Complete Course Grid and Syllabus

Diploma in Electronics and Instrumentation Engineering

Assam Energy Institute, Sivasagar

Course: Diploma in Electronics and Instrumentation Engineering

Total Number of Credits: 343

SEMESTER I					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
MA101	Mathematics-I	3	1	0	11
PY101	Physics-I	3	1	0	11
CY101	Chemistry-I	2	1	0	8
ME101	Engineering Mechanics	2	1	0	8
CS101	Fundamentals of Computer Engineering	2	0	2	8
ME103L	Engineering Workshop Practices Laboratory	0	0	3	3
CY101L	Chemistry Laboratory	0	0	2	2
Total					**51**
HU101	Universal Human Values	1	1	0	5
HU102	Communication Skills*	2	0	1	7
*For selective students with less proficiency in English					

SEMESTER II					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
MA102	Mathematics-II	3	1	0	11
PY102	Physics-II	3	1	0	11
CY102	Chemistry-II	3	0	0	9
EIE101	Fundamentals of Electrical and Electronics Engineering	3	1	0	11
CS102	Computer Programming	2	0	2	8
ME102L	Engineering Drawing	0	0	3	3
PY101L	Physics Laboratory	0	0	2	2
EIE101L	Fundamentals of Electrical and Electronics Engineering Laboratory	0	0	2	2
Total					**57**
HU103	Community Internship	1	1	0	5

SEMESTER III					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
EIE201	Digital Electronics	3	1	0	11
EIE202	Analog Electronics	3	1	0	11
ME 203	Material Science and Engineering	3	0	0	9
EIE203	Instrumentation and Transducers	3	1	0	11
MA201	Transform Calculus	3	1	0	11
EIE201L	Digital Electronics Laboratory	0	0	2	2
EIE202L	Analog Electronics Laboratory	0	0	2	2
EIE204	Group Discussion	0	0	2	2
Total					**59**

SEMESTER IV					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
EIE205	Electronic Circuits	3	1	0	11
EIE206	Linear Integrated Circuits	3	1	0	11
EIE207	Basics of Control System	3	1	0	11
EIE208	Electronic Instruments and Measurements	3	0	0	9
EIE209	Principles of Communication Engineering	3	0	0	9
EIE206L	Linear Integrated Circuits Laboratory	0	0	2	2
EIE208L	Electronic Instruments and Measurements Laboratory	0	0	2	2
EIE210	Project	0	0	5	5
EIE211	Seminar	0	0	2	2
Total					**62**

SEMESTER V					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
EIE301	Microprocessors and Applications	3	1	0	11
EIE302	Power Electronics	3	1	0	11
EIE303	Industrial Process Control and Instrumentation	3	0	0	9
HU301	Humanities	2	0	0	6
HU302	Engineering Economics	2	1	0	8
EIE301L	Microprocessors and Applications Laboratory	0	0	2	2
EIE302L	Power Electronics Laboratory	0	0	2	2
EIE304	Project	0	0	5	5
EIE305	Industrial Training	0	0	5	5
Total					**59**

SEMESTER VI					
Course Code	**Subjects**	**L**	**T**	**P**	**Credits**
EIE306	Computer aided PCB Design	3	1	0	11
EIE307	Industrial Automation	3	1	0	11
EIE308	Embedded System and Programming	3	1	0	11
	Departmental Elective	3	0	0	9
	Open Elective	3	0	0	9
EIE306L	Computer aided PCB Design and PLC Laboratory	0	0	2	2
EIE308L	Embedded System and Programming Laboratory	0	0	2	2
Total					**55**

Department Elective/Open Elective	
EIE309	Biomedical Electronics & Instrumentation
EIE310	Electrical Safety
EIE311	Troubleshooting of Electronic Equipment
EIE312	Solar Power System
EIE313	Industrial Electrical Systems

Category	Diploma in Electronics and Instrumentation Engineering	Credits
HU	Humanities and Social Science	31
MA	Mathematics	33
PY	Physics	24
CY	Chemistry	19
	Institute Requirement Engineering	46
	Engineering Drawing (Manual and Computer Aided), Manufacturing Practices and Practice course of Department	6
EIE	Departmental Core	164
	Departmental Elective	9
	Open Elective	9
	Project/ Industrial visit/ Training/Seminar/Group Discussion	19
Total		**360**

Institute Requirement Engineering				
Course Code	**Subjects**	**Semester**		**Credits**
		Odd	**Even**	
ME101	Engineering Mechanics	Odd		8
CS101	Fundamentals of Computer Engineering	Odd		8
EIE101	Fundamentals of Electrical and Electronics Engineering		Even	11
CS102	Computer Programming		Even	8
EIE101L	Fundamentals of Electrical and Electronics Engineering Laboratory		Even	2
ME203	Material Science and Engineering	Odd		9
Total				**46**

Engineering Drawing and Engineering Workshop Practices Course of Department				
Course Code	**Subjects**	**Semester**		**Credits**
		Odd	**Even**	
ME103L	Engineering Workshop Practices Laboratory	Odd		3
ME102L	Engineering Drawing		Even	3
Total				**6**

Syllabus

Semester I

Mathematics-I

1.1 Course Number: MA101
1.2 Contact Hours:3-1-0 Credits:11
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dr. Rupjit Saikia & Dr. Satish Kumar Tiwari

2. Objective:

This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Co-ordinate Geometry, Complex Numbers, Differential Calculus and Vector Algebra.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Trigonometry**	Concept of angle; Measurement of angle in degree, grades and radians and their conversions; Trigonometric ratios; Sum, difference formulae and their applications (Without proof); Product formula (Transformation of Product to Sum and Differences and vice versa); Trigonometric Ratios of multiple angles, sub-multiple angles (2A,3A, A/2); Graph of sinx, cosx, tanx, cosecx, secx and cotx., Basic concept of inverse trigonometric functions.	8
2	**Co-ordinate Geometry**	Equation of straight line in various standard form (Without Proof); Intersection of two straight lines Angle between two straight lines; Parallel lines and perpendicular lines; Perpendicular distance formula Sections of a cone: Circle, Parabola, Ellipse and Hyperbola; General equation of a circle and its characteristics; Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations (without proof).	8
3	**Complex Numbers**	Definition of Complex numbers; Real and imaginary parts of a Complex number; Conjugate of a complex number; Modulus and amplitude of a complex number; Addition, Subtraction, Multiplication and Division of complex numbers, Polar and Cartesian form of a complex number and its conversion from one	7

		form to other, De-Movier's theorem and its application.	
4	**Differential Calculus**	Definition of function; Concept of limits; Four standard limits $\lim_{x\to a}\frac{x^n-a^n}{x-a}, \lim_{x\to 0}\frac{\sin x}{x}, \lim_{x\to 0}\frac{a^x-1}{x}$ *and* $\lim_{x\to 0}(1+x)^{1/x}$, Differentiation of $x^n, \sin x, \cos x, e^x$ *and* $\log_a x$ by the first principle rule of derivative, Differentiation of sum, product and quotient of functions; Differentiation of function of a function; Differentiation of trigonometric and inverse trigonometric functions; Logarithmic differentiation; Exponential functions.Definition & meaning of partial derivative. Evaluation of partial derivatives. Definition & examples of homogeneous functions. Euler's theorem (1st order) on Homogeneous functions for 2 variables (without proof). Problems.	12
5	**Vector Algebra**	Definition, notation and rectangular resolution of a vector; Addition and subtraction of vectors; Scalar and vector products of 2 vectors; Simple problems related to work; moment and angular velocity.	6
	Total		**41**

4. Reading

4.1 Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40th Edition, 2007.
2. Mathematics Textbook for Class XI and XII (NCERT).
3. S. L. Loney, The Elements of Coordinate Geometry Part-1 Cartesian Coordinate.

4.2 Reference Books:

1. R. D. Sharma, Mathematics for Class 11and 12.
2. E. Kreyszig, Advanced Engineering Mathematics, Khanna Publisher.
3. Murray R. Spiegel, Robert E. Moyer, College Algebra, Tata McGraw Hill, New Delhi, 2nd Edition, 2000.
4. Frank Ayers, Elliot Mendelson, Calculus, McGraw Hill, New York, 4th Edition.

5. Outcome of the Course:

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

1) Solve problems involving angles, triangles, and periodic phenomena using trigonometric functions. Apply trigonometry in real-world situations, such as navigation, physics, and engineering
2) Understand the cartesian coordinate system and the relationship between points, lines, and curves. Represent geometric figures using equations and inequalities.
3) Understand the concept of a derivative as the rate of change and slope of a function.
4) Apply complex numbers in solving equations and expressing solutions.
5) Understand the geometric and algebraic properties of vectors.

Physics-I

1.1 Course Number: PY101
1.2Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 1st Year - Odd
1.4 Prerequisite: Class 10th level Physics and Mathematics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Physics is the mother of all engineering disciplines hence students must have a fundamental understanding of the topic in order to grasp their core engineering diploma subjects more readily. As a result, while reviewing the curriculum, emphasis was placed on the concepts, laws, working equations, and basic notions of physics to assist students in studying the key courses. This will give a solid foundation for future self-development in order to cope with new advances.
ii) The course material places a strong emphasis on the practical application of physical concepts and analysis in a variety of engineering and technological sectors.
iii) The course will assist diploma engineers in using fundamental ideas and principles to tackle complex engineering issues and comprehend various technology-based applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Units and Measurements**	Physical quantities: Fundamental and derived, Units and systems of units (FPS, CGS and SI units), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis. Measurements: Need, Measuring instruments, Least count, Types of measurement (direct and indirect), Errors in measurements (systematic and random), Absolute error, Relative error, Error propagation, Error estimation and significant figures.	8
2	**Scalars and Vectors**	Scalar and Vector quantities: Examples, Representation of vectors, Types of vectors, Addition and Subtraction of Vectors, Triangle and Parallelogram law, Scalar and Vector product,	7

		Resolution of a vector and its application to inclined plane. Kinematics equations in scalar and vector form with related numerical problems.	
3	**Force and Motion**	Force, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, Rockets, Impulse and its applications. Circular motion, Angular displacement, Angular velocity, Angular acceleration, Frequency, Time period, Relation between linear and angular velocity, Linear acceleration and angular acceleration (related numerical),Centripetal and centrifugal forces with live examples. Moment of inertia and its physical significance, Definition of torque and angular momentum and their examples.	8
4	**Work, Power and Energy**	Work: Concept and unit, Examples of zero work, Positive work and negative work. Friction: Concept, Types of friction, Laws of limiting friction, Coefficient of friction, Reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane (for rough and smooth surfaces) and related applications. Energy and its unit, Kinetic energy, Gravitational potential energy with examples and derivations, Mechanical energy, Conservation of mechanical energy for freely falling bodies, Transformation of energy (examples). Power and its unit, Power and work relationship, Calculation of power (numerical problems).	7
5	**Properties of Matter**	Elasticity: Definition of stress and strain, Moduli of elasticity, Hooke's law, Significance of stress-strain curve. Pressure: Definition, Unit, Atmospheric pressure, Gauge pressure, Absolute pressure, Fortin'sBarometer and its applications. Surface tension: Concept, Unit, Cohesive and adhesive forces, Angle of contact, Ascent Formula, Applications of surface tension, Effect of temperature and impurity on surface tension. Viscosity and coefficient of viscosity, Terminal velocity, Stokes' law and effect of temperature on viscosity, Application in hydraulic systems. Hydrodynamics: Fluid motion, Streamline and turbulent flow,	12

		Reynold's number, Equation of continuity, Bernoulli's Theorem (formulae and numerical problems) and its applications.	
Total			**42**

4. Readings

4.1 Textbooks:

1. Textbook of Physics for Class XI (Part-1, Part-2); N.C.E.R.T., Delhi.

4.2 Reference Books:

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
2. Concepts in Physics by H. C. Verma, Vol. I&II, Bharti Bhawan Ltd., New Delhi.
3. Engineering Physics by P. V. Naik, Pearson Education Pvt. Ltd, New Delhi.
4. Engineering Physics by D. K. Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi.
5. Comprehensive Practical Physics, Vol, I & II, J. N. Jaiswal, Laxmi Publications (P) Ltd., New Delhi.
6. Practical Physics by C. L. Arora, S. Chand Publication.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Explain and identify physical quantities along with their units and make measurements with accuracy by minimizing different types of errors.
2) Understand the scalar and vector quantities and use this knowledge in solving relevant real-life problems.
3) Describe the types of friction, its coefficients and methods to reduce or increase friction between different surfaces.
4) Analyze different types of motion, acting forces along the motion and conservation of momentum principle to describe rocket propulsion, recoil of gun etc.
5) Compare and relate physical properties associated with linear motion and rotational motion along with the application of conservation of angular momentum.
6) Understanding of relationships for work, energy and power and solve related problems. Explain the principle of conservation of energy also identify various forms of energy, and energy transformations.
7) Describe the phenomenon related to properties of matter such as pressure, surface tension, stress, strain, elasticity, viscosity and their effect.

Chemistry-I

1.1 Course Number: CY101
1.2 Contact Hours: 2-1-0 Credits:8
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Chemistry and Mathematics
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To impart the knowledge of fundamental principles of chemistry for future learning of engineering principles
ii) To make students realize the importance of fundamental chemistry in engineering disciplines.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Atomic Structure**	Atomic number, isotopes and isobars. Thompson's model and its limitations, Rutherford's model and its limitations, Bohr's model and its limitations Quantum number, Aufbau principle, Hund's rule, Pauli's exclusion principle, electronic configuration.	5
2	**Periodic Properties of Elements**	Classification of Elements, Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements -atomic radii, ionic radii, inert gas radii Ionization enthalpy, electron gain enthalpy, electro negativity, valency. Nomenclature of elements with atomic number greater than 100. Basic Concepts of s, p, d and f-block Elements	6
3	**Chemical Bonding and Molecular Structure**	Orbit vs. Orbital, Valence electrons, ionic bond, covalent bond; Lewis structure, polar character of covalent bond, covalent character of ionic bond, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, Valence-Bond Theory.	6
4	**Concept of Moles and Chemical Equation**	Phases, Mole concept and problems, Standard solution, normal solution and molar solution, concentration terms-normality, molarity, gm/l, ppm, normality equation, acid-base titration. Chemical equation-definition, qualitative and quantitative significance, limitations, balancing by partial and ion-electron method, electronic concept of oxidation and reduction, Stoichiometric calculations.	5
5	**Acids-Bases and Salt**	Acids, bases and salts, Theories of acids and bases- Arrhenius, Bronsted-Lowry, Lewis theory, Strong acids and strong bases, Concept of pH and pKa, conjugate acid-base pair, classification of	4

		salts, hydrolysis of salts and its effect, Concept of Buffer, Indicator.	
6	**Phase of Substances**	Kinetic Theory of gases, Boltzmann distribution, Ideal gas & Real gas, Types of solutions (solution, dispersion, colloids), expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties – relative lowering of vapour pressure, Raoult's law , elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Vant Hoff factor. Micelle, lipid bilayer. Applications of Micelles	6
Total			**32**

4. Readings

4.1 Suggested Readings:

1. NCERT Textbook (Class XI and XII)
2. Engineering Chemistry, B. K. Sharma
3. A Textbook of Engineering Chemistry, Sashi Chawla
4. Engineering Chemistry, Jain and Jain
5. Applied Chemistry, Dr.Raman Rani Mittal

5. Outcomes of the Course:

After completion of this course students will be able to

1) Know about the structure of an atom and write the electronic configurationsof atoms.
2) Understand the variation of physical and chemical properties of elements such as ionization potential, electron affinity, electro negativity and learn about the periodic table.
3) Understand chemical bonding, concept of hybridization, as well as structure and shape of molecules.
4) Impart knowledge about various atomic and molecular quantities, strength and balancing chemical reaction.
5) Explore acid-base chemistry with a focus on the equilibrium aspects of these reactions.
6) Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of particles. explain the laws governing behaviour of ideal gases and apply gas laws in various real life situations. Understand the properties of liquids in terms of intermolecular attractions.

