Tripura University

(A Central University)

Curriculum Structure For

B.Tech in Electronics and

Communication Engineering

Third Semester

2021

THIRD SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/ week	Credit	Full Marks
1.	Humanities Science - 2	HU 301	Effective Technical Communication	3	0	0	3	3	100
2.	Basic Science - 7	BS 302	Mathematics-III	2	1	0	3	3	100
3.	Basic Science - 8	BS 303	Biology for Engineers	2	0	0	2	2	100
4.	Engineering Science - 5	ES 304	Engineering Mechanics	2	1	0	3	3	100
5.	Program Core - 1	PC EC 305	Electronic Devices	3	1	0	4	4	100
6.	Program Core - 2	PC EC 306	Digital Electronics	4	0	0	4	4	100
7.	Program Core - 3	PC EC 307	Electronic Devices Lab	0	0	2	2	1	100
8.	Program Core - 4	PC EC 308	Digital Electronics Lab	0	0	2	2	1	100
9.	Program Core - 5	PC EC 309	Python Programming Lab	0	0	2	2	1	100
10.	Mandatory Course - 3	MC 310	Indian Constitution	2	0	0	2	0	100
			Total :	**18**	**3**	**6**	**27**	**22**	**1000**

1. Effective Technical Communication (HS 301)

Course Code	HS 301
Course Title	Effective Technical Communication
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	1st year B.Tech
Course Category	Humanities Science (HS)
Number of classes	36 hours

Course Outcomes:

At the end of the course, the student will be able to -

CO Number	CO Description	K-level
CO-1	Explain the nature and objective of Technical Communication relevantfor the work place as Engineers	K2
CO-2	Apply the technical writing for the purposes of Technical Communication and itsexposure in various dimensions.	K3
CO-3	Builteffective verbal and non-verbal communication skills.	K3
CO-4	Analyze ethical, legal, cultural, and global issues affecting Technical Communication and Develop appropriate life skills.	K4

Module 1: Essentials of Communication(09 hours)

What is Communication, Process of Communication, Levels of communication, The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group) Communication Barriers to communication, Non-verbal Communication, , Technology Enabled communication, Impact of Technology, Selection of appropriate communication Technology, Importance of Technical Communication, Differences between general and technical communication.

Module 2: Technical Writing Skills (09 hours)

Technical writing process – Choosing right words, phrases and sentence patterns, clarity of purpose, planning content, effective style of writing, formatting, proofreading.

Technical Reports & Proposals: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Writing of Reports & Proposals.

Business letters:Sales & Credit letters; Claim and Adjustment Letters; Letters of Enquiry, Order Placement letters.

Email Writing: Reasons for popularity; guiding principles for composition; some common pitfalls; maintaining common etiquette.

Module: 3 Workplace Communication (09 hours)

Applying for a job: Skimming advertisements; Writing job applications; Preparing CV, Resume.

Group Discussions: Group Discussion types; GD as a part of selection process; Key skills to succeed in group discussions; Dos and Don'ts of group discussions; Use of body language in GDs.
Job Interviews: Objectives; Types; Stages of Interview, Face to face Interviews; Telephonic Interviews.
Effective Business Presentations: Importance in workplace communication; Planning, Preparing, Organizing, Rehearsing, and Delivering Oral presentations, Handling Questions; Visual aids in presentations; Power Point Presentations
Ethics in Communication: Communication challenges in culturally diverse workforce; Bias-free communication.

Module: 4 Developing soft skills/ Life Skills (09 hrs)

Introduction to soft skills: Soft skills as a competitive weapon in today's changing workplace.
Classification of soft skills: Time management, Attitude, Responsibility, Ethics & Values, self-confidence, Teamwork and Interpersonal skills, Problem solving skills.
Personality Development: Developing Right personality to enhance Life Skills, Personality types; Personality attributes; and Leadership Qualities.
Body Language: Emotions displayed by body language: Aggressive, Submissive, Attentive, Nervous, Upset, Bored, Relaxed, Defensive; Hand Shake; Eye Contact; Posture and Positioning.
Personality traits and soft skills in early stages of career advancement and for future career advancement.

