FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2019-2020)

and

Syllabi

B.E. III and IV Semester

of

Four Year Degree Programme

in

Electronics and Communication Engineering

(With effect from the academic year 2019– 2020)

(As approved in the faculty meeting held on 25-06-2019)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2019

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electronics and Communication Engineering) III – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	MC111PO	Indian Constitution	2	-	-	2	30	70	3	-
2	HS201EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
3	HS202CM	Finance and Accounting	3	-	-	3	30	70	3	3
4	BS205MT	Mathematics – III	3	-	-	3	30	70	3	3
5	ES212ME	Elements of Mechanical Engineering	3	-	-	3	30	70	3	3
6	ES216EC	Digital Electronics	3	-	-	3	30	70	3	3
7	PC221EC	Electronic Devices	3	-	-	3	30	70	3	3
8	PC222EC	Network Theory	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
9	PC251EC	Electronic Devices Lab	-	-	2	2	25	50	2	1
10	PC252EC	Electronic Workshop	-	-	2	2	25	50	2	1
			23	**-**	**04**	**27**	**290**	**660**		**23**

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam)
PO: Political Science EG: English CM: Commerce MT: Mathematics
ME: Mechanical Engineering EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

3. All mentioned **Mandatory Courses** for BE (All Branches) should be offered either in I – Semester or II – Semester only **from the academic year 2019-2020**.
4. For those of the students admitted in BE (All Branches) during the academic year 2018-2019 the Mandatory Courses were not offered during the I – Semester or II – Semester may be compulsorily offered either in III – Semester or IV – Semester **for the academic year 2019-2020 only**.

Course Code	Course Title						Core/Elective
MC 111 PO	**Indian Constitution**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

- To create awareness among students about the Indian Constitution.
- To acquaint the working conditions of union, state, local levels, their powers and functions.
- To create consciousness in the students on democratic values and principles articulated in the constitution.
- To expose the students on the relations between federal and provincial units.
- To divulge the students about the statutory institutions.

Course Outcomes

After completing this course, the student will

1. Know the background of the present constitution of India.
2. Understand the working of the union, state and local levels.
3. Gain consciousness on the fundamental rights and duties.
4. Be able to understand the functioning and distribution of financial resources between the centre and states.
5. Be exposed to the reality of hierarchical Indian social structure and the ways the grievances of the deprived sections can be addressed to raise human dignity in a democratic way.

UNIT-I

Evolution of the Indian Constitution: 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution.

UNIT-II

Union Government: Executive-President, Prime Minister, Council of Minister
State Government: Executive: Governor, Chief Minister, Council of Minister
Local Government: Panchayat Raj Institutions, Urban Government

UNIT-III

Rights and Duties: Fundamental Rights, Directive principles, Fundamental Duties

UNIT-IV

Relation between Federal and Provincial units: Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India

UNIT-V

Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women

Suggested Readings:

1. Abhay Prasad Singh & Krishna Murari, Constitutional Government and Democracy in India, Pearson Education, New Delhi, 2019
2. D.D. Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi
3. Subhash Kashyap, Our Parliament, National Book Trust, New Delhi

4. Peu Ghosh, Indian Government &Politics, Prentice Hall of India, New Delhi
5. B.Z. Fadia & Kuldeep Fadia, Indian Government &Politics, Lexis Nexis, New Delhi

Course Code	Course Title						Core/Elective
HS201EG	**Effective Technical Communication in English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To expose the students to:

- Features of technical communication
- Types of professional correspondence
- Techniques of report writing
- Basics of manual writing
- Aspects of data transfer and presentations.

Course Outcomes

On successful completion of the course, the students would be able to:

1. Handle technical communication effectively
2. Use different types of professional correspondence
3. Use various techniques of report writing
4. Acquire adequate skills of manual writing
5. Enhance their skills of information transfer and presentations

UNIT I

Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)

UNIT II

Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.

UNIT III

Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.

UNIT IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.

UNIT V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication: Principles and Practice* (3rd ed.). New Delhi.
2. Rizvi, Ashraf, M. (2017). *Effective Technical Communication* (2nd ed.). Tata McGraw Hill Education. New Delhi.
3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). Tata McGraw Hill Education. New Delhi.

4. Tyagi, Kavita &Misra, Padma. (2011). *Advanced Technical Communication*. New Delhi, PHI Learning.
5. Jungk, Dale. (2004). *Applied Writing for Technicians,* McGraw-Hill Higher Education, New York.

Course Code	Course Title						Core/Elective
HS202CM	**Finance and Accounting**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course will introduce the students

- To provide basic understanding of Financial and Accounting aspects of a business unit
- To provide understanding of the accounting aspects of business
- To provide understanding of financial statements
- To provide the understanding of financial system
- To provide inputs necessary to evaluate the viability of projects
- To provide the skills necessary to analyse the financial statements

Course Outcomes

After successful completion of the course the students will be able to

1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement of finances.
4. Analyse the liquidity, solvency and profitability of the business unit.
5. Evaluate the overall financial functioning of an enterprise.

UNIT-I

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)

UNIT-II

Final Accounts: Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit-Balance Sheet (including problems with minor adjustments)

UNIT-III

Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)

UNIT-IV

Basics of Capital Budgeting techniques: Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities- Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).

UNIT-V

Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis-liquidity, solvency, turnover and profitability ratios.

Suggested Readings:

1. Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, Pearson Education
2. Rajasekharan, Financial Accounting, Pearson Education

3. Sharma.S.K. and Rachan Sareen, Financial Management, Sultan Chand
4. Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education
5. Sharan, Fundamentals of Financial Management, Pearson Education

Course Code	Course Title						Core/Elective
BS205MT	**Mathematics – III**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- To provide an overview of probability and statistics to engineers

Course Outcomes

After completing this course, the student will be able to:

1. Solve field problems in engineering involving PDEs.
2. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

UNIT - I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

UNIT - II

Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, one dimensional diffusion equation and its solution by separation of variables.

