Syllabus of B.Tech 1st Year

NIT Agartala

Semester - I

	Group - I					Group - II				
Sl. No	**Course**	**L**	**T**	**P**	**Credit**		**L**	**T**	**P**	**Credit**
1	Engineering Mathematics-I	2	1	0	3	Engineering Mathematics-I	2	1	0	3
2	Engineering Physics-I	2	1	0	3	Engineering Physics-I	2	1	0	3
3	Engineering Chemistry-I	3	0	0	3	Engineering Chemistry-I	3	0	0	3
4	Basic Electrical Engineering	3	0	0	3	Basic Electronics	3	0	0	3
5	Engineering Mechanics	3	1	0	4	Disaster Management	2	0	0	2
6	Language (Professional Communication in English)	3	0	0	3	Introduction to Programming	3	0	0	3
7	Engineering Chemistry Laboratory	0	0	2	1	Engineering Physics Laboratory	0	0	2	1
8	Workshop Practice	0	0	2	1	Engineering Graphics	1	0	2	2
9						Computer Programing Laboratory	0	0	2	1
10	Basic Electrical Engineering Laboratory	0	0	2	1	Basic Electronics Laboratory	0	0	2	1
11	NSS/NCC	0	0	3	0	NSS/NCC	0	0	3	0
	Total Credit in 1st Sem	16	3	9	22	**Total Credit in 1st Sem**	16	2	11	22

Semester - II

	Group - I					Group - II				
Sl. No	**Course**	**L**	**T**	**P**	**Credit**		**L**	**T**	**P**	**Credit**
1	Engineering Mathematics-II	2	1	0	3	Engineering Mathematics-II	2	1	0	3
2	Engineering Physics-II	2	1	0	3	Engineering Physics-II	2	1	0	3
3	Engineering Chemistry-II	2	0	0	2	Engineering Chemistry-II	2	0	0	2
4	Basic Electronics	3	0	0	3	Basic Electrical Engineering	3	0	0	3
5	Disaster Management	2	0	0	2	Engineering Mechanics	3	1	0	4
6	Introduction to Programming	3	0	0	3	Language (Professional Communication in English)	3	0	0	3
7	Engineering Physics Laboratory	0	0	2	1	Engineering Chemistry Laboratory	0	0	2	1
8	Engineering Graphics	1	0	2	2	Workshop Practice	0	0	2	1
9	Computer Programing Laboratory	0	0	2	1					
10	Basic Electronics Laboratory	0	0	2	1	Basic Electrical Engineering Laboratory	0	0	2	1
	Total Credit in 2nd Sem	15	2	8	21	**Total Credit in 2nd Sem**	15	3	6	21
	Total First Year Credit				43	**Total First Year Credit**				43

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ENGINEERING PHYSICS-I

(UPH11B07)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Program Outcomes (POs):

Programs must validate that their students achieve the following outcomes

PO - 1	**Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO - 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	**Environment and sustainability:** Understand the impact of the professional and engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibili-ties and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environ-ments.

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PO-12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologi-cal change.

PEOs (Program Educational Objectives):

PEO-1	Specify and design prototypes to study physical systems that perform electrical/optical/magnetic characterization
PEO-2	Developing the knowledge of Wave-Mechanical and Optical properties of matter
PEO-3	Knowledge of basic building block of mechanics

PSOs (Program Specific Objectives):

Students will be able to

PSO-1	Learn and develop their concepts for technological applications.
PSO-2	Successfully apply the principles, learned as a part of this course, to different engineering aspects and practical day to day life.
PSO-3	Apply optical concepts in practical life.

Course Objective:

1. To impart knowledge of basic concepts of applied physics.
2. To familiarize the students with topics like Electromagnetism, Waves and Oscillations, Interference, Diffraction and Polarization.
3. To provide a balance account of the fundamentals of modern physics.
4. To familiarize the students with some of the recent developments in these areas, best suited to the Engineering applications in different branches.
5. To develop enhance the problem honing skill in the field of engineering.

Course Content:

1. Mathematical Preliminary:

Vector Differentiation, Scalar and Vector Fields, Directional Derivatives, Vector Differential Operator, Gradient, Divergence, Curl, Line, Surface & Volume integrals and their applications, Green's theorem.