LIST OF SOFTWARE/LEARNING WEBSITES

1. http://www.free-english-study.com/
2. http://www.english-online.org.uk/course.htm
3. http://www.english-online.org.uk/
4. http://www.talkenglish.com/
5. http://www.learnenglish.de/

***RECOMMENDED BOOKS*:**

1) Sanjay Kumar &Pushp Lata Communications Skills , 2nd Edition,Oxford University Press
2) Meenakshi Raman & Sangeeta Sharma Technical Communication: Principles & Practice Oxford University Press
3) Barun Kumar Mitra, Personality Development and Soft Skills Oxford University Press.
4) Personality Development, Harold R. Wallace & L. Ann Masters, Cengage Learning, NewDelhi.
5) Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
6) Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
7) Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, McGraw Hill & Co. Ltd., 2001, New Delhi.
8) A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
9) Skills for Effective Business Communication by Michael Murphy, Harward University, U.S

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2. Mathematics-III (BS 302)

Course Code	BS 302
Course Title	Mathematics-III
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	B.Tech 1st Year Mathematics
Course Category	Basic Science (BS)
Number of classes	36 hours

Course Outcome:-

After completion of the course, students will be able to:

CO Number	CO Description	K-level
CO-1	Solve problems in 1st and 2nd order linear Partial Differential Equations	K3
CO-2	Apply Fourier series expansion of a given function and solve PDEs by variables separable method	K3
CO-3	Identify mean and variance of a given probability distribution	K3
CO-4	Solve numerically algebraic/transcendental equation and ordinary differential equations	K3

Course Content:-

Module 1: Partial Differential Equations (10 hours)

First order partial differential equations, solutions of first order linear and quasi-linear partial differential equation (Pp + Qq =R) by Lagrange method. Homogeneous and non-homogeneous type of second order linear differential equation with constant coefficients by complimentary function and particular integral method.

Module 2: Fourier series(08 hours)

Expansion of a function in Fourier series for a given range - Half range sine and cosine expansions. One-dimensional wave equation and one-dimensional heat flow equation - method of separation of variables - Fourier series solution.

Module 3: Probability (08 hours)

Classical and axiomatic definition of probability, conditional probability, Bayes' theorem, independent events, random variables, expectation and higher order moments, probability mass function and probability density function, distribution function, Sample space, Events, Random Variables; Definitions of probability, conditional Probability, examples of discrete and continuous distributions: Normal, Poisson, Binomial distributions.

Module 4: Numerical Analysis (10 hours)

Numerical solution of algebraic and transcendental equations by Regula-Falsi method Newton-Raphson's method; Finite Differences - Newton's Forward, backward difference interpolation formulae - Lagrange interpolation; Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8

rule; Solving first order differential equations –Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta method of 4th order.

***REFERENCES / SUGGESTED LEARNING RESOURCES*:-**

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 1965.
2. Rajnish Verma& H.K. Dass, Higher Engineering Mathematics, S Chand, 2014.
3. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993
4. Jain, Iyengar and Jain, Numerical methods for Scientific and Engineering Computation, New Age International Publications, 2008.
5. ErwynKreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition, 2008.

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3. Biology for Engineers (BS-303)

Course Code	BS-303
Course Title	Biology for Engineers
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	-
Course Category	Basic Science (BS)
Number of classes	26 hours

Course Outcome:

After completion of the course, students will be able to:

CO Number	CO Description	K-level
CO-1	Demonstrate the understanding of biology and its branches, major classifications of life, Cells, Cellular systems their functions and biological molecules.	K2
CO-2	Illustrate the molecular basis of genetic information and the flow of genetic information from DNA to RNA to protein and the concept of mutations, re-combinations and its applications.	K2
CO-3	Classify microorganisms, growth, nutrition with their various methods used for the isolation, identification, control and maintenance of microbial cultures.	K4
CO-4	Explain the fundamental principles of energy transactionsin physical and biological and physiological systems, basic metabolisms.	K2

Course Content:

Module 1: Introduction to Biology, Classification and Biomolecules (8 hours).