Engineering Mechanics

1.1 Course Number: ME101
1.2 Contact Hours: 2-1-0 Credits: 8
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Physics & Mathematics
1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar Singha, Dr. Abhimanyu Kar & Dr. Karthik Babu NB

2. Objective:

i) To develop the ability to model and analysis of mechanical engineering systems using vectorial representation of forces and moments.
ii) To be able to draw free-body diagrams of mechanical components and systems.
iii) To develop the capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.
iv) To understand the phenomenon of friction and the ability to solve problems related to the same. Ability to apply the principles of virtual work.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basics and statics of particles**	Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vector representation of forces –Vector operations of forces – additions, subtraction, dot product, cross product –Coplanar Forces – rectangular components – Equilibrium of a particle – Forces inspace – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.	7
2	**Equilibrium of rigid bodies**	Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions	7

3	**Properties of surfaces and solids**	Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, and Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section –Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.	7
4	**Dynamics of particles**	Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Simple problems – Impact of elastic bodies.	7
5	**Friction and rigid body dynamics**	Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder and disc/wheel.	7
	Total		**35**

4. Readings

4.1 Textbooks:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

4.2 References Books:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P)
Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition,
Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.

4. Meriam J.L. and Kraige L.G., “Engineering Mechanics- Statics - Volume 1, Dynamics- Volume
2”, Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3rd
Edition, Vikas Publishing House Pvt. Ltd., 2005.

5. Outcome of the Course:

On successful completion of this course, the student will be able to

1) Illustrate the vectorial and scalar representation of forces and moments
2) Analyse the rigid body in equilibrium
3) Evaluate the properties of surfaces and solids
4) Calculate dynamic forces exerted in rigid body
5) Determine the friction and the effects by the laws of friction

Fundamentals of Computer Engineering

1.1 Course Number: CS101
1.2 Contact Hours: 2-0-2 Credits: 8
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Basic knowledge of computers
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi

2. **Objective:**

The aim of the course is to help the students to attain the following basic competency through various teaching-learning experiences:

i) Identifying and learning about various computer hardware and their uses.
ii) Understanding of computer memory and its internal architecture.
iii) Basic knowledge of software including different operating systems and its working.
iv) Introduction to web designing using HTML coding.
v) Developing awareness regarding cyber security.
vi) Evolving logical thinking and problem-solving skills.
vii) The course will assist diploma engineers in using fundamental ideas and principles to tackle complex engineering issues and comprehend various technology-based applications.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Computer Organization**	Introduction to generations of computer and its classification, Logical organization of computer (functional block diagram), Input & Output devices (keyboard, mouse, joystick, scanner, OCR, OMR, MICR, barcode reader, web camera, monitor, printer, plotter), Central processing unit.	5
2	**Memory & Architecture**	Primary, secondary and auxiliary memory, Main memory unit, RAM, ROM, Cache memory, Registers, System bus, Hard disks & optical disks, CPU, SMPS, Motherboard, Ports and Interfaces, Expansion cards, Ribbon cables, Memory chips, Processors.	4

3	**Human Computer Interface**	Types of software (System and application), Operating system as user interface, Types of operating systems (Window, Linux, Mac), MS Office (Word, Excel, PowerPoint), Unix Shell and Commands, Programming languages, Compiler, Interpreter, VI editor, Computer viruses and its type, Detection and prevention of viruses.	5
4	**Computer Networks & Web Design**	Internet, TCP/IP, World Wide Web, Browser, Internet address (Domain name, URL), Search engine. Introduction to computer networks, Data communication and its components, Data transmission mode, LAN, MAN, WAN, Wireless LAN, Client/server network and peer-to-peer network, Intranet, Extranet. Hyper Text Mark-up Language (HTML), Cascading Style Sheet (CSS), Creating web pages, Lists, Hyperlinks, Tables, Web forms, Inserting images, Frames, Hosting options and domain name registration.	10
5	**Information Security**	Protection, Security, Risk, Threat, Vulnerability, Exploit, Attack, Confidentiality, Integrity, Availability, Non-repudiation, Authentication, Authorization, Codes, Plain text, Encryption, Decryption.	3
	Total		**27**

List of Experiments:

1. Introduction to various components of Computer system.
2. Study and Practice of handling Microsoft Windows – Folder related operations, My-Computer, Window explorer, Control Panel.
3. Introduction to Microsoft Office.
4. Creation and editing of Text files using MS Word.
5. Creation and operating of spreadsheet using MS Excel.
6. Creation and editing power-point slides using MS Power Point.
7. Introduction to Unix operating system (Ubuntu).
8. Study and practice of Open Office: Open Office Writer, Open Office Spreadsheet, Open Office Impress.
9. Study and practice of Basic Linux Commands.
10. Study and practice of Vim editor and its various commands in different modes.
11. Introduction to inter-networking protocols, world wide web, browsers and search engines.
12. Understanding of IP addresses, significance and uses of various domain names and URLs.

13. Create webpages and webforms including lists, hyperlinks, images, table etc. by using basic HTML program with HTML tag.
14. Modify the same webpages by using CSS codes.
15. Write the complete HTML coding using CSS for the following table:

Gradesheet of Diploma Students

	Maths	Physics	Chemistry	Human Values	Communication Skills	Engineering Themodynamics
Tom	47	39	25	33	43	36
Jimi	23	45	25	37	40	39
Tus	50	43	38	44	40	37
Ross	31	30	42	35	29	22
Max	34	35	38	44	49	43

16. Write the complete HTML coding using CSS for the following form :

Admission Form for Assam Energy Institute

First Name: enter your name Last Name: enter your title

Password: enter your password

Select Gender: Male Female

Answer the following questions:

Why do you want to join Assam Energy Institute?

Which branch have you selected and why?

Submit Form

4. Readings:

4.1 References Books:

1. A. Goel, Computer Fundamentals, Pearson Education.
2. P. Aksoy, L. De Nardis, Introduction to Information Technology, Cengage Learning.
3. P. K. Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers.
4. R. S. Salaria, Computer Fundamentals, Khanna Publishing House.
5. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House.
6. Andrew S. Tanenbaum, David J. Wetherall Computer Networks (5th Edition), PHI.
7. M. Merkow, J. Breithaupt, Information Security Principles and Practices, Pearson Education.
8. J. Minnick, Web Design with HTML5 and CSS3 (8th edition), Cengage Learning.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Describe functional units of a computer, its various peripherals and their applications.
2) Identify computer hardware as well as software (in the lab).

3) List the features of Word, Excel, PowerPoint and also able to perform calculations on excel sheet and demonstrate the use of PowerPoint for seminar presentations.
4) Identify various operating system file management commands (create, copy, move, delete and rename folders and files).
5) Demonstrate installation of application software in windows as well as in Linux operating system.
6) Acknowledge various computer languages and also able to differentiate between compiler and interpreters.
7) State computer networks such as LAN, MAN and WAN together with the internet, intranet and extranet.
8) Design basic web pages using the HTML along with the CSS.
9) Aware regarding the issues related to cyber security.

Engineering Workshop Practices Laboratory

1.1 Course Number: ME103L
1.2 Contact Hours: 0-0-3 Credits: 3
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar Singha, Dr. Abhimanyu Kar & Dr. Karthik Babu NB

2. **Objective:**

i) To get a hands-on basic training of various common manufacturing processes
ii) To understand the feasibility of different manufacturing processes depending on the raw materials and the product.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	b Sessions
1	**Carpentry**	Study of the joints in roofs, doors, windows and furniture, Hands-on-exercise: oodwork, joints by sawing, planning and cutting	2
2	**itting Shop**	roduction and practice of various fitting processes: Use of hand tools in fitting, preparing a male and female joint of M.S.	3
3	**Welding Shop**	roduction and practice of various Welding processes: Electric Arc welding Practice and Gas welding, TIG, MIG, Gas Cutting and application. Joints such as a Lap joint, a T-joint or a Butt joint are to be prepared.	2
4	**Machine Shop**	roduction and practice of various Machining processes: Plain and Stepped cylindrical turning, grooving, knurling and Thread-cutting of a job in lathe.	3
5	**Sheet Metal Work**	sics of Sheet Metal Work, essential properties required for sheet metal (malleable and formable), Forming & Bending, Model making – Trays and funnels, Different type of joints.	2
	Total		**12**

4. Readings

4.1 Textbooks:

1. Elements of Workshop Technology, Vol. I and II by Hajra Choudhary, Khanna Publishers

4.2 Reference Books:

1. Workshop Technology by WAJ Chapman, Viva Books
2. Workshop Manual by Kannaiah / Narayana,Scitech

5. Outcome of the Course:

1) Practical knowledge of the several manufacturing processes
2) Skills developed in carpentry, fitting welding, machining and sheet metal work
3) Basic idea of how things are produced in the industry

Chemistry Laboratory

1.1 Course Number: CY101L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level Chemistry
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To incorporate the habit of working in laboratory while maintaining discipline, safety and integrity.
ii) To provide hands-on experience on the basic methods of quantitative analysis.

3. Course Content:

Sl. No.	List of Experiments
1	Introduction of a Chemistry Laboratory
2	Preparation of standard solution of oxalic acid or potassium permanganate.
3	Determination of strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator
4	Standardization of $KMnO_4$ solution using primary standard oxalic acid solution.
5	Determination of Fe content in Mohr Salt using $KMnO_4$ solution
6	Estimation of total hardness of given water sample using standard EDTA solution
7	Determination of Alkalinity of given water sample using known concentration of an acid
8	Determination of pH of given water sample
9	Determination of the total dissolved solid of a given water sample
10	Determination of viscosity of a solution using Ostwald viscometer

4. Outcome of the Course:

1) To prepare solution of a given strength
2) To use basic laboratory techniques and equipment such as titration, pH meter, viscometer etc.
3) To estimate of strength of acid /base and ions present in domestic/industry water
4) To estimate iron content in metal and alloys
5) To determine the quality of domestic/industry water

Universal Human Values

1.1 Course Number: HU101
1.2 Contact Hours: 1-1-0 Credits: 5
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: All Faculties of AEI

2. **Objective:**

i) To help the student see the need for developing a holistic perspective of life.
ii) To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence
iii) To strengthen self-reflection
iv) To develop more confidence and commitment to understand, learn and act accordingly.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Motivation and Objectives of Human Values Course**	Introduction to the objectives of the course. Content and process of the course including mode of conduct. Daily life as lab for the course. Activities in the course.	2
2	**Purpose of Education**	How human being has a need for Knowledge, what should be the content of knowledge, how the content should be discussed in education. Complimentarily of skills and values, how the current education system falls short.	3
3	**Peers Pressure, Social Pressure**	In various dimensions of life, how do these things work. What is the way out? In the context of education, peer pressure etc.	2
4	**Concept of Competition and Excellence**	How competition leads to degradation of self and relationships. How excellence is the basic need of a human being. What is excellence?	2
5	**Time Management**	How does one deal with myriads of activities in college? Focus of the mind.	2
6	**Concept of**	How preconditioning affects our thinking, behavior, work, relationships, society and nature. How do we	3

	Preconditioning	develop pre-conditioning? What are the various sources of preconditioning? How do we evaluate our Preconditioning? How do we come out of it?	
7	**Concept of Natural Acceptance in Human Being**	What is natural acceptance? How can the concept of natural acceptance be used to evaluate our preconditioning? Universal nature of natural acceptance. Are anger, jealousy, hatred natural? How do we feel when we experience them? Which feelings are natural for a human being and which are not?	3
8	**Understanding Relationships**	Are relationships important? What is the role of relationships in our life? If relationships are important then why they are important? If they are important then why it is the case that we are not discussing them? What are the notions/conditions and factors which stop us to explore more into relationships? Relationships in family and extended family. Dealing with anger, Basic expectations in relationships. Seven types of relations, Gratitude as a universal value in relationships, Nine universal values in human relationships, Trust as the founding value, Concept of acceptance, Unconditional acceptance in relationships, Our preconditioning affecting our relationships, Our relationships with subordinate staff, with people of opposite gender, caste, class, race, How relationships have the power to force a person to change his preconditioning.	4
9	**Concept of prosperity Material goods**	What role others have played in making material goods available to me: Identifying from one's own life.	2
10	**Idea of Society**	What is a society? What constitutes a society? What systems are needed for a society to work? What is the purpose of society and various systems which are working in it? How understanding of Human Nature is important in order to understand the purpose of Society and various social systems? And what happens when this understanding is lacking?	2
11	**Balance in nature**	Balance which already exists in nature, How human beings are disturbing the balance. Resource depletion and pollution, our own role in wastage of electricity, water and in use of plastics, Waste management, Issues like global warming, animal extinction	2
	Total		**27**

4. Readings

4.1 Suggested Readings:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. On Education - J Krishnamurthy
4. Siddhartha - Hermann Hesse
5. Old Path White Clouds -ThichNhatHanh
6. Diaries of Anne Frank - Anne Frank
7. Life and Philosophy of Swami Vivekananda
8. Swami Vivekananda on Himself
9. Small is Beautiful - E. F Schumacher
10. Slow is Beautiful - Cecile Andrews
11. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi
12. Rediscovering India - by Dharampal
13. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
14. India Wins Freedom -Maulana Abdul Kalam Azad
15. Autobiography of a Yogi – by ParamhansaYogananda
16. Gandhi and Question of Science – Sahasrabudhe

5. Outcome of the Course:

1. Analyze the significance of value inputs provided in formal education along with skills and develop a broader perspective about life and education.
2. Formulate their aspirations and concerns at different levels of living, and the way to fulfill them them in a sustainable manner.
3. Evaluate their current state of understanding and living and model a healthy lifestyle.
4. Examine the issues of home sickness, interactions with seniors on the campus, peer pressure with better understanding and feel grateful towards parents, teachers and others
5. Develop more confidence and commitment for value-based living in family, society and nature.