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2. Electromagnetics:

Gauss's Theorem of Electrostatics, Ampere's law, Magnetostatics and laws of Electromagnetic Induction, Self and Mutual induction, Concept of Displacement Current, Difference between Conduction Current and Displacement Current, Eddy Current, Maxwell's Equations, Propagation of Electromagnetic Waves in Free Space, Solution of propagation of Plane Electromagnetic Wave in free space and medium, Eddy Current, Concept of Field Energy (Poynting Vector)

3. Oscillations & Waves:

Plane progressive wave, Energy of waves, Reverberation, Sabine's law(derivation), Damped Vibration:-differential equation and solution, critical damping, logarithmic decrement, analogy with electrical circuit, Forced damped Vibration, Amplitude and Velocity Resonance, sharpness of resonance and quality factor, applications of oscillatory motions.

4. Interference:

Coherence (temporal and spatial), Fresnel's Bi-prism, Conditions for interference, Techniques of obtaining interference: Interference of Light due to division of wave front, Interference of Light due to division of amplitude; Newton's Ring, colour of thin film.

5. Diffraction:

Types of Diffraction; Fresnel and Fraunhofer, Difference between Interference and Diffraction, Zone plate; positive and Negative Zone plates, action of zone plate as a convex lens, Fraunhofer Diffraction at a Single Slit and Double slit, Plane transmission diffraction grating spectra, Comparison between Prism and Grating Spectra, Resolving Power and limit of resolution, Rayleigh's criterion, Resolving Power of Microscope, Telescope and prism.

6. Polarization:

Polarization, types of polarized light, polarizer and analyzer, Effect of polarizer on natural light, Effect of analyzer on plane polarized light-Malus Law, Nicol's Prism; Polaroid, Anisotropic crystal; Birefringence, calcite crystal; Huygens' explanation of double refraction;

Huygens' construction of wave fronts; experimental determination of principal refractive indices; phase difference between o – ray and e – ray; superposition of waves linearly polarized at right angles; Conditions for obtaining linearly polarized light, circularly polarized light and elliptically polarized light, retarders or wave plates; Babinet Compensator.

Reference Books

1. D. J. Griffith, Introduction to Electrodynamics, PHI Pubs.
2. G. B. Arfken and H. J. Weber, Mathematical Methods For Physicists, Elsevier Academic Press.
3. H. J. Pain, The Physics of Vibrations and Waves, John Wiley & Sons Ltd.
4. A. Ghatak, Optics, Tata Mc Graw Hill
5. Optics, E. Hecht, Pearson.
6. F. A. Jenkins and H. E. White, Fundamentals of Optics, Tata Mc Graw Hill

Course Outcome:

CO-1	Understand the concept of electric & magnetic fields for Electromagnetic Wave propagation through different media.
CO-2	Relate wave nature of light with the physical parameters of wave.

Mapping with the POs/ PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PEO-1	PEO-2	PEO-3
CO-1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**
CO-2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

To establish the correlation between COs & PSOs

2: Slight (Low) 3: Moderate (Medium) 4: Substantial (High) and for No Correlation "-"

CO	PSO-1	PSO-2	PSO-3

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CO-1	**3**	**4**	**-**
CO-2	**3**	**3**	**-**

ENGINEERING PHYSICS-II

(UPH12B09)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Program Outcomes (POs):

Programs must validate that their students achieve the following outcomes

PO - 1	**Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO - 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	**Environment and sustainability:** Understand the impact of the professional and engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibili-ties and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environ-ments.

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PO-12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologi-cal change.

PEOs (Program Educational Objectives):

PEO-1	Specify and design prototypes to study physical systems that perform electrical/optical/magnetic characterization
PEO-2	Developing the knowledge of Wave-Mechanical and Optical properties of matter
PEO-3	Knowledge of basic building block of mechanics

PSOs (Program Specific Objectives):

Students will be able to

PSO-1	Learn and develop their concepts for technological applications.
PSO-2	Successfully apply the principles, learned as a part of this course, to different engineering aspects and practical day to day life.
PSO-3	Find the difference between Classical domain and Quantum domain.

Course Objective:

1. To impart knowledge of basic concepts of applied physics.
2. To familiarize the students with topics like Quantum Mechanics, Relativity, Concepts of solids, LASER and Optical Fibre.
3. To provide a balance account of the fundamentals of modern physics.
4. To familiarize the students with some of the recent developments in these areas, best suited to the Engineering applications in different branches.
5. To develop enhance the problem honing skill in the field of engineering.