UNIT - III

Discrete random variables, expectation of discrete random variables, moments, variance of a sum, continuous random variables & their properties, distribution- functions, and densities.

UNIT - IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

UNIT - V

Test of significance; Large sample test for single proportion, difference of properties, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chi- square test for goodness of fit and independence of attributes.

Suggested Readings:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
2. Advanced Engineering Mathematics, R.K. Jain & Iyengar, Narosa Publications.
3. Engineering Mathematics, P. Sivaramakrishna Das & C. Vijaya Kumar, Pearson India Education Services Pvt. Ltd.
4. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.

5. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2006.
6. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, 2003.
7. S. Ross, “A First Course in Probability”, Pearson Education India, 2002.
8. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, Wiley, 1968.
9. T. Veerarajan, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.
10. Mathematical Statistics, S.C. Gupta & V.K. Kapoor, S. Chand Pub.

Course Code	Course Title						Core/Elective
ES212ME	**Elements of Mechanical Engineering**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn certain fundamental topics related to mechanical engineering
- To understand and applications of thermodynamics.
- To understand the working principles of IC engines, gas turbines, hydraulic turbines and pumps.
- To understand the basic modes of heat transfer
- To familiarize the design and working principles of transmission Systems and various manufacturing processes

Course Outcomes

1. State and differentiate various classifications of IC engines and reciprocating air compressors with specific focus on similarities and differences between (i) 2 stroke and 4 stroke engines and (ii) CI and SI engines. Subsequently, the student would be able to compute the performance parameters of the engines and gas turbines.
2. Compare various types of heat transfer, analyse the governing equations, understand the applications of heat exchangers and solve related problems
3. Demonstrate the working principles of hydraulic turbines and pumps
4. Classify different types of power transmission systems like gears, gear trains, belts, ropes etc. with emphasis on their kinematic mechanisms and solve related problems
5. Understand various manufacturing processes like, welding, , machining, etc. and recognize their suitability for manufacturing of different industrial products

UNIT-I

IC Engines: Working of four stroke and two stroke petrol and diesel engine with p-V diagrams, valve timing diagram, calculation of indicated power, brake power, specific fuel consumption, mechanical and thermal efficiencies.

Gas Turbines: Classification, calculation of efficiency of simple open gas turbine cycle (joule cycle/ Brayton cycle) and applications.

UNIT-II

Heat Transfer: Basic modes of heat transfer, Fourier's law of conduction, Newton's law of cooling, Stefan-Boltzmann law of radiation. One dimensional steady state conduction heat transfer through plane walls without heat generation.

Heat exchangers: Classification and application of heat exchangers in industry, derivation of LMTD in parallel and counter-flow heat exchangers and problems

UNIT-III

Hydraulic turbines: Classification, working principle, calculation of overall efficiencies of Pelton wheel and Francis turbines.

Hydraulic pumps: definition and classifications

Reciprocating pump: classification, working principle and limitations**.**

Centrifugal pump: classification, working principle and limitations

UNIT-IV

Power Transmission Elements: Gears: Definitions and uses of Spur, helical &Bevel gears.
Gear trains: Classifications and simple problems on simple/compound &Reverted gear train.
Belt drives: Definitions of velocity ratio, creep and slip, open and cross belt drives.

UNIT-V

Basic Manufacturing Processes:

Welding: Definitions and method of soldering, brazing and welding and differences. Brief description of Arc welding and Oxy- Acetylene welding.
Machining: Working mechanism of Lathe, Milling and grinding machines.
Additive Manufacturing: introduction to 3D printing and applications.

Suggested Readings:

1. R.K. Rajput "Thermal Engineering", Laxmi Publications, 2005
2. C. Sachdeva "Fundamentals of Engineering Heat and Mass transfer", Wiley Eastern Ltd,2004.
3. P.N. Rao "Manufacturing Technology", Vol. 1 &2, Tata McGraw Hill publishing co, 2010.
4. S.S. Rattan, "Theory of Machines", Tata McGraw Hill, New Delhi 2010.
5. Bansal, R.K. Fluid Mechanics and Hydraulic Machines, Laxmi publications(p)ltd. Delhi,1995

Course Code	Course Title						Core/Elective
ES216EC	**Digital Electronics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn the principles of digital hardware and support given by it to the software.
- To explain the operation and design of combinational and arithmetic logic circuits.
- To design hardware for real world problems.

Course Outcomes

At the end of this course the students will be able to

1. Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.
2. Understand the number representation and design combinational circuits like adders, MUX etc.
3. Design Combinational circuits using PLDS and write VHDL code for basic gates and combinational circuits.
4. Analyse sequential circuits using flip-flops and design registers, counters.
5. Represent a sequential circuit using Finite State machine and apply state minimization techniques to design a FSM

UNIT – I

Design Concepts: Digital Hardware, Design process, Design of digital hardware. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples. Optimized implementation of logic functions using K-Map and Quine-McCluskey Tabular method

UNIT – II

Number representation: Addition and Subtraction of signed and unsigned numbers.

Combinational circuit building blocks: Half adder, Full adder, Multiplexers. Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits.

UNIT – III

Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays(PLAs), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables (LUTs)

Introduction to Verilog HDL: Verilog code for basic logic gates, adders, decoders

UNIT – IV

Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables. Registers, Counters, Verilog code for flip-flops

UNIT – V

Synchronous Sequential Circuits: Basic Design Steps, Finite State machine(FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.