Communication Skills

1.1 Course Number: HU102
1.2 Contact Hours: 2-0-1 Credits: 7
1.3 Semester-offered: 1st Year –Odd
1.4 Prerequisite: Class 10th level English
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) To make the students confident of speaking in English impeccably and with utmost enthusiasm.
ii) To familiarize the students with different styles of communication.
iii) To enlighten the students with the seven concepts of communication.
iv) To make the students understand the nuances of communication.
v) To train the students and make them comprehend various aspects of Interview skills.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Parts of Speech**	Recognition and review of Nouns, Pronouns, Verbs, Adverbs, Adjectives, Prepositions, Conjunctions, Interjections, Knowledge of Courses/ Subjects, Object and Compliment of the Verb,Verbals –Infinitival, Gerund and Preposition Recognition and review	3
2	**Prepositions of time and place**	Contextual teaching of prepositions of time - on, in, at, since, for, ago, before, to, past, to, from, till/until, by Prepositions of place: in, at, on, by, next to, besides, near, between, behind, in front of, under, below, over, above, across, through, to, into, towards, onto, from	3
3	**Clause, phrases and Relative Clauses**	Basic definitions of clauses and phrases, Focus on Relative Pronouns and their use in sentences as relative clauses.	2
4	**Courses/Subjects Verb Agreement**	Rules that guide the agreement of the Courses/Subjects to its verb	2

5	**Sentence types and Transformation of sentences**	Assertive sentences, Exclamatory sentences, Interrogative sentences, Negative sentences, Compound sentences, complex sentences, simple sentences, Degrees of Comparison	2
6	**Voice**	Change from Active Voice to Passive Voice and vice versa	2
7	**Punctuation**	Use of the comma, semi-colon, colon, apostrophe, exclamation mark, question mark and quotation marks	2
8	**Word formation**	Change of one part of speech to the other: from Verbs to Nouns, Nouns to Verbs, Adjectives to Nouns, Nouns to Adjectives, Verbs to adverbs, and Adverbs to Verbs	2
9	**Affixation**	Prefixes and Suffixes and new word formations	2
10	**Nominal Compounds**	Common nominal compound	2
11	**Paragraph Writing**	Descriptive Paragraph on various related topics.	2
	Total		**24**

4. Readings

4.1 Suggested Readings**:**

1. Essential English Grammar with Answers by Raymond Murphy (Cambridge University Press)
2. English for Polytechnics by Dr Papori Rani Barooah (Eastern Book House Publishers)
3. English Grammar by Annie Brinda (Cambridge University Press)

5. Outcome of the Course:

1) Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others.
2) Understand and practice different techniques of communication.
3) Practice and adhere to the 7Cs of Communication.
4) Familiarize with different types of Communication.
5) Understand and practice Interview Etiquettes.

Semester II

Mathematics-II

1.1 Course Number: MA102
1.2 Contact Hours: 3-1-0 Credits:11
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dr. Rupjit Saikia & Dr. Satish Kumar Tiwari

2. **Objective:**

This course is designed to give a comprehensive coverage at an introductory level to the subject of complex numbers, vector calculus, probability & statistics and differential equations (PDE and DE).

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Complex Numbers**	Definition of Complex numbers; Real and imaginary parts of a Complex number; Conjugate of a complex number; Modulus and amplitude of a complex number; Addition, Subtraction, Multiplication and Division of complex numbers, Polar and Cartesian form of a complex number and its conversion from one form to other, De-Movier's theorem and its application.	8
2	**Vector Calculus**	Definition, notation and rectangular resolution of a vector; Addition and subtraction of vectors; Scalar and vector products of 2 vectors; Simple problems related to work; moment and angular velocity. Gradient; Divergence and Curl.	8
3	**Ordinary Differential Equations**	Definition of differential equations; Order and degree of a differential equation; General and particular solution of a differential equation; Formation of differential equation whose general solution is given; Solution of first order and first-degree differential equation by variable separation method; Homogeneous differential equation of 1st order, Exact differential equation, First order linear differential equation.	9
4	**Partial Differential**	Origin of PDE, Derivation of PDE, Lagrange's Method of Solving the Linear PDE of Order One, Charpit's	9

	Equations	Method of Solving equation of order one but of any degree.	
5	**Probability and Statistics**	Definitions of probability and simple theorems, conditional probability, Bayes Theorem, random variables, discrete and continuous distributions, Correlation and regression.	8
	Total		**42**

4. Readings

4.1Textbook:

1. H. K. Das, Applied Mathematics for Polytechnics.
2. B.S. Grewal, Higher Engineering Mathematics, Khana Publishers, New Delhi, 40th Edition, 2007.
3. Mathematics Textbook for Class XI and XII (NCERT).
4. R. D. Sharma, Mathematics for Class 11and 12.
5. E. kreyszig, Advanced Engineering Mathematics, Khanna Publisher.
6. M. D. Raisinghania, Advanced Differential Equation.
7. R. K. Jain and S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.

1.5 Reference Books:

1**.** J. W. Brown and R. V. Charchill**,** Complex variable & applications, McGraw Hills.
2. S. Narayan, A Text book of Vector algebra, S.Chand & CO.
3. J. J. Sciller, R. A. Srinivasan, M. R. Spiegel, Probability & Statistics, Schaum's outline series, McGraw Hill.
4. M. R. Spiegel, S. Lipschutz, D. Spellman, Vector Analysis, McGraw-Hill Book Company, New York.

5. Outcome of the Course:

1) The applications of complex numbers, vector calculus, probability & statistics in engineering and science related problems.
2) The technique of solving differential equations problems of engineering and science.

Physics-II

1.1 Course Number: PY102
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 1st Year – Even
1.4 Prerequisite: Class 10th level Physics & Mathematics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Physics is a core science subject from which all engineering technologies have evolved, a thorough understanding of the basic principles and applied aspects will assist students in understanding, applying, and evolving technologies more effectively, thereby improving the quality of life in society.
ii) This course will provide the knowledge of the physical environment through observations and predictions.
iii) The course attempts to enhance the student's factual knowledge along with the applications. This will foster a scientific mindset and aid in the application of fundamental concepts and principles to engineering and technology-based challenges.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Wave motion and its applications**	Wave motion, Transverse and longitudinal waves with examples, Definitions of wave velocity, Frequency and Wavelength and their relationship, Sound and light waves and their properties, Wave equation, Amplitude, Phase, Phase difference, Principle of superposition of waves and beat formation. Simple Harmonic Motion (SHM): Definition, Expression for displacement, Velocity, Acceleration, Time period, Frequency. Simple harmonic progressive wave and energy transfer, Free, Forced and resonant vibrations with examples. Ultrasonic waves: Introduction and properties, Applications of ultrasonics	7

		in engineering and medicals.	
2	**Optics**	Basic optical laws of reflection and refraction, Refractive index, Images and image formation by mirrors, Lens and thin lenses, Lens formula, Power of lens, Magnification of mirror & lens. Total internal reflection, Critical angle and conditions for total internal reflection, Applications of total internal reflection.	7
3	**Electrostatics**	Coulomb's law, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Gauss law: Application of Gauss law, Calculation of electrostatic potential at a point due to point charge, Relation between potential and electric field intensity. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors (related numerical), Dielectric and its effect on capacitance, Dielectric breakdown.	8
4	**Current Electricity**	Electric Current, Resistance, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, Ohm's law and its verification, Kirchhoff's laws. Cells, Internal resistance, Concept of terminal voltage and Electromotive force (EMF). Chemical effect of current, Electrolysis, Faraday's law of electrolysis, Heating effect of current, Joule's law, Electric power, Electrical energy and related numerical problems, Advantages of electrical energy over other forms of energy.	7
5	**Magnetism & Electromagnetism**	Biot-Savart law, Magnetic lines of force, Uniform & non-uniform field, Magnetic flux, Ampere's circuital law, Solenoid, Lorentz Force, Direction of magnetic force, Permanent magnets and electromagnets, Magnetic force on a current-carrying conductor, Magnetic moment, Magnetic dipole, Torque on a current loop, Moving coil galvanometer, Conversion of a galvanometer into ammeter and voltmeter. Magnetization, Types of magnetic materials: Dia, para	8

		and ferromagnetic with their properties. Electromagnetic induction, Faraday's Laws, Lenz law, Self and mutual induction, Motional electromotive force, Eddy currents, Alternating current, Transformers (step-up & step-down), Displacement current, Electromagnetic waves and its spectrum.	
6	**Modern Physics**	Particle Aspect of Radiation: Black body radiation, Photoelectric effect, Experimental study of Photoelectric effect and Einstein's explanation, Wave aspect of particles: De Broglie waves, Wave particle duality, Uncertainty Principle. Electron Orbits, Alpha particle scattering experiment; Rutherford's model of atom, Bohr model, energy levels, hydrogen spectrum	5
	Total		**42**

4. Readings

4.1 Textbooks:

1. Textbook of Physics for Class XII (Part-1, Part-2); N.C.E.R.T., Delhi

4.2 Reference Books:

1. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
2. Concepts in Physics by H. C. Verma, Vol. I & II, Bharti Bhawan Ltd., New Delhi.
3. Engineering Physics by P. V. Naik, Pearson Education Pvt. Ltd., New Delhi.
4. Engineering Physics by H. K. Malik and A. K. Singh, Mc Graw Hill.
5. Modern approach to Applied Physics- I and II, A. S. Vasudeva, Modern Publishers.
6. A Textbook of Optics, N. Subramanyam, Brij Lal, M. N. Avahanulu, S Chand and Company Ltd.
7. Introduction to Fiber Optics, Ajoy Ghatak and K. Thyagarajan, Cambridge University Press India Pvt. Ltd., New Delhi.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to;

1) Explain wave motion, periodic motion as well as simple harmonic motion and their basic parameters such as amplitude, frequency, wavelength, velocity and related numerical problems. Also, able to describe ultrasonic waves and its applications in engineering, medical and industrial areas.
2) Understand the basic optical laws of refraction and reflection, establish the location and characteristics of the images formed by mirrors and lenses. Also, able to explain critical angle, total internal reflection and its applications.
3) Describe electric filed, electric flux, electric potential along with the examples, also able to explain the function of capacitors in simple circuits and solve simple problems.
4) Express electric current as flow of charge and concept of resistance. Also, able to list the effects of an electric current and its common applications, state Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, Faraday's law, Joule's law and their numerical applications.
5) Understand magnetism, its intensity, flux and related laws, explain the operation of appliances like moving coil galvanometer. Also, able to differentiate among different types of magnetic materials for engineering applications, learn the eddy currents, alternating current, displacement current and applications of electromagnetic induction in transformers.
6) Have basic idea of atomic structure and modern Physics regarding wave-particle duality, uncertainty principle.

Chemistry-II

1.1 Course Number: CY102
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Chemistry & Mathematics
1.5 Syllabus Committee Members: Dr. Sabyasachi Pramanik & Dr. Souvik De

2. Objective:

i) To apply the fundamental concepts of chemistry for the understanding of process and technology relevant to industry.
ii) To become familiar with the scope, methodology, and application of modern chemistry and to learn to appreciate its ability to explain the physical world.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Organic Chemistry**	General introduction, IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electrometric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions. Classification of Hydrocarbons: Aliphatic Hydrocarbon- Alkane, Alkene, Alkyne. Aromatic Hydrocarbon- Benzene: resonance, aromaticity; chemical properties: mechanism of electrophilic substitution – nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation.	6
2	**Alcohols, Phenols and Ethers**	Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, with special reference to methanol and ethanol. Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols. Ethers: Nomenclature, methods of preparation, physical and	6

		chemical properties, uses.	
3	**Energy & Environment**	Sources of Energy, Fuels- classification, examples, relative merits, types of coal, Gaseous fuels: LPG, natural gas, CNG: Composition and applications. determination of calorific value of solid fuels, Bomb calorimeter, theoretical oxygen requirement for combustion, proximate & ultimate analysis of coal, manufacture of metallurgical coke, flue gas analysis, problems. Knocking and anti-knocking for petrol and diesel (octane number and cetane number) - diesel index Industrial revolutions and pollution. Air/water/ soil pollution, greenhouse gas & effect, chemical reactions involved, acid rain, effects of depletion of ozone layer, greenhouse effect and global warming – pollution due to industrial wastes; remedies of pollutions.	8
4	**Chemical Kinetics**	Rate of a reaction (average and instantaneous), factors affecting rates of reaction: concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half-life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation.	6
5	**Electrochemistry**	Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea), dry cell – electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.	6
Total			**32**

4. Reading

4.1 Suggested Reading:

1. NCERT Textbook (Class XI and XII)
2. Engineering Chemistry, B. K. Sharma
3. A Textbook of Engineering Chemistry, Sashi Chawla
4. Engineering Chemistry, Jain and Jain
5. Applied Chemistry, Dr.Raman Rani Mittal

4. Outcome of the Course:

After completion of this course students will able to

1) Explain why the element carbon gives rise to a variety of compounds, and how those organic compounds are classified and will learn about the naming of organic compound and basic concept of mechanism of organic reactions.

2) Learn about the name of alcohols, phenols and ethers according to the IUPAC system of nomenclature. Understand the reactions involved in the preparation of alcohols and their corresponding chemical reactions.

3) Understand the importance of chemistry related to the environment, energy and fuels and importance of fuels in our daily life. Knowledge of environmental pollutions, green chemistry and water related chemistry.

4) Understand the factors that influence chemical reaction rates, reaction mechanisms, and the quantitative techniques used to describe those rates.

5) Understand the fundamental aspects of redox chemistry and the technologies made possible from discoveries in the field of electrochemistry and to identify the appropriate materials, design and operation conditions to reduce the likelihood of corrosion in engineering systems and operations.

Fundamentals of Electrical and Electronics Engineering

1.1 Course Number: EIE101
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Mathematics & Science
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma

2. **Objective:**

i) To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
ii) To introduce the students about domestic wiring, the functioning of various electrical apparatus and the safety measures. Emphasize the effects of electric shock and precautionary measures.
iii) To establish the basic knowledge of DC and AC electric circuits and magnetic circuits and its application in generators, motors, transformers.
iv) To introduce the students about basic knowledge of electronic components like Diode, BJT, FETs, Op-Amp, Digital Circuits etc. and their application.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**DC Circuit Analysis**	Electrical circuit elements (R, L and C), voltage and current sources, Series and parallel resistive circuits, Ohm's Law, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits. Source Transformation, Superposition Theorem, Thevenin and Norton's Theorem.	9
2	**AC Circuit Analysis**	A.C. Circuits: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits,	10

		voltage and current relations in star and delta connections.	
3	**Magnetic Circuits and Electrical Machines**	Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Ideal and Practical transformer, Principle of operation, EMF equation. Construction and Working principle of AC and DC machines; Basic equations and characteristic of motors.	8
4	**Semiconductor Devices**	Energy bands in solids, Types of materials (insulator, semi-conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction, junction diode and V-I characteristics, types of diodes. Diode as rectifier –half wave and full wave rectifier, Working of BJT, BJT as amplifier.	10
5	**Introduction to Analog and Digital Circuits**	Introduction to Operational Amplifiers-Ideal, Practical Op-Amp, Inverting and Non-inverting amplifier. Introduction to Boolean Algebra, Logic Gates and their implementation as adder and subtractor, Flip-Flop and its application.	10
Total			**47**

4. Readings

4.1 Recommended Books:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN:9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
7. Sedha, R.S., A text book of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978-8121927833
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi,2015, ISBN-13: 0070634244-978

9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504

5. Outcome of the Course:

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

1) Demonstrate an understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

2) Demonstrate an understanding of basic concepts of analysis of simple DC and AC circuits used in electrical devices like generators, motors and transformers etc.