Detailed content of the module: Introduction to Biology and its branches. Molecular taxonomy- three major kingdoms of life. Prokaroytic and Eukaryotic cells. Energy and Carbon utilization. Cells: Animal and Plant cell structures and functions. Cell cycle and Cell division.Transport across cell membrane. Cell signaling.

Molecules of life. Monomeric units and polymeric structures. Sugars, starch and cellulose. Lipids, Amino acids and proteins. Nucleotides, DNAand RNA. Proteins- structure and function. Proteins as enzymes, transporters, receptors and structural elements. Enzyme classification. Mechanism of enzyme action. Enzyme kinetics.

Module 2: Fundamentals of genetics and flow of informations (6 hours)

Detailed content of the module: General principles of genetics, Concept of segregation and independent assortment.Molecular basis of information transfer, molecular basis of coding and decoding genetic information. DNA as genetic material. Concept of genetic code. Define gene in terms of complementation and recombination. Mutation. Recombinant DNA technology. Gene mapping. Application of recombinant DNA technology, recombinant products available in the market and at laboratory scale.

Module 3: Microbiology and applications (6 hours)

Detailed content of the module: Microorganisms and environment: Identification and classification of microorganisms. Ecological aspects of single celled organisms.Microbial integrations.Growth, nutrition and reproduction. Growth kinetics.Isolation and identification of microorganisms. Pure cultures and their characteristics. Maintenance of cultures. Sterilization.Physical and chemical methods of control of microorganisms. Management of toxic industrial wastes.

Module 4:Fundamentals of energy transaction and metabolism (6 hours)

Detailed content of the module: Thermodynamics –laws and its application in biological systems. Energy yielding and energy consuming biochemical processes.
Metabolism- Glycolysis & Krebs cycle, Role of ATP and concept of energy change.Equilibrium constant. Physiological steady-state, Living body as a thermodynamic system.
Fundamental aspects of analysis of living systems; quantitative aspects of physiology and engineering applications to clinical medicine based on body fluid balance, solute transport, basic endocrinology, reproduction physiology, neurophysiology, skeletal and smooth muscle physiology.

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd. 12th Edition, 2020
2. Guyton and Hall, Medical Physiology, 14th Edition, Elsevier Saunders, 2020
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman andCompany.
4. Principles of Genetics, D. Peter Snustad and Michael J. Simmons. 7th Edition, Wiley Publisher, 2015
5. Prescott's Microbiology, Joanne Willey and Kathleen Sandman and Dorothy Wood, 2020. 11th Edition McGraw Hill

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4. Engineering Mechanics (ES 304)

Course Code	ES 304
Course Title	Engineering Mechanics
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	10+2 Mathematics &Physics
Course Category	Engineering Science (ES)
Number of classes	36 hours

Course Outcome:-

After completion of the course, students will be able to:

CO Number	CO Description	K-level
CO-1	Differentiate coplanar, concurrent & non-concurrent forces and their resultants and confidently tackle equilibrium equationsand its applications.	K3
CO-2	Explain centroid of simple figures, centre of gravity, moment of inertia of composite sections & mass moment of inertia of circularplates, cylinder, cone, sphere & hook.	K2
CO-3	Analyze simple truss, compound truss, frame & virtual work.	K4
CO-4	Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, analyze D'Alembert's principle and differentiate longitudinal, transverse, torsional and damped vibrations.	K2

Course Content:-

Module 1: Fundamentals of Engineering Mechanics: (09 Hours)

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particleequilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces,Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant ofForce System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium ofCoplanar Systems and Spatial Systems; Static Indeterminacy

Friction covering, Types of friction, Limiting friction, Laws of Friction, Static andDynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Module 2: Centre of Gravity & Moment of Inertia: (09 Hours)

Centroid and Centre of Gravity covering, Centroid of simple figures from first principle,centroid of composite sections; Centre of Gravity and its implications;
Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia,Moment of inertia of standard sections and composite sections; Mass moment inertia of circularplate, Cylinder, Cone, Sphere, Hook.