Suggested Readings:

1. Moris Mano and Michael D CIletti, Digital Design, Pearson, fourth edition,2008
2. Zvi Kohavi, Switching and Finite Automata Theory, 3rd ed., Cambridge University Press-New Delhi, 2011.
3. R. P Jain, Modern Digital Electronics,4th ed., McGraw Hill Education (India) Private Limited, 2003
4. Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, "Digital Systems: Principles and Applications," PHI, 10/e, 2009.
5. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.

Course Code	Course Title						Core/Elective
PC221EC	**Electronic Devices**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Study semiconductor physics and Analyse the behavior of Semiconductor diodes in Forward and Reverse bias.
- Develop Half wave and Full wave rectifiers with L, C Filters.
- Explain V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.
- Design DC Biasing techniques and evaluate A.C parameters for BJT in Amplifier Applications.
- Explore V-I characteristics of FETs, MOSFETs and study IC fabrication techniques.

Course Outcomes

1. Interpret the characteristics and apply diode models to analyse various applications of diodes.
2. Identify the merits and demerits of various filters, formulate and design rectifier circuits with filters Calculate ripple factor, efficiency and % regulation of rectifier circuits.
3. Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability.
4. Analyse, Compare and design of BJT amplifiers with various biasing circuits.
5. Distinguish the working principles of BJT and FET also between FET & MOSFET.

UNIT-I

Introduction to Semiconductor Physics: Energy bands in intrinsic and extrinsic Silicon. Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers, Poisson and continuity equation.

Junction Diode: PN Junction formation, Characteristics, biasing – band diagram and current flow, Diode current equation, Breakdown in diodes, Diode as a circuit element, Small signal diode models, Diode switching characteristics, Zener Diode, Zener voltage regulator and its limitation, Schottky diode.

UNIT-II

PN Diode Applications: Half wave, Full wave and Bridge rectifiers – their operation, performance characteristics and analysis. Filters (L, C filters) used in power supplies and their ripple factor calculations, design of Rectifiers with and without Filters.

Special Diodes: Elementary treatment on the functioning of Light Emitting diode, Photo diode and Solar cells.

UNIT-III

Bipolar Junction Transistor: Transistor Junction formation (collector-base, base-emitter Junctions), Transistor biasing – band diagram for NPN and PNP transistors, current components and current flow in BJT, Ebers moll model, Modes of transistor operation, BJT V-I characteristics in CB, CE, CC configurations, BJT as an amplifier, BJT biasing techniques, operating point stabilization against temperature and device variations, Bias stabilization and compensation techniques, Biasing circuits design.

UNIT-IV

Small Signal Transistors equivalent circuits: Small signal low frequency h-parameter model of BJT, Approximate model, Analysis of BJT amplifiers using Approximate model for CB, CE and CC configurations; High frequency - Π model, Relationship between hybrid - Π and h – parameter model.

UNIT-V

Junction Field Effect Transistors (JFET): JFET formation, operation & current flow, V-I characteristics of JFET,

MOSFETs: Enhancement & Depletion mode MOSFETs, current equation, V-I characteristics, DC-biasing, Low frequency small signal model of FETs. Analysis of CS, CD and CG amplifiers, MOS Capacitor.

Integrated Circuit Fabrication process: Oxidation, diffusion, ion implantation, photolithography, etching, CMOS Process flow

Suggested Readings:

1. G. Streetman and S. K. Banerjee, *Solid State Electronic Devices*, 7th edition, Pearson, 2014.
2. S. M. Sze and K. N. Kwok, *Physics of Semiconductor Devices*, 3rd edition, John Wiley& Sons, 2006.
3. D. Neamen, D. Biswas, *Semiconductor Physics and Devices*, McGraw-Hill Education.
4. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, *Electronic Devices and Circuits*, 3rd ed., Mc Graw Hill Education, 2010.
5. Robert Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11th ed., Pearson India Publications, 2015.

Course Code	Course Title						Core/Elective
PC222EC	**Network Theory**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Concepts of Two Port networks, study about the different two port parameter representations.
- Concepts about the image impedance on different networks, design of attenuators.
- Design concepts of equalizers.
- Design concepts of different filters.
- Design concepts of network synthesis.

Course Outcomes

1. Able to Express given Electrical Circuit in terms of A, B, C, D and Z, Y Parameter Model and Solve the circuits and how they are used in real time applications.
2. Able to learn how to calculate properties of networks and design of attenuators.
3. Able to design of equalizers.
4. Able to design different types of filters using passive elements.
5. Able to synthesize the RL & RC networks in Foster and Cauer Forms.

UNIT-I

Two Port networks: Z, Y, h, g and ABCD parameters, equivalence of two ports networks, T-PI transforms, Reciprocity theorem, Interconnection of two port networks and Brune's test for inter connections.

UNIT-II

Symmetrical and Asymmetrical Networks: Characteristic impedance and propagation constant of symmetrical T and pi networks, Image and iterative impedances, Image transfer constant and iterative transfer constant of asymmetrical L, T and pi networks,

UNIT-III

Constant k- Filters- Low pass, high pass, band pass and band elimination filter design, m-derived low pass and high pass filter design, Composite filter design and notch filter.