3) Demonstrate an understanding of basic concepts of semiconductor material, electronics devices, and Digital electronics to perform the multidisciplinary tasks.

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Computer Programming

1.1 Course Number: CS102
1.2 Contact Hours: 2-0-2 Credits: 8
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Computer knowledge
1.5 Syllabus Committee Members: Dr. Rupjit Saikia & Dr. Satish Kumar Tiwari

2. **Objective:**

To enable student, develop structured solutions to problems and implementing them using computers. This involves two parts: i) Formulating a solution for a given problem as a well-defined sequence of actions, and ii) Expressing solution in a machine-readable form or a programming language.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basics of C Programming**	1.1 Introduction to number system 1.2 Introduction to flowchart and algorithm 1.3 History of C, where C stands 1.4 C character set, tokens, constants, variables, keywords 1.5 C operators (arithmetic, Logical, assignment, relational, increment and decrement, conditional, bit wise, special, operator precedence), C expressions data types. 1.6 Formatted input, formatted output.	7
2	**Decision Making**	2.1 Decision making and branching if statement (if, if-else, else-if ladder, nested if-else) Switch case statement, break statement. 2.2 Decision making and looping while, do, do-while statements for loop, continue statement.	7
3	**Arrays and Strings**	3.1 Arrays Declaration and initialization of one dimensional, two dimensional and character arrays,	7

		accessing array elements. 3.2 Declaration and initialization of string variables, string handling functions from standard library (strlen(), strcpy(), strcat(), strcmp()).	
4	**Functions and Structures**	4.1 Functions: Need of functions, scope and life time of variables, defining functions, function call (call by value, call by reference), return values, storage classes. category of function (No argument No return value, No argument with return value, argument with return value), recursion. 4.2 Structures: Defining structure, declaring and accessing structure members, initialization of structure, arrays of structure.	7
	Total		**28**

4. Readings

4.1 Recommended Books:

1. Programming in C by Sachaum Series, McGraw Hills
2. Programming in C by Kerning Lan and Riechle Prentice Hall of India, New Delhi
3. Programming in C by BalaguruSwamy, Tata McGraw Hill, New Delhi
4. Let us C by Yashwant Kanetkar, BPB Publications, New Delhi
5. Vijay Mukhi Series for C and C++
6. Programming in C by R Subburaj,Vikas Publishing House Pvt Ltd.,Jangpura, New Delhi
7. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
9. Elements of C by MH Lewin, Khanna Publishers, New Delhi

5. Outcome of the Course:

Student will be able to computationally formulate basic problems and write code snippets to execute them. Also, the students will be able to take decisions when to use an array, when to use loop and when to use conditional statements.

Engineering Drawing

1.1 Course Number: ME102L
1.2 Contact Hours: 0-0-3 Credits:3
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Mathematics
1.5 Syllabus Committee Members: Dr. Naveen Mani Tripathi, Dr. Sanat Kumar Singha, Abhimanyu Kar & Dr. Karthik Babu

2. Objective:

i) To understand the basic concepts of dimensioning and scales and their roles in engineering drawing.
ii) To draw orthographic projections of points, straight lines, laminae and solids when the mentioned objects are located with different configurations with respect to the plane of projections.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Engineering Drawing**	1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards. 1.2 Different types of lines in engineering drawing as per BIS specifications 1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments. 1.4 Free hand and instrumental lettering (alphabets and numerals) – upper case (capital letters), single stroke, vertical and inclined at 75degree, free hand and instrumental lettering in the ratio of 7:4	6
2	**Dimensioning Technique and Scales**	2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions) 2.2 Dimensioning of overall sizes, circles, angles, tapered surfaces, holes, counter sunk holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches 2.3 Scales – their needs and importance (theoretical instructions), type of scales, definition of representative	6

		fraction and length of scale	
3	**Orthographic Projections**	3.1 Theory of orthographic projections (elaborate theoretical instructions) 3.2 Projection of Points in different quadrants 3.3 Projection of straight lines (1st angle and 3rd angle) 3.4 Line parallel to both the planes 3.5 Line perpendicular to any one of the reference planes 3.6 Line inclined to any one of the references plane 3.7 Projection of planes – different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only. 3.8 Three views of orthographic projection of different objects	15
4	**Projection and Sections of Solids**	4.1. Definition and salient features of a solid 4.2. Types of Solid (polyhedral and solids of revolution) 4.3 To make projections, sources, top view, front view and side view of various types of solids. 4.4 Importance and salient features 4.5 Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. 4.6 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections. 4.7 Orthographic sectional views of different objects	9
5	**Isometric Views**	5.1 Fundamentals of isometric projections and isometric scale 5.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.	3
Total			**39**

4. Readings

4.1 Textbooks:

1. A Textbook of Engineering Drawing by Surjit Singh; Dhanpat Rai& Co., Delhi

2. Engineering Drawing by PS Gill; SK Kataria& Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I by DK Goel, GBD Publication.

4.2 Reference Book:

1. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar

5. Outcome of the Course:

Knowledge of working with various drawing instruments.

1) Classify dimensioning methods and scales.
2) Understand the difference between first angle and third angle projection schemes.
3) Draw the orthographic and isometric views of simple objects.

Physics Laboratory

1.1 Course Number: PY101L
1.2 Contact Hours: 0-0-2 Credits:2
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Physics
1.5 Syllabus Committee Members: Dr. Shikha Dwivedi & Dr. Nimisha Raghuvanshi

2. Objective:

i) Experiments demonstrate the principle of physics covered in the theory and also provide the familiarities with various apparatus along with developing an attitude of perfection in practical tasks.
ii) The basic purpose of laboratory experiments in physics is to verify and validate the concepts, principles and hypotheses related to the physical phenomena.

3. List of Experiments:

1. To determine the volume of an unknown cylinder using Vernier Callipers.
2. To determine the cross-sectional area of a thin wire using Screw Gauge.
3. To determine the radius of curvature of a convex lens using Spherometer.
4. To verify and understand the law of conservation of energy using simple pendulum.
5. To determine the angle of minimum deviation for a glass prism by plotting a graph between the angle of incidence and angle of deviation.
6. To measure the angle of incidence, angle of refraction and the angle of emergence of a rectangular glass slab and interpret the results.
7. To verify the laws of reflection of light using plane mirror.
8. To study the magnetic field lines formed around a Bar magnet.
9. To verify the Ohm's Law using a single resistance, two resistances connected in series and two resistances connected in parallel by plotting a graph of potential difference versus current.
10. To measure the value of an unknown resistance using meter bridge.

4. Readings (Textbooks / Reference Books):

1. Textbook of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi.
2. Comprehensive Practical Physics, Vol, I & II, J.N. Jaiswal, Laxmi Publications (P)Ltd.

3. Practical Physics by C. L. Arora, S. Chand Publication.
4. E-books/e-tools/ learning physics software/YouTube videos/websites etc.

5. Outcomes of the Course:

After undergoing this subject, the student will be able to:

1) Use various measuring device such as Vernier Callipers, Screw Gauge and Spherometer.
2) Understand the law of conservation of energy using simple pendulum.
3) Learn about the angle of minimum deviation of a glass prism using laws of refraction.
4) Verify the laws of reflection using mirror and the laws of refraction using glass.
5) Study the magnetic field lines of a Bar magnet.
6) Verify the Ohm's law and find an unknown resistance using meter bridge.

Fundamentals of Electrical and Electronics Engineering Laboratory

1.1 Course Number: EIE101L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: Class 10th level Mathematics & Science
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma

1. Introduction to basic electrical circuit elements (R, L and C).
2. Study of CRO and Digital Multimeter
3. Measurement of Amplitude, Frequency and Time-period with the help of CRO.
4. Verification of the ohm's law.
5. Verification of KCL and KVL.
6. Verification of Mesh and Nodal Analysis for the given circuits.
7. Verification of Basic Theorems (The venin, Norton and Superposition).
8. Study of Step-up and Step-down Transformer.
9. Analysis of RLC circuit.
10. Study of speed control of DC motor.
11. Study of V-I Characteristics of PN-Junction Diode.
12. Study the operation of Half Wave and Full Wave rectifier.
13. Study of BJT and FET Characteristics.
14. Study the operation of Op-Amp in Inverting and non-inverting mode.
15. Verification of Basic Logic Gates.

Recommended Books:

1. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN :978-0-07-0088572-5
2. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
3. Sedha, R.S., A text book of Applied Electronics, S. Chand, New Delhi, 2008, ISBN-13: 978-8121927833
4. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504.

Community Internship

1.1 Course Number: HU103
1.2 Contact Hours: 1-1-0 Credits: 5
1.3 Semester-offered: 1st Year –Even
1.4 Prerequisite: NA
1.5 Syllabus Committee Members: All Faculties of AEI

2. **Objective:**

i) Explore career alternatives prior to graduation.
ii) Integrate theory and practice.
iii) Assess interests and abilities in their field of study.
iv) Learn to appreciate work and its function in the economy.
v) Develop work habits and attitudes necessary for job success.
vi) Develop communication, interpersonal and other critical skills in the job interview process.
vii) Build a record of work experience.
viii) Acquire employment contacts leading directly to a full-time job following graduation from college.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	Understanding Society	**Understanding Society** Social structure and relationships, Social institutions and social groups, Socialization and social control: development of self	3
2	Community Health	Illness and Disease, Health and public health: Meaning, components, determinants of health, Wellbeing and Quality of life, Health as an aspect of social development, Nutrition and malnutrition, Community Health: relevance, needs assessment, developing mechanisms for people's participation, Community Mental Health	5

3	**Working with Groups**	Social Groups: Definitions, characteristics, functions and group structure, Principles of group work and Models of group work practice, Leadership - Theories of leadership, roles and responsibilities of group leader, Leadership Power, Leadership Styles, Leadership in Administration, Techniques and skills in group work,Group worker: roles and functions	5
4	**Work with Communities**	Understanding Community: Definitions, types, approaches and framework, Community dynamics: Caste, class, religion and gender, Issues of identity, inclusion and exclusion, Community power structure, Community organization- principles, steps and process, Community work and community participation - Strategies and principles; Models and processes, Professionalism and inculcation of ethics in community practice	5
5	**Personality Development**	Definition of Personality, Determinants of Personality-biological, psychological and sociocultural factors,Communication, Flow and barriers of Communication, Listening, Spirituality and its role in personality development Stress: Causes, Management and Impact, Groups in organization, Interactions in group, Group Decision Taking, Team Building	5
6	**Development Communication**	Communication: concept, principles and its significance Process of Communication, Forms of communication: Verbal, non-verbal and written. Self-awareness in communication Barriers to communication	3
	Total		**26**

4. Readings

4.1 Suggested Readings:

1) Davis, K. 1969. Human Society, New York: The Macmillan.
2) Giddens, A.1999. Sociology, Cambridge: The Polity Press.
3) Dasgupta, M. & Lincoln, C.C. 1996, Health, Poverty and Development in India. New Delhi: Oxford University Press.
4) Trecker, H.B. 1972, Social Group Work: Principles and Practices. New York: Association Press.
5) Weil, M. (ed,) 1996, Community Practice: Conceptual Models. New York: The Haworth Press Inc.
6) Hergenhahn, B. R., &Olson., M. H. 2003, An Introduction to Theories of Personality, New Jersey: Prentice Hall.

5. Outcome of the Course:

As a result of participation in the course, students will be able to:

1) Assess and improve upon their own cultural competency skills.
2) Demonstrate understanding of theory and research guiding positive youth development programs.
3) Develop familiarity with positive youth development programs and approaches in building relationships with families and communities.
4) Understand how observation, documentation, and assessment are used to support children and families.
5) Develop applied professional skills to foster positive developmental outcomes for children and families.

Semester III

Digital Electronics

1.1 Course Number: EIE201
1.2 Contact Hours: 3-1-0 Credits:11
1.3 Semester-offered: 2nd Year –Odd
1.4 Pre-requisite: Fundamental of Electrical and Electronics Engineering
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr.M. Chakkarapani & Dr. Santosh Kumar Verma

2. **Objective:**

i) To present a problem oriented introductory knowledge of Digital circuits and its applications.
ii) To help in understanding for future subjects like microprocessor and embedded systems.

