Course Content

1. Communication Skills

COURSE TITLE (ECH-111) **Communication Skills**	**CREDIT HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Humanities**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Acknowledge** the importance and basic concepts of communications.	A-1	10
CLO-2	**Identify** common errors usually made by the Learners of English as second language.	A-2	10
CLO-3	**Communicate** effectively in technical writing and presentation, using basic-to-intermediate level English while developing the understanding of essentials of communication skills.	A-3	10

Course Outline for Theory

Vocabulary building, common writing errors, purposeful writing, business writing, critical reading, reading for understanding, introduction to communication process, seven Cs of communication, types of listening, listening skills, verbal and non-verbal communication, basic presentation skills, Presentation Strategies and public speaking skills, use of Audio-Visual Aids, basics of group communication, communicate effectively in job interviews.

Recommended Books

1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Fourth edition. Oxford University Press. (or Latest Edition)
2. Practical English Grammar Exercises 1 by A. J. Thomson and A. V. Martinet. Third edition. Oxford University Press. (Or Latest Edition)
3. A Practical Guide to Business Writing: Writing in English for Non-Native Speakers by Khaled Mohamed Al Maskari. Wiley. (Latest Edition)
4. Communication Skills for Engineers by Sunita Marshal, C. Muralikrishna (Latest Edition)
5. Elizabeth Tebeaux and Sam Dragga- The Essentials of Technical Communication., Oxford University Press. (Latest Edition)
6. John Langan- College Writing Skills. 9th Edition Connect Writing. (or Latest Edition)
7. Exploring the World of English by Saadat Ali Shah, Ilmi Kitab Khana. (Latest Edition)

Course Content

2. Calculus and Analytical Geometry

COURSE TITLE (ECN-111) **Calculus and Analytical Geometry**	**CREDIT HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Natural Sciences**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** the ideas of rate of change, derivatives and it basic Applications.	C-2	1
CLO-2	**Apply** the techniques of integration for solving and analyzing problems in integral calculus.	C-3	2
CLO-3	**Describe** the vector calculus and analytical geometry in multiple dimensions for investigation of different engineering problems.	C-2	2

Course Outline for Theory

Definition of derivatives: differentiation of different function, rule of differentiation, chain rule implicit differentiation
Applications: slope, equation of tangent and normal. maxima, minima and point of inflection Indefinite integral, different technique for integration i.e., integration by parts, integration by substitution, by partial fraction, integration of different trigonometric identity
Definition of definite integrals: Application of definite integral, i.e., area under the curve, area between the curve, mean value theorem, finding the volume by slicing, volume of solid revolution, Disk and Washer method, moment, and center of mass etc.
Vectors in space: vector calculus, divergence, curl of vector field, directional derivatives, multivariable functions, partial derivatives, spherical, polar, cylindrical coordinates
Vectors in plane: Dot product and cross products, line, and plane in space.
Applications: work, angle between two vectors, area of triangle, area of parallelogram etc.

Recommended Books

1. H. Anton, I. C. Bivens, S. Davis, "Calculus, Early Transcendental", 11th edition (or Latest Edition), John Wiley, New York, 2016.
2. Essential Calculus by James Stewart, 2nd Ed. (or Latest Edition)
3. G. B. Thomas, A. R. Finney, "Calculus", 14th Ed. (or Latest Edition), Pearson Publisher
4. S.M Yousaf, "Calculus and Analytic Geometry" (or Latest Edition)
5. Advanced Engineering Mathematics by Erwin Kreyszig, (Latest Edition) Willey

Course Content

3. Islamic Studies/Social Ethics

COURSE TITLE (ECH-112) (ECH-113) **Islamic Studies/Social Ethics**	**CREDIT HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Humanities**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Recite** from the Holy Qur'an with correct pronunciation.	C-1	12
CLO-2	**Apply** understanding of basic concepts of teaching of Islam (faith, pillars, dawat, preaching and seerat).	C-3	12
CLO-3	**Understand** compilation of the Holy Quran and basic concepts of Hadith.	A-2	12
CLO-4	**Present** Islam as a complete code of life.	A-3	8

Course Outline for Theory

History of Islam: Compilation of the Holy Quran and Hadith, fundamental doctrine of Islam i.e., Tawheed, oneness of Allah, Prophet hood, the Day of Judgment, revealed books, Ibadaat (worship), philosophy of Ibadaat, Namaz, Zakat, Hajj & Sawm

Importance of preaching of Islam: its needs and effects, difficulties in the ways of preaching of Islam,

Sectarianism: its causes and effects in Muslim society, definition of right, classification of right, importance of rights, importance of peace and causes of terrorism.
Khutba Hajjatul Wida (last Address of the Holy Prophet Peace be upon him): Seeratun-Nabi (Peace Be upon him).
Life of Holy Prophet (Peace Be upon him): The life of the Holy prophet before and after prophet hood. The Hijra (Migration to Madina), Treaty of Al madina, Makki and Madani

Islam and civilization: Definition of civilization, impacts of Islamic civilization on the Sub-continents, international impacts of Islamic civilization, impacts of human thoughts, social and humanistic effects, importance of ethics, human rights (Hoqooq Ul Ibad) with detail.

Knowledge and Islam: Definition of Knowledge, classification of knowledge, importance of technology in the light of Holy Qur'an and Sunnah, relevant verses of the Holy Quran about technology (Baqara 28,30,33,201, Nahal:76, Jasia: 13, Araf: 32, Noor: 55 etc), Islamic and scientific knowledge.

Recommended Books

1. A guidebook for Muslims by Syed. Abul Hasan Ali Nadvi. (Latest Edition)
2. An Introduction to Islam by Dr. Muhammad Hameedullah. (Latest Edition)
3. What is Islam by Maulana Manzoor Nomani. (Latest Edition)
4. Islamiat (A standard book for CSS), Prof. Dr. Arif Naseem. (Latest Edition)
5. Islamiat for Students O levels, Farkhanda Noor Muhammad. (Latest Edition)

Course Content

4. Applied Physics

COURSE TITLE (ECN-111) **Applied Physics**	**CREDIT HOURS** (3+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Natural Sciences**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** fundamental physical principles.	C2	1
CLO-2	**Apply** these principles, together with logical and mathematical reasoning, to situations of the physical world.	C3	2
CLO-3	**Analyze** different physical problems using the laws of physics.	C4	2
CLO-4	**Identify** knowledge of constructing basic circuits and demonstration of relevant theorems using Resistors and Capacitors.	P1	2
CLO-5	**Differentiate** classroom knowledge and laboratory techniques for learning of basic principle used in magnetism.	P1	1

Course Outline for Theory

Electric charge, Conductors and insulators, Coulomb's law, Electric field, Field due to a point-charge Electric dipole and line of charge, Flux of an electric field, Permittivity of a medium, Gauss's law, Application of Gauss's Law, Electric potential, calculating the potential from electric field, Potential due to a point-charge and a group of point-charges. Potential due to a dipole, Potential due to a continuous charge distribution, Capacitors, calculating capacitance, Capacitors in series and parallel, Factors affecting capacitance, Application of Capacitors, Current and Conductors, Electric current and current density, Resistance and resistivity, Ohm's law, The Steady Magnetic Field, Resistors in series and parallel, Temperature dependence of resistance and other factors affecting resistance, Application of resistors, the magnetic field, Magnetic force on a current carrying conductor, Torque on a current-loop, Magnetic field due to current, Force between two parallel current-carrying conductors, Biot Savart law and its applications, Ampere's law, Inductance and inductors, Factors affecting inductance Permeability Faraday's law of induction, Lenz's law, Energy stored in a magnetic field, Self-induction, Mutual Induction, Magnets and magnetic materials, Di-magnetic material, Para-magnetic material, Ferromagnetism.