UNIT-IV

Attenuators and Equalizers- Design of symmetrical T, pi, Bridge-T and Lattice attenuators, impedance matching networks, Inverse networks, Equalizers, Constant resistance equalizer, full series and full shunt equalizer**.**

UNIT-V

Network Synthesis: Hurwitz polynomials, positive real functions, Basic Philosophy of Synthesis, L-C Immitance functions, RC impedance functions and RL admittance functions. RL impedance functions and RC admittance functions. Cauer and Foster's forms of RL impedance and RC admittance. Properties of RC, RL Networks**.**

Suggested Readings:

1. Ryder J.D, *Network Lines Fields*, 2nd edition, Prentice Hall of India,1991.
2. P.K. Jain and Gurbir Kau, *Networks, Filters and Transmission Lines,* Tata McGraw-Hill Publishing Company Limited.
3. A. Sudhakar Shyammohan, *Circuits Networks: Analysis Synthesis*, 4th edition, Tata McGraw-Hill, 2010.
4. Van Valkenburg M.E, *Introduction to Modern Network Synthesis,* Wiley Eastern 1994.
5. S.P. Ghosh and A.K. Chakraborty, *Network Analysis and Synthesis,* McGraw Hill, 1st edition, 2009.

Course Code	Course Title						Core/Elective
PC251EC	**Electronic Devices Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ED PC221EC	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Study the characteristics of PN diode
- Learn the characteristics of BJT in CE, CB and CC configurations
- Plot the characteristics of FET in CS and CD configurations
- Observe the parameters of BJT and FET amplifiers
- Design biasing circuits

Course Outcomes

1. Understand characteristics of Diodes
2. Plot the characteristics of BJT in different configurations.
3. Record the parameters of BJT and FET amplifiers.
4. Understand biasing techniques of BJT.
5. Use the SPICE software for simulating electronic circuits.

List of Experiments

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode Characteristics and its application as voltage regulator.
3. Design, realization and performance evaluation of half wave rectifiers without and with filters.
4. Design, realization and performance evaluation of full wave rectifiers without and with filters.
5. V-I Characteristics of BJT in CB configuration.
6. V-I Characteristics of BJT in CE configuration.
7. V-I Characteristics of JFET in CS configuration.
8. Frequency response of Common Emitter BJT amplifier.
9. Frequency response of Common Source FET amplifier.
10. BJT Biasing circuit design.
11. V-I characteristics of UJT
12. Simulate any two experiments using PSPICE

Note: A minimum of 10 experiments should be performed

Suggested Readings:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text – Lab Manual*, 7th Edition, TMH 2001.

Course Code	Course Title						Core/Elective
PC252EC	**Electronic Workshop**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To learn the usage of basic electronic components, equipment and meters used in electronic laboratories
- To learn practical electric AC and DC circuits
- Verify the truth tables of combinational and sequential circuits
- Realize combinational and sequential circuits
- Design adder / subtractor

Course Outcomes

1. Use the basic electronic components and design circuits.
2. Verify various parameters of the circuits by applying theorems.
3. Understand the pin configuration of ICs and verify the operation of basic gates
4. Design and verify the combinational and logic circuits.

List of Experiments

Part A

1. Study of all types of discrete Active & passive devices, display devices, integrated components, electro mechanical components (switches, sockets, connectors etc.,) electromagnetic components (relays). Study and use of different meters (volt/ammeter, AVO/Multi meter) for the measurement of electrical parameters. Measurement of RLC components using LCR Meter.
2. Soldering and Desoldering
3. PCB design and circuit assembling
4. Study of CRO and its applications.
5. Design and Verification of Superposition and Tellegan's theorem
6. Design and Verification of of Thevenin's and Maximum Power Transfer Theorem.
7. Measurement of two-port network parameters.
8. Measurement of Image impedance and Characteristics impedance.

Part B

Implement using digital ICs

9. Verification of truth tables of Logic gates and realization of Binary to Gray and Gray to Binary code converters.
10. Realization of Half adder/sub and full adder/sub using universal logic gates.
11. Realization of Full adder/Sub using MUX and Decoder
12. Design 2's complement Adder/subtractor using IC 74283 and verify experimentally.
13. Verification of truth tables of Flip Flops and Flip flop conversions form one form to the other.

Note: A minimum of 6 experiments in Part-A and 4 experiments in Part-B should be performed. The students may use any commercial / open source SPICE programs available like MULTISIM, PSPICE, TINA, LAB VIEW for simulation.

Suggesting Reading:

1. Paul B. Zbar, Albert P. Malvino, *Michael A. Miller, Basic Electronics, A Text – Lab Manual,* 7thEdition, TMH 2001.
2. Paul Tobin, *PSPICE for Circuit Theory and Electronic Devices,* Morgan & Claypool publishers, 1st ed., 2007.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Electronics and Communication Engineering) IV – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	MC112CE	Environmental Science	2	-	-	2	30	70	3	-
2	MC113PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	-
3	HS213MP	Industrial Psychology	3	-	-	3	30	70	3	3
4	BS206BZ	Biology for Engineers	3	-	-	3	30	70	3	3
5	ES215EC	Signals and Systems	3	-	-	3	30	70	3	3
6	PC231EC	Analog Electronic Circuits	3	-	-	3	30	70	3	3
7	PC232EC	Electromagnetic Theory and Transmission Lines	3	-	-	3	30	70	3	3
8	PC233EC	Pulse and Linear Integrated Circuits	3	-	-	3	30	70	3	3
9	PC234EC	Computer Organisation and Architecture	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
10	PC261EC	Analog Electronic Circuits Lab	-	-	2	2	25	50	3	1
11	PC262EC	Pulse and Linear Integrated Circuits Lab	-	-	2	2	25	50	3	1
			25	**-**	**04**	**29**	**320**	**730**		**23**

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam)
PY: Philosophy BZ: Biology/ Life Sciences CE: Civil Engineering
MP: Mechanical / Production Engineering EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.
3. The students have to undergo a Summer Internship of two-week duration after IV – Semester and credits will be awarded in VII – Semester after evaluation.
4. All mentioned **Mandatory Courses** for BE (All Branches) should be offered either in I – Semester or II – Semester only **from the academic year 2019-2020**.
5. For those of the students admitted in BE (All Branches) during the academic year 2018-2019 the Mandatory Courses were not offered during the I – Semester or II – Semester may be compulsorily offered either in III – Semester or IV – Semester **for the academic year 2019-2020 only**.

