-I, Electrical Machines I & II		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objective(s):

The purpose of learning this course is-

1. To understand the difference between Renewable and non-renewable energy sources
2. To understand methods of conversion of wind energy to other form of energy.
3. To understand methods of conversion of wind energy to other form of energy.
4. To solve numerical problems of Renewable and non-renewable energy sources

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Physics of Wind Power:** History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions	5
2	**Wind generator topologies:** Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, BDFRM, Power electronics converters. Generator-Converter configurations, Converter Control.	12
3	**The Solar Resource:** Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.	3
4	**Solar photovoltaic:** Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.	8

5	**Network Integration Issues:** Overview of grid code technical requirements. Fault ride-through for wind farms-real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.	**8**
6	**Solar thermal power generation:** Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.	**3**
Total		**39**

Course Outcomes:

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

CO1. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.

CO2. Understand the basic physics of wind and solar power generation.

CO3. Understand the power electronic interfaces for wind and solar generation.

CO4. Understand the issues related to the grid-integration of solar and wind energy systems.

Suggested Learning Resources:

Text Books

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. G.M. Masters, "Renewable and Efficient Electric Power Systems**",** John Wiley and Sons, 2004.
3. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill,1984.

Reference Books

1. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd.,2006.
2. G.N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications,2004.
3. J.A. Duffie and W.A. Beckman, "Solar Engineering of Thermal Processes", John Wiley&Sons,1991.

Name of the Course:	Electrical and Hybrid Vehicle	Subject Code:	PEC-EE03B
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Electric Machine-I, Electric Machine-II		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objectives:

The purpose of learning this course is-

1. To understand the basic difference between conventional and Hybrid vehicles.
2. To understand different configuration and control of Electric drives.
3. To understand energy storage system in Hybrid vehicles.
4. To understand different energy management strategies of Hybrid vehicles.
5. To solve numerical problems on the topics studied

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Introduction :** Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies,fuel efficiency analysis.	10
2	**Electric Trains :** Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives (BLDC, PMSM), Configuration and control of Switch Reluctance Motor drives, drive system efficiency.	10
3	**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power	10

	electronics, selecting the energy storage technology, Communications, supporting subsystems.	
4	**Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).	**10**
Total		**40**

Course Outcomes:

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

CO1. Understand the models to describe hybrid vehicles and their performance.
CO2. Understand the basic concept of electric traction.
CO3. Understand the different possible ways of energy storage.
CO4. Understand the different strategies related to energy storage systems.

Suggested Learning Resources:

Text Books

1. C. Mi, M. A. Masrurand D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.

Reference Books

1. M. Ehsani, Y. Gao, S. E. Gayand A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

Name of the Course:	Internet of Things	Subject Code:	OEC-EE02A
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	Data Structure		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	0	0	3

Course Objective(s):

The purpose of learning this course is-

1. Able to understand the application areas of IOT
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
3. Able to understand building blocks of Internet of Things and characteristics

Detailed Syllabus

Module No	Description	Lecture Hours
1	**Environmental Parameters Measurement and Monitoring:** Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
2	**Sensors:** Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
3	**Important Characteristics of Sensors:** Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	9
4	**Architecture of Smart Sensors:** Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	8
5	**Sensor Interfacing:** Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
6	**Smart Sensor:** Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5
Total		44

Course Outcomes:

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

CO1. Determine the Market perspective of IoT.
CO2. Use of Devices, Gateways and Data Management in IoT.
CO3. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
CO4. Building state of the art architecture in IoT.

Suggested Learning Resources:

Text Books

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

Reference Books

1. Jeeva Jose, Internet of Things, Khanna Publishing House. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
2. Internet of Things, Arsheep Bahga and Vijay Madisetti

Name of the Course:	Image Processing	**Subject Code:**	OEC EE 02B
Semester:	6th	**Course Nature:**	Theory
Pre-Requisite(s):	Signal and Systems, Mathematics & Statistics -IV		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objective(s):

The purpose of learning this course is-

1. To learn digital image fundamentals.
2. To understand the filtering process of digital images.
3. To analyse the processed image for information retrieving.
4. To analyse redundancy in image compression.