Module 3: Trusses, Frames & Virtual Work :(09 Hours)

Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections;Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zeroforce members; Beams & types of beams; Frames & Machines;

Virtual Work and Energy Method- Virtual displacements, principle of virtual work forparticle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems withfriction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational),energy equation for equilibrium. Applications of energy method for equilibrium. Stability ofequilibrium.

Module 4: Dynamics& Mechanical Vibrations :(09Hours)

Dynamics - Basic terms & General principles of dynamics, Types of motion, Instantaneous centre of rotation in plane motion, D'Alembert's principle and its application, Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Vibration - Basic concepts of Longitudinal, Transverse and Torsional vibrations, Free & Forced vibration, Resonance and its effects, Damped vibration.

***TEXT BOOKS / REFERENCES*:**

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and RudraPratap (2011), Introduction to Statics and Dynamics, Oxford UniversityPress
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications
11. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education.
12. Bansal R.K. (2010), A Text Book of Engineering Mechanics by Laxmi Publications.
13. Irving, H.Shames, Engineering Mechanics-Statics and Dynamics, by Prentice-Hall of India.
14. Khurmi R. S. (2010), Engineering Mechanics, S. Chand & Co.
15. NPTEL web or video courses on Engineering Mechanics.
16. Timoshenko&D.H.Young, EngineeringMechanics, Tata McGraw-Hill publishing Co. Ltd.

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5. Electronics Devices (PC EC 305)

Course Code	PC EC 305
Course Title	Electronics Device
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	10+2 Physics
Course Category	Program Core
Number of classes	50 hours

Course Outcome:

After the completion of the course, the students will be able to:

CO Number	CO Description	K-level
CO-1	Analyse the properties of semiconductor materials and application of semiconductor electronics	K4
CO-2	Analyse PN junctions in semiconductor devices under various conditions.	K4
CO-3	Analysethe fundamental physical processes of optoelectronic transitions and apply the concepts to different optoelectronic device	K4
CO-4	Explain current conduction mechanism of BJT.	K2
CO-5	Explain and utilize the mathematical models of MOS capacitor and MOS transistors.	K2

Course Content:

Module 1: Introduction to Semiconductor Physics (14 hours)

Free electron theory, Electron levels in a periodic potential, Bloch's theorem, Born-von Karman boundary condition, Kronig-Penny model (to introduce origin of band gap), Density of states and energy band diagrams, Direct and indirect bandgaps, Compound Semiconductor, Types of electronic materials: metals, semiconductors, and insulators, Concept of Effective mass.

Intrinsic and extrinsic semiconductors, Fermi Dirac Distribution, Concept of Fermi level, calculation of carrier density, Dependence of Fermi level on carrier concentration and temperature (equilibrium carrier statistics), Degenerate and nondegenerate semiconductor, Highly doping effect.

Module 2: PN Junction (14 hours)

Carrier transport: diffusion current, drift current, mobility and resistivity, design of resistors,Carrier generation and recombination, Carrier injection process, Poisson and continuity equation, P-N junction, Forward and reverse bias characteristics, concept of quasi fermi level. Transition and Diffusion Capacitances, Charge storage and Transient behavior, Drift and Diffusion current conduction mechanism in PN junction, I-V characteristics, Different breakdown Mechanism, Avalanche breakdown, Zener diode, Tunnel process, Tunnel Diode, Thermionics Emission process Metal-semiconductor junction (Ohmic and Schottky Junction).