Course Outline for Lab

- Investigate the properties of series combination of Capacitors
- Determine the given resistance by leakage method using ballistic Galvanometer
- Study the variation of Photoelectric current with intensity of incident beam
- Determine the temperature coefficient of resistance of coil by wheat stone bridge
- Study Ohm's law
- Investigate the properties of Series Combination of Resistances
- Investigate the properties of Parallel combination of Resistances
- Practical Demonstration of Ampere Law
- Practical Demonstration of Faraday Law
- Demonstrate the function of transformer as Step Up and Step-Down Transformer
- Any other contents relevant to the theory course outlines

Recommended Books
1. Halliday, Resnick and Walker, “Fundamentals of Physics” (Latest Edition) 2. Hugh D. Young and R.A. Freedman, University Physics. (Latest Edition) 3. Raymond A Serway and John W. Jawett, Jr. Physics for Scientists and Engineers with modern Physics, (Latest Edition) 4. Fundamentals of Electromagnetic Phenomenon by D. Corson & Lorrain. (Latest Edition)

Course Content

5. Information and Communication Technology

COURSE TITLE (ECC-111) **Information and Communication Technology**	**CREDIT HOURS** (1+1) **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Computing**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Define** the working of computer hardware and software.	C1	1
CLO-2	**Compare** problem solving skills and develop small scale computer programs.	C2	1
CLO-3	**Use** the concepts of data communication and networks.	C3	1
CLO-4	**Explain** the working of hardware components of computer.	P2	1
CLO-5	**Follow** typing speed and develop office application skills.	P3	1

Course Outline for Theory

Introducing Computer Systems: Basic Definitions, Computer and Communication Technology, the applications of ICT - particularly for engineering technology
Basic Operations and Components of a Generic Computer System: Basic operations: Input, Processing, output, storage Basic components: Hardware, Software, Data, Users, types of storage devices
Processing Data: Transforming data into information, how computers represent and process data, Processing Devices, CPU architectures
The Internet: The Internet and the World Wide Web- browsers, HTML, URLs/ How DNS works, Email and other programs
Introduction to Embedded Systems: What is an Embedded System, Applications, Components, Programming Languages, Popular Development Platforms.
Networking Basics: Uses of networks, Common types of networks (LAN, WAN, MAN etc.), Introduction to OSI Model, Future of Networks
Database Management: Hierarchy of Data, Maintaining Data, Database Management Systems
Exposure to ICT Tools and Blogs (Student Assignment)
Protecting your privacy, your computer and your data: Basic Security Concepts, threats to users, threats to hardware, threats to Data

Course Outline for Lab

- Introduction to basics of internet e.g., using search engines, using Wikipedia, checking your Email
- Personal computer components, inside the CPU
- Introduction to typing tutors, typing practice. Introduction to MS word
- Introduction to MS Power point, MS Excel
- Introduction to HTML, HTML codes, Writing small HTML codes
- Introduction to web designing, Introduction to programming languages
- Any other contents relevant to the theory course outlines

Recommended Books
1. "Introduction to Computers", Peter Norton, McGraw-Hill. (Latest Edition) 2. "Computing Essentials", Timothy O'Leary and Linda O'Leary, McGraw-Hill. (Latest Edition) 3. Using Information Technology: A Practical Introduction to Computers & Communications", Williams Sawyer, McGraw-Hill. (Latest Edition) 4. "Discovering Computers, Complete: Your Interactive Guide to the Digital World. Cengage Learning" Shelly GB, Vermaat ME, (Latest Edition)

Course Content

6. Workshop Practices

COURSE TITLE (ECT-111) **Workshop Practices**	CREDIT HOURS (0+1) **0 Theory + 16 Lab Sessions**	KNOWLEDGE AREA/DOMAIN **Foundation**

	After completion of this course students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Display** the use of safety equipment during workshop practice.	P2	7
CLO-2	**Participation** in workshop activities individually as well as in a group.	A2	9

Course Outline for Lab

- Use of carpenter's tools
- Exercise in preparing simple joints
- Bench fitting practice
- Exercise in marking and fittings
- Smith's forge
- Exercise in bending, Upsetting, and swaging
- Introduction to various technical facilities in the workshop including mechanical and electrical equipment Concepts in electrical safety
- Safety regulations, Earthing concepts
- Electric shocks, and treatment
- Use of tools used by electricians
- Wiring regulations
- Types of cables and electric accessories including switches plugs, circuit breakers, fuses etc., symbols for electrical wiring schematics e.g., switches, lamps, sockets etc.
- Drawing and practice in simple house wring and testing methods
- Wiring schemes of two-way and three-way circuits and ringing circuits
- Voltage and current measurements
- Electric soldering and soldering tools, Soldering methods and skills
- PCB designing, transferring a circuit to PCB, etching, drilling, and soldering component on PCB testing.

Recommended Books

1. S. K. Choudhury, "Elements of Workshop Technology", Latest Edition.
2. Chapman, "Workshop Technology", Latest Edition

Course Content

7. Linear Circuit Analysis

<table>
<tr><td colspan="2">COURSE TITLE
(ECT-121)
Linear Circuits Analysis</td><td>CREDIT HOURS
(2+1)
32 Theory + 16 Lab Sessions</td><td colspan="2">KNOWLEDGE AREA/DOMAIN

Foundation</td></tr>
<tr><td colspan="2">After completion of this course students will be able to:</td><td></td><td>Bloom's Taxonomy Level</td><td>PLO</td></tr>
<tr><td>CLO-1</td><td colspan="2">Understand circuit reduction techniques, source conversions and circuit solving techniques.</td><td>C2</td><td>2</td></tr>
<tr><td>CLO-2</td><td colspan="2">Explain the basics of mathematics & electrical engineering.</td><td>C1</td><td>1</td></tr>
<tr><td>CLO-3</td><td colspan="2">Perform experiments in laboratory, interpret experimental data and observe its conformance with analyzed results of circuits.</td><td>P2</td><td>2</td></tr>
<tr><td colspan="5">Course Outline for Theory</td></tr>
<tr><td colspan="5">Electrical elements and circuits: Resistance, inductance, and capacitance. Difference between AC and DC.
Laws of resistances: Ohm's law, Kirchhoff's laws, circuits containing resistance, capacitance, and inductance. Series and parallel circuits employing resistances, capacitors, and inductors. Circuit analysis techniques, Mesh/Loop analysis. Nodal analysis of circuits with DC source. Idea and real current/voltage source. Network theorems employing Thevenin and Norton theorem. Principle of superposition. Reciprocity and maximum power transfer theorem.</td></tr>
<tr><td colspan="5">Course Outline for Lab</td></tr>
<tr><td colspan="5">• Learn the use of basic instruments in electrical i.e., function generators power supplies, oscilloscopes.
• Design and implement circuits using different laws verify the node voltages and loop currents using instruments. Verify Circuit-theorems using lab instruments.
• Verify circuit transformations using lab instruments broadly defined Engineering Technology Problems.</td></tr>
<tr><td colspan="5">Recommended Books</td></tr>
<tr><td colspan="5">1. Charles Alexander and M Sadiku, "Fundamentals of Electric Circuits", McGraw- Hill, Latest Edition.
2. S. Franco, "Electric Circuits Fundamentals", Oxford University Press, Latest Edition.
3. R.E Thomas, Rosa & G. Toussaint, "The Analysis & Design of Linear Circuits" John Wiley, Latest Edition.
4. J D Irwin and R M Nelms, "Basic Engineering Circuit Analysis", Wiley, Latest Edition.
5. W Hayt, J Kemberly and S Durbin, "Engineering Circuit Analysis", McGraw- Hill, Latest Edition.</td></tr>
</table>

Course Content

8. Differential Equations

COURSE TITLE (ECN-121) Differential Equations	CREDIT HOURS (2+0) 32 Theory + 0 Lab Sessions	KNOWLEDGE AREA/ DOMAIN Natural Sciences	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Have** knowledge of differential equations, solutions of first and higher orders homogenous and non-homogenous differential equations by appropriate methods.	C-2	1
CLO-2	**Solve** linear differential equations using the Laplace Transform technique and power series methods.	C-4	1

Course Outline for Theory

Basic concept of differential equation, I.e., Definition, order, degree, and geometric meaning of Diff: equation. Solution of First order Diff. Equation: Separable of equation, Exact Diff: Equation, integrating Factor, Linear ODEs. Second and higher order Differential Equation: Homogenous linear ODE with constant coefficient, Cauchy Euler Equation, Non-homogenous Equation by undetermined coefficient, by variation of parameter and similar higher order Diff. equation. Finding Laplace and inverse-Laplace of different functions, S-shafting theorem, solution of differential equations using Laplace transform. Basic concept of power series, radius of convergence, convergence interval, using power series method to find the solution of Differential Equation.