Detailed Syllabus

Module No	**Description**	**Lecture Hours**
1	Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.	**8**
2	Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.	**9**
3	Color Image Processing-Color models – RGB, YUV, HSI; Color transformations – formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.	**8**
4	Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.	**3**
5	Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub band filter banks, wavelet packets.	**6**
6	Image Compression-Redundancy – inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG 2000.Image classification.	**6**
Total		**40**

Course Outcomes:

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

CO1. Mathematically represent the various types of images and analyze them
CO2. Process these images for the enhancement of certain properties
CO3. Process these images for optimized use of the resources.
CO4. Develop algorithms for image compression and coding.

Suggested Learning Resources:

Text Books

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004

Reference Books

1. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

Name of the Course:	Principles of Management	Subject Code:	HSMC EE 302
Semester:	6th	Course Nature:	Theory
Pre-Requisite(s):	School history		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
3	**0**	**0**	**3**

Course Objectives:

1. Relate, discuss, understand, and present management principles, processes and procedures in consideration of their effort on individual actions.
2. Participate, summarize and/or lead class discussions, case problems and situations from both the text and student experience that relate to the text material.
3. Knowledge and understanding of the Principles of Management will enable the student manager and/ or employee and gain valuable insight into the workings of business and other organizations.

Detailed Syllabus

Module	Content	Hour
1	**Basic concepts of management**: Definition – Essence, Functions, Roles, Level. **Functions of Management**: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organization Structure –Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness.	5
2	**Management and Society** – Concept, External Environment, CSR, Corporate Governance, Ethical Standards. **People Management** – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. **Managerial Competencies** – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship	5
3	**Leadership:** Concept, Nature, Styles. **Decision making**: Concept, Nature, Process, Tools & techniques. **Economic, Financial & Quantitative Analysis** – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.	5

4	**Customer Management** – Market Planning & Research, Marketing Mix, Advertising & Brand Management. **Operations & Technology Management** – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.	5
	Total:	20

Course Outcome:

CO1: Recognize the role of a manager and how it relates to the organization's mission.
CO2: Know critical management theories and philosophies and how to apply them.
CO3: Explain the relationship between strategic, tactical, and operational plans
CO4: Recognize the part communication plays in the management function.

Suggested Learning Resources:

Text Books

1. Drucker, F. Peter - Management-Tasks, Responsibilities & Practices.
2. Koontz "O" Donnel Weihrich - Elements of Management.
3. Koontz H, "O" Donnel C - Management-A Book of Reading.

Reference Books

1. Drucker, F. Peter - The Practice of Management.
2. Terry and Franklin - Principles of Management
3. Stoner - Principles of Management
4. William H. Newman and - The Process of Management. E. Kirby Wassen

Name of the Course:	Power System Laboratory II	Subject Code:	PCC-EE 21
Semester:	6th	Course Nature:	Practical
Pre-Requisite(s):	Basic Electrical and Electronics Engineering Laboratory, Electric Circuit Theory Laboratory.		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
0	0	2	1

Course Objective(s):

The purpose of learning this course is-

1. To solve D.C. networks by different circuit analysis methods.
2. To understand the characteristics of different type of IDMT rely
3. To study the load flow by various method.
4. To simulate the different motor protection scheme.