Course Content:

1.Introduction to Quantum Mechanics:

Blackbody Radiation, Planck's Radiation Formula, de Broglie's hypothesis, Davisson Germer Experiment, Stern-Gerlach Experiment, Heisenberg's uncertainty principle and its application, Wave packets, Phase velocity and group velocity, probability

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current density, Operators, Hermitian operators, expectation 1values, Interpretation of wave function, Postulates of quantum mechanics, Orthogonal & orthonormal functions, Schrödinger equation in one dimensional problems, Particle in a box, Eigen values and Eigen function, stationary states, Tunneling problems, Bound States.

2. Relativity:

Reference Frames, Michelson - Morley Experiment and its consequences, Lorentz Transformation, Postulates of Relativity, Relativistic Mass & Mass-Energy Equivalence, Time Dilation, Length Contraction, Relativistic Kinematics, Principle of Simultaneity, Twin Paradox.

3. Concepts of Solids:

Statistical distributions, M-B, B-E and F-D statistics and their simple applications, Planck's radiation law, Degenerate Fermi Gas.

Crystallographic planes, reciprocal lattice and miller indices, Inter-planer spacing (cubic system only), Bragg's diffraction, Laue's equation of X-ray diffraction, Crystal structure analysis, Lattice Vibration, Electrons in a crystalline solid, free electron theory, electronic conduction in solids, Band theory of solids, Kronig - Penny model.

4. Introduction to Laser and Optical Fibre:

Spontaneous and stimulated emission, Einstein's A-B coefficients, Meta - Stable states, Population inversion, basic principle of laser (three and four level), optical cavity and resonator, Ruby and He-Ne laser, holography.

Propagation of light in fibre, step and graded index fibre, numerical aperture, attenuation in optical fibre, introduction of optical window, application of laser and optical fibre.

Suggested Books:

1. A. K. Ghatak and S. Lokanathan, Quantum Mechanics, Macmillan India Ltd.
2. R. Eisberg and Resnick, Quantum Physics of Atoms, Molecules, Solids, Nuclei

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and Particles, Wiley India Pvt. Ltd.

3. Robert Resnick, Introduction to Special Relativity, John Wiley & Sons.
4. F. Reif, Statistical Mechanics, Mc Graw Hill.
5. B.K. Agarwal, Elements of Statistical Mechanics
6. Kittel, Introduction solid State Physics, Willy Eastern Limited
7. K. Thyagrajan, A. Ghatak, Lasers, Fundamentals and Applications, Springer Pub.
8. D. J. Griffiths, Introduction to Quantum Mechanics, Pearson
9. M. Ali Omar, Elementary Solid State Physics: Principles and Applications, Pearson Pub.

Course Outcome:

CO-1	Apply the knowledge of LASER & Fibre Optics for technological applications.
CO-2	Understand/Identify different statistical distributions and their relevant applications in Engineering Physics.
CO-3	Identify the basic difference between classical domain and quantum domain of Physics.

Mapping with the POs/ PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PEO-1	PEO-2	PEO-3
CO-1	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**
CO-2	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO-3	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

To establish the correlation between COs & PSOs

2: Slight (Low) 3: Moderate (Medium) 4: Substantial (High) and for No Correlation "-"

CO	PSO-1	PSO-2	PSO-3
CO-1	**4**	**4**	**-**
CO-2	**3**	**3**	**-**
CO-3	**2**	**2**	**3**

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ENGINEERING PHYSICS LABORATORY

(UPH12P06)

Total Credit: 01 **Contact Periods: 02 (0L+0T+2P)**

Program Outcomes (POs):

Programs must validate that their students achieve the following outcomes

PO - 1	**Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO - 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	**Environment and sustainability:** Understand the impact of the professional and engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibili-ties and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environ-ments.

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PO-12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologi-cal change.

PEOs (Program Educational Objectives):

PEO-1	Adapt to work with new environments, assimilate updated information, and solve complex problems.
PEO-2	Learn the fundamental application of Physics to set up modern experimental techniques.

PSOs (Program Specific Objectives):

Students will be able to

PSO-1	Achieve confidence in handling instruments professionally and develop the modern laboratory techniques.
PSO-2	Acquisition of skills in measuring, calibrating instruments, taking readings with minimum errors.