Recommended Books

1. Advanced Engineering Mathematics by Erwin Kreyszig, Willey 2014. (or Latest Edition)
2. W. E. Boyce, R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems, 10th edition", John Wiley & Sons, Inc., 2012. (or Latest Edition)
3. D. G. Zill, M. R. Cullen, "Differential Equations with Boundary-Value Problems", 10th edition, Brooks/Cole, 2013. (or Latest Edition)

Course Content

9. Pakistan Studies

COURSE TITLE (ECH-121) **Pakistan Studies**	**CREDIT HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Humanities**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the difference between ideological and non-ideological states.	A-1	12
CLO-2	**Discuss** Pakistan Movement, and political and constitutional history of Pakistan.	A-3	8
CLO-3	**Understand** current issues of Pakistan, and their cause and solutions.	A-4	12

Course Outline for Theory

Pakistan ideology: Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal, and Quaid-e-Azam Muhammad Ali Jinnah, Aims and objective of the creation of Pakistan. Indus Civilization, Location and Geo-Physical features, Reformist Movement in Subcontinent. Muslim League 1906, Lahore Resolution 1940, 3rd June plan and Independence 1947, Constitution and Law, Constitutional Assembly, Nature and Structure of Constitution, Features of 1956, 1973 Constitutions. Amendments in the Constitution (17th, 18th, 19th, and 20th), Foreign Policy, Objectives, Contemporary Pakistan, Economic institutions and issues, Society and social structure, Ethnicity, Determinants of Pakistan Foreign Policy and challenges, Futuristic stance of Pakistan

Recommended Books

1. Amin, Tahir. Ethno – National Movement in Pakistan, Islamabad: Institute of Policy Studies, Islamabad. (Latest Edition)
2. Afzal, M. Rafique. Political Parties in Pakistan, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, (Latest Edition)
3. Struggle for Pakistan by Mr. Ishtiaq Hussain Qureshi (Latest Edition)

Course Content

10. Solid State Electronics

COURSE TITLE (ECT-121) **Solid State Electronics**	**CREDIT HOURS** (2+0) **32 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/DOMAIN** **Foundation**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Know** the general concepts of Solid-State Physics.	C1	1
CLO-2	**Compare** the different application of semi-conductor devices to develop the sustainable solutions.	C2	7
CLO-3	**Construct** circuits with semiconductor devices to design solutions for societal problems.	C3	3

Course Outline for Theory

Understand the differences between metals, insulators, and semiconductors and origin of their properties based on the crystal structures of materials, intrinsic and extrinsic semiconductors, and role of doping in engineering the properties of semiconductor structures. Understand the fabrication process of silicon wafers, starting from silica. Generation and recombination of charge carriers in semiconductors under electrical, optical, and thermal excitation, and transport of these carriers under an electric field. Formation of p-n junctions, p-n junction devices, fabrication, electrical characteristics, and their wide range of applications as diodes, LEDs, and solar cells. Metal-semiconductor contacts resulting in ohmic vs. Schottky (rectifying) junctions.

Recommended Books

1. B.G. Streetman, S.K. Banerjee "Solid State Electronic Devices", 7th edition, Pearson (2015)
2. M. Razeghi, Fundamentals of Solid-State Engineering, 3rd ed., Springer, 2009.

Course Content

11. Computer Programming

COURSE TITLE (ECC-121) **Computer Programming**	**CREDIT HOURS** (0+1) **0 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Computing**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** C++ to analyze and solve problems in effective way.	C-3	5
CLO-2	**Illustrate** the use of Integrated Development Environment (IDE), especially Code Blocks for writing and compiling programs.	P-2	1
CLO-3	**Write** and compile simple programs, and remove errors.	P-3	5

Course Outline for Lab

- Introduction to C++
- Data Types and Operators
- Arithmetic Operations
- Repetitive Statements/Loops, Functions, Iteration (for Loop, While, Do-While), Iteration (Do-While)
- Recursion, File Handling
- Structures Arrays- One Dimensional
- Sorting Algorithms
- Arrays – Two Dimensional
- Strings, Pointers
- Open ended Lab

Recommended Books

1. C++ How to Program, latest Edition, Deitel & Deitel, Prentice Hall. (Latest Edition)
2. Problem Solving with C++, latest Edition, Walter Savitch, Addison Wesley (Latest Edition)
3. Introduction to Computation and Programming Using Python: With Application to Understanding Data, latest Edition by Guttag, John. (Latest Edition)
4. "C++ programming in easy steps" by Mike McGrath (Latest Edition)
5. "Thinking in C++" by Bruce Eckel
6. For the advanced programmer: "The C++ Programming Language" by Bjarne Stroustrup, published by Addison Wesley (Latest Edition)

Course Content

12. Fundamentals of Economics

COURSE TITLE (ECM-121) **Fundamentals of Economics**	**CREDIT HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Management Science Elective**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**

CLO-1	**Estimate** the depreciation of an asset using standard depreciation techniques to assess its impact on present or future value.	C-2	2
CLO-2	**Predict** the cost effectiveness of individual projects using the methods learnt and the effects of inflation on economic analysis of engineering projects.	C-3	11
CLO-3	**Analyze** the appropriate engineering economics analysis method(s) for problem solving i.e. present worth, annual cost, rate of return, payback, break-even, benefit-cost ratio.	C-4	2
Course Outline for Theory			
Basic concepts, technological economy defined Types of Business organizations, financial statements and financial ratios, Time value of money, cash flow series and its types, basic cost concepts. Profit and interest, discrete and continuous compounding, nominal and effective interest rate. Economic analysis of alternatives, Alternatives having identical lives, Alternatives having different lives, PW, AW, FW, Cost-benefit analysis and rate of return analysis, Break-even and payback analysis. Use of spreadsheet for economic analysis, economic effects of inflation. Replacement and retention decisions Depreciation, amortization and depletion of economic resources. Price, Supply and Demand Relationship. Project financing. Factors of production, Capital budgeting, economic analysis in the service sector.			
Recommended Books			
5. Technological Economics by Shoubo Xu (Springer), (Latest Edition) 6. Engineering Economy, Latest Edition, Leland T. Blank and Anthony J. Tarquin, McGraw Hill, (Latest Edition) 7. Contemporary Engineering Economics, Latest edition, Chan S Part Pearson Prentice Hall (Latest Edition) 8. Engineering Economic Analysis by Donal G. Newnan, Jerome P. Lavelle, Ted G. Eschenbach, 12th edition, Oxford University Press, (or Latest Edition)			

Course Content

13. Entrepreneurship

COURSE TITLE (ECS-121) **Entrepreneurship**	**CREDIT HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Management Science Elective**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** the understanding of entrepreneurship concept as a whole and the role of entrepreneurship in economic development.	A-3	7
CLO-2	**Compare** the role and importance of the small and medium sized enterprises in the economy.	A-4	6
CLO-3	**Find** an attractive market and apply the understanding of business planning concept for new business creation and growth.	A-3	12
Course Outline for Theory			

The concept of entrepreneurship, the economist view of entrepreneurship, the sociologist view, Behavioral approach, Entrepreneurship and Management. The process of entrepreneurship, Entrepreneurial Management, The entrepreneurial business, Entrepreneurship in service institutions, the new venture. The innovation concepts, Importance of innovation for entrepreneurship, Sources of innovative opportunities, the innovation process, Risks involved in innovation. Entrepreneurial profile, Trait approach to understanding entrepreneurship, Factors influencing entrepreneurship, the environment, Socio cultural factors, Support systems. Teamwork, Networking organization, Motivation and compensation, Value system. Defining SMEs, Scope of SMEs, Entrepreneurial, managers of SME, Financial and marketing problems of SMEs, Framework for developing entrepreneurial marketing, Devising entrepreneurial marketing plan, Entrepreneurial marketing strategies, Product quality and design, Role of entrepreneur in the economic development generation of services, Employment creation and training, Ideas, knowledge and skill development, The Japanese experience, Case Studies of Successful Entrepreneurs
Recommended Books
1. Technology Ventures: From Idea to Enterprise by Thomas Byers, Richard Dorf, Andrew Nelson, 4th Edition, McGraw Hill (Latest Edition) 2. Paul Burns and Jim Dew Hurst: “Small Business and Entrepreneurship”, Palgrave Macmillan Publishing Company, Second Edition (Latest Edition) 3. Peter F. Drucker: “Innovation and Entrepreneurship”, Harper Business, Reprint Edition (Latest Edition) 4. The Startup Owner’s Manual: The Step-By-Step Guide for Building a Great Company by Steve Blank, Bob Dorf, K & S Ranch, (Latest Edition) 5. The Lean Startup: How Today’s Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries, Penguin Books (Latest Edition) 6. John B. Miner, “Entrepreneurial Success”, Berrett-Koehler Publishers, (Latest Edition)

Course Content
14. Electrical Network Analysis

COURSE TITLE (ECT-211) **Electrical Network**		CREDIT HOURS (2+1) **32 Theory + 16 Lab Sessions**	KNOWLEDGE AREA/DOMAIN **Foundation**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the behavior of complex electrical networks.	C2	1
CLO-2	**Apply** differential equations and Laplace Transform to solve electrical networks.	C3	2
CLO-3	**Analyze** the RLC circuits to develop sustainable solutions.	C4	7
CLO-4	**Demonstrate** the basic principles of AC circuit analysis using lab equipment adhering to ethical values.	P4	8
CLO-5	**Imitate** the AC network response using SPICE software for lifelong learning.	P3	12

Course Outline for Theory

Current and voltage transients, RLC circuits with DC and AC excitation, resonant circuit: series and parallel resonance in AC circuit, Q-Factor, self and mutual inductances, introduction to phasor representation of alternating voltage and current, star-delta transformation for AC circuits, phase sequence, vector diagrams of three phase networks, power in three phase circuits, impedance, and power triangles. Two-port networks and their interconnections. Application of Laplace transform in circuit analysis and introduction to difference equations

Course Outline for Lab

- Learn the use of basic instruments Design and implement RLC circuits and observe resonance and impedance characteristics.
- Verify the node voltages and loop currents in RLC circuits using.
- Verify Circuit-theorems using lab instruments.
- Verify circuit transformations using lab instruments.
- Learn the use of Circuit Simulation computer package such as SPICE.
- Observe transient and steady state response in RL, RC and RLC circuits using SPICE.

