

**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	
<b>Theory Courses</b>										
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
<b>Practical/ Laboratory Courses</b>										
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
			<b>25</b>	<b>-</b>	<b>04</b>	<b>29</b>	<b>320</b>	<b>730</b>		<b>23</b>

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:**

- Each contact hour is a clock hour
- The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.
- 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.
- 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**.
- 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		
<b>MC112CE</b>	<b>Environmental Science</b>				<b>Mandatory</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	<b>2</b>	-	-	-	<b>30</b>	<b>70</b>	-

**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. Saunders 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, IPE, 1999.

Course Code	Course Title				Core/Elective		
<b>MC113PY</b>	<b>Essence of Indian Traditional Knowledge</b>				<b>Mandatory</b>		
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		
<b>HS213MP</b>	<b>Industrial Psychology</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	<b>3</b>	-	-	-	<b>30</b>	<b>70</b>	<b>3</b>
<p><b>Course Objectives</b> The course will introduce the students to</p> <ul style="list-style-type: none"> <li>➤ To Know Industry Structures and functions.</li> <li>➤ Develop an awareness of the major perspectives underlying the field of Industrial Psychology</li> <li>➤ Understanding for the potential Industrial Psychology has for society and organizations now and in the future.</li> </ul> <p><b>Course Outcomes</b> After completing this course, the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Understanding of key concepts, theoretical perspectives, and trends in industrial psychology.</li> <li>2. Evaluate the problems thorough and systematic competency model.</li> <li>3. Analyse the problems present in environment and design a job analysis method.</li> <li>4. Create a better work environment for better performance.</li> <li>5. Design a performance appraisal process and form for the human behavior.</li> </ol>							

**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, 11<sup>th</sup> 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. Dunnette, M.D., *Handbook of Industrial and Organizational Psychology*.
9. Blum & Taylor, *Industrial Psychology*

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

**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		
<b>ES215EC</b>	<b>Signals and Systems</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	<b>3</b>	-	-	-	<b>30</b>	<b>70</b>	<b>3</b>

**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, 2<sup>nd</sup> Edition, 2009
2. Alan V O P Penheim, A. S. Wlisky, *Signals and Systems*, 2<sup>nd</sup> Edition, Prentice Hall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, *Signals and Systems*, 4<sup>th</sup> 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		
<b>PC231EC</b>	<b>Analog Electronic Circuits</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	<b>3</b>	-	-	-	<b>30</b>	<b>70</b>	<b>3</b>

**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-lateralisation, introduction to staggered tuned amplifiers.

***Suggested Readings:***

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

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

**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  $\pi$  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  $\lambda/2$ ,  $\lambda/4$  and  $\lambda/8$  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		
<b>PC233EC</b>	<b>Pulse and Linear Integrated Circuits</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	<b>3</b>	-	-	-	<b>30</b>	<b>70</b>	<b>3</b>

**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		
<b>PC234EC</b>	<b>Computer Organisation and Architecture</b>				<b>Core</b>		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	<b>3</b>	-	-	-	<b>30</b>	<b>70</b>	<b>3</b>

**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	
<b>PC261EC</b>	<b>Analog Electronic Circuit Lab</b>					<b>Core</b>	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>AEC PC231EC</b>	-	-	-	2	25	50	1
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>➤ Design and analyse BJT, FET amplifiers.</li> <li>➤ Design and analyse multivibrators</li> <li>➤ Analyse Oscillator circuits</li> <li>➤ Understand Op-Amp. Applications</li> <li>➤ Understand filter circuits</li> </ul> <b>Course Outcomes</b> <ol style="list-style-type: none"> <li>1. Calculate gain and bandwidth of BJT, FET.</li> <li>2. Study multivibrator circuits.</li> <li>3. Study oscillator circuits.</li> <li>4. Demonstrate filter circuits.</li> <li>5. Demonstrate power amplifier and Op-Amp. Circuits</li> </ol>							

#### 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*, 7<sup>th</sup> Edition, TMH 2001.

Course Code	Course Title					Core/Elective	
<b>PC262EC</b>	<b>Pulse and Linear Integrated Circuits Lab</b>					<b>Core</b>	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
<b>PLIC PC233EC</b>	-	-	-	<b>2</b>	<b>25</b>	<b>50</b>	<b>1</b>
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>➤ To implement high pass and low pass circuit and study it's performance</li> <li>➤ To implement clipping and clamping circuits and study it's performance</li> <li>➤ To design and test bi-stable, mono-stable multi-vibrators</li> <li>➤ To study the characteristics of a Schmitt trigger</li> <li>➤ To build sweep circuits and study it's performance</li> </ul> <b>Course Outcomes</b> <ol style="list-style-type: none"> <li>1. Design and analyse linear and non-linear wave shaping circuits.</li> <li>2. Design and analyse clipping and clamping circuits.</li> <li>3. Design and analyse multivibrator circuits.</li> <li>4. Design and analyse multivibrator circuits.</li> <li>5. Design and analyse Schmitt trigger circuit</li> </ol>							

### 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 Monostable 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", 5<sup>th</sup> Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.
2. David A. Bell, Laboratory Manual for "Electronic Devices and Circuits", 4<sup>th</sup> Edition, Prentice-Hall of India Private Limited, New Delhi, 2004.