Course Code	Course Title						Core/Elective
MC112CE	**Environmental Science**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

- To create awareness and impart basic knowledge about the environment and its allied problems.
- To know the functions of ecosystems.
- To understand importance of biological diversity.
- To study different pollutions and their impact on environment.
- To know social and environment related issues and their preventive measures.

Course Outcomes

After completing this course, the student will be able to:

1. Adopt environmental ethics to attain sustainable development.
2. Develop an attitude of concern for the environment.
3. Conservation of natural resources and biological diversity.
4. Creating awareness of Green technologies for nation's security.
5. Imparts awareness for environmental laws and regulations.

UNIT-I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness.

Natural Resources: Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources –Use and over exploitation, deforestation & its effect on tribal people. Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification**.** Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

UNIT-II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

UNIT-III

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.

UNIT-IV

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management.

Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation.

UNIT-V

Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India.

Field Work:

- Visit to a local area to document environmental issues- agricultural area/ pond/lake/terrestrial ecosystem
- Visit to a local polluted area- market/slum area/Industrial area/traffic area

Suggested Reading:

1. A.K. De, *Environmental Chemistry,* Wiley Eastern Ltd.
2. E.P. Odum, *Fundamentals of Ecology,* W.B. Sunders Co., USA.
3. M.N. Rao and A.K. Datta, *Waste Water Treatment,* Oxford and IBK Publications.
4. Benny Joseph, *Environmental Studies,* Tata McGraw Hill, 2005.
5. V.K. Sharma, *Disaster Management,* National Centre for Disaster Management, IIPE,1999.

Course Code	Course Title						Core/Elective
MC113PY	**Essence of Indian Traditional Knowledge**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

The course will introduce the students to

- To get a knowledge in Indian Philosophical Foundations.
- To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
- To explore the Science and Scientists of Medieval and Modern India

Course Outcomes

After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among difference traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

UNIT – I

Introduction to Indian Philosophy: Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

UNIT – II

Indian Philosophy & Literature: Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India.

Indian languages and Literature-II: Northern Indian languages & Philosophical & cultural & literature.

UNIT – III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – IV

Indian Fine Arts & Its Philosophy (Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

Text Books:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition’’, ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN-13:978-8187276333,2007

3. NCERT, "Position paper on Arts, Music, Dance and Theatre'', ISBN 81-7450-494-X, 2006
4. S. Narain, "Examination in Ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978-8120810990,2014
7. Chatterjee. S & Dutta "An Introduction to Indian Philosophy"

Course Code	Course Title						Core/Elective
HS213MP	**Industrial Psychology**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course will introduce the students to

- To Know Industry Structures and functions.
- Develop an awareness of the major perspectives underlying the field of Industrial Psychology
- Understanding for the potential Industrial Psychology has for society and organizations now and in the future.

Course Outcomes

After completing this course, the student will be able to:

1. Understanding of key concepts, theoretical perspectives, and trends in industrial psychology.
2. Evaluate the problems thorough and systematic competency model.
3. Analyse the problems present in environment and design a job analysis method.
4. Create a better work environment for better performance.
5. Design a performance appraisal process and form for the human behavior.

UNIT-I

Industrial Engineering: Meaning, Definition, Objective, Need, Scope, Evolution and developments. Concept of Industrial Engineering, Historical development of Industrial Engineering, main departments of Industry.

Organization Structure: Introduction, Principles of Organization, Organizational theories, Departmentalism, Authority, power, Organizational effectiveness, structuring the Organization, Organizational change, Organization charts.

UNIT-II

Motivation, Morale and Behavioural Science: Motivation, Characteristics, Kinds of motivation, Thoughts of motivational philosophy, Human needs, Incentive as motivators, Managing Dissatisfaction and frustration, Morale, Absenteeism, Behavioural Science.

Social environment: Group dynamics in Industry Personal psychology, Selection, training, placement, promotion, counselling, job motivations, job satisfaction. Special study of problem of fatigue, boredom and accidents.

UNIT-III

Understanding Consumer Behavior: Consumer behaviour, study of consumer preference, effects of advertising, Industrial morale: The nature and scope of engineering psychology, its application to industry

UNIT-IV

Work Methods: Efficiency at work, the concept of efficiency, the work curve, its characteristics, the work methods; hours of work, nature of work, fatigue and boredom, rest pauses. The personal factors; age abilities, interest, job satisfaction, the working environment, noise, illumination, atmospheric conditions, increasing efficiency at work; improving the work methods, Time and motion study, its contribution and failure resistance to time and motion studies, need for allowances in time and motion study.

UNIT-V

Work and Equipment Design: Criteria in evaluation of job-related factor, job design, human factors, Engineering information, input processes, mediation processes, action processes, methods design, work space and its arrangement, human factors in job design. Accident and Safety: The human and economic costs of accidents, accident record and statistics, the causes of accidents situational and individual factors related to accident reduction.

Suggested Readings:

1. TR Banga and SC Sharma, *Industrial Engineering and Management*, Khanna Publishers, 11th Edn., 2014.
2. Tiffin, J and McCormic E.J., *Industrial Psychology*, Prentice Hall, 6th Edn., 1975.
3. McCormic E.J., *Human Factors Engineering and Design*, McGraw Hill, 4th Edn.,1976.
4. Mair, N.R.F., *Principles of Human relations*
5. Gilmer, *Industrial Psychology*
6. Ghiselli & Brown, *Personnel and Industrial Psychology.*
7. Myer, *Industrial Psychology.*
8. Dunnete, M.D., *Handbook of Industrial and Organizational Psychology.*
9. Blum & Taylor, *Industrial Psychology*

Course Code	Course Title						Core/Elective
BS206BZ	**Biology for Engineers**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system.