Recommended Books

1. M. E. Van Valkenburg, "Network Analysis", Pearson, Edition 3rd, 2006
2. S. Franco, "Electric Circuits Fundamentals", Oxford University Press, (Latest edition).
3. C. Alexander and M. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill, 4th Edition, 2008
4. RE Thomas, Rosa & G. Toussaint, "The Analysis & Design of Linear Circuits" John Wiley, Latest Edition.
5. J D Irwin and R M Nelms, "Basic Engineering Circuit Analysis", Wiley, Latest Edition

Course Content

15. Linear Algebra

COURSE TITLE (ECN-211) **Linear Algebra**		CREDIT HOURS (2+0) **32 Theory + 0 Lab Sessions**	KNOWLEDGE AREA/ DOMAIN **Natural Sciences**	
After completion of this course students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** basic definitions, properties, and theorems of linear algebra.		C-1	1
CLO-2	**Illustrate** the operations on matrices to solve systems of linear equations.		C-2	1
CLO-3	**Apply** linear transformations and matrix theory to model real-life situations.		C-3	2

Course Outline for Theory

Algebra of matrices; inverse of a matrix; Gauss-Jordan method for the solution of a system of linear algebraic equations; vectors in the plane and in three dimensions; vector spaces; subspaces; span and linear independence; basis and dimension; homogeneous systems; coordinates and isomorphism; rank of a matrix; determinant; inverse of a matrix; applications of determinants; determinants from a computational point of view; properties of determinants; eigenvalues and eigenvectors; systems of linear differential equations; diagonalization; Hermitian matrices; singular value decomposition; quadratic forms; positive definite matrices; non-negative matrices; floating-point numbers; Gaussian elimination; pivoting strategies; matrix norms and condition numbers; orthogonal transformations; eigenvalue problem; least square problems, Vectors in 2-Space and 3-Space, Inner Product (Dot Product) Vector Product (Cross Product), Vector and Scalar Functions and Their Fields.

Recommended Books

1. Introductory Linear Algebra by Bernard Kolman (Latest Edition)
2. Advanced Engineering Mathematics by Erwin Kreyszig, 10th Ed. Willey 2014. (or Latest Edition)
3. D. C. Lay, S. R. Lay, J. J. McDonald, "Linear Algebra and Its Applications", 5th Edition, Pearson Education, 2015. (or Latest Edition)
4. Linear Algebra and its Applications by Gilbert Strang, 4th Edition, (or Latest Edition)

Course Content

16. Digital Electronics

COURSE TITLE (ECT-212) **Digital Electronics**	**CREDIT HOURS** (1+1) **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/DOMAIN** **Foundation**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** fundamental concepts of digital system, Boolean functions, and techniques for simplification of functions.	C2	1
CLO-2	**Analyze** the working of combinational and sequential logic circuits using digital logic principles and Boolean algebra.	C4	2
CLO-3	**Apply** the principles of digital system to design solutions for Broadly Defined Problems.	C3	3
CLO-4	**Execute** small-scale digital circuit using Boolean algebra and K-maps for sustainable solutions.	P4	7
CLO-5	**Justify** results of experiments in the form of well-written manuals and reports.	A3	9

Course Outline for Theory

Number Systems, Complement, Boolean Algebra, Logic Simplification, K-Map, Universal Gate, Combinational Logic, Sequential Logic, Latches, Flip-Flops (SR, JK, data and toggle) and their applications. Adders (half adder and full adder), Multiplexers and Demultiplexers, Counters (synchronous and asynchronous), Shift Registers (left and right registers), and simple Arithmetic Logic Unit (ALU).

Course Outline for Lab

- Basic logic gates
- Hardware implementation of combinational logic circuits such as multiplexers and demultiplexers, encoders/decoders
- Implementation of sequential circuits such as flip-flops, registers, shift registers, counters, and other digital circuits.

Recommended Books

1. Morris Mano and Charles R. Kime, "Logic and Computer Design Fundamentals", Prentice Hall
2. Tocci and Widmer, "Digital Systems: Principles and Applications".

Course Content

17. Professional Ethics

COURSE TITLE (ECS-212) **Professional Ethics**	CREDIT HOURS (3+0) **48 Theory + 0 Lab Sessions**	KNOWLEDGE AREA/ DOMAIN **Social Sciences**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** the basic concepts of a profession, professional ethics, various moral and social issues, importance of values and professional ethics in personal life and professional career, and consequences of acting unethically in organization and society.	C-1	8
CLO-2	**Apply** acquired knowledge in various roles with ethical principles at various professional levels.	A-3	8
CLO-3	**Resolve** the ethical dilemmas using common ethical values and identify possible actions to be taken in response.	A-5	8

Course Outline for Theory

Introduction: Introduction to ethics, personal and professional ethics, the nature of engineering ethics; legal, professional, and historical definitions; origin of professional ethics, profession, and professionalism; professional accountability, professional success, professional risks, professional associations; benefits of acting ethically and consequences of acting unethically.

Value of Ethics: Values in professional ethics, central responsibility of engineering technology professionals, ethics in different fields of work, IEEE code of ethics, ethical code for engineering technology professionals, global issues in professional ethics, ethics in manufacturing and marketing, intellectual property rights, business ethics and corporate governance.

Ethical Dilemmas: Common ethical dilemmas, resolution of ethical dilemmas, possible actions in response to dilemmas, probable consequences of these actions.

Recommended Books

1. Engineering Ethics Concepts & Cases by Charles E Harris Cengage 2014, (or Latest Edition)
2. Kenneth Blanchard, Professional Ethics, 4th Edition (or Latest Edition)
3. Ethics in Engineering 4th edition, by Mike W. Martin, Roland Schinzinger, McGraw-Hill, New York, 2005. (or Latest Edition)
4. The Seven Habits of Highly effective people by Stephan r. Covey (Latest Edition)
5. Engineering Ethics: Concepts and Cases, 4th edition, by Charles E. Harris, Michael S. Pritchard, Michael J. Rabins, Wadsworth, 2008 (or Latest Edition)
6. Professional Ethics: R. Subramanian, Oxford University Press, 2015. (or Latest Edition)
7. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015. (or Latest Edition)

Course Content

18. Technical Drawing

COURSE TITLE (ECC-211) **Technical Drawing**	CREDIT HOURS (0+1) **0 Theory + 16 Lab Sessions**	KNOWLEDGE AREA/DOMAIN **Computing**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Recognize** basic tools and shapes of Engineering Drawing.	C-1	1
CLO-2	**Understand** Engineering Drawing tools and use its principles to represent engineering drawing models.	C-2	1
CLO-3	**Practice** Engineering Drawing principles to draw 2-D & 3D sketches using modern tools.	P-3	5

Course Outline for Lab

Mechanical Drawing: Sheet layout, free hand sketching, basic drafting techniques, drawing and lettering, dimensioning, projections and section of solids, practice of assembly drawing.
Civil Drawing: Plans, Elevations and Sections
Electrical Drawing: Electrical safety drawings, electric substation equipment layout, schematic diagrams of substations, lighting, and power distribution boards in contrast with house and industrial wiring diagrams, electrical symbols and one-line diagrams of a typical power system and its parts using all details, 2D modelling using AutoCAD, layering using AutoCAD, 3D Wireframe modelling in AutoCAD, 3D Solid modelling in AutoCAD, Helical Spring using AutoCAD, 3D Surface modeling, Open Ended Lab

Recommended Books

1. Mitchel & Spencer, "Technical Drawing" (Latest Edition)
2. Choudhry, "Elements of Workshop Technology" Volume –I. (Latest Edition)
3. Chapman, "Workshop technology" Part-I, II, & III. (Latest Edition)