Course Objective:

1. To develop the practical skill in Engineering Physics lab, which includes activities such as handling of instruments, calibration of equipment, measure basic parameters etc.

2. To understand the principles of mechanics and optics instruments along with underlying physics.

Course Content:

List of Experiments:

1. Determination of moment of inertia of a flywheel.
2. Measurement of angle of prism and the angle of minimum deviation for parallel rays on spectrometer and hence find the refractive index of the material of the prism.
3. To determine the radius of curvature of the convex surface of a lens by Newton's Rings.
4. Determination of the frequency of a tuning fork by Melde's apparatus.
5. Verification of Faraday and Lenz's law of induction.
6. Determination of earth's horizontal magnetic field intensity and magnetic moment of a magnet by employing magnetometer.
7. Determination of self-inductance of a coil with Anderson's Bridge.
8. Determination of

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i) Plank's constant and work function using photoelectric cell.

ii) Verification of inverse square law of radiation using a photoelectric cell.

9. Measurement of unknown wavelength of laser with a diffraction grating.
10. Determination of unknown resistance by Carrey Foster bridge method.
11. Determination of Young's Modulus of elasticity of the material of a bar by the method of flexure.
12. Determination of surface tension of a liquid by capillary tube method.
13. Determination of the co-efficient of viscosity of glycerin by Stoke's method.
14. Determination of rigidity modulus of the material of the wire by Torsional Pendulum.

Course Outcome:

CO-1	Coverage of basic experiments illustrating the principles in general physics relevant to the study of science and engineering
CO-2	Acquisition of skills in measuring, calibrating instruments, taking readings, while minimizing errors, etc

Mapping with the POs/ PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PEO-1	PEO-2	PEO-3
CO-1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**
CO-2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

To establish the correlation between COs & PSOs

2: Slight (Low) 3: Moderate (Medium) 4: Substantial (High) and for No Correlation "-"

CO	PSO-1	PSO-2	PSO-3
CO-1	**3**	**3**	**2**
CO-2	**3**	**3**	**1**

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ENGINEERING CHEMISTRY-I

(UCY11B10)

Total Credit: 03 **Contact Periods: 03 (3L+0T+0P)**

Program Outcomes (POs):

Programs must validate that their students achieve the following outcomes

PO - 1	**Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO - 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	**Environment and sustainability:** Understand the impact of the professional and engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibili-ties and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a

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	member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologi-cal change.

PEOs (Program Educational Objectives):

PEO-1	Acquire the fundamental principles of chemistry with modern experimental and theoretical skills.
PEO-2	Ability to analyze the problems in the context of practical relevance to the society while maintaining environmental safety and economic factors.
PEO-3	Enhancing their professional growth along with scientific knowledge through continuing education.

PSOs (Program Specific Objectives):

Students will be able to

PSO-1	Learn and develop their concepts on a wide spectrum of basic topics in chemistry from chemical bonding, polymers, electrochemistry to control of pollution, among others.
PSO-2	Successfully apply the principles, learned as a part of this course, to different engineering aspects and practical day to day life.
PSO-3	Gauge the relevant environmental and societal issues and look for their solutions using the concepts of chemistry acquired from this course.

Course Objective:

1. Chemical bonding, which deals with different types of chemical bonds present in various chemical compounds and biological molecules, will cover bonding, structure, geometry and hybridization of various molecules.

2. Studying this topic the students will learn about the extraction and production of oil and gas to meet energy needs, as well as refining of crude oil into several value added products.

3. To get knowledge about water quality parameters and find ways to make water suitable for domestic and industrial uses.

4. Pollution, different types of polluting agent is incorporated to make the student aware of ways to keep atmosphere pollution free.

5. Electrochemistry deals with conductance in electrolytic solutions and its applications.

6. The objective of introducing polymer is to provide an overview of the fundamentals of polymer science and engineering, including the chemical structure of polymers, their methods of preparation, and a variety of properties exhibited by polymers.

Course Content:

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Unit-1: Chemical Bonding

Ionic and covalent bonds; valence bond theory (VBT) of covalency-atomic orbitals and their overlap, hybridization of orbitals-definition, types, associated geometries, VSEPR theory, shapes of simple molecules like H_2O, CO_2, NH_3, CH_4, C_2H_6, C_2H_2 BF_3, PCl_5, SF_6, inter-halogen and noble gas compounds in the light of the hybridization state of the central atom and VSEPR effects; molecular orbital theory (MOT) - concept of molecular orbitals, molecular orbital energy level diagrams; homonuclear diatomic molecules (like He_2, O_2, N_2) and their molecular ions; bond order, bond length and magnetic properties; non-covalent interactions: van der Waals and hydrogen bonding and their effect over physical properties.