3**. Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Digital System**	Conversion of number from one number system to another including decimal points, Binary addition, subtraction, multiplication, division, Binary Coded Decimal (BCD) numbers and their limitations, addition of BCD coded numbers, conversion of BCD to decimal and vice-versa, Excess-3 code, gray code, binary to gray and gray to binary conversion, Concept of parity, error detection and correction using parity.	7
2	**Logic Gates and Simplification**	Positive and negative logic, pulse waveform, definition, symbols, truth tables, pulsed operations of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates, Sum of products form(minterm), Product of sum form (maxterms), simplification of Boolean expressions with the help of laws of Boolean algebra Karnaugh mapping techniques up to 4 variables and their applications.	7

3	**Combinational Circuits, Decoders, Encoders and their Applications**	Half adder, full adder circuits and their operation, Parallel binary adder, 2-bit binary full adder, symbols and logic diagrams of 2×1 and 4×1 multiplexers. Realization of Boolean expression using multiplexer/ demultiplexers (design of 4×1 mux using 2×1 and1×4demux using 1×2 demux) Basic Binary decoder, 4-line to 16-line decoder circuit BCD to decimal decoder, BCD to 7-segmentdecoder/driver, LED/LCD display, Encoder, decimal to BCD encoder, decimal to BCD priority encoder, Magnitude comparators, symbols and logic diagrams of 2-bit and 4-bit comparators.	9
4	**Latches and Flip-flop**	Latches, SR Latch, Flip-flops, difference between latch and flip-flop, Conversion from one flip flop to another. Race around condition, JK flip-flop, master slave and their operation using waveform and truth tables.	6
5	**Sequential circuits:Shift Registers and Counters**	Shift registers functions, serial-in-serial out, serial-in-parallel-out, parallel-in serial-out, parallel-in-parallel out, Universal shift register,4-bit Asynchronous counter, 4-bit Synchronous binary counter, Up/down Asynchronous counters, divided by N-counter MOD-3, MOD-5, counters, Ring counter, Johnson's Counter, and applications.	9
Total			**38**

4. Readings

4.1 Textbooks:

1. Digital Electronics by KS Jamwal, DhanpatRai& Co., New Delhi
2. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala
3. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
4. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
5. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi

4.2 Reference Books:

1. Digital Electronics and Applications by Malvino leach, Tata McGral Hill, New Delhi
2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
3. Digital Fundamentals by Thomas Floyds, Universal Book Stall
4. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi

5. Outcome of the Course:

1) Use digital electronics in the present contemporary world
2) Design various combinational digital circuits using logic gates
3) Do the analysis and design procedures for synchronous and asynchronous sequential circuits

Analog Electronics

1.1 Course Number: EIE202
1.2 Contact Hours: 3-1-0 Credits:11
1.3 Semester-offered: 2nd Year –Odd
1.4 Pre-requisite: Fundamental of Electrical and Electronics Engineering
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani& Dr. Santosh Kumar Verma

2. Objective:

i) To expose the students about semiconductor materials, device, performance characteristics and their application.
ii) To introduce basic principles, operation and applications of the various analog electronic circuits and devices like: BJT, and FETs.
iii) To expose the basic principle of operations and application of various electronic circuits like: Rectifiers, Clippers, Clampers, Filters and Waveform Generators.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Semiconductor Diode**	PN junction diode, mechanism of current flow in PN junction, Drift and diffusion current, depletion layer, forward and reverse biased PN junction, potential barrier, Concept of junction capacitance in forward and reverse bias condition. V-I characteristics, static and dynamic resistance and their calculation from diode characteristics. Types of diodes, characteristics and applications of zener diodes. Zener and avalanche breakdown.	10
2	**Introduction to Bipolar Transistor**	Bipolar junction transistor: Construction of PNP and NPN transistor, their symbols and mechanism of current flow; Current relations in transistor; concept of leakage current; CB, CE, CC configuration of the transistor; Input and output characteristics in CB and CE configurations; input and output dynamic resistance in CB and CE configurations; Current amplification factors. Comparison of CB CE and CC Configurations; Transistors as an amplifier in CE Configurations.	10
3	**Field Effect Transistors**	Construction, operation and characteristics of FET and its application. Construction, operation and characteristics of MOSFET in depletion and enhancement modes and its applications. CMOS –advantages and applications. Comparison of JFET, MOSFET and BJT.	8

4	**Rectifiers and Switched Mode Power Supplies**	Diode as half wave, full wave and bridge rectifier. PIV, rectification efficiencies and ripple factor calculations, shunt capacitor filter, series inductor filter, LC filter. Transistor-based voltage regulator: Introduction to shunt and series voltage regulator, load and line regulation, and Short circuit protection.	10
5	**RC Circuits**	Response of high pass and low pass RC circuits to sine, step, pulse and square wave inputs, Low-pass, High-pass, Band-stop and Band-pass filters.	9
Total			**47**

4. Readings

4.1 Textbooks:

1. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
2. Electronics Devices and Circuits-I by Naresh Gupta, JyoteshMalhotra and harish C Saini, Eagle Prakashan, Jalandhar
3. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi.

4.2 Reference Books

1. Basic Electronics and linear Circuit by NN Bhargava and Kulshreshta, Tata McGraw Hill, New Delhi.
2. Electronic Components and Materials by SM Dhir, Tata McGraw Hil, New Delhi.
3. Electronic Devices and Circuits by Millman and Halkias; McGraw Hill.
4. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill, New Delhi

5. Outcome of the Course:

After the completion of this course the student will be able to:

1) Demonstrate an understanding about semiconductor materials, device, performance characteristics and their application.

2) Demonstrate the basic principle of operation and applications of the various analog electronic circuits and devices like: BJT, and FETs. and solve the numerical problems related to these circuits.

3)Demonstrate the basic principle of operations and application of various electronic circuits like: Rectifiers, Clippers, Clampers, Filters and Waveform Generators.

Materials Science and Engineering

1.1 Course Number: ME203
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 2nd Year –Odd
1.4 Pre-requisite: Class-XII Physics
1.5 Syllabus Committee Members: Dr. M. Chakkarapani, Dr. Santosh Kumar Verma

2. Objective:

i) To Understand the classification of materials, bonding and the crystal structure.
ii) To understand the Properties of conducting, insulating, semiconducting, dielectric and semiconductor materials.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Introduction and historical importance of Materials, Classification of Materials, Engineering Materials, Advanced Materials and Future Materials like ceramics, polymers, composites, Dielectric etc. Bravais Lattices, Crystal Structures, Crystalline, Quasi Crystalline and Non-Crystalline Materials, Miller Indices, Miller-Bravais Indices for Planes and Directions of Cubic and Non-Cubic Structures, structure of ceramics, polymers, and composites materials. Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall effect.	8
2	**Diffusion and Heat treatment**	Phase Diagrams: Phase Rule, Equilibrium Phase Diagrams, Phase Systems - Isomorphous, Eutectic with No and Limited Solid Solubility and Peritectic, Iron-Carbon Phase Diagram, TTT Diagram. Imperfections in Solids and Strengthening Mechanisms: Point Defects, Line Defects and Dislocations, Interfacial Defects and Bulk or Volume Defects, Recovery, Recrystallization and Grain Growth. Alteration of properties by heat treatment, Heat treatment method, Quantification of altered material properties by heat treatments.	9

3	**Mechanical behavior of Metals and Alloys**	Types of Loading, Stress-Strain Curves for Brittle and Ductile Materials, Theoretical and Observed Shear Stress, Critical Resolved Shear Stress, Deformation – Elastic, Anelastic, Plastic and Super Plastic, Yield Criteria, Macroscopic Aspects of Plastic Deformation, Toughness Measurements by S-S Curve, Impact Testing and Fracture Toughness Testing. Types of Mechanical Loading and Failures: Ductile and Brittle Fracture, Modes of Fracture Toughness, Impact Fracture, Ductile-Brittle Transition, Types of Impact Testing, Fatigue, Crack Initiation and Propagation, Fatigue Testing, Creep, Stages of Creep Curve, Stress and Temperature Effects.	10
4	**Dielectric and Magnetic Property of Materials**	Introduction, polarization of dielectric material, dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity. Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.	8
5	**Properties of Metals and Semiconductors**	Energy band in Metals, Semiconductors and Insulators, types of semiconductors, Intrinsic and Extrinsic semiconductors, Effect of temperature on the electrical conductivity of metals, insulator and semiconductor, thermal properties, thermal conductivity of metals and semiconductors, factors affecting the resistivity of electrical materials, electrical conductivity of doped materials, thermoelectric effects.	7
Total			**42**

4. Readings

4.1 Textbooks:

1. C.S.Indulkar and S. Thiruvengadam, S., “An Introduction to Electrical Engineering”.
2. P L Kapoor. A Textbook of Electrical and Electronics Engineering Materials: Khanna publishers
3. Kenneth G. Budinski, “Engineering Materials: Prentice Hall of India, New Delhi

5. Outcome of the Course:

After the completion of this course the student will be able to:

1) Describe the fundamentals of material science and concepts of unit cell & crystallography.
2) Classify materials based on their conducting, insulating, semiconducting, dielectric properties.
3) Know the practical uses of various materials in different electrical engineering field.

Instrumentation and Transducers

1.1 Course Number: EIE203
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 2nd Year –Odd
1.4 Pre-requisite: Fundamental of Electrical and Electronics Engineering
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani& Dr.Santosh Kumar Verma.

2. Objective:

i) To introduce the student to principles and theory of instruments analysis and their operation.
ii) To introduce the student to the techniques of troubleshooting instruments in the electronics laboratory for the safety instruments.
iii) To teach the student to solve problems related to instruments to apply for instrumental analysis.
iv) To understand the active and passive transducers.
v) To understand and describe the operation of variable resistance, variable inductive and capacitive transducers.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basic Building Blocks of Any Instrumentation Systems**	Scope and necessity of instrumentation, Important process variables and their units, Building blocks of instrumentation system, Measurement, method of measurement, types of instruments. Static and dynamic characteristics of instruments. Errors in measurement, sources of errors, limiting errors and loading effect.	10
2	**Display and Recording Devices**	Operating mechanism in indicators and recording devices, Various indicating. Integrating and recording methods and their combination, Merits and demerits of circular chart and strip chart recorder, Basics of printing devices, Scanning, data logging and field buses, Bar graph LCD, seven segment display, X-Y recorder, scanners, Design experiments for display system.	10
3	**Instrument Selection**	Factors affecting instrument selection, accuracy, precision, linearity, resolution, sensitivity, hysteresis, reliability, serviceability, loading effect, range advantage and limitation, cost-effectiveness and availability, Environmental effects, and Calibration tools.	8
4	**Transducers-I**	Definition, working principle, classification (active, passive, primary, secondary, mechanical, electrical, inverse, analog, digital) and selection criteria. Resistive transducer: Principle of operation. Strain gauge, load cell, strain measuring	10

		circuit.	
5	**Transducers-II**	Inductive transducer- working principle and types, LVDT-working, advantages and disadvantages. Capacitive transducer:Principle of operation, linear displacement and angular displacement measurement, advantages and disadvantages.	10
Total			**48**

4. Readings

4.1 Textbooks:

1. Mechanical and Industrial Measurement of by RK Jain, Khanna Publishers, New Delhi
2. Electrical and Electronics Measurement of by AK Shawney, Dhanpat Rai and Company, New Delhi
3. Advanced Instrumentation and Control by MF Kureshi
4. Electrical and Electronics Measurement and Instrumentation by A. K. Shawney, Dhanpat Rai and Co., New Delhi
5. Mechanical and industrial measurement by R.K.Jain, Khanna Publishers, New Delhi

4.2 Reference Books:

1. Industrial Instrumentation by Donald P Eickrman

2.Transducers by Peter Norton

5. Outcome of the Course:

After the completion of this course the student will be able to:

1) Select the required instruments for general application and analysis.
2) Demonstrate the techniques of troubleshooting techniques for instrument safety.
3) Solve problems related to various instruments and their sub elements like: Bridges, and Q-meter etc.
4) Classify different types of transducers and explain its characteristics.
5) Demonstrate the operation of resistive, inductive and capacitive transducers.

Transform Calculus

1.1 Course Number: MA201
1.2 Contact Hours: 3-1-0 Credits:11
1.3 Semester-offered: 2nd Year –Odd
1.4 Pre-requisite: NA
1.5 Syllabus Committee Members: Dr. Rupjit Saikia, Dr. Satish Kumar Tiwari & Dr. M. Chakkarapani

2. Objective:

i) To apply Laplace Transforms to find the solutions of ordinary differential equations.
ii) To apply Fourier Transforms to solve the boundary value problems.
iii) To introduce Z-transform concepts and its applications in solving difference equations.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Laplace Transforms-I**	Laplace transform, Properties of Laplace transform, Laplace transform of Unit Step functions, Dirac delta function, Laplace transform of derivatives and integrals.	9
2	**Laplace Transforms-II**	Inverse Laplace transform, Convolution Theorem, Laplace transform of Periodic functions, Evaluation of integrals by L.T and Solutions of ODE.	10
3	**Z - Transforms**	Definition of Z-Transform and its properties, Evaluation of Inverse Z- Transform, Convolution theorem and Application to difference equation.	9
4	**Fourier Transforms-I**	Fourier Transform: Fourier Integral formula, Fourier Transform, Fourier sine and cosine transforms. Linearity, Scaling, frequency shifting and time shifting properties.	10
5	**Fourier Transforms-II**	Inverse Fourier Transform, Self-reciprocity of Fourier Transform. Convolution theorem. Application to boundary value problems.	10
Total			**48**

4. Readings

4.1 Textbooks:

1. Grewal. B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publishers, Delhi, 2012.
2. Veerarajan. T., “Transforms and Partial Differential Equations”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
3. Murray R. Spiegel, Schaum's Outline of Laplace Transforms, McGraw Hill, 1965.

4.2 Reference Books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2007.
2. Ray Wylie. C and Barrett.L.C, “Advanced Engineering Mathematics” Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

5. Outcome of the Course:

1) Apply Laplace Transform techniques for solving the different engineering represented by differential equations.
2) Use Fourier Transform for solving different boundary value problems.
3) Apply Z-Transforms for solving the difference equations.

Digital Electronics Laboratory

1.1 Course Number: EIE201L
1.2 Contact Hours: 0-0-2 Credits:2
1.3 Semester-offered: 2nd Year –Odd
1.4 Pre-requisite: NA
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani& Dr. Santosh Kumar Verma.

1. Verification of the truth tables of basic logic gates.
2. Verify the NAND and NOR gates as universal logic gates.
3. Design and verification of the truth tables of Half and Full adder circuits.
4. Verification of the truth table of the Multiplexer.
5. Verification of the truth table of the Demultiplexer.
6. Verify the truth table of a J-K flip-flop.
7. Verify the truth table of a T flip-flop and D flip-flop.
8. Verify the Operate the counters.
9. Design of 4-bit shift register (shift right).
10. Design of 4-bit shift register (shift left).

Recommended Books:

1. Digital Electronics and Applications by Malvino leach, Tata McGral Hill, New Delhi
2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
3. Digital Fundamentals by Thomas Floyds, Universal Book Stall
4. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi
5. Digital Electronics by KS Jamwal, DhanpatRai& Co., New Delhi
6. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala
7. Digital Electronics by BR Gupta, DhanpatRai& Co., New Delhi
8. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
9. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi

Analog Electronics Laboratory

1.1 Course Number: EIE202L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 2nd Year –Odd
1.4 Pre-requisite: NA
1.4 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

1. Study of VI characteristics of zener diode.
2. Half wave and full wave rectifier with and without filters.
3. To plot and study the input and output characteristics of BJT in common emitter configuration.
4. To plot and study the input and output characteristics of BJT in common base configuration.
5. To plot and study the input and output characteristics of BJT in common collector configuration.
6. To obtain DC and AC load line for fixed bias circuit.
7. Study of Positive/negative clippers with and without positive/negative bias.
8. Study of Positive/negative clamper circuits.
9. Study of Feedback amplifier.
10. Study of Voltage regulator.

Recommended books:

1. Basic Electronics and linear Circuit by NN Bhargava and Kulshreshta, Tata McGraw Hill, New Delhi.
2. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
3. Electronic Components and Materials by SM Dhir, Tata McGraw Hil, New Delhi.
4. Electronic Devices and Circuits by Millman and Halkias; McGraw Hill.
5. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill, New Delhi
6. Electronics Devices and Circuits-I by Naresh Gupta, JyoteshMalhotra and harish C Saini, Eagle Prakashan, Jalandhar
7. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi.

Semester IV

Electronic Circuits

1.1 Course Number: EIE205
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Fundamental of Electrical and Electronics Engineering and Analog Electronics
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma.