Module 3: Light-semiconductor interaction (12 hours)

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Rate equations for carrier density, Radiative and non-radiative recombination mechanisms in semiconductors, concept of Phonons, Joint density of states, Density of states for photons, Electro Luminescence, Photo Luminescence, LED: device structure, materials, characteristics, Photodetector: device structure, materials, characteristics, Solar Cell: device structure, materials, characteristics.

Module 4: Transistor (10 hours)

BJT: Device structure, Operations, Early effect, Current equations, Input and Output characteristics of CE, CB, CC, Ebers Moll Model, Gummel Poon-model. MOS Device: Device structure, Accumulation, depletion and Inversion, CV characteristics of MOS device. MOSFET: Device Structure, Threshold voltage, IV characteristics, E-MOSFET, D-MOSFET

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley &Sons, 2006.
4. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.
6. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. 1995.
7. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., 2007.
8. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley, 2008.
9. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India,1997.

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6. Digital Electronics (PC EC 306)

Course Code	PC EC 306
Course Title	Digital Electronics
Number of Credits	4 (L: 4, T: 0, P: 0)
Prerequisites	Basic electronics
Course Category	Program Core (PC)
Number of classes	48 hours

Course Outcome:

After the completion of the course, the students will be able to:

CO Number	CO Description	K-level
CO-1	Explain the number systems, code conversions and their applications.	K2
CO-2	Apply Boolean algebra and design & analyze combinational logic circuits using basic, Universal and derived gates	K3
CO-3	Construct modular combinational circuits with MSI devices like MUX/DEMUX, Decoder, Encoder etc	K3

CO-4	Analyze and design procedures for synchronous and asynchronous sequential circuits with FF's	K4
CO-5	Explain the concept of various interfacing circuits ex. Digital-to-Analog and Analog-to-Digital converters.	K2

Course Content:

Module 1: Number system and Boolean algebra (14 hours)

Introduction to number system and codes. Boolean algebra; Review of Boolean expression and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps, Queen Mccluskey method, Don't care conditions Binary codes, Boolean identities, basic logic functions, standard forms of logic expressions, simplification of logic expressions, AND, OR, NOT, NAND, NOR, X-OR & X-NOR gates.

Module 2: Combinational logic and Binary codes (12 hours)

Half adders, full adders, parallel adder, BCD adder, decoder, BCD to seven segment decoder, octal to binary encoder, decimal to BCD encoder, priority encoder, subtractors, multiplexers, de-multiplexers, comparators, parity bit checker/generator, Hazards in combinational circuits, weighted and non weighted codes, cyclic codes, Gray code, XS 3 code, error detecting and correcting codes, codes conversion.

Module 3: Sequential circuits and logic families (12 hours)

Latches and Flip Flops (SR, D, JK, T); Master-Slave JK FF, Edge triggered FF, Timing in sequential circuits; Shift register; Counters – synchronous, asynchronous; Sequential circuit design examples, brief overview of Transistor as a switch; Logic gate characteristics – propagation delay, speed, noise margin, fan-out and power dissipation; Standard TTL, ECL, RTL and static CMOS gates.

Module 4: Interface circuits (10 hours)

Digital to Analog converter (DAC) - weighted resistor method, R-2R ladder method; Analog to Digital converter (ADC) - parallel comparator method, counter method, successive approximation method, dual-slope method.

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

1. Mano M.M., Ciletti M.D., "Digital Design", Pearson India, 4th Edition.
2. Wakerly J.F., "Digital Design: Principles and Practices," Pearson India, 4th 2008 Edition.
3. Taub& Schelling - Digital Integrated Electronics – McGraw Hill International Edition.
4. Malvino& Leach - Digital Electronics and Circuit design — TMN.
5. Harris D., Harris S., "Digital Design and Computer Architecture", Elsevier Publications, 2nd 2007 Edition.