Unit-2: Fuels

Definition and classification of fuels; characteristics of good fuel; comparison among solid, liquid and gaseous fuels; calorific value of fuels-definition, units, higher and lower calorific values, determination of the calorific value of a solid fuel by bomb calorimeter; solid fuel: coal- origin, types; proximate and ultimate analysis; liquid fuel: petroleum- origin, refining of crude oil, cracking; isomerization; catalytic hydrogenation; desulfurization; synthetic petrol; synthesis of gasoline: Fischer-Tropsch and Bergius methods knocking; octane number; cetane number. Numerical problems.

Unit-3: Water

Introduction; hardness of water: causes, types, units, disadvantages of using hard water for domestic and industrial purposes (e.g., scale and sludge formation in boilers, caustic embrittlement, boiler corrosion, etc.); softening of hard water (lime-soda, permutit and ion-exchange processes); chemical analysis of water- estimation of free chlorine, total alkalinity, hardness and dissolved oxygen. Numericals on hardness.

Unit-4: Pollution and its Control

Pollution-introduction, air pollutants, particulates, smog, photochemical smog, acid rain, green house effects; ozone layer depletion; analysis of gaseous effluents-oxides of nitrogen, oxides of sulphur and H_2S; chemical analysis of effluent liquid streams; BOD, COD; control of air pollution-particulate emission, gaseous pollutants.

Unit-5: Electrochemistry

Arrhenius theory of electrolytic dissociation; electrolytes, classification; degree of dissociation; dissociation constant of weak acids; conductance of solutions-specific, molar and equivalent conductance, variation of molar conductance with dilution for strong and weak electrolytes; Kohlrausch's law of independent migration of ions; Ostwald's dilution law; Nernst equation for single electrode and electrochemical cells; concept of pH and pOH; buffer solutions; solubility product; common ion effect; indicators and theory of acid-base indicators; Photoelectric effect and solar cells. Numericals.

Unit-6: Polymer Chemistry

Introduction; types of polymerization; classification of polymers based on chain characteristics, source, method of synthesis and molecular forces involved; mechanism of polymerization

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reaction; glass transition and crystalline melting point temperatures; factors influencing glass transition and crystalline melting point temperatures; preparation, properties and uses of the following-polyethylene, PVC, polystyrene, PAN, teflon, nylon-6:6, polyester, rubber-monomer, structure, compounding of rubber, vulcanization, synthetic rubbers-Buna-S, Buna-N, neoprene, butyl rubber and polyurethanes, weight average and number average molecular weight (expression and numerical problems), PDI.

Course Outcome:

CO-1	To predict the structure and properties of different materials using the knowledge of chemical bonding.
CO-2	Knowledge on conventional and non-conventional energy sources and future energy resources in sustainable development.
CO-3	Develop novel systems to analyse water for domestic and industrial use at very low cost.
CO-4	Knowledge of contemporary environmental issues and adverse effects of pollution to living forms and ways to keep problems arising from pollution at bay.
CO-5	Acquire the knowledge of electrochemistry and its principles and apply the same to various disciplines.
CO-6	Comprehend idea about the synthesis and applications of polymers.

Reference Books:

1. Shashi Chawla, A Text Book of Engineering Chemistry, 3rd Edition, Dhanpat Rai & Co., New Delhi, 2007.
2. Jain and Jain, Engineering Chemistry, 15th Edition, Dhanpat Rai Publishers.
3. Dr S. Vairam and Dr. Suba Ramesh, Engineering Chemistry, 1st Edition, Wiley-India, New Delhi.
4. S. S. Dhara, A Text book of Engineering Chemistry,11th Edition, S Chand & Co. Ltd., New Delhi.