2. Objective:

i) To present application-oriented approach to the students in the field of electronic circuits.
ii) To understand the basics of feedback amplifiers, oscillators.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lecture
1	**Concept of transistor biasing**	Concept of transistor biasing and selection of operating point. Need for stabilization of operating point. Different types of biasing circuits. D.C and A.C load line	8
2	**Single stage transistor amplifier and h-parameters**	Single stage transistor amplifier circuit, calculation of currents and voltage gain of a single stage amplifier circuit. h and r-parameters and their significance. Calculation of current gain, voltage gain, input impedance and output impedance using hand r-parameter. Analysis of high frequency response of CE amplifier. High frequency equivalent circuits of BJT (CE configuration), Short circuit current gain, cut-off frequency, Miller effect, Cascode amplifier.	12
3	**Feedback amplifiers**	Effect of positive and negative feedback on gain, frequency response and distortion, Feedback topologies and its effect on input and output impedance, Feedback amplifier circuits in each feedback topologies (no analysis required)	8
4	**Oscillators & Tuned Amplifiers**	Classification of oscillators, Barkhausen criterion, Analysis of RC phase shift and Wien bridge oscillators, Working of Hartley, Colpitts and Crystal oscillators.	8
5	**Power amplifiers**	Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers, efficiency and distortion, Transformer-less class B and Class AB power	6

		amplifiers, Class C power amplifier (no analysis required).	
Total			**42**

4. Readings

4.1 Textbooks:

1.Sedra A. S. and K. C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2013
2. Millman J. and C. Halkias, Integrated Electronics, 2/e, McGraw-Hill, 2010

4.2 Reference Books:

1.Neamen D., Electronic Circuits - Analysis and Design, 3/e, TMH, 2007
2. Rashid M. H., Microelectronic Circuits - Analysis and Design, Cengage Learning, 2011.
3. Spencer R. R. and M. S. Ghausi, Introduction to Electronic Circuit Design, Pearson, 2003
4. Razavi B., Fundamentals of Microelectronics, Wiley, 2015

5. Outcome of the Course:

1) The student can acquire the basic knowledge of electronic circuits, semiconductor devices, thus being prepared to pursue any area of Electronics and Instrumentation engineering spectrum in depth as desired.

2) The students will be able to effectively understand electronic circuits and lead the exploration of new applications and techniques for their use.

Linear Integrated Circuits

1.1 Course Number: EIE206
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Fundamental of Electrical and Electronics Engineering, Analog Electronics
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma

2. Objective:

i) To establish the basic knowledge of Ideal and Practical Op-Amp, related circuits and their application.
ii) To introduce basic principles, operation and applications of the various Op-Amp circuits like: Convertors, ADC, DAC and Function Generators.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Basics of Operational Amplifiers**	Basic information about op-amps– Ideal Operational Amplifier– General operational amplifier stages and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.	8
2	**Applications of Operational Amplifiers**	Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, Integrator, Differentiator, Instrumentation amplifier, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Active filters.	10
3	**Analog Multiplier and PLL**	Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell –Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed-loop analysis, Voltage controlled oscillator	8
4	**Analog to Digital and Digital to Analog Converters**	Analog and Digital Data Conversions, D/A converter – specifications – weighted resistor type, R-2 Ladder type, Voltage Mode and Current-Mode R – 2R Ladder types – switches for D/A converters high speed sample-and-hold circuits, A/D Converters – specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage-to-Time Conversion – Over-sampling A/D Converters, Sigma – Delta converters.	10

5	**Waveform Generators and Special Function ICs**	Sine-wave generators, Multi vibrators and Triangular wave generator, Saw-tooth wave generator,IC-L8038 function generator, IC 555, Introduction to IC Voltage regulators– Three terminal fixed and adjustable voltage regulators– IC-723.	8
Total			**44**

4. Readings

4.1 Textbooks:

1. Sergio Franco, 'Design with operational amplifiers and analog integrated circuits', McGraw-Hill, 1997.
2.D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.

4.2 Reference Books:

1. Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', Wiley International, 1995.
2. J. Michael Jacob, 'Applications and Design with Analog Integrated Circuits', Prentice Hall of India, 1996.
3. Ramakant A. Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall / Pearson Education, 1994.
4. Taub and Schilling, Digital Integrated Electronics, McGraw-Hill, 1997.
5. William D. Stanely, 'Operational Amplifiers with Linear Integrated Circuits'. Pearson Education, 2004.

5. Outcome of the Course:

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

1) Demonstrate the basic concepts Ideal and Practical Op-Amp, related circuits and also solve their application related problems.
2) Demonstrate the working principal and application of various Op-Amp circuits like: Convertors, ADC, DAC and Function Generators.

Basics of Control System

1.1 Course Number: EIE207
1.2 Contact Hours: 3-1-0 Credits:11
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Mathemetics-I & II and Transform Calculus
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma.

2. Objective:

i) To understand the operation of manual and automatic control systems.
ii) To analyse and understand the stability aspects of physical systems using transfer function model.
iii) To provide adequate knowledge to understand the time response specifications of second order systems and multiloop control systems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Basic elements of the control system, open loop and closed-loop control systems, manually controlled closed loop systems, automatic controlled closed loop systems, control system examples from mechanical systems, electrical systems.	12
2	**Control system representation**	Transfer function, block diagram, reduction of block diagram, Mason's formula signal flow graph.	8
3	**Time Response Analysis**	Standard test signals, time response of first and second-order system, time constant, time response of second other system, time response specifications, steady-state errors and error constants.	9
4	**Stability**	Routh Hurwitz Criterion, Root Locus, Bode Plotting	10
5	**Multiloop Control System**	Introduction to feed forward, cascade, ratio, split range, control system.	9
Total			**48**

4. Readings

4.1 Textbooks:

1. Control Systems by Nagrath and Gopal.
2. Control Systems by B.C. KUO.
3. Control Systems by Ogata.
4. Control Systems by RC Shukla.

4.2 References Books:

1. Chemical Process Control by Stephenapolis.

5. Outcome of the Course:

1) Illustrate different applications of manual and automatic control systems.
2) Develop the transfer function model of physical system and analyse their stability.
Analyse the time response of a second order system and multiloop control systems.

Electronic Instruments and Measurements

1.1 Course Number: EIE208
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: NA
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma.

2. Objective:

i) To learn the basic principles of all measuring instruments.
ii) To understand the voltage, current and resistance measurement using multimeter and electronic voltmeter.
iii) To understand the operation of digital storage oscilloscope and digital meters.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Multimeter**	Movingcoil and moving iron type instruments (voltmeter and ammeter), Multimeter. Specifications of multimeter and their applications, wheat stone Bridge, AC bridges,: Maxwell's induction bridge, Hay's bridge, Schering bridge and Anderson bridge.	9
2	**Electronic voltmeter**	Advantages over conventional multimeter for volt measurement with respect to input impendence and sensitivity. Principles of voltage, current and resistance measurement (block diagram only) Specifications of electronics voltmeter. Types of AC milli voltmeters and their block diagram description. Typical specification and their significance.	9
3	**Cathode Ray Oscilloscope**	Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls specifications of CRO and their explanation. Measurement of current, voltage, frequency, time period and phase using CRO.CRO probes, special features of dual beam, dual trace, delay sweep. Digital storage oscilloscope: block diagram and working.	8
4	**Signal Generators and Analysis Instruments**	Explanation of block diagram specifications of low frequency and RF generators, Pulse generator, function generator. Distortion factor meter; wave analyzer and spectrum analyser.	8

5	**Digital Instruments**	Comparison of analog and digital instruments. Working principle of ramp, dual slope and integration type digital voltmeter. Working principle of logic probe, logic pulser, logic analyzer, logic comparator, Signature analyzer and logic analyser.	8
Total			**42**

4. Readings

4.1 Textbooks

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai & Sons, Delhi
2. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

4.2 Reference Books:

1. Electronics Instrumentation by Cooper, Prentice Hall of India

5. Outcome of the Course:

1) Describe operation of electronic measuring instruments.
2) Measure the voltage, current and resistance through multimeter and electronic voltmeter.
3) Explain the principle of operation of DSO and digital meters.

Principles of Communication Engineering

1.1 Course Number: EIE209
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Transform Calculus
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma.

2. Objective:

i) Distinguish various analog Modulation techniques used in various Communication systems.
ii) To understand basics about noise and it's impact on the communication systems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	**Introduction**	Overview of Communication system, Communication channels, Need for modulation, Baseband and Pass band signals, Amplitude Modulation: Double sideband with Carrier (DSB-C), Double side band without Carrier DSB-SC, Single Side Band Modulation SSB, Modulators and Demodulators, Vestigial Side Band(VSB),Radio Transmitter and Receiver.	10
2	**Angle Modulation and its types**	Angle Modulation, Bandwidth of FM and PM Signals, Modulators and Demodulators of FM and PM (block diagram, working principle)	8
3	**Pulse Modulation and its types**	Pulse Modulation, Digital Transmission of Analog Signals: Sampling Theorem and its applications, Pulse Amplitude Modulation (PAM), Pulse Width Modulation, Pulse Position Modulation, Their generation and Demodulation, Pulse Code Modulation (PCM),Time Division and Frequency Division Multiplexing	10
4	**Differential Pulse Code Modulation and Noise**	Differential Pulse Code Modulation, Delta Modulation. Adaptive Delta Modulation	9
5	**Certain parameters of noise**	Sources of Noises, Noise in Amplitude Modulation: Analysis, Signal to Noise Ratio, Figure of Merit. Noise in Frequency Modulation, Introduction to mobile communication (an overview)	8
Total			**45**

4. Readings

4.1 Textbooks:

1. Rishabh Anand, Communication Systems, Khanna Publishing House, Delhi
2. B.P. Lathi, "Modern Digital and Analog communication Systems", 3rd Edition, Oxford University Press.
3. H.P. Hsu & D. Mitra "Analog and Digital Communications", 2nd Edition, Tata McGraw-Hill.
4. Communication Systems (Analog and Digital), Sanjay Sharma, Katson Books.

4.2 Reference Books:

1. Herbert Taub and Donald L. Schilling, "Principles of Communication Systems", Tata McGraw Hill.
2. Simon Haykin, "Communication Systems", 4th Edition, Wiley India.

5. Outcome of the Course:

1) Analyze the Amplitude and Frequency Modulated signals.
2) Familiarize the process of reproduction of base band signal.
3) Analyze various pulse analog and pulse digital Modulation Techniques.
4) Understand the noise and its impact on the various process involved in the communication systems

Linear Integrated Circuits Laboratory

1.1 Course Number: EIE206L

1.2 Contact Hours: 0-0-2 Credits: 2

1.3 Semester-offered: 2nd Year –Even

1.4 Pre-requisite: Fundamental of Electrical and Electronics Engineering, Analog Electronics

1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma.

1. To design and setup a voltage follower circuit with OPAMP IC 741C and observe the waveforms.
2. To design and setup an inverting amplifier circuit with OP AMP 741C for a gain of 10, plot the waveforms, observe the phase reversal, and measure the gain.
3. To design and setup a non-inverting amplifier circuit with OPAMP IC 741C for a gain of 11, plot the waveform, observe the phase reversal, and measure the gain.
4. To design and setup a summing amplifier circuit with OP AMP 741C for a gain of 2 and verify the output.
5. To design and setup a difference amplifier circuit with OPAMP IC 741C for a gain of 2 and verify the output.
6. To design and setup a zero-crossing detector circuit with OP AMP 741C and plot the waveforms.
7. To design and setup a Schmitt trigger, plot the input-output waveforms and measure VUT and VLT.
8. To design and setup a Differentiator circuit using OP AMP 741C and plot their pulse response.
9. To design and setup an Integrator circuit using OP AMP 741C and plot its pulse response.
10. To design and setup symmetrical and asymmetrical astable multivibrators using Op-Amp 741, plot the waveforms and measure the frequency of oscillation.
11. To design and setup a monostable multivibrator using Op-amp 741 andPlot the waveforms.
12. To Design and setup a RC phase shift oscillator using Op-Amp 741 and (i) Plot the output waveform (ii) Measure the frequency of oscillation
13. To design and setup symmetrical and asymmetrical astable multivibrators using IC 555 and **(**i) Plot the output waveform (ii) Measure the frequency of oscillation
14. To design and setup symmetrical and asymmetrical monostable multivibrators using IC 555
    and **(**i) Plot the output waveform (ii) Measure the frequency of oscillation.
15. To set up voltage-controlled oscillator using IC566 and plot the waveforms.

Recommended Books:

1. Sergio Franco, ‘Design with operational amplifiers and analog integrated circuits’, McGraw-Hill, 1997.

2.D. Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd., 2000.
3. Ramakant A. Gayakwad, ‘OP-AMP and Linear IC’s’, Prentice Hall / Pearson Education, 1994.

Electronic Instruments and Measurements Laboratory

1.1 Course Number: EIE208L

1.2 Contact Hours: 0-0-2 Credits:2

1.3 Semester-offered: 2nd Year –Even

1.4 Pre-requisite: NA

1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma.

1. Measurement of DC/AC current and voltage by Ammeter
2. To study block wise construction of a multimeter and measuring voltage, current and resistance using multimeter.
3. Study of the AC Mill voltmeter.
4. Study of the Electronic voltmeter
5. Measurement of Capacitance using Schering Bridge
6. Measurement of Inductance using Maxwell Bridge
7. Measurement or unknown resistance using kelvin's Bridge.
8. Study the working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes
9. Study of distortion factor meter and determination of the % distortion of the given oscillator.
10. Study the working and applications of Function Generator

Recommended books:

1. Electronics Measurement and Instrumentation by AK Sawhney, DhanpatRai& Sons, Delhi
2. Electronics Instrumentation by Cooper, Prentice Hall of India
3. Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
4. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

Semester V

Microprocessors and Applications

1.1 Course Number: EIE301
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Digital Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) Understand the architecture of 8085 and 8086.
ii) Impart the knowledge about the instruction set.
iii) Understand the basic idea about the data transfer schemes and its applications.
iv) Develop skill in simple program writing for 8085 & 8086 and applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to microprocessor 8085**	Introduction to Microprocessor, Basic Block diagram of Microcomputer system, Architecture of 8085, Pin Diagram of 8085, Interrupts.	10
2	**Instructions and Programmingin 8085**	The instruction set of 8085, Timing Diagram, Programming of 8085.	10
3	**Introduction to Microprocessor 8086**	Introduction to 16-bit microprocessor, Introduction to 8086, Pin Diagram and Block Diagram of 8086 and Interrupts.	8
4	**Peripheral Interface**	Interfacing and I/O ports, PPI e.g. 8255 A, 8155 in detail, 8257 in detail, Serial I/O data communication.	9
5	**Semiconductor Memories**	RAM, SRAM, DRAM, ROM, EPROM, EEPROM, Flash Memory.	9
Total			**46**

4. Readings

1. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
2. Microprocessor and Applications by B Ram
3. Comprehensive Study of Microprocessor by Naresh Grover

4. Introduction to Microprocessor by Adithya P Mathur, Tata McGraw Hill Publishers, New Delhi
5. Microprocessorsand Microcontrollers by Krishna Kant, PHI Learning Private Limited.

5. Outcome of the Course:

After the completion of this course the student will be able to:

1) Understand and demonstrate the basic architecture of 8085 and 8086.
2) Impart the knowledge about the instruction set.
3) Understand the basic idea about the data transfer schemes and its applications.
4) Develop skill in simple program writing for INTEL 8085 and INTEL 8086.