Course Content

19. Electronic Devices

COURSE TITLE (ECT-213) Electronic Devices	CREDIT HOURS (2+1) 32 Theory + 16 Lab Sessions	KNOWLEDGE AREA/DOMAIN Foundation	
After completion of this course students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Explain** structure and operation of electronic devices, particularly Diodes, Bipolar Junction Transistors (BJTs), and Field-Effect Transistors (FETs).	C2	1
CLO-2	**Solve** basic electrical circuits containing Diodes, BJTs and FETs.	C3	2
CLO-3	**Investigate** the circuits containing semiconductor device to develop solutions for societal problems.	C4	6
CLO-4	**Practice** in the lab using semiconductor devices to develop sustainable solutions.	P3	7
CLO-5	**Demonstrate** the results of experiments in the form of well-written manuals and reports.	A3	9

Course Outline for Theory

Physics of semiconductor, concept of Doping, formation of P & N type semiconductor, PN junction formation, Drift & diffusion currents, Diode Characteristics curve, resistances in Diode, Ideal & practical Models, Q-point, Diode as Half wave & Full wave Rectifier, Diode Switching Circuit, introduction to Clippers, Clippers Circuits, Clampers Circuits, Bipolar Junction Transistors, Common Base Characteristics, Common Emitter Characteristics, Common collector Characteristics, Bias Circuits, BJT as inverter, Transistor types, rating & specification, Zener Diode, LED, Laser Diode, Photo & tunnel Diode, Field Effect Transistors, JFET, JFET current source, JFET Analog switch, JFET Biasing, JFET as Analog switch, Chopper, MOSFET types & configuration, Amplifier fundamentals

Course Outline for Lab

- Investigate the electrical characteristics of Diodes BJT and FET.
- Design, implementation, and measurements of electronic circuits for rectifiers
- Zener diode regulators
- Biasing in BJT and FET
- Small signal amplifiers in BJT and FET
- Operational amplifiers using lab equipment and computer simulation tools.

Recommended Books

1. Behzad Razavi, "Fundamentals of Microelectronics", Latest Edition
2. Theodore F. Bogart, Jeffrey S. Beasley, Guillermo Rico, "Electronic devices and circuits" ,6th Edition
3. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, Latest Edition.

Course Content

21. Electrical Machines

COURSE TITLE (ECT-221) **Electrical Machines**	**CREDIT HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the electrical machines to sketch their equivalent circuits, phasor diagrams, rotating magnetic fields and the relationships between different parameters.	C-2	2
CLO-2	**Illustrate** the voltage regulation, losses, and efficiency of various electrical machines.	C-3	3
CLO-3	**Simulate** different electrical machines using software.	P-3	5

Course Outline for Theory

Magnetic Circuits and Calculations. Linear DC machines. Transformers: Principle of Operation, Construction, Types, Instrumentation Transformers. DC Machines: Construction, Types, Armature Reaction, Torque Speed Characteristics, Measurement of Losses and Efficiency. AC Machines: AC Machine Armature Winding, Induced EMF. Synchronous Generator. Special Purpose Motors, Introduction to Brushless DC Motor. Switched-Reluctance Motor. Stepper Motor.

Course Outline for Lab

- Safety precaution in performance and operation of experiments
- To identify and study main parts of a DC machine
- Different Types of Connections in Dc Generators
- O.C.C of Separately Excited Dc Generator
- External characteristics of Separately Excited Dc Generator
- Characteristics of DC shunt motor
- Plotting Graph of Torque Speed Curve of a Shunt DC motor using MATLAB
- Plotting Graph of Speed(n) Vs Field Resistance (RF) of a Shunt DC Motor
- Plotting Graph of Torque Speed Curve of a Shunt DC motor using MATLAB

Recommended Books

1. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw-Hill. (Latest Edition)
2. Fitzgerald, Kingsley, and Umans, "Electric Machinery", McGraw-Hill. (Latest Edition)

Course Content

22 Technical Report Writing

COURSE TITLE (ECH-221) **Technical Report Writing**		CREDIT HOURS (3+0) **48 Theory + 0 Lab Sessions**	KNOWLEDGE AREA/ DOMAIN **Humanities**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Discuss** the basic concepts in technical writing and use of a standard word processing software along with referencing tool for report writing.	A-2	10
CLO-2	**Initiate** technically correct statements, assignments, final year project report, project proposal, short reports, research paper and business/ professional correspondence.	A-3	10

Course Outline for Theory

Introduction to technical writing, technical communication process, proposal write-up and improvement strategies, introduction to research and research types, choosing research problems and research advisors, how to carry out research, different parts of technical writing, formulation – problem statement, literature review, design – methodology, analysis - data analysis and interpretation good writing style techniques, uses of correct words, presenting and publishing research, write business/professional correspondence, cover letter and CV, writing meeting minutes, introduction to informal writing, uses of informal reports.

Recommended Books

1. Technical Report Writing Today, by Daniel Riordan, 10th Edition (or Latest Edition)
2. Technical Writing and Professional Communication, Leslie Olsen and Thomas Huckin, 2nd Edition. (or Latest Edition)
3. Communication for Engineering Students by J. W. Davies, (or Latest Edition)
4. Science Research Writing for Non-Native Speakers of English by Hilary Glasman-Deal, Imperial College Press. (Latest Edition)

Course Content

23 Instrumentations and Measurements

<table>
<tr><td colspan="2">COURSE TITLE
(ECT-222)
Instrumentations and Measurements</td><td>CREDIT HOURS
(2+1)
32 Theory + 16 Lab Sessions</td><td colspan="2">KNOWLEDGE AREA/ DOMAIN
Breadth</td></tr>
<tr><td colspan="2">After completion of this course students will be able to:</td><td>Bloom's Taxonomy Level</td><td>PLO</td></tr>
<tr><td>CLO-1</td><td>Apply the principles of measurement techniques for practical scenarios and various operations.</td><td>C-3</td><td>2</td></tr>
<tr><td>CLO-2</td><td>Apply different types of bridges for measurement of resistance inductance, and capacitance.</td><td>C-3</td><td>3</td></tr>
<tr><td>CLO-3</td><td>Operate different modern instruments for measurement of electrical quantities.</td><td>P-3</td><td>5</td></tr>
<tr><td>CLO-4</td><td>Report effectively the laboratory work including procedures, results, and conclusion of experiments.</td><td>P-4</td><td>10</td></tr>
<tr><td colspan="5">Course Outline for Theory</td></tr>
<tr><td colspan="5">Precision measurements terminologies including resolution, sensitivity, accuracy, and uncertainty; engineering units and standards. Principles of different measurement techniques; instruments for measurement of electrical properties, pressure, temperature, position, velocity, flow rates (mass and volume) and concentration; systems for signal processing and signal transmission. Modern instrumentation techniques; static and dynamic responses of instrumentation and signal conditioning; basic data manipulation skills using personal computers and graphs; data acquisition systems. Principles of operation, construction and working of different analog and digital meters, oscilloscope, recording instruments, signal generators, transducers, and other electrical and non-electrical instruments. Types of bridges for measurement of resistance, inductance, and capacitance; power and energy meters; high-voltage measurements.</td></tr>
<tr><td colspan="5">Course Outline for Lab</td></tr>
<tr><td colspan="5">• To study and become familiar with Oscilloscope.
• Conversion of galvanometer into voltmeter, ammeter, and ohmmeter.
• Measurement of Self-Inductance by Three Ammeter Method, Measurement of Capacitance by Three Voltmeter Method.
• Wheatstone bridge, Kelvin bridge, Maxwell Bridge, Hay Bridge, Schering Bridge, Wien Bridge.
• LDR & RTD, Ultrasonic Sensor.
• Electronic Wattmeter & Energy Meter.</td></tr>
<tr><td colspan="5">Recommended Books</td></tr>
<tr><td colspan="5">1. Klaas B. Klaassen and Steve Gee, "Electronic Measurement and Instrumentation," Cambridge University Press, 1996, ISBN: 0521477298.
2. David A. Bell "Electronic Instrumentation and Measurements", 3rd Edition.</td></tr>
</table>

Course Content

24 Amplifiers and Oscillators

COURSE TITLE (ECT-223) **Amplifiers and Oscillators**	**CREDIT HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** the various amplifiers circuits to determine voltage/current gains, input/output impedance, efficiency/losses, loading effects.	C-4	2
CLO-2	**Design** the typical multistage amplifiers and oscillators.	C-6	3
CLO-3	**Evaluate** the performance of amplifiers and oscillators in laboratory.	P-4	4

Course Outline for Theory

Classification of Amplifiers based on Biasing, Class A Amplifier, Class B Amplifier, Class AB Amplifier, Class C Amplifier. Push-Pull Amplifier, and Complementary Symmetry Amplifier; Classification of Amplifiers Voltage. Feedback Amplifier, Current Feedback Amplifier, Effect of Feedback on Frequency Response. Practical Amplifier Considerations: Input and Output Impedance, Amplifier Loading, Impedance Matching. Oscillators: Basic Theory, Tank Circuit, Damped and Un-damped Oscillations.