Mapping with the POs/ PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PEO-1	PEO-2	PEO-3
CO-1	**3**	**2**		-	-	-	-	-	-	-	-	-	**2**	-	-
CO-2	-	**2**		-	-	-	-	-	-	-	-	-	**2**	-	-
CO-3	-	-	-	-	-	-	-	-	-	-	-	-	**2**	-	-
CO-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**

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CO-5	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO-6	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**-**

To establish the correlation between COs & PSOs

2: Slight (Low) 3: Moderate (Medium) 4: Substantial (High) and for No Correlation "-"

CO	PSO-1	PSO-2	PSO-3
CO-1	**-**	**4**	**-**
CO-2	**-**	**-**	**3**
CO-3	**4**	**-**	**-**
CO-4	**-**	**-**	**2**
CO-5	**2**	**-**	**-**
CO-6	**-**	**-**	**-**

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ENGINEERING CHEMISTRY LABORATORY

(UCY11P05)

Total Credit: 01 **Contact Periods: 02 (0L+0T+2P)**

Program Outcomes (POs):

Programs must validate that their students achieve the following outcomes

PO - 1	**Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO - 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	**Environment and sustainability:** Understand the impact of the professional and engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibili-ties and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environ-ments.

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PO-12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologi-cal change.

PEOs (Program Educational Objectives):

PEO-1	Adapt to work with new environments, assimilate updated information, and solve complex problems.
PEO-2	Learn the fundamental application of chemistry to set up modern experimental techniques.

PSOs (Program Specific Objectives):

Students will be able to

PSO-1	Achieve confidence in handling chemicals, glassware and instruments professionally in chemical industries and develop the modern laboratory techniques.
PSO-2	Successfully apply their practical experience to determine analytical estimation of materials applicable in our daily life.

Course Objective:

1. Students will learn laboratory techniques in chemistry, carrying out practicals and to determine the quality of water sample.
2. Analytical estimation of metal ions in supplied chemical compound..
3. By applying their practical knowledge student will get exposure to the Chemical Industry.

Course Content:

1. Preparation of primary standard solution (oxalic acid, $K_2Cr_2O_7$).
2. Preparation and standardization of solution (NaOH, HCl, $KMnO_4$).
3. Determination of total hardness of water sample by complexometric titration method.
4. Estimation of total amount of chloride present in a water sample through argentometric titration method.
5. Estimation of carbonate and bicarbonate alkalinity of a water sample by acid base titration method.
6. Determination of iron present in Mohr's salt solution by redox titration.
7. Estimation of acetic acid present in commercial vinegar sample.
8. Determination of alkali content in a given antacid tablet through acid base titration method.
9. Synthesis of aspirin.
10. Separation of caffeine from tea powder.

Course Outcome:

CO-1	Acquisition of necessary laboratory training required for measuring, weighing, transferring chemicals, data collection, while minimizing errors, etc.
CO-2	Acquire analytical skills for preparation of chemicals and estimation of material contstituents.

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CO-3	Developing the knowledge to handle water related problems for domestic and industrial purposes.

Reference Books:

1. S. Chawla, Essentials of Experimental Engineering Chemistry, Dhanpat Rai & Co., 3rd Edition, 2010.

2. A. I. Vogel, G. H. Jeffery, Vogel's Text Book of Quantitative Chemical Analysis, Published by Longman Scientific & Technical, 5th Edition, 1989.

3. A. J. Elias, A Collection of Interesting Gneral Chemistry Experiments, Universities Press, 2002.

4. A. K. Nad, B. Mahapatra and A. Ghoshal; An Advanced Course in Practical Chemistry, New Central Book Agency (P) Ltd, 3rd Edition, 2011.

Mapping with the POs/PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO-2	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO-3	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

To establish the correlation between Cos & PSOs

2: Slight (Low) 3: Moderate (Medium) 4: Substantial (High) and for No Correlation "-"

CO	PSO-1	PSO-2
CO-1	**4**	**-**
CO-2	**3**	**-**
CO-3	**-**	**4**

ENGINEERING CHEMISTRY-II

(UCY12B11)

Total Credit: 02 **Contact Periods: 02 (2L+0T+0P)**

Program Outcomes (POs):

Programs must validate that their students achieve the following outcomes

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PO - 1	**Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO - 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO-6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	**Environment and sustainability:** Understand the impact of the professional and engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibili-ties and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environ-ments.
PO-12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technologi-cal change.

PEOs (Program Educational Objectives):

PEO-1	Acquire the fundamental principles of chemistry with modern experimental and theoretical skills.

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PEO-2	Ability to analyze the problems in the context of practical relevance to the society while maintaining environmental safety and economic factors.
PEO-3	Enhancing their professional growth along with scientific knowledge through continuing education.