Power Electronics

1.1 Course Number: EIE302
1.2 Contact Hours: 3-1-0 Credits:11
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: FEEE and Analog Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) To get an overview of thyristors and other power electronics devices and their switching characteristics.
ii) To understand the operation of half wave and full wave-controlled rectifiers.
iii) To study the operation of inverters, choppers, dual converters and cycle converters.
iv) To study the operation of thyristorised control of electric drives.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Thyristors and other power electronics devices**	Power Diode-Characteristics and Principle of working, SCR: Construction and working principles, two transistor analogy, VI characteristics, specifications & ratings, Turn-On and Turn-off methods. Construction & working principle of DIAC, TRIAC & their V-I characteristics. Construction, working principle of UJT, VI characteristics. Brief introduction to Gate Turn off thyristor (GTO), MOSFET, IGBT.	12
2	**Controlled Rectifiers**	A Single-phase half wave controlled rectifier with load (R, R-L), Single Phase half controlled and fully controlled full wave bridge/centre tap rectifier.	8
3	**Inverters, Choppers, Dual Converters and Cycloconverters**	Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, Inverters & their application. Choppers: Introduction, types of choppers. Step up and step-down choppers. Dual Converters & cyclo converters: Introduction, types & basic working principle of dual converters & cyclo converters & their application.	10

4	**Thyristorised Control of Electric drives**	DCdrive control, Half wave and Full wave drives. Chopper drives (Speed control of DC motor using choppers), AC drive control, Phase control (Speed control of induction motor using variable frequency). Typesof braking-regenerative braking, plugging,dynamic braking.	8
5	**Uninterrupted Power supplies**	UPS, on-line, offline & its specifications, Automatic battery charger circuit for UPS.	7
Total			**45**

4. Readings

4.1 Textbooks:

1. Power Electronics by P.C. Sen Tata McGraw Hill. New Delhi
2. Power Electronics by P.S. Bhimbhrah, Khanna Publishers, New Delhi
3. Power Electronics by M.S. Berde, Khanna Publishers, New Delhi
4. Power Electronics by MH Rashid
5. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi
6. Power Electronics by S Rama Reddy, Narosa Publishing House Pvt.Ltd., New Delhi
7. Power Electronics by Sugandhi and Sugandhi

4.2 Reference Books:

1. Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

5. Outcome of the Course:

1) Illustrate the process of selection of different power semiconductor switches.
2) Analyze the performance of controlled rectifier circuits.
3) Illustrate the operation of different topologies in inverters, choppers, dual converters and cyclo converters.
4) Analyse the operation of thyristor-based DC and AC drives.

Industrial Process Control and Instrumentation

1.1 Course Number: EIE303
1.2 Contact Hours:3-0-0 Credits:9
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Physics-I and II
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) To understand the operation and selection of flow and level sensors.
ii) To study the operation of pressure and temperature sensors.
iii) To learn the method to measure pH, moisture, humidity, viscosity and density.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Trends in process control, selection of key variables for process control, hydraulic, pneumatic and electronic instrumentation.	8
2	**Flow and Level Measurement**	Construction, working principle, selection criteria and application of flow measurement with orifices, magnetic, ultrasonic, vortex flow meters, turbine flow meter and rotameter. Construction, working principle, selection criteria and application of level detectors, float level devices, level gauges, optical level devices, radiation level sensors, thermal level sensors, level switch.	12
3	**Temperature Measurement**	Construction, working principle, selection criteria and application of temp sensors – thermocouples, RTD's thermisters, radiation pyrometry, IR detectors.	8
4	**Pressure Measurement**	Construction, working principle, selection criteria and application of pressure sensors – bellows, tiaphragon, bourdon and helical types, electronic pressure sensor, manometers, pressure gauges, vaccum sensors, high pressure sensors, pressure switch.	8
5	**Measurement System**	Measure system for Density, pH, humidity, moisture and viscosity measurement. Introduction to Industrial Measurement.	8
Total			**44**

4. Readings

4.1 Textbooks:

1. Mechanical measurements by AK Sawhney; Dhanpat Rai and Co. New Delhi
2. Mechanical and Industrial measurementsby RK Jain, Khanna Publisher, New Delhi

4.2 Reference Books:

1. Process control instrumentation technology by Custis D Johnson: Joh Wiley and sons
2. Process/Industrial Instruments and Control Handbook by considine: Douples M: Magraw Hill
3. Mechanical Measurement by Becwith and Buch: pearson

5. Outcome of the Course:

1) Demonstrate the flow and level sensors.
2) Classify and choose the pressure and temperature sensors for realtime measurements.
Make use of viscosity and density measuring methods for the given liquids.

Humanities

1.1 Course Number: HU301
1.2 Contact Hours: 2-0-0 Credits:6
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: Diploma level English
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) Foster intellectual curiosity, global knowledge, critical thinking, personal responsibility, and ethical and cultural awareness.
ii) Prepare students to use language effectively.
iii) Establish a framework for students to develop an aesthetic appreciation for fine arts.
iv) Prepare students to be responsible citizens, lifelong learners, and world-ready leaders in their chosen fields.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Sociology**	Definition of sociology, some sociological concepts: social structure, status, role, norms, values etc. Socialization, and culture and change. Social stratification - various approaches and concept of social mobility. Population and society - Trends of demographic change in India and the world, Human Ecology, Trends of Urbanization in the developing countries and the world. Major social institutions - Family and marriage, caste and tribe and organizations: (i) formal organization (bureaucracy) (ii) informal organization. Processes of social change - Modernization (including Sanskritization), industrialization, environmental/ecological changes and development. Social movements - protest movements, reformist movement and radical movements in India.	9

2	**Introduction to Literature**	Nature of Literature: Literature as a Humanistic Experience. Definitions: (i) Humanities: concern with culture, values, ideologies; (ii) Literature: concepts of imitation, expression, intuition & imagination. Major Themes of Literature: Nature, Science, Selfhood, Love, Rebellion. The Language of Literature: Modes of literary and non-literary expression. The concepts of Figurative language, imagery, symbolism, style. The Forms of Literature: Prose Narratives (short stories & novels) Poetry, Drama and Essays (Suitable texts are to be chosen by the instructors), Use of a Learner Dictionary.	7
3	**Introduction to Philosophy**	Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsifications, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism, and under-determination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories. Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence, and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviorist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics	7
Total			**23**

4. Readings.

4.1 Textbooks/Reference Books:

(A) Introduction to Sociology:

(a) L. Broom, P. Selznick and D. Dorrock, Sociology, 11th Edn. 1990 (Harper International).
(b) M. Haralambos, Sociology: Themes and Perspectives, Oxford University Press, 980.
(c) M.S.A. Rao (ed) Social movements in India, vols. 1-2, 1984, Manohar.
(d) David Mandelbaum, Society in India, 1990, Popular.
(e) M.N. Srinivas, Social change in modern India, 1991, Orient Longman.
(f) Guy Rocher, A. General Introduction to Sociology, MacMillan, 1982.

(B) Introduction to Literature:

(a) David Murdoch (ed.). The Siren's Song: An Anthology of British and American Verse, Orient Longman, 1988.
(b) S. Alter & W. Dissanayake (eds.) The Penguin Book of Modern Indian Short Stories. Penguin Books (India), 1989.
(c) Bertrand Russell, Impact of Science on Society. Allen &Unwin, 1952.
(d) Henrik Ibsen, A Doll's House, Macmillan India, 1982.
(e) George Orwell, Animal Farm, Penguin, 1951.
(f) J. Bronowski. The Ascent of Man, BBC, 1973.

(C) Introduction to Philosophy:

(a) A.C. Grayling (ed.) Philosophy: A Guide through the Courses/Subjects, Oxford Univ. Press, London, 1995.
(b) Marx W. Wartofsky, Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Macmillan, London, 1968.
(c) I.B. Cohen, The Birth of a New Physics, Vakils, Feffer and Simons Pvt. Ltd., Bombay, 1968.
(d) H. Eves and C.V. Newsom, Foundations and Fundamental Concepts of Mathematics, Boston, PWS-Kart Pub. Co., 1990.
(e) K.E. Goodpaster and K.M. Sayre (eds.) Ethics and Problems of 21st Century, Univ. of Notre Dame Press, London, 1979.
(f) S.D. Agashe, A. Gupta & K. Valicha (eds.) Scientific Method, Science, Technology and Society: A Book of Readings, Univ. of Bombay Press, 1963.

5.Outcome of the Course:

Students will demonstrate:

Knowledge of the conventions and methods of at least one of the humanities in addition to those encompassed by other knowledge areas required by the General Education program.

Engineering Economics

1.1 Course Number: HU302
1.2 Contact Hours: 2-1-0 Credits: 8
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: Diploma level Mathematics
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) To make fundamentally strong base for decision making skills by applying the concepts of economics.
ii) Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
iii) Prepare engineering students to analyze profit/revenue data and carry out make economic analysis in the decision-making process to justify or reject alternatives/projects.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Economics**	Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic analysis – Material selection for product design selection for a product – Process planning.	14
2	**Value Engineering**	Make or buy decision – Value engineering – Function – Aims – Value engineering procedure – Interest formulae and their applications –Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment Present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples all methods.	12

3	**Cash Flow**	Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples all methods.	12
Total			**38**

4. Readings:

4.1 Textbooks:

1. Panneer Selvam, R., "Engineering Economics", Prentice Hall of India Ltd, 2001.
2. Smith, G.W., "Engineering Economy", Lowa State Press, 1973.

4.2 Reference books:

1. Park, C.S., "Contemporary Engineering Economics", Prentice Hall of India, 2002.
2. Newman, D.G. and Lavelle, J.P., "Engineering Economics and Analysis", Engineering Press, 2002.
3. Degarmo, E.P., Sullivan, W.G. and Canada, J.R, "Engineering Economy", Macmillan, 1984.
4. Grant, E.L., Ireson, W.G. and Leavenworth, R.S., "Principles of Engineering Economy", Ronald Press, 1976.

5.Outcome of the Course:

Upon completing the course, students will be able to:

1) Understand major principles of economic analysis for decision making among alternative courses of action in engineering.
2) Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.
3) Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and breakeven analysis.

Microprocessors and Applications Laboratory

1.1 Course Number: EIE301L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Digital Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, &Dr. Santosh Kumar Verma.

1. Study of 8085 Microprocessor kit.
2. Write a program using 8085 and verify for: a. Addition of two 8-bit numbers. b. Addition of two 8-bit numbers (with carry)
3. Write a program using 8085 and verify for: a. 8-bit subtraction (display borrow) b. 16-bit subtraction (display borrow).
4. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition method.
5. Check for minimum number of additions and test for typical data and write a program using 8085 for multiplication of two 8- bit numbers by bit rotation method and verify.
6. Write a program using 8085 for division of two 8- bit numbers by repeated subtraction method and test for typical data.
7. Write a program using 8085 for dividing two 8- bit numbers by bit rotation method and test for typical data.
8.Write a program to interface a two-digit number using seven-segment LEDs. Use 8085 microprocessor and 8255 PPI.
9. Write a program to control the operation of stepper motor using 8085 microprocessor and 8255 PPI.
10. Write a program for traffic light controller using 8085 microprocessor and 8255 PPI.

Recommended Books:

1. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
2. Microprocessor and Applications by B Ram
3. Comprehensive Study of Microprocessor by Naresh Grover
4. Introduction to Microprocessor by Adithya P Mathur, Tata McGraw Hill Publishers, New Delhi
5. Microprocessor by SK Goel.
6. 8051 by Mcakenzie, Prentice Hall of India, New Delhi.

Power Electronics Laboratory

1.1 Course Number: EIE302L
1.2 Contact Hours: 0-0-2 Credits:2
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Analog Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

1. Study of Characteristics of SCR, MOSFET & amp; IGBT.
2. Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.
3. Study of Single-Phase half with R and RL loads
4. Study of Fully controlled bridge converter with R and RL loads.
5. Study of Single Phase Cyclo converter with R and RL loads.
6. Study of Step up and step-down choppers.
7. Study of Series & parallel Inverter
8. Study of DC drive control
9. Study of AC drive control
10. To test the performance of given UPS.

Recommended Books:

1. Power Electronics by P.C. Sen Tata McGraw Hill. New Delhi
2. Power Electronics by P.S. Bhimbhrah, Khanna Publishers, New Delhi
3. Power Electronics by M.S. Berde, Khanna Publishers, New Delhi
4. Power Electronics by MH Rashid
5. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi
6. Power Electronics by S Rama Reddy, Narosa Publishing House Pvt.Ltd., New Delhi
7. Power Electronics by Sugandhi and Sugandhi
8. Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

Semester VI

Computer aided PCB Design

1.1 Course Number: EIE306
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Analog Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) To understand the procedure to be adopted for making computer aided electrical drawing.
ii) To understand the operation of electrical and electronic circuits by simulation.
iii) Familiarize the PCB software for PCB layout design.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction PCB &Computer Aided Electrical Drawing**	Need for PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials, Procedure to be adopted for computer aided drawings, Electrical machines - AC and DC, motor R-L series, parallel circuit R-C series, parallel circuit R-L-C series, parallel circuit, D.C. machine parts and cross-sectional view A.C. machine parts and cross-sectional view.	9
2	**Computer Aided Electronics Drawing**	Symbols and notations of electronic components - Resistor, Inductor, transformer and Capacitor Semiconductor device Diodes, Zener diode, Transistors PNP/ NPN, Tunnel diode, photo diode, varactor, FET, MOSFET, IGBT, UJT etc. Half-wave, full-wave and bridge rectifier, Power amplifier and voltage amplifier and different types of oscillators circuits.	9
3	**Simulation of Electrical Circuits**	Getting started, ending, commonly used blocks, creating a model, Assigning Variables, Observing Variables during Simulation, Storing/Saving Data, Creating and Masking Sub-systems Series and parallel R-L circuit, Series and parallel R-C circuit, Series and parallel R-L-C circuit Resonance in AC Circuit and Electrical machines circuits Graphics, Plot, sub plot, label, legend etc.	10

4	**Simulation of Electronics Circuits**	Half wave, full wave and bridge rectifier, Buck converter, Power amplifier and voltage amplifier Different types of oscillators circuits.	8
5	**Computer Aided PCB Design**	Overview of software for PCB design PCB layout of rectifier circuit PCB layout of amplifier circuit PCB layout of oscillator circuit	8
Total			**44**

4. Readings

4.1 Textbooks:

1. AutoCAD 2013 for Engineers and Designers, Sham TickooDream tech press, New Delhi, Latest edition.
2. Introduction to PSpice Using OrCAD for Circuits and Electronics by Muhammad H;RashidPHI Learning, New Delhi, Latest edition

4.2 Reference Books:

1. Mastering AutoCAD 2013 and AutoCAD LT 2013 George OmuraSybex, New Delhi, Latest edition.
2. Mastering electronics workbench: Version 5 and Multisim Version 6 John Adams McGraw-Hill, New Delhi, Latest edition

5. Outcome of the Course:

1) Understand the necessity and evolution of PCB layout.
2) Simulate and analyze electrical and electronic circuits.
3) Design PCB layout for rectifier, amplifier and oscillator circuits.