Course Outline for Lab

- Introduction to development of all types of Amplifiers.
- Implementation of amplifiers to different applications.
- Introduction to development of all types of Oscillators.
- Implementation of Oscillators to different applications.

Recommended Books

1. Thomas Floyd, (2009) "Electronics Fundamentals: Circuits, Devices, and Applications," 8th Edition, Prentice Hall, ISBN: 0131111388.
2. Donald A. Neaman, (2006), "Electronic Circuits Analysis and Design", Third Edition, ISBN: 9780070634336
3. TF Bogart, "Electronic devices and circuits", Prentice Hall International Inc.

Course Content

25 Microprocessors and Microcontrollers

COURSE TITLE (ECT-224) **Microprocessors and Microcontrollers**	**CREDIT HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the architecture of microcontroller and its assembly instructions.	C-2	1
CLO-2	**Understand** built-in I/O's micro-controller.	C-3	2
CLO-3	**Practice** and program microcontroller-based circuits.	P-3	3
CLO-4	**Report** the outcome of an experiment/task.	A-3	10
CLO-5	**Report** effectively the laboratory work including procedures results, and conclusion of experiments.	P-4	10

Course Outline for Theory

Introduction to Intel family microprocessors, instruction set architecture (ISA). Assembly Language Programming, hardware model, read/write cycles, exception/interrupt processing, I/O devices, DMA, interfacing to memory and I/O devices. Introduction to PIC/Atmel 8051.

Introduction to microcontrollers; architecture and programming, Arithmetic Instructions, Logic Instructions, Program Control Instructions, Introduction to Interrupts

Course Outline for Lab

- Introduction to development kit of any microcontroller
- Development of different applications on microcontroller kit.
- Learn to read datasheets/manuals in order to develop practical applications.
- Assembly and C language-based microcontroller (PIC or Raspberry Pi)
- Interfacing for interrupt and data-based applications involving LED/ LCD, GPIO ports, communication ports, A/D, and D/A interfacing.
- Project can be input voltage-based speed control of DC Motor / stepper motor using PWM.

Recommended Books

1. Douglas V. Hall, "Microprocessor and Interfacing", Tata McGraw-Hill. (Latest edition)
2. Mazidi, Books on microcontroller. (Latest edition)

Course Content
26 Signals and Systems

COURSE TITLE (ECT-225) **Signals and Systems**		CREDIT HOURS (0+1) **0 Theory + 16 Lab Sessions**	KNOWLEDGE AREA/DOMAIN **Foundation**
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** different mathematical tools to classify different types of signals to design engineering alternatives.	C2	3
CLO-2	**Relate** the basics of signals and systems with real life scenarios to understand their hands on applications.	P1	2
CLO-3	**Explain** the different transformation techniques to understand the signals in different domains.	P2	2

Course Outline for Lab

Continuous-time and discrete-time signals; commonly encountered signals; unit impulse and unit step functions; sampling and aliasing; continuous-time and discrete-time systems; basic properties. Linear Time-Invariant Systems, The convolution sum; the convolution integral; properties; difference and differential equations. Fourier Series Representation of Periodic Signals, Continuous and discrete-time periodic signals; properties of continuous and discrete-time Fourier series; Fourier series and LTI systems. Continuous-Time Fourier Transform, Properties; convolution and multiplication properties. Discrete-Time Fourier Transform, Properties; convolution and multiplication properties. Laplace Transform, Region of convergence; inverse Laplace transform; properties; analysis of LTI systems using the Laplace transform. z-Transform, Region of convergence; inverse z-transform; properties; analysis of LTI systems using the z-transform.

Recommended Books

1. A Oppenheim, A Willsky and H Nawab, "Signals and Systems" Pearson, Edition 2nd
2. Simon Haykin and Barry Van Veen, "Signals and Systems" Wiley, Edition 2nd

Course Content
27 Communication Systems

COURSE TITLE (ECT-311) **Communication Systems**	**CREDIT HOURS** (1+1) **16 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the fundamental concepts of analog and digital communication systems.	C-1	1
CLO-2	**Illustrate** various types of analog and digital modulation and demodulation techniques and their properties, including bandwidth, channel capacity, transmission techniques.	C-2	3
CLO-3	**Demonstrate** the waveforms of modulation/demodulation techniques in time/frequency domain and error performance in the presence of noise in both time and frequency domain.	C-3	5
CLO-4	**Realize** a hardware project by incorporating theoretical knowledge and practical skill.	P-3	3
CLO-5	**Explain** various analog and digital modulation and demodulation techniques by applying simulation tool.	P-2	5

Course Outline for Theory

Basic definitions; modulation and de-modulation techniques: amplitude, angle, pulse modulation, digital modulation techniques.

Information theory; error detection and correction.

Multiplexing techniques; noise and its effects on signal transmission; BER performance of various modulation techniques under noisy environment.

Course Outline for Lab

- Amplitude Modulation: Baseband and carrier communications, Double Sideband (DSB), Single Sideband (SSB), Vestigial Sideband (VSB), Super-heterodyne AM Receiver, Carrier Acquisition.
- Television Angle Modulation: Instantaneous frequency, Bandwidth of FM/PM, Generation of FM/PM, Demodulation of FM/PM Noise
- Mathematical representation, Signal to Noise Ratio, Noise in AM, FM, and PM systems Pulse Modulation
- Sampling and Quantization, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, Quantization Noise, Signal to Quantization Noise Ratio, Pulse code Modulation, Delta Modulation, Frequency Shift Keying, Phase Shift Keying.

Recommended Books

1. B. P. Lathi, (2009) "Modern Digital and Analog Communication Systems," 4th Edition, Oxford University Press, ISBN: 0195110099.
2. Leon W. Couch, (2012) "Digital and Analog Communication Systems," 8th Edition, Prentice Hall, ISBN: 0131424920.

Course Content
28 Control Systems

COURSE TITLE (ECT-312) Control Systems	CREDIT HOURS (2+1) 32 Theory + 16 Lab Sessions	KNOWLEDGE AREA/DOMAIN Breadth	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Illustrate** and develop a mathematical model of electrical and mechanical systems and understand the block diagram representation and signal flow graph techniques.	C-2	3
CLO-2	**Analyze** stability of Linear Time Invariant systems using stability tools. E.g., Routh Hurwitz Criteria, Bode etc.	C-4	4
CLO-3	**Analyze** industrial applications of control technology, having servo mechanism and PID controller familiarization.	C-4	2
CLO-4	**Use** MATLAB Simulink to evaluate various control blocks outputs	P-3	5

Course Outline for Theory

Introduction to control systems; open-loop and closed-loop systems.
Transfer functions; block diagrams, signal flow graphs.
Introduction to modeling; formation of differential equations of electrical, mechanical, and other systems, transfer functions.
Stability; Routh's stability criterion, types, and analysis of feedback control systems; root locus, transfer function matrices; PID controllers and compensators.

Course Outline for Lab

- Using MATLAB for control systems
- Modelling of physical systems, linear control system modelling
- LTI Systems
- First & Second Order system response, Nyquist Criteria, Root-Locus & Bode plots
- PI, PD and PID controllers
- Servo motor control

Recommended Books

1. Katsuhiko Ogata, (2009) "Modern Control Engineering," 5th Edition, Prentice Hall, ISBN: 0130609072.
2. Constantine H. Houpis and Stuart N. Sheldon, (2013), "Linear Control System Analysis and Design with MATLAB", Sixth Edition, ISBN-13: 978-1466504264

Course Content

29 Numerical Analysis

COURSE CODE & TITLE (ECN-311) Numerical Analysis	CREDIT & CONTACT HOURS (2+1) 32 Theory + 16 Lab Sessions	KNOWLEDGE AREA/ DOMAIN Natural Science-I	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** different numerical techniques such as: error propagation, interpolation, differentiation, integration, eigenvalues, and solution of algebraic and differential equations.	C-2	1
CLO-2	**Apply** numerical techniques to different linear and nonlinear problems.	C-3	2
CLO-3	**Apply** proper software tools and techniques of MATLAB Programming for developing numerical computation solutions.	P-3	5

Course Outline for Theory

Mathematical preliminaries and error analysis, round- off errors and computer arithmetic, Divided Differences, use of Divided-difference Table. Newton's Interpolation Polynomial, Interpolation with Equally Spaced Data, Newton's Forward & Backward Difference Formulae, Gauss Formulae, Stirling's Interpolation Formula, Bessel's Interpolation Formula, Solution of Nonlinear Equations by Bisection Method, Regula Falsi, Secant, Newton-Raphson Method, Fixed Point Iteration. Solution of Equations by Jacobi Iterative Methods, Gauss Seidel Method. Numerical Differentiation, Numerical Differentiation Formulae Based on Equally Spaced Data. Numerical Differentiation Based on Newton's Forward Differences. Numerical Differentiation Based on Newton's Backward Differences. Numerical Differentiation Based on Stirling's Formula. Numerical Differentiation Based on Bessel's Formula. Numerical Differentiation Based on Lagrange's Formula. Factorization for Linear System.