PSOs (Program Specific Objectives):

Students will be able to

PSO-1	Acquire the concepts of chemistry involved in various engineering materials that will find relevance to their engineering programs.
PSO-2	Apply their knowledge of chemistry, acquired from this course, to different engineering problems.
PSO-3	Assess the practical solutions to problems in day to day life.

Course Objective:

1. To introduce the principles of corrosion, common corrosion types, corrosion control methods, and material selection to reduce corrosion cost.

2. The students will learn about cement, its large-scale industrial manufacturing process, the mechanism of setting and hardening of cement, and various types of cement.

3. The topic on refractories will discuss about the manufacturing process, properties, types of refractories, their uses in heat treatment systems in industry and in society.

4. The purpose of incorporating lubricants is to make students aware of different types of lubricants and of their uses in machine parts to reduce the wear and tear and running cost of engine.

Course Content:

Unit-1: Corrosion

Introduction, definition, classification; dry corrosion-factors affecting dry corrosion, mechanism, types; oxidation corrosion; Pilling-Bedworth rule; corrosion by other gases; hydrogen related corrosion; liquid metal corrosion; wet corrosion-types; chemical corrosion; factors affecting chemical corrosion; mechanism of wet corrosion-electrochemical mechanism; evolution of H_2 and absorption of O_2; differential aeration theory, passivity, pitting, waterline and stress corrosion; corrosion control- purification, alloying, application of protective coatings, cathodic protection, etc.

Unit-2: Cement

Introduction, classification; Portland cement-definition, raw materials, manufacture, ideal composition and physical requirement according to I.S code; setting and hardening of cement; heat of hydration; special cements: high-alumina cement, white Portland cement, water-proof cement, Sorel cement, barium and strontium cement.

Unit-3: Refractories

Definition, objective of using, classification based on chemical nature; properties-refractoriness, strength, dimensional stability, chemical inertness, thermal expansion, thermal conductivity,

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porosity, spalling, electrical conductivity, etc., and interrelations between them; selection of good refractory; common refractory bricks: silica, fireclay, high-alumina, carbon and carborundom bricks, properties and uses.

Unit-4: Lubricants

Introduction; mechanism-thick-film, thin-film and extreme pressure lubrication; classification of lubricants-lubricating oils, greases and solid lubricants, their properties, uses and additives required (e.g., antioxidants, corrosion preventers, etc.); properties of lubricating oils: viscosity, flash and fire-point, cloud and pour point, aniline point etc.; cutting fluids.

Course Outcome:

CO-1	Understand electrochemical reaction fundamentals, different types of corrosions and their prevention methods.
CO-2	Relate physical, chemical and other properties of different cements as modern building block materials for numerous applications.
CO-3	Usefulness of refractory materials in metallurgical furnaces and other heat treatment equipment were also understood.
CO-4	Understanding the role of lubrication in reducing friction, wear and tear of machinery parts in engines, and so on.

Reference Books:

1. Shashi Chawla, A Text Book of Engineering Chemistry, 3rd Edition, Dhanpat Rai & Co., New Delhi, 2007.

2. Jain and Jain, Engineering Chemistry, 15th Edition, Dhanpat Rai Publishers

3. Dr S. Vairam and Dr. Suba Ramesh, Engineering Chemistry, 1st Edition, Wiley-India, New Delhi.

4. S. S. Dhara, A Text Book of Engineering Chemistry, 11th Edition, S. Chand & Co. Ltd., New Delhi.

Mapping with the Pos/ PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PEO-1	PEO-2	PEO-3
CO-1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO-2	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
CO-3	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
CO-4	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

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To establish the correlation between COs & PSOs

2: Slight (Low) 3: Moderate (Medium) 4: Substantial (High) and for No Correlation "-"

CO	PSO-1	PSO-2
CO-1	**3**	**-**
CO-2	**-**	**4**
CO-3	**-**	**4**
CO-4	**3**	**-**

ENGINEERING MATHEMATICS-I

(UMA11B11)

Total Credit: 03 **Contact Periods: 03**
(2L+1T+0P)

Purpose of the inclusion of the subject:

Engineering Mathematics is a branch of applied Mathematics concerning mathematical methods and techniques that are typically used in engineering and industry. Engineering Mathematics is an interdisciplinary subject motivated by engineers' needs both for practical, theoretical and other considerations out with their specialization, and to deal with constraints to be effective in their work.