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7. Electronics Devices Lab (PC EC 307)

Course Code	PC EC 307
Course Title	Electronics Device Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	10+2 Physics
Course Category	Program Core
Number of classes	20 – 24 hours

Course Outcome:

After the completion of the course, the students will be able to:

CO Number	CO Description	K-level
CO-1	Analyze circuits in different biasing modes of PN junction	K4
CO-2	Analyze circuits in different breakdown mechanism of PN junction	K4
CO-3	Analyze IV characteristics of optoelectronics devices	K4
CO-4	Interpret different modes of BJT	K2

List of Experiments*(Minimum 6experiments to be performed). Use of virtual laboratory to perform few experiments may be exploredif available.*

1. To study and plot the IV Characteristics of P-N Junction Diode
2. To study and plot the IV Characteristics of Zener Diode
3. To study and plot the IV Characteristics of Tunnel Diode
4. To study and plot the Input and Output Characteristics of Transistor CE Configuration
5. To study and plot the Input and Output Characteristics of Transistor CB Configuration
6. To study and plot the Input and Output Characteristics of Transistor CC Configuration
7. To study and plot the characteristics of Light Emitting Diode
8. To study and plot the characteristics of Solar Cell
9. To study and plot the characteristics of Photo Diode

Design, Simulation and Implementation of following experiments using any TCAD Software

10. To study and analyze the CV characteristics of PN junction diode
11. To study and analyzation of doping effect on Built in potential, Depletion Width, junction Capacitance etc.
12. To study and plot the IV Characteristics of MOSFET
13. To study and plot the CV Characteristics of MOS Capacitor

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.
2. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M.Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley &Sons, 2006.
4. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ. Press, 2011.
6. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. 1995.
7. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., 2007.

8. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley, 2008.
9. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India,1997.

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8. Digital Electronics Lab (PC EC 308)

Course Code	PC EC 308
Course Title	Digital Electronics lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Basic electronics
Course Category	Program Core (PC)
Number of classes	20-24 hours

Course Outcome:

After studying the subject students will be able:

CO Number	CO Description	K-level
CO-1	Examine the truth table of different logic gates and verify the law of Boolean algebra.	K4
CO-2	Examine De Morgan's theorem.	K4
CO-3	Built various combinational circuits such as Half Adder, Full Adder, Half & Full Sub tractor, Different Code Converters.	K3
CO-4	Built and analyze Encoder, Decoder, Magnitude Comparator, Multiplexers, De-multiplexers.	K3
CO-5	Examinethe truth table different flip-flops and understand working of Shift Registers, counters, ADC's and DAC's.	K4

List of Experiments*(Minimum 6experiments to be performed). Use of virtual laboratory to perform few experiments may be exploredif available.*

1) Study of different basic digital logic gates and verification of their Truth Table
2) Study and verification of the law of Boolean Algebra and De-Morgan's Theorem
3) Construction and verification of various combinational circuits such as Half Adder, Full Adder, Half & Full Subtractor, Different Code Converters.
4) Construction and verification of Encoder, Decoder, Magnitude Comparator.
4) Study of Multiplexer, De-multiplexer.
5) Construction and verification of various types of Flip-Flops using gates and IC's
6) Construction and Verification of different Shift Registers.
7) Construction and verification of different types of Counters.
8) Study of different types of ADC and DAC.

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

1. Lab Manual.
2. Mano M.M., Ciletti M.D., "Digital Design", Pearson India, 4th Edition.
3. Wakerly J.F., "Digital Design: Principles and Practices," Pearson India, 4th 2008 Edition.

4. Taub& Schelling - Digital Integrated Electronics – McGraw Hill International Edition.
5. Malvino& Leach - Digital Electronics and Circuit design — TMN.
6. Harris D., Harris S., "Digital Design and Computer Architecture", Elsevier Publications, 2nd 2007 Edition.