Detailed Syllabus

Module No	Description	Hrs.
1	Study of the characteristics of on delay relay and off delay relay.	2
2	Test to find out polarity, ratio and magnetization characteristics of CT and PT.	2
3	Test to find out characteristics of under voltage relay	2
4	Study on AC load flow using Gauss-seidel method	2
5	Study on AC load flow using Newton Raphson method	2
6	Simulation of DC distribution by network analyzer.	2
7	Study of different transformer protection schemes by simulation.	2
8	Study of different generator protection schemes by simulation.	2
9	Study of different motor protection schemes by simulation.	2
10	Study of different characteristics of over current relay.	2
11.	Test to find out characteristics of earth fault relay.(hardware and simulation)	2
12.	Formation of bus admittance matrix of an interconnected system using matlab	2
13.	Simulation and analysis of different types of fault.	2
Total		26

Course Outcomes:

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

CO1. Explicate the function of various types of electromagnetic relays.

CO2. Validate the concept of protection and pilot relaying schemes through simulation.

CO3. Apply various protective devices and its coordination techniques to distribution system.

CO4. Identify and analyze the real time power system problems and power flow techniques.

Suggested Learning Resources:

Text Books

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
2. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

Reference Books

1. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
2. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

Name of the Course:	Measurements and Instrumentation Laboratory	**Subject Code:**	PCC-EE22
Semester:	6th	**Course Nature:**	Laboratory
Pre-Requisite(s):	Electrical Circuit Analysis		
Lecture Periods/Week	**Tutorial Periods/Week**	**Practical Periods/Week**	**Credits**
2	**0**	**2**	**3**

Course Objective(s):

The purpose of learning this course is-

1. To design and validate DC and AC bridges.
2. To analyze the dynamic response and the calibration of few instruments.
3. To learn about various measurement devices, their characteristics, their operation and their limitations.
4. To understand statistical data analysis.

Detailed Syllabus

Lectures/Demonstrations:

Lectures/ Demonstrations:	Description	Class Hours
1	Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.	**3**
2	Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, C_p, $C_{pk.}$	**3**
3	Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.	**6**
4	Current and Voltage Measurements. Shunts, Potential Dividers. Instrument Transformers, Hall Sensors.	**3**
5	Measurements of R, L and C.	**3**
6	Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.	**3**
7	Digital Storage Oscilloscope.	**3**
Total		**24**

Experiments:

Experiment No	Description	Class Hours
1	Measurement of a batch of resistors and estimating statistical parameters	**2**
2	Measurement of L using a bridge technique as well as LCR meter.	**2**
3	Measurement of C using a bridge technique as well as LCR meter.	**2**
4	Measurement of Low Resistance using Kelvin's double bridge.	**2**

5	Measurement of High resistance and Insulation resistance using Megger.	**2**
6	Usage of DSO for steady state periodic waveforms produced by a function Generator. Selection of trigger source and trigger level, selection of time-scale And voltage scale. Bandwidth of measurement and sampling rate.	**2**
7	Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.	**2**
8	Usage of DSO to capture transients like a step change in R-L-C circuit.	**2**
9	Current Measurement using Shunt, CT, and Hall Sensor.	**2**
10	Study and calibration of LVDT transducer for displacement measurement.	**2**
11	Rotational speed measurement system by using photo magnetic pickup.	**2**
12	Study and calibration of force cell with force indicator.	**2**
13	Characteristics of LDR, photo diode and Phototransistor.	**2**
14	Angular displacement measurement using capacitive transducer.	**2**
15	Water level measurement by using capacitive transducer.	**2**
16	Light intensity measurement using Lux meter.	**2**
17	Measurement and calibrate unknown temperature using Thermocouple.	**2**
Total		**34**

Course Outcomes:

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

CO1. Design and validate DC and AC bridges.
CO2. Analyze the dynamic response and the calibration of few instruments.
CO3. Learn about various measurement devices, their characteristics, their operation and their limitations.
CO4. Understand statistical data analysis.

Suggested Learning Resources:

Text Books

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing

Reference Books

1. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication

Name of the Course:	ELECTRONICS DESIGN LABORATORY	Subject Code:	PCC-EE23
Semester:	6th	Course Nature:	Theory+Lab
Pre-Requisite(s):	Digital Electronics, Analog Electronics, Basic Electrical Engg		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
1	0	3	3

Course Objective(s):

The purpose of learning this course is-

1. To develop ideas of design problem solutions.
2. To build up better understanding of various subject areas of electrical engineering as well as fundamental science by common design problem solutions.