Historically, Engineering Mathematics consisted mostly of applied analysis, most notably: differential equations; real and complex analysis (including vector and tensor analysis); approximation theory (broadly construed, to include asymptotic, variational and perturbative methods, representations, numerical analysis); Fourier analysis; potential theory; as well as linear algebra and applied probability, outside of analysis. These areas of Mathematics were intimately tied to the development of Newtonian physics, and the mathematical physics of that period. This history also left a legacy: until the early 20th century subjects such as classical mechanics were often taught in applied mathematics departments at American universities, and fluid mechanics may still be taught in (applied) mathematics as well as engineering departments.

The success of modern numerical computer methods and software has led to the emergence of computational mathematics, computational science, and computational engineering , which occasionally use high-performance computing for the simulation of phenomena and the solution of problems in the sciences and engineering. These are often considered interdisciplinary fields, but are also of interest to Engineering Mathematics.

Why we are teaching that subject in line of PO/PEOs?

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This course is taught in order to develop Engineering knowledge of students in the field of Mathematics. The course inspires students to build up skills for solving real life problems. This course helps students to perform investigation by a**pplying** different techniques to improve different methodologies.

Courses objective:

The objectives of the course Engineering Mathematics are:

1. To apply the knowledge in modern industry or teaching, or secure acceptance in high-quality graduate programs in mathematics and other fields such as the field of quantitative/mathematical finance, mathematical computing, statistics and actuarial science
2. To exhibit ethical and professional behavior
3. To make connections between different mathematical concepts, such as geometric, analytic and numerical interpretations of functions, derivatives and integrals.
4. To develop ability to understand and create rigorous formal mathematical arguments by applying basic mathematical logic.
5. To learn the application of mathematics in real life problems and analyzing the results.

Course content:

Unit- 1

Infinite series: Convergence of Sequence, Bounded Sequence, Monotonic Sequence, Convergent Divergent and Oscillatory Series, Geometric Series, Positive term series, pseries, Comparison Test, D'Alembert's Ratio tests, Raabe's Test, Gauss's Test, Cauchy's Integral Test, Cauchy's Root test, Logarithmic Test.

Unit 2

Calculus of function of one variable: Successive differentiation, Leibnitz's theorem, Mean Value theorem and Taylor's theorem, expansion of functions into Taylor's and Maclaurin's series, Indeterminate forms.

Unit – 3

Function of several Variables: Partial Derivatives, Chain Rule, Differentiation of Implicit functions, Exact Differentials, Euler's theorem on homogeneous function and its converse. Maxima, Minima and Saddle points, Simple problems in extrema of functions with constraints. Method of Lagrangian Multipliers.

Unit – 4

Ordinary Differential Equation: Linear equations and Bernoulli's equation, Ordinary linear differential equation of nth order, Solution of homogeneous and non-homogeneous equations, Variation of parameters, Solution of simple simultaneous ordinary differential equation.

Unit – 5

Laplace Transform: Transforms of elementary functions, Inverse transforms, properties of Laplace transform. Convolutions. Transforms of periodic functions, unit step functions, shifting theorems. Solutions of ODE's using transforms.

Course outcome: At the end of the course, students will be able to

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1. Use various convergence tests (geometric series test, divergence test, integral test, comparison tests, alternating series tests, ratio test, and root test) to determine convergence or divergence of series.
2. Apply function of single variables in the field of engineering optimization, modelling etc.
3. Use multivariable functions of real variables in engineering and physics, because observable physical quantities are real numbers (with associated units and dimensions), and any one physical quantity will generally depend on a number of other quantities.
4. Solve the basic application problems described by first order and higher order differential equations in orthogonal trajectories, electrical circuit, mechanical system, simple harmonic motion etc.
5. Use Laplace Transform in signal processing. in the frequency domain. This can be a powerful tool to study a signal in the frequency domain.

Program Outcomes (POs):

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

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effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PEOs (Program Educational Objectives):

PEO-1: To empower students to identify, formulate and solve Electrical Engineering problems by applying their knowledge in the field of mathematics, Science, Communication and Computing skills and enabling them to understand specific problem areas and finding the optimum solutions for the same.

PEO-2: To widen the talents of the students to become effective collaborators and innovators, leading in efforts to