Industrial Automation

1.1 Course Number: EIE307
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Industrial Process Control and Measurement
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i)To understand the procedure to be adopted for making computer aided electrical drawing.
ii) To study programmable logic controller and various programming languages.
iii)To induce concept of Supervisory Control and Data Acquisition Systems & distributed control systems and their applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA).	8
2	**Computer aided measurement and control systems**	Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer based data acquisition system, Internet of things (IoT) for plant automation.	8
3	**Programmable logic controllers**	Programmable controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.	10
4	**Supervisory Control and Data Acquisition Systems**	Introduction SCADA, Typical SCADA architecture, Benefits of SCADA, Types of SCADA, RTU & MTU functions, Communications in SCADA, Interfacing SCADA system with PLC and Application of SCADA.	10
5	**Distributed Control System**	Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.	8
Total			**44**

4. Readings

4.1 Textbook:

1. Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies

4.2 Reference Books:

1. Process Control Instrumentation Technology By. C.D. Johnson, PHI
2. Industrial control handbook, Parr, Newnem
3. Programmable logic controller, Dunning, Delmar

5. Outcome of the Course:

1) Understand the operation of various automation components used in industrial automation.
2) Develop a logic for various industrial applications using PLC.
3) Understand and demonstrate the Supervisory Control and Data Acquisition Systems & distributed control systems for industrial automation.

Embedded System and Programming

1.1 Course Number: EIE308
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Microprocessors and Application
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) To understand what is an Embedded System and then define it
ii) Look at embedded systems from a historical point of view
iii) Classify embedded systems
iv) Look at certain applications & purposes of embedded systems

3. Course Content:

Unit-wise distribution of content and number of lectures

UNIT	Topics	Sub-topic	Lectures
1	**Introduction to embedded system**	History & need of Embedded System; Basic components of Embedded System; Block diagram, Pin diagram. Programming Language Classification of Embedded System	10
2	**Registers & memory of at89c51**	Description of RAM; Description of CPU Registers; Functions of SFR	6
3	**Introduction to assembly language**	Assembly language programming – macros - Data representation, Basic structure of programming in assembly language	8
4	**Introduction of embedded c**	Introduction to Embedded C; Difference between C & Embedded C; Programming style; Basic structure of C program	12
5	**Timers, Interrupts, Interfacing**	Timers/Counters, polling, Interrupts, Serial Communications, Interfacings with LCD, Keyboard	8
Total			**44**

4. Readings

4.1 Textbook:

1. Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.

4.2 Reference Books:

1. Designing Embedded Systems with PIC Microcontrollers: principles and applications by Tim Wilmshurst, Elsevier.
2. 8051 microcontroller,3rd edition, Kenneth Ayala, Cengage Learning
3. Embedded Systems Design by Steve Heath, II edition, Newness publications
4. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers by Tammy Noergaard, Elsevier.

5. Outcome of the Course:

1) Better understanding of microcontroller which will help the students to develop various projects
2) To further develop embedded application using Embedded C Programming

Computer aided PCB Design and PLC Laboratory

1.1 Course Number: EIE306L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Analog Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

1. Study of simulation software and generation of various signals (Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp)
2. Transient responses of series RLC, RL, RC circuits with Sine and Step inputs
3.Simulation of diode bridge rectifiers with R, RL load
4. Simulation of Buck and boost converter
5. Study of PCB Lay-Out Preparation software
6. PCB layout for bridge Rectifier.
7. PCB layout for Buck converter.
8. PCB layout for Astable Multivibrator and set up this circuit.
7. Study of PLC Programming Software.
9. Implementation of Basic Logic Gates using PLC.
10. Operation of Relay and Switches using PLC.

Recommended Books:

1. AutoCAD 2013 for Engineers and Designers, by Sham TickooDream,Tech press, New Delhi, Latest edition.
2. Mastering AutoCAD 2013 and AutoCAD LT 2013 by George Omura, Sybex, New Delhi, Latest edition.
3. Mastering electronics workbench: Version 5 and Multisim Version 6 by John Adams, McGraw-Hill, New Delhi, Latest edition
4. Introduction to PSpice Using OrCAD for Circuits and Electronics by Muhammad H;RashidPHI Learning, New Delhi, Latest edition

Embedded System and Programming Laboratory

1.1 Course Number: EIE308L
1.2 Contact Hours:0-0-2 Credits:2
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Microprocessors and Applications
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

1. Addition, subtraction, multiplication and division of two 8-bit numbers
2. Addition of two 16-bit numbers
3. BCD to seven segments
4. Find GCD and LCM for given two-byte length numbers.
5. Generation of 5ms delay with and without interrupt for timer.
6. Counting no of pulses in the external clock using counter.
7. Send a string serially with 9600 baud rate & receive a string serially and storing in internal RAM.
8. 16X2 LCD display interfacing.
9. Matrix keypad interfacing
10. ADC interfacing.
11. Stepper motor interfacing.
12. Temperature sensor and Relay control

Textbooks:

1.Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.
2. Designing Embedded Systems with PIC Microcontrollers: principles and applications by Tim Wilmshurst, Elsevier.
3. 8051 microcontroller,3rd edition, Kenneth Ayala, Cengage Learning

Reference Books:

1. Embedded Systems Design by Steve Heath, II edition, Newnes publications
2. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers by Tammy Noergaard, Elsevier.

Departmental Elective/ Open Elective

Biomedical Electronics and Instrumentation

1.1 Course Number: EIE309
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Class-X level Science and FEEE
1.4 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) To introduce the fundamentals of transducers as applicable to physiology.
ii) To explore the human body parameter measurements setups.
iii) To make the students understand the basic concepts of forensic techniques.
iv) To give basic ideas about how multimedia evidences are useful in crime investigation.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Fundamentals of Biomedical Engineering**	Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers	8
2	**Non-Electrical Parameters Measurement and Diagnostic Procedures**	Measurement of blood pressure - Cardiac output - Heart rate, Heart sound, Pulmonary function measurements, Spirometry, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers, pH of blood – measurement of blood pCO2, pO2, Finger-tipOxymeter - ESR, GSR measurements.	7
3	**Electrical Parameters Acquisition and Analysis**	Electrodes for Biomedical Applications, Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.	9

4	**Imaging Modalities and Analysis**	Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.	7
5	**Life Assisting, Therapeutic and Robotic Devices**	Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system,Introduction to Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.	9
Total			**40**

4. Readings

4.1 Textbooks:

1. “Handbook of Biomedical Instrumentation”, R.S. Khandpur, Second Edition, Tata McGraw Hill, 2003.
2. “Handbook of Analytical Instruments”, Khandpur R S, Tata McGraw Hill,1989
3. “Biomedical Instrumentation”, Shakthi Chatterjee & Aubert Miller, CENGAGE Learning, 2010.
4. “Handbook of Biomedical Instrumentation”, Chandralekha Goswami, Manglam Publications, 2010.

4.2 Reference Books:

1. “Principles of Applied Biomedical Instrumentation”, L.A.Geddes&L.E.Baker, Wiley India Pvt.Ltd, Third Edition, 1989.
2. “Medical Instrumentation: Application and Design”, JohnG.Webster, Wiley India Pvt.Ltd, Third Edition, 2002.
3. “The Biomedical Engineering Handbook”, Joseph D. Bronzino, CRC Press, 1995.
4. “Encyclopedia of Medical Devices and Instrumentation”, John G. Webster, Second Edition, Wiley Inter science, 2006.
5. “Principles of Biomedical Instrumentation and Measurements”, Richard Aston, Merril Publishing Co, 1990.
6. “Telemedicine: Medicine and Communication”, Thorsten M Buzug, Heinz Handels, Dietrich Holz, Springer Verlag, 2001.

5. Outcome of the Course:

After the completion of this course the student will be able to:
1) Understand the physiology of biomedical system.
2) Measure biomedical and physiological information.
3) Discuss the application of Electronics in diagnostics and therapeutic area.

Electrical Safety

1.1 Course Number: EIE310
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: FEEE
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) To impart knowledge on electrical hazards and safety equipments.
ii) To analyze and apply various grounding and bonding techniques.
iii) To select appropriate safety method for low, medium and high voltage equipments.
iv) To carry out proper maintenance of electrical equipment by understanding various standards.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Electrical Hazards**	Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags.	10
2	**Grounding and Bonding**	General requirements for grounding and bonding- definitions-grounding of electrical equipment- bonding of electrically conducting materials and other equipment- connection of grounding and bonding equipment- system grounding- purpose of system grounding electrode system.	7
3	**Safety Methods**	The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system- lockout-tag out- flash hazard calculation and approach distances- calculating the required level of arc protection-safety equipment, procedure for low, medium and high voltage systems- the one minute safety audit.	9
4	**Safety Team**	Electrical safety programme structure, development- company safety team- safety policy programme implementation- employee electrical safety teams- safety meetings- safety audit accident prevention- first aid- rescue techniques-accident investigation.	7
5	**Maintenance of Electrical Equipment**	Safety related case for electrical maintenance- reliability centered maintenance (RCM) - eight step maintenance programme-frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- standard for electrical safety in work place-occupational safety and health administration standards.	8
Total			**41**

4. Readings

4.1 Textbooks:

1. Dennis Neitzel, Al Winfield, ‘Electrical Safety Handbook’, McGraw-Hill Education, 4th Edition,2012.

4.2 Reference Books:

1. John Cadick, ‘Electrical Safety Handbook’, McGraw-Hill School Education Group, 1994.
2. Maxwell Adams.J, “Electrical safety- a guide to the causes and prevention of electric hazards”,The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, ‘Electrical safety in the workplace’, Jones & Bartlett Learning,

5. Outcome of the Course:

1) Understand various types of electric hazards and appropriate safety equipment used in industries.
2) Analyze and apply various grounding and bonding techniques.
3) Select appropriate safety method for low, medium and high voltage equipment.
4) Carry out proper maintenance of electrical equipment by understanding various standards.

Troubleshooting of Electronic Equipment

1.1 Course Number: EIE311
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Instrumentation and Transducers, Electronic Circuits
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences so as to maintain different types of electronic equipment.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Fundamental Troubleshooting Procedures**	Inside an Electronic Equipment: Reading Drawings and Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions	6
2	**Nature of faults**	Nature of faults, Fault location procedure, Fault finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques, approaching components for tests, Grounding systems in Electronic Equipment, Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.	8
3	**Passive Components and Their Testing**	Passive Components- Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, variable resistors as potentiometers, failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and	6

		Thermistor Types of capacitors and their performance	
4	**Failures in components**	Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, Testing of inductors and inductance measurement	4
5	**Testing of Semiconductor Devices**	Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure, Test procedures for Diodes, special types of Diodes, Bipolar Junction Transistors, Field Effect Transistors, Thyristors Operational Amplifiers, Fault diagnosis in op-amp circuits.	4
Total			**28**

4. Readings

1. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 2006
2. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001
3. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F. M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi
4. Consumer Electronics by S. P. Bali, Pearson
5. Opamps - Design, Application and Troubleshooting by David L Terrell, Butterworth-Heinemann
6. Electronic Testing and Fault Diagnosis by G. C. Loveday, A. H. Wheeler Publishing

5. Outcome of the Course:

1) The students will be able to troubleshoot electronic equipment.
2) They will be able to troubleshoot analog components and circuits.
3) They will understand the basics about faults in semiconductor devices

Solar Power System

1.1 Course Number: EIE312
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: FEEE and Power Electronics
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. Santosh Kumar Verma.

2. Objective:

i) To understand the different types if solar PV cells and its electrical characteristics.

ii) To examine the operation of grid connected off-grid and hybrid solar PV systems.

iii) To design a practical PV system through the understanding of module connections, inverter selection and sizing.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Types of Solar Power Plant**	Grid Connected solar Power Plant, Grid interactive solar power plant, Net Metering Solar Power Plant Off-Grid /Hybrid solar power plant, Schemes of solar power plant.	8
2	**Selection of PV module technology**	Introduction, Crystalline technology, thin film technology, Bi-facial technology, Comparison between PV module technology, Comparison between solar power plant energy output.	7
3	**PV module characteristics**	Characteristics of a Solar Cell, Power Characteristics of a Solar Cell, Fill factor and Equivalent Solar cell Circuit, STC and NOCT, I-V under partial shading.	9
4	**Inverters Selection and Sizing**	Types of solar inverter, Selection of string /central / off grid inverter, Selection of power conditioning unit (PCU), Sizing of solar inverter for roof top and grid connected projects, Selection and sizing of string inverter, Selection and sizing of central inverter.	7
5	**Connection of PV Module (Series and**	Series Circuits, Parallel Circuits, Combining Series & Parallel Circuits, PV module string connection, Matching the PV Array to The Voltage Specifications of An Inverter,	10

	Parallel Circuit)	Matching the PV-Array to the Inverter's Current Rating, Matching the PV-Array to the Inverter's Power Rating, Summary of Calculations for Matching Array and Inverter.	
Total			**41**

4. Readings

4.1 Textbook:

1. Gilbert M. Masters: Renewable and Efficient Electric Power Systems. John Wiley & Sons, 2004

4.2 Reference Books:

1. Roger A. Messenger & Jerry Ventre: Photovoltaic Systems Engineering. CRC Press, 2004.
2. Solanki: Solar Photovoltaics: Fundamentals, Technologies and Applications. PHI Learning Pvt Ltd, 2009

5. Outcome of the Course:

1) Analyse the performance of different types of solar PV cells based on its electrical characteristics.
2) Design grid connected, off-grid and hybrid solar PV systems based on the requirements.

Industrial Electrical Systems

1.1 Course Number: EIE313
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 3rd Year –Even
1.4 Pre-requisite: Analog Electronics and Power Electronics
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. Santosh Kumar Verma.

2. Objective:

i) To understand the basics of residential and commercial wiring systems.

ii) To realize various types of heating, welding and traction system.

iii) To understand and analyse the operation of UPS, Electric Traction and industrial electrical systems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Electrical System Components**	LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.	10
2	**Residential and Commercial Electrical Systems**	Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.	8
3	**Illumination Systems**	Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.	9
4	**Industrial System**	DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.	8

5	**Automation**	Study of basic PLC, Role of in automation, advantages of process automation, Panel Metering and Introduction to SCADA system for distribution automation.	8
Total			**43**

4. Readings

4.1 Textbooks:

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

4.2 Reference Books:

1. Web site for IS Standards.
2. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 1997.
3. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

5. Outcome of the Course:

1) Maintain/Troubleshoot various lamps and fittings in residential and commercial wiring systems.
2) Apply the concepts in designing heating, welding and illumination systems.
3) Design Illumination systems for various applications.
4) Work in the areas of UPS systems and traction systems production, commissioning and maintenance.