Detailed Syllabus

Module No	Description	Lecture Hours
1	Basic concepts on measurements.	4
2	Sensors and signal conditioning circuits	4
3	Introduction to electronic instrumentation and PC based data acquisition	4
4	Electronic system design, Analog system design.	4
5	Interfacing of analog and digital systems	4
6	Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout.	4
7	Group projects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application.	16
Total		40

Course Outcomes:

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

CO1. Understand the practical issues related to practical implementation of applications using electronic circuits.
CO2. Design a Printed Circuit Board, get it made and populate/solder it with components.
CO3. Choose appropriate components, software and hardware platforms for design and use them successfully to implement the design.
CO4. To build leadership quality working in a team with other students to implement an application.

Name of the Course/ Subject	Digital Signal Processing Laboratory	Subject Code:	PEC-EE-92A
Semester	6th	Course Nature	Practical
Prerequisite(s):	Signal & Systems		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
0	0	2	1

Course Objective(s):

The purpose of learning this course is to-

1. Implement Linear and Circular Convolution.
2. Implement FIR and IIR filters.
3. Study the architecture of DSP processor.
4. Demonstrate Finite word length effect.

Detailed Syllabus:

Module	Description	Number of Hours
Simulation Laboratory using standard Simulator	1. Sampled sinusoidal signal, various sequences and different arithmetic operations. 2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution. 3. Z-transform of various sequences – verification of the properties of Z-transform. 4. Twiddle factors – verification of the properties. 5. DFTs / IDFTs using matrix multiplication and also using commands. 6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions 7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods. 8. Butterworth filter design with different set of parameters. 9. FIR filter design using rectangular, Hamming and Blackman windows	18
Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA	1. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of	6

	MAC instruction. 2. Writing of small programs in VHDL and downloading onto Xilinx FPGA. 3. Mapping of some DSP algorithms onto FPGA. 4. Digital Filter design using Matlab & Simulink.	

Course Outcome(s) (COs):

After completion of this course, the learners will be able to

CO1. Carry out simulation of DSP systems.

CO2. Demonstrate their abilities towards DSP processor-based implementation of DSP systems.

CO3. Analyze Finite word length effect on DSP systems.

CO4. Demonstrate the applications of FFT to DSP and to implement adaptive filters for various applications of DSP.

Name of the Course/ Subject	Wind and Solar Power Energy System Laboratory	Subject Code:	PEC-EE-92B
Semester	6th	Course Nature	Practical
Prerequisite(s):	Electrical Machines, Power Electronics		
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
0	0	2	1

Course objectives:

The purpose of learning this course is

1. To understand the different concepts of renewable sources like wind and solar
2. To understand the different operational behavior changes with different controlling parameters of renewable sources.
3. To understand the different controlling parameters for battery storage systems.
4. To understand the concept of developing a simulation model for renewable sources.

Detailed Syllabus

Experiment No	Experiment Name	No of period
1	To determine the I-V and P-V characteristics of different types of PV modules.	2
2	To determine the I-V and P-V characteristic of series and parallel combination of PV modules.	2
3	To show the effect of variation in tilt angle on PV module power.	2
4	To demonstrate the effect of shading on PV module output power.	2
5	To show the effect of the bypass diode on the PV module.	2
6	To determine the I-V and P-V characteristic of PV module by varying radiation and intensity.	2
7	To show the effect of wind speed on output power of a wind turbine.	2
8	To show the effect of different loads in a solar and grid-tie inverter system.	2
9	To monitor the health of EV battery systems.	2
10	To simulate the I-V and P-V characteristics of a PV module using MATLAB.	2

Course Outcome:

After completion of this course the learners will be able to

CO1. Remember the working principle of solar cell and wind turbine.
CO2. Apply the concept of charging and discharging to monitor the health of EV battery system.
CO3. Evaluate the effect of different loads in a solar and grid-tie inverter system.
CO4. Create a MATLAB simulation to draw the I-V and P-V characteristics of the PV module.