Lab Outlines

Introduction to MATLAB. Newton Raphson & Bisection Method. False Position & Secant Method. Linear system of equations. Extreme Value Theorem. Gauss Elimination method with backward substitution. LU Factorization for Linear System. Crout factorization of Tridiagonal Linear System S. Jacobi Method of solving linear systems. Gauss Siedel Method of solving linear systems and Lagrange's interpolation. Newton's Divided Difference Interpolation Method. Natural Cubic Spline Method. Open-ended Lab.

Recommended Books

1. Numerical Analysis by Richard L.Burden, J. Douglas Faires by Brooks/ Cole Boston USA, (Latest Edition)
2. Numerical Methods for Scientific Computing by J.H. Heinbockel Trafford Publishing USA, (Latest Edition)
3. Applied Numerical Analysis, by C. F. Gerald and P. O. Wheatley, (Latest Edition)
4. Numerical Methods Using MATLAB by John H. Mathews and Kurtis D. Fink, (Latest Edition)
5. Numerical Mathematics and Computing by W. Cheney and D. Kincaid, (Latest Edition)
6. E. Kreyszig, Advanced Engineering Mathematics, 9th edition, Wiley, (Latest Edition)
7. A. Greenbaum & T. P. Chartier, Numerical Methods, Princeton University Press, (Latest Edition)

D. P. O'Leary, Scientific Computing with Case Studies, SIAM, (Latest Edition)

Course Content

30 Project Management

COURSE TITLE (ECM-311) **Project Management**	**CREDIT HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/DOMAIN** **Management Science Elective**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** and understand the basic concepts of management with a special focus on project management.	A-1	11
CLO-2	**Demonstrate** competency in various project management knowledge areas, project scheduling and controlling techniques including Critical Path Method and Earned Value Management.	A-3	11
CLO-3	**Use** computers in Project Management, especially a tool like MS Project & Primavera etc.	C-3	5

Course Outline for Theory

- Introduction to management: History of management, functions and functional areas of management, levels of management, managerial skills, types of organizations, managerial control, principles of management.
- Introduction to Project Management: Definition of Project and project management, knowledge areas of project management, project life cycle, project characteristics, project constraints, project organization structure.
- Project Quality Management: History of Quality Management, Defining Quality, relationship between project management and quality management, Quality Management Frameworks
- Project Stakeholder Management: The roles of project manager and project sponsor, Project team selection, skills and competencies of project manager, building and managing successful project teams, stakeholder management.
- Project Cost estimating and Budgeting: Cost components and methods for cost estimation in projects, cost control in projects, life cycle cost, cost scheduling and forecasting, project resource allocation and levelling, Estimation of outstanding work, elements of budgets and estimates, earned value management.
- Project Risk Management: Defining risk and uncertainty, business and project risk, probability and impact of risk, risk management process.
- Project Time Management: Introduction to project scheduling, Critical Path Method, Network representation of projects, critical activities, and critical path, project Gantt chart.
- Project Closure: Project evaluation, project and project management success, success criteria for projects, project audits, project termination process.
- Project Management tool: Introduction and use of project management tools like MS project and primavera.

Recommended Books

1. A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute (Latest Edition)
2. Project Management: A Systems Approach – A Book Review, Harold Kerzner, ISBN-10: 1118022270; ISBN-13: 978-1118022276 (Latest Edition)

Course Content

31 Industrial Electronics

COURSE TITLE (ECT-312) Industrial Electronics	CREDIT HOURS (2+1) 32 Theory + 16 Lab Sessions	KNOWLEDGE AREA/DOMAIN Depth	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** the working principles of different electric heating techniques and sensors to measure non-electrical quantities used in the industry.	C4	2
CLO-2	**Employ** different techniques to control industrial processes using ladder logic diagram, wiring diagram, PLC, and SCADA systems.	P5	5
CLO-3	**Develop** an industrial application-oriented project by adopting the concepts learned from industrial electronics.	P1	3
CLO-4	**Examine** the health and safety issues in the electronic industry and ways to cope with it using proactive approach.	C4	6

Course Outline for Theory

Electric heating: Principles and applications; induction and dielectric heating; high-frequency welding. Spot welding control, Industrial control: Speed control of DC, AC, and servo motors. Process control. Measurement of non-electrical quantities: Temperature, displacement, pressure, time, frequency; digital industrial measuring systems, Ultrasonic generation, and applications. X-ray applications in industry. Photo-electric devices, Industrial control using PLCs. Data acquisition. Distributed control system in process industries, Industrial safety, and its techniques to avoid any hazard using proactive approach

Course Outline for Lab

- Experiments related to the principles of welding, electric heating, PLCs
- speed control of DC, AC, and servo motors
- Industrial safety guidelines and its inspection
- Industrial automation
- industrial measurement systems
- Industrial-oriented projects by adopting the concepts learned from electronics
- ladder logic diagram, wiring diagram, and PLC and SCADA system.

Recommended Books

1. Frank D. Petruzella, "Programmable Logic Controllers," McGraw-Hill, ISBN: 0078298520.
2. Frank D. Petruzella, "Industrial Electronics," McGraw-Hill, ISBN: 0028019962
3. Programmable Logic Controllers Frank D. Petruzella
4. Industrial Electronics Frank D. Petruzella
5. Principles of Industrial Instrumentation Patranabis. D

Course Content

33 Power Electronics

COURSE TITLE (ECT-321) **Power Electronics**	**CREDIT HOURS** (2+1) **32 Theory + 16 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN** **Breadth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** different types of AC-DC, DC-DC, DC-AC, and AC-AC converters under different loading conditions.	C-4	3
CLO-2	**Design** power electronics converters for modern societal applications.	C-5	4
CLO-3	O**perate** power electronics trainer and apply MATLAB for the analysis and design of converters.	P5	5

Course Outline for Theory

Introduction to power electronics; solid-state devices used in power electronics: power diode. Power BJT, power MOSFET, SCR, GTO, GBT, TRIAC, DIAC. Semi controlled, fully-controlled and uncontrolled rectifiers: single-phase and three-phase, six-pulse, twelve-pulse and twenty-four pulse rectifiers. Single-phase and three-phase inverters;44 pulse-width-modulated (PWM) inverters. UPS; types of converters; switched mode power supplies, AC and DC motor drives.

Course Outline for Lab

- Controlled and Uncontrolled Rectifiers
- TRIAC Characteristics
- SCR Characteristics
- Single Phase Controlled rectifiers
- 3 Phase Controlled rectifiers
- Buck Converter
- First Quadrant Chopper (DC Motor Speed Control)
- AC Power Control Using TRIAC-DIAC Combination
- PWM Inverter.

Recommended Books

1. Cyril W. Lander, (1994) "Power Electronics," Third Edition, McGraw-Hill UK, ISBN: 0077077148.
2. Muhammad H. Rashid, (1993) "Power Electronics: Circuits, Devices and Applications," 4th Edition, Prentice Hall, ISBN: 0131011405.