Course Outcomes

After completing this course, the student will be able to:

1. Apply biological engineering principles, procedures needed to solve real-world problems.
2. Understand the fundamentals of living things, their classification, cell structure and biochemical constituents.
3. Apply the concept of plant, animal and microbial systems and growth in real life situations.
4. Comprehend genetics and the immune system.
5. Know the cause, symptoms, diagnosis and treatment of common diseases.
6. Apply basic knowledge of the applications of biological systems in relevant industries.

UNIT-I

Introduction to Life: Characteristics of living organisms, Basic classification, cell theory, structure of prokaryotic and eukaryotic cell, Introduction to Biomolecules: definition, general classification and important functions of carbohydrates, lipids, proteins, vitamins and enzymes.

UNIT-II

Biodiversity: Plant System: basic concepts of plant growth, nutrition, photosynthesis and nitrogen fixation. Animal System: Elementary study of digestive, respiratory, circulatory, excretory systems and their functions. Microbial System: History, types of microbes, economic importance and control of microbes.

UNIT-III

Genetics and Evolution: Theories of evolution and Evidences; cell division–mitosis and meiosis; evidence of laws of inheritance; variation and speciation; nucleic acids as a genetic material; central dogma; Mendel laws, gene and chromosomes.

UNIT-IV

Human Diseases: Definition, causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis. Immunity immunization, antigen – antibody immune response.

UNIT-V

Biology and its Industrial Applications: Transgenic plants and animals, stem cell and tissue engineering, bioreactors, bio pharming, recombinant vaccines, cloning, drug discovery, biological neural networks, bioremediation, biofertilizer, biocontrol, biofilters, biosensors, biopolymers, bioenergy, biomaterials, biochips, basic biomedical instrumentation.

Suggested Readings:

1. A Text book of Biotechnology, R.C. Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
6. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012.

Course Code	Course Title						Core/Elective
ES215EC	**Signals and Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
- To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.
- To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Course Outcomes

1. Define and differentiate types of signals and systems in continuous and discrete time
2. Apply the properties of Fourier transform for continuous time signals
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs
4. Apply Z-transforms for discrete time signals to solve Difference equations
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation

UNIT –I

Some useful operations on signals: Time shifting, Time scaling, Time inversion. Signal models: Impulse function, Unit step function, Exponential function, Even and odd signals. Systems: Linear and Non-linear systems, Constant parameter and time varying parameter systems, Static and dynamic systems, Causal and Non-causal systems, Lumped Parameter and distributed parameter systems, Continuous-time and discrete-time systems, Analog and digital systems.

UNIT-II

Fourier series: Signals and Vectors, Signal Comparison: correlation, Signal representation by orthogonal signal set, Trigonometric Fourier Series, Exponential Fourier Series, LTI system response to periodic inputs.

UNIT-III

Continuous-Time Signal Analysis: Fourier Transform: Aperiodic signal representation by Fourier integral, Fourier Transform of some useful functions, Properties of Fourier Transform, Signal transmission through LTI Systems, ideal and practical filters, Signal energy. Laplace transform: Definition, some properties of Laplace transform, solution of differential equations using Laplace transform.

UNIT-IV

Discrete-time signals and systems: Introduction, some useful discrete-time signal models, Sampling continuous-time sinusoids and aliasing, Useful signal operations, examples of discrete-time systems. Fourier analysis of discrete-time signals, periodic signal representation of discrete-time Fourier series, aperiodic signal representation by Fourier integral.

UNIT-V

Discrete-time signal analysis: Z-Transform, some properties of Z-Transform, Solution to Linear difference equations using Z-Transform, System realization. Relation between Laplace transform and Z-Transform. **DTFT:** Definition, Properties of DTFT, comparison of continuous-time signal analysis with discrete-time signal analysis.

Suggested Readings:

1. B. P. Lathi, *Linear Systems and Signals,* Oxford University Press, 2nd Edition, 2009
2. Alan V O P Penheim, A. S. Wlisky, *Signals and Systems,* 2nd Edition, Prentice Hall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, *Signals and Systems,* 4th Edition, Pearson 1998.
4. Douglas K. Linder, *Introduction to Signals and Systems,* McGraw Hill, 1999
5. P. Ramakrishna Rao, *Signals and Systems,* TMH.

Course Code	Course Title						Core/Elective
PC231EC	**Analog Electronic Circuits**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Analyse frequency response of Amplifiers in different frequency ranges.
- Familiarize with concept and effect of negative feedback
- Study positive feedback and Design different types of oscillators.
- Design Power Amplifiers and calculate their efficiencies.
- Familiarize with concept of tuned Amplifiers.

Course Outcomes

1. Design and Analyse low frequency, mid frequency and high frequency response of small signal single stage and Multistage RC coupled and Transformer Amplifiers using BJT and FET.
2. Identify the type of negative feedback, Analyse and design of negative feedback amplifiers.
3. Design Audio Frequency and Radio Frequency oscillators
4. Distinguish between the classes of Power Amplifiers and their design considerations
5. Compare the performance of single and double tuned amplifiers

UNIT-I

Small Signal Amplifiers: Classification of amplifiers, mid-frequency, Low-frequency and high frequency analysis of single and multistage RC coupled amplifier with BJT and FET. Analysis of transformer coupled amplifier in mid frequency, Low frequency and high frequency regions with BJT.