University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus

DEPARTMENT OF ELECTRICAL ENGINEERING

9th BOARD OF STUDIES MEETING – MINUTES

PERIOD

January 2024

Venue: Online Platform

Meeting Link: https://meet.google.com/aky-ezxp-nij

DEPARTMENT OF ELECTRICAL ENGINEERING

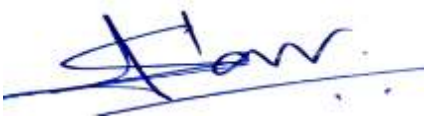
DATE: 19-12-2023

SUBJECT: Meeting of Ninth Board of Studies of U.G. Electrical Engineering program under Autonomous status of IEM.

The meeting of Board of Studies – IEM / EE, is hereby convened on 11-01-2024 at 11-00 AM in online mode with link https://meet.google.com/aky-ezxp-nij to discuss and decide as per the following agenda:

1. Review of the suggestions of the experts put forward in last BOS.
2. Discussion in detail of the proposed syllabus of 2nd year,4th semester for the batch 2022-26 and discussion about the 6th semester elective subjects.
3. Discussion about the setup of two new laboratories namely Wind and Solar Power Energy lab and DSP lab.
4. Any other point as approved by the Chairman.

All members are requested to attend and actively participate in the meeting.



DR. SUBHAJIT KAR
HEAD OF THE DEPARTMENT & CHAIRMAN/BOS
ELECTRICAL ENGINEERING DEPRATMENT
INSTITUTE OF ENGINEERING & MANAGEMENT
SALTLAKE, SECTOR V, KOLKATA-700091

9th Board of studies Meeting in the Department of Electrical Engineering

Venue: **Online mode with meeting link https://meet.google.com/aky-ezxp-nij**
Date & Time: **11th January (Thursday), 2024** at **11-00 am**

MINUTES OF 9th BOARD OF STUDIES MEETING OF EE PROGRAM OF INSTITUTE OF ENGINEERING & MANAGEMENT HELD ON 11-01-2024 at 11-00 AM.

Ref. Notice of 9th BOS meeting dated 19-12-2023

Attendance of the members present in the 9th BOS meeting is appended in this minutes as annexure. Following points were discussed in seriatim as per the agenda points:

1. **Review of the suggestions of the experts put forward in last BOS**

   Few suggestion regarding the modifications of 3rd semester syllabus were put forward by the industry and academia experts in the 8th BOS. These suggestions have been incorporated and put forward as the first agenda in the 9th BOS.

2. **Discussion in detail of the proposed syllabus of 2nd year,4th semester for the batch 2022-26 and discussion about the 6th semester elective subjects**

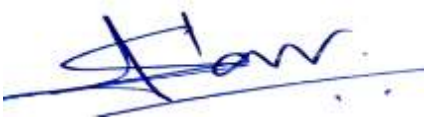
   It was indicated that, although the syllabi being followed is in accordance with the model syllabi of AICTE, a thorough review was done by the eminent experts and following suggestions were put forward from their end.

   - A change in course name from Electric Machine I to Electrical Machine I was suggested.
   - Inclusion of J & P transformer handbook as a reference book in Electrical Machine I syllabus.
   - Efficiency improvement of transformers and different A.C and D.C Machines are required to be included in the laboratory syllabus of Electrical Machine I laboratory.
   - In the syllabus of Signals and Systems, proposal for the increase of the number of contact hours of 2nd module from 8 to 10.
   - Experts advised to focus on the application part in Module 3 of the syllabus of Signals and Systems.
   - Inclusion of modified Z transform in the syllabus of Signals and Systems are proposed by the experts.