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9. Python Programming Lab (PC EC 309)

Course Code	PC EC 309
Course Title	Python Programming Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	ES 208(Programming for Problem Solving Lab)
Course Category	Program Core (PC)
Number of classes	20-24 hours

Course Outcome:
After studying the subject students will be able:

CO Number	CO Description	K-level
CO1	Demonstrate different number data types, number operations and input text file.	K2
CO2	Examine to create, concatenate and print a string, sub-string.	K4
CO3	Apply python script for various operations and create, append, and remove lists in python.	**K3**
CO4	Make use of tuples, directories and modules in python programs.	**K3**
CO5	Create python class for number operations and string.	**K6**

List of Experiments*(Minimum 6 experiments to be performed). Use of virtual laboratory to perform few experiments may be explored if available.*

1) Write a program to
   a) Demonstrate different number data types in Python.
   b) Perform different Arithmetic and Logical Operations on numbers in Python.
   c) Find largest of three numbers.
2) Write a Python program to
   a) Construct the given pattern, using a nested for loop.
   b) Find factorial of a number using Recursion.
3) Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
4) Write a program to create, concatenate and print a string and accessing sub-string from a given string.
5) Write a python script to
   a) Print prime numbers less than 20,
   b) Print the current date in the format "Day Month DD hh:mm:ss IST yyyy".

6) Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
7) Write a program to create, append, and remove lists in python.
8) Write a program to demonstrate working with tuples and dictionaries in python.
9) Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
10) Write a Python class to convert an integer to a roman numeral, implement pow(x, n) and reverse a string word by word

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
2. R. Nageswara Rao, "Core Python Programming", dream tech
3. Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Pyhon", Wiley
5. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication

10. Indian Constitution (MC 310)

Course Code	MC 310
Course Title	Indian Constitution
Number of Credits	0 (L: 2, T: 0, P: 0)
Prerequisites	Nil
Course Category	Mandatory Course (MC)
Number of classes	25 hours

Course Outcome:-

After completion of the course, students will be able to:

CO Number	CO Description	K-level
CO-1	Explain about framing and nature of Indian Constitution.	K2
CO-2	Identify thefundamental rights and duties of individual and demonstrate the knowledge on Directive Principles of State Policy.	K3
CO-3	Outline the Federal Structure, Centre- State relation, Union Executive and Amendment Procedure	K2
CO-4	Demonstrate the meaning of local self govt., types of local self govt. in rural and urban areas.	K2

Course Content:

Module 1: Constitutional Framework(05 hours)

1. Meaning of Constitutional Law and Constitutionalism.
2. Historical perspective of the Constitution of India.

3. Salient features of the Constitution of India.

Module 2: Fundamental Rights, Duties and Directive Principles of State Policy(06 hours)

1. Fundamental Rights- Articles 14, 19 and 21.
2. Fundamental Duties.
3. Directive Principles of State Policy; Its Legal Status and Significance

Module 3: Nature of India's Political System(07 hours)

1. Federal structure, Distribution of Legislative and Financial Powers between the Union and States.
2. Parliamentary Form of Government- Powers and Position of President of India.
3. Emergency Provisions.
4. Amendment Procedures of the Constitution of India.

Module 4: Rural and Urban Local Self Govt. (07 hours)

1. 73rd Amendment of the Constitution and Panchayati Raj Institutions.
2. 74th Amendment of the Constitution and Urban Local Self Govt. (Municipal Corporation, Municipal Council and Nagar Panchayat).
3. TTAADC

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

1. Fadia, B.L- "Indian Govt. and Politics "Sahitya Bhawan, Agra.
2. D.D.Basu- "An introduction to the Constitution of India"Lexis Nexis publishers.
3. M.V.Pylee- "Constitutional Govt. in India" S.Chand and Company Ltd.
4. S.C.Kashyap(ed)- "Perspectives on the constitution" Shipra Publication.
5. B.K. Sharma- "Introduction to the Constitution of India" Prentice Hall India Private Ltd.
6. Bhattacharya, D.C. and Banerjee, Malay- "Indian Govt. and Politics" Vijaya Publishing House
7. J.C. Johari- "Indian Govt. and Politics" (2 vols)
8. Das Nityananda- "Grassroot Democracy and Panchayati Raj in Tripura" Progressive Publishers

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