Course Content

34 Industrial Automation

COURSE TITLE (ECT-322) **Industrial Automation**	CREDIT HOURS (1+1) **16 Theory + 16 Lab Sessions**	KNOWLEDGE AREA/DOMAIN Depth	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** the controller for automation and prototyping to understand industrial automation to improve productivity.	C4	2
CLO-2	**Identify** fundamental issues within sustainable industrial development from an automation perspective and be able to exemplify the consequences.	C5	5
CLO-3	**Design** different types of prototypes of automation /robots on LabVIEW according to their usage and specifications.	P2	3

Course Outline for Theory

Introduction to Industrial Automation, architecture of industrial automation. Measurement system specifications, industrial measurement. Temperature sensors, Pressure and Force Sensors, hydraulic, proximity, infrared, light, ultrasonic and radiation sensors. Analog to Digital conversion of sensor output. control of dc and ac motors, stepper motor control, servo motors control, position control friction, backlash and resilience machine tool control, remote position control; process control, pneumatic controllers. Flow and level Sensors. Programmable Logic Control Systems and their evolution, Architecture of PLC. Architecture of PLC. PLC programming languages. PLC software environment+ Ladder programming Introduction. PLC software environment+ Ladder programming Introduction. Ladder programming Instruction Set. Ladder programming Instruction Set. Ladder programming of practical scenarios.
Industrial Motor Control Circuits. Industrial safety standards. SCADA

Course Outline for Lab

- Measurement system specifications, industrial measurement.
- Temperature sensors, Pressure and Force Sensors
- hydraulic, proximity, infrared, light, ultrasonic and radiation sensors.
- Analog to Digital conversion of sensor output.
- control of dc and ac motors
- stepper motor control
- servo motors control
- position control friction
- backlash and resilience machine tool control
- remote position control
- process control, pneumatic controllers
- Flow and level Sensors
- Programmable Logic Control Systems and their evolution
- Architecture of PLC. Architecture of PLC
- PLC programming languages
- PLC software environment+ Ladder programming Introduction
- PLC software environment+ Ladder programming Introduction
- Ladder programming Instruction Set.
- Ladder programming Instruction Set

Recommended Books
1. Automation, Production Systems & Computer Integrated Manufacturing, Miikell P. Goover 2. R.R. Hunter, “Automated process control systems”, Prentice Hall Inc. 3. N.M. Morris, “Control Engineering”, Mc-Graw-Hill.

Course Content

35 VLSI Technology

COURSE TITLE (ECT-323) VLSI Technology	CREDIT HOURS (2+1) 32 Theory + 16 Lab Sessions	KNOWLEDGE AREA/DOMAIN Depth	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** the general concept of VLSI Technology methodologies.	C2	1
CLO-2	**Identify** and formulate different types of VLSI Front-End/Back-End techniques.	C3	2
CLO-3	**Analyze** different solutions for Front-End/Back-End IC problems.	C4	2
CLO-4	**Report** effectively the laboratory work including procedures, results, and conclusion of experiments**.**	P-4	10
CLO-5	**Apply** the basic Front-End IC design problems to manage the lab project.	A-4	11

Course Outline for Theory

Review of Integrated Electronics. Basic terminologies, size and complexities, overview of IC design process, economics, yield, trends in VLSI technology, Integrated Circuit Technology. IC production process, semiconductor processes, design rules and process parameters, layout techniques and practical considerations, Modes of Transistor, Device Modelling. Small signal model, diode model, BJT model, MOS models, passive component models (monolithic capacitors and resistors). DC characteristics of CMOS Inverter, Noise Margin, Introduction to Static & Dynamic Logic Circuits, Structural & Behavioural Modelling of Combinational & Sequential Logic Circuits with VHDL/Verilog language

Course Outline for Lab

- Introduction to SPICE, DSCH & MICROWIND
- Implementation of CMOS gates Schematic using DSCH
- pn-Junction, MOSFET modeling and simulation
- BJT Modeling, BJT Noise Modeling
- Implementation of CMOS Basic gates Layout using MICROWIND
- Structural & Behavioral Modeling of Combinational & Sequential simple Logic Circuits with VHDL/Verilog language

Recommended Books

1. Digital Integrated Circuits, Jan M. Rabaey, A. Chandrakasan, Borivoje Nikolic, Pearson Publisher
2. CMOS VLSI Design: A Circuits & Systems Perspective by N. Weste, David Harris, Pearson Publisher
3. VLSI Design Circuit Methodology, Liming Xiu
4. Digital Design & Fabrication, V. G. Oklobdzija
5. S.M. Kang & Y. Leblibici, "CMOS Digital Integrated Circuits-Analysis & Design", TMH, Ed. 2003.
6. B.G. Streetman & S. Banerjee, "Solid State Electronic Devices", PHI.
7. K. Eshraghian & Pucknell, "Introduction to VLSI", PHI.
8. B. Razavi, "Design of Analog CMOS Integrated Circuits", TMH.
9. N.H.E. Weste & K. Eshraghian, "Principles of CMOS VLSI Design: A System Perspective", McGraw Hill Pub.
10. Zainalabedin Navabi, "Verilog Computer-Based Training Course", McGraw-Hill.

Course Content

36 Integrated Circuits Fabrication (Elective-I)

COURSE TITLE (ECT-324) **Integrated Circuits Fabrications**	**CREDIT HOURS** (1+0) **16 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/DOMAIN** **Depth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Know** about the general concept of Silicon wafer processing methods.	C2	1
CLO-2	**Understand** different methods of IC fabrication processing steps and environment of clean room.	C2	2

Course Outline for Theory

Introduction to Silicon Wafer Processes such as Raw Materials & Purification, CZ & FZ Crystal Growth Methods to develop Ingot tube, Liquid-Encapsulated Czochralski GaAs Growth, Wafer & Die Preparation methods, Cleaning steps, Clean room, Common airborne contaminants, Containment Reduction: Level 1, 2 & 3, IC Fabrication Processes: Epitaxy, Oxidation, Lithography, Etching, Diffusion, Ion Implantation, Film Deposition, Packaging, VLSI Process Integration

Recommended Books

1. Silicon VLSI Technology, Fundamentals, Practice & Modeling, James D. Plummer, M.D.Deal, P. B. Griffin, Pearson Publisher, ISDN: 978-81-317-2604-4
2. Introduction to Semiconductor Manufacturing Technology, Hong Xiao, SPIE digital library
3. IC Fabrication technology, Gouranga Bose,
4. Semiconductor Devices, Kannaan Kano, Prentice Hall Publisher, ISBN:81-203-2877-9

Course Content

37 Electromagnetic Field Theory (Elective-II)

COURSE TITLE (ECT-325) **Electromagnetic Field Theory**	**CREDIT HOURS** (1+0) **16 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/DOMAIN** **Depth**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the basic vector algebra and calculus, orthonormal and non-orthonormal coordinate systems, introduces the concepts of gradients, divergence, and curl operations.	C2	1
CLO-2	**Analyze** the theory of magnetostatics in general and apply them in various situations.	C4	2
Course Outline for Theory			
Vector algebra, coordinate systems and transformations, Vector calculus, electrostatic fields in materials, electrostatic boundary value problems, resistance, and capacitance calculation. Magneto-static fields, magneto-static fields and materials, inductance calculation. Faraday's Law, displacement current and Maxwell's equation.			
Recommended Books			
1. William Hayt and John A. Buck, "Engineering Electromagnetics", McGraw-Hill, ISBN: 0073104639, Latest Edition. 2. Sadiku, Matthew N, "Elements of Electromagnetics", Oxford University Press, ISBN: 0195103688, Latest Edition. 3. J. D. Kraus, "Electromagnetics", John Wiley & Sons, Latest edition. 4. David K. Cheng, "Fundamentals of Engineering Electromagnetics", Addison Wesley			

Course Content

38 Critical Thinking

COURSE TITLE (ECS-321) **Critical Thinking**	**CREDIT HOURS** (3+0) **48 Theory + 0 Lab Sessions**	**KNOWLEDGE AREA/ DOMAIN Social Sciences**	
After completion of this course students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Use** critical thinking skills when making business decisions and react with curiosity instead of emotion.	C-1	12
CLO-2	**Choose** the right techniques to recognize assumptions and draw conclusions.	C-3	12
CLO-3	**Translate** an abstract idea into something tangible.	P-4	12

Course Outline for Theory

Understanding Critical Thinking: What is Critical Thinking, Characteristics of a Critical Thinker, Common Critical Thinking Styles Making Connections, Left- and Right-Brain Thinking, and Whole-Brain Thinking, The Critical Thinking Process: The Critical Thinking Model, the Standards of Critical Thinking, Identifying the Issues, Identifying the Arguments, Clarifying the Issues and Arguments, Establishing Context, Checking Credibility and Consistency, Evaluating Arguments, Case Study, Developing Critical Thinking Skills: Asking Questions, Probing Techniques, Pushing My Buttons, Critical Thinking Questions, Active Listening Skills, challenging assumptions, Creating Explanations: Defining Explanations, Steps to Building an Explanation, Making Connections, Creative Thinking Techniques: Brainstorming, imagining the opposite, Mind mapping, DeBono's thinking Hats, Techniques for Thinking Creatively, Creative Thinking Exercise, Presenting and communicating your ideas to others.

Recommended Books

1. Diestler, Sherry. Becoming a Critical Thinker. New Jersey: Prentice Hall, (Latest Edition)
2. Browne, M. Neil, and Stuart M. Keeley. Asking The Right Questions. New Jersey: Prentice Hall, (Latest Edition)