3. **Discussion about the setup of two new laboratories namely Wind and Solar Power Energy lab and DSP lab**

   Two new laboratories are proposed in the sixth semester namely Wind and Solar Power Energy lab and DSP lab. Following points were put forward by the experts regarding the contents of these laboratories.

- In the syllabus of DSP lab, exposure to MATLAB platform should be provided along with Python language.
- Maximum Power Point Tracking is proposed to be included in the syllabus of Wind and Solar Power Energy lab.



(DR. SUBHAJIT KAR) **11-01-2024**
HOD/EE
CHAIRMAN/BOS

List of BOS members of Electrical Engineering Department

Sl No.	Name of the Faculty	Designation	Responsibility
1.	DR. SUBHAJIT KAR	ASSOCIATE PROFESSOR & HEAD OF THE DEPARTMENT, IEM, SALTLAKE CAMPUS	CHAIRMAN
2.	DR. ARUN KUMAR BAR	PRINCIPAL, DEAN/ ENGINEERING,IEM, SALTLAKE CAMPUS	MEMBER
3.	PROF. DR. MALAY GANGOPADHYAY	DEAN (ACADEMICS) & HOD, ECE DEPARTMENT, IEM, SALTLAKE CAMPUS	MEMBER
4.	DR AMITABHA SINHA	PROFESSOR, DEPARTMENT OF MICROELECTRONICS AND VLSI TECHNOLOGY, MAKAUT	MEMBER
5.	PROF. DR. ABHINANDAN DE	ASSOCIATE PROFESSOR, DEPT OF EE, IIEST, SHIBPUR	MEMBER
6.	PROF. DR. MADHUBANTI MAITRA	PROFESSOR, DEPT OF EE, JU	MEMBER
7.	PROF. DR. MRINAL KANTI NASKAR	PROFESSOR, DEPT OF ETCE, JU	MEMBER
8.	MR. SANKAR NATH MUKHOPADHYAY	HEAD, ASIA INSTITUTE OF POWER MANAGEMENT, CESC LIMITED	MEMBER
9.	BIKRAM KUMAR SAMANTA	RESEARCH SCHOLAR, IIT KHARAGPUR	MEMBER
10.	PROF. (DR) SANJAY BHADRA	HEAD OF THE DEPARTMENT ELECTRICAL ENGINEERING, IEM NEWTOWN CAMPUS	MEMBER

11.	DR. SANJOY MONDAL	ASSOCIATE PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
12.	DR. MADHUMITA PAL	ASSOCIATE PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
13.	TAPAS KUMAR DATTA	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
14.	SOMNATH HAZRA	ASSISTANT PROFESSOR & ASSISTANT HOD, IEM, SALTLAKE CAMPUS	MEMBER
15.	RAJAT SUBHRA PAL	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
16.	RANJITA CHOWDHURY	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
17.	ANKIT RAY GHATAK	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
18.	SAHITYA ROY	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
19.	DEBASHIS JANA	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
20.	NIRBAN KUMAR SAHA	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
21.	DR. MANDAKINEE BANDOPADHYAY	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER

22.	PROF. SOURAV DAS	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
23.	PROF. BED PRAKASH DAS	ASSISTANT PROFESSOR, IEM, SALTLAKE CAMPUS	MEMBER
24.	PROF. (DR.) ARNAB GHOSH	ASSISTANT PROFESSOR, IEM, NEWTOWN CAMPUS	MEMBER
25.	PROF. ARIJIT GANGULY	ASSISTANT PROFESSOR, IEM, NEWTOWN CAMPUS	MEMBER
26.	PROF. SUBHOJIT PAUL	ASSISTANT PROFESSOR, IEM, NEWTOWN CAMPUS	MEMBER
27.	PROF. SOMNATH GARAI	ASSISTANT PROFESSOR, IEM, NEWTOWN CAMPUS	MEMBER