UNIT-II

Feedback Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations, Local Versus global feedback

UNIT-III

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillators, LC oscillators, Crystal oscillator, Amplitude and frequency stability of oscillator.
Regulators: Transistorized series and shunt regulators

UNIT-IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push-pull audio power amplifiers under Class-A. Class-B, Class D and Class-AB operations

UNIT-V

RF Voltage Amplifiers: General consideration, Analysis and design of single tuned and double tuned amplifiers with BJT, Selectivity, gain and bandwidth. Comparison of multistage, single tuned amplifiers and double tuned amplifiers. The problem of stability in RF amplifiers, neutralization & uni-laterisation, introduction to staggered tuned amplifiers.

Suggested Readings:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, Electronic Devices and Circuits, 3rd ed., McGraw Hill Education, 2010.
2. David A. Bell, Electronic Devices and Circuits, 5th ed., Oxford University Press, 2009.
3. S Salivahanan, N Kumar, and A Vallavaraj, Electronic Devices and Circuits, 2nd ed., McGraw Hill Education, 2007.
4. Jacob Millman, Christos Halkias, Chetan Parikh, Integrated Electronics, 2nd ed., McGraw Hill Education (India) Private Limited, 2011.
5. Donald L Schilling & Charles Belove, Electronics Circuits, Discrete & Integrated, 3rd ed., McGraw Hill Education (India) Private Limited, 2002.

Course Code	Course Title						Core/Elective
PC232EC	**Electromagnetic Theory and Transmission Lines**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Analyse fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications to describe the relationship between Electromagnetic Theory and circuit theory
- Formulate the basic laws of static electricity and magnetism and extend them to time varying fields to define the Maxwell's equations in differential and integral form.
- Derive the wave equations for conducting and di-electric mediums to analyse the wave propagation characteristics of Uniform Plane Waves (UPW) in normal and oblique incidences
- Analyse fundamental concepts of Transmission lines and to formulate the basic relationship between distortion less transmission lines & applications.
- To understand the concepts of RF Lines and their characteristics, Smith Chart and its applications, acquire knowledge to configure circuit elements, QWTs and HWTs and to apply the same for practical problems.

Course Outcomes

1. Understand the different coordinate systems, vector calculus, coulombs law and gauss law for finding electric fields due to different charges and to formulate the capacitance for different capacitors.
2. Learn basic magnetostatics concepts and laws such as Biot-Savarts law and Amperes law, their application in finding magnetic field intensity, inductance and magnetic boundary conditions.
3. Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems.
4. Determine the Transmission Line parameters to characterize the distortions and estimate the characteristics for different lines.
5. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems

UNIT-I

Review of coordinate systems. Coulomb's Law, Electric field due to various Charge configurations and Electric flux density. Gauss's Law and its applications. Work, Potential and Energy, The dipole. Current and Current density, Laplace and Poisson's equations. Calculation of capacitance for simple configurations.

UNIT-II

Steady magnetic-Biot-Savart's law, Ampere's law. Stoke's theorem, Magnetic flux and magnetic flux density. Scalar and vector magnetic potentials. Electric and Magnetic fields boundary conditions. Maxwell's equations for static and time varying fields.

UNIT-III

Uniform plane waves in free space and in conducting medium, Polarization. Instantaneous, average and complex Poynting theorem and its applications.

Reflection and Refraction: Normal and Oblique incidence on dielectrics and conducting medium.

UNIT-IV

Overview of T and π networks. Types of Transmission Lines-Two wire lines. Primary and secondary constants. Transmission Line equations. Infinite line and characteristic impedance- Open and short circuit lines and their significance. Distortion less transmission line, Concept of loading of a transmission line, Campbell's formula.

UNIT-V

Impedance at any point on the transmission line- Input impedance. RF and UHF lines, transmission lines as circuit elements. Properties of λ/2, λ/4 and λ/8 Lines. Reflection coefficient and VSWR. Matching: Stub matching. Smith chart and its applications.

Suggested Readings:

1. Matthew N.O. Sadiku, *Principles of Electro-magnetics*, 6th edition, Oxford University Press, 2016
2. William H. Hayt Jr. and John A. Buck, *Engineering Electromagnetics*, 7th edition, Tata McGraw Hill, 2006.
3. John D. Ryder, *Networks Lines and Fields*, 2nd edition, Pearson, 2015.
4. E.C. Jordan and K.G. Balmain, *Electromagnetic Waves and Radiating Systems*, 2nd edition, Pearson, 2015
5. K.D. Prasad, *Antennas and Wave Propagation*, Khanna Publications.

Course Code	Course Title						Core/Elective
PC233EC	**Pulse and Linear Integrated Circuits**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Analyse the behavior of Linear and non-linear wave shaping circuits
- Analyse and design of Multivibrators
- Understand the operation of OP-AMP and its internal circuits
- Analyse the applications of OPAMP and 555 Timer
- Explain the operation of various data converter circuits and PLL.

Course Outcomes

1. Construct different linear networks and analyse their response to different input signals
2. Understand, Analyse and design multi vibrators and sweep circuits using transistors.
3. Distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
4. Analyse DC and AC characteristics for Single/Dual input Balanced/Unbalanced output configurations using BJTs.
5. Distinguish various linear and non-linear applications of Op-Amp. Analyse the operation of the most commonly used D/A and A/D converter types.

UNIT I

Linear Wave Shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe.

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, applications of voltage comparators. Clamping operation, clamping circuit taking Source and Diode resistances into account, Clamping circuit theorem.

UNIT II

Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors,

Time Base Generators: General features of a time base signal, methods of generating voltage time base waveform.

UNIT III

Differential amplifiers: Classification, DC and AC Analysis of Single/Dual input Balanced and Unbalanced output configurations using BJTs. Level Translator.

Operational Amplifier: OP AMP Block diagram, ideal Opamp characteristics, Opamp and its features, Opamp parameters and Measurements, Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR. Frequency response and Compensation Techniques.

UNIT IV

OPAMP Applications: Inverting and Non-Inverting Amplifiers, Integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop. Log and Anti Log Amplifiers.

UNIT V

555 Timer: Functional Diagram, Monostable, Astable and Schmitt Trigger Applications. Fixed and variable voltage regulators, PLL and its Applications.

Data Converters: Digital-to-analog converters (DAC): Weighted resistor, inverted R-2R ladder, Analog-to-digital converters (ADC): dual slope, successive approximation, flash, Specifications.

Suggested Reading:

1. J. Millman and H. Taub, Pulse, Digital and Switching Waveforms - McGraw-Hill, 1991.
2. David A. Bell, Solid State Pulse circuits - PHI, 4th Edn., 2002.
3. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits" Pearson,2018, 4th edition
4. D.Roy Chowdhury, Shail B.Jain, "Linear Integrated Circuits", 4/e, New Age International (P) Ltd., 2008.
5. Anand Kumar A, "Pulse and Digital Circuits", Prentice-Hall of India private Limited, New Delhi, 2007.
6. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.

Course Code	Course Title						Core/Elective
PC234EC	**Computer Organisation and Architecture**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Implement the fixed-point and floating-point addition, subtraction, multiplication & Division.
- Describe the basic structure and operation of a digital computer.
- Discuss the different ways of communicating with I/O devices and standard I/O interfaces.
- Analyze the hierarchical memory system including cache memories and virtual memory.
- Understand issues affecting modern processors.

Course Outcomes

1. Perform mathematical operations on fixed and floating point digital data.
2. Illustrate the operation of a digital computer.
3. Understand I/O interfacing of a computer.
4. Interface microprocessor with memory devices.
5. Understand latest trends in microprocessors.

UNIT-I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non-restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

UNIT-II

Basic Computer organization and Design: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and micro program sequencer.

UNIT-III

Central Processing Unit: General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

UNIT-IV

Input-output Organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor, CPU-IOP communication, I/O channel.

UNIT-V

Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory: mapping functions, Virtual memory: address mapping using pages, Memory management.

Suggested Readings:

1. Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
2. William Stallings, "Computer Organization and Architecture: Designing for performance," 7/e, Pearson Education, 2006.
3. John P. Hayes, “Computer Architecture and Organization,” 3/e, TMH, 1998.
4. Govindarajalu, “Computer Architecture and Organization” TMH.
5. Hebbar, “Computer Architecture”, Macmillan,2008

Course Code	Course Title						Core/Elective
PC261EC	**Analog Electronic Circuit Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
AEC PC231EC	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Design and analyse BJT, FET amplifiers.
- Design and analyse multivibrators
- Analyse Oscillator circuits
- Understand Op-Amp. Applications
- Understand filter circuits

Course Outcomes

1. Calculate gain and bandwidth of BJT, FET.
2. Study multivibrator circuits.
3. Study oscillator circuits.
4. Demonstrate filter circuits.
5. Demonstrate power amplifier and Op-Amp. Circuits

List of Experiments

1. Two Stage RC Coupled CE BJT amplifier.
2. Two Stage RC Coupled CS FET amplifier.
3. Voltage Series Feedback Amplifier.
4. Voltage Shunt Feedback Amplifier.
5. Current series feedback Amplifier
6. RC Phase Shift Oscillator.
7. Hartly & Colpitt Oscillators
8. Design of Class A and Class B Power amplifiers.
9. Constant-k low pass & high pass filters.
10. m-Derived low pass & high pass filters.
11. Series and Shunt Voltage Regulators
12. RF Tuned Amplifier

SPICE:

13. Two Stage RC Coupled CS FET amplifier.
14. Voltage Series Feedback Amplifier
15. Current Shunt Feedback Amplifier

Note: A minimum of 10 experiments should be performed. It is mandatory to simulate any three experiments using SPICE.

Suggested Reading:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text–Lab Manual*, 7thEdition, TMH 2001.

Course Code	Course Title						Core/Elective
PC262EC	**Pulse and Linear Integrated Circuits Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PLIC PC233EC	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To implement high pass and low pass circuit and study it`s performance
- To implement clipping and clamping circuits and study it`s performance
- To design and test bi-stable, mono-stable multi-vibrators
- To study the characteristics of a Schmitt trigger
- To build sweep circuits and study it`s performance

Course Outcomes

1. Design and analyse linear and non-linear wave shaping circuits.
2. Design and analyse clipping and clamping circuits.
3. Design and analyse multivibrator circuits.
4. Design and analyse multivibrator circuits.
5. Design and analyse Schmitt trigger circuit

List of Experiments

1. Low Pass and High Pass RC Circuits
2. Two level Clipping Circuit
3. Clamping Circuit
4. Transistor Switching Times
5. Collector Coupled Bistable Multivibrators
6. Collector Coupled Monstable Multivibrators
7. Collector Coupled Astable Multivibrators
8. Schmitt Trigger Circuit
9. Measurement of OPAMP Parameters
10. Inverting and Non-inverting OPAMP Voltage follower
11. Integrator and Differentiator using OPAMP
12. Active filters
13. Astable and Mono stable multi vibrator using NE555 IC
14. Astable and Monostable multivibrator using OPAMP
15. Miller Sweep Circuit
16. UJT Relaxation Oscillator

Note: A minimum of 10 experiments should be performed

Suggested Readings:

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 5th Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.
2. David A. Bell, Laboratory Manual for "Electronic Devices and Circuits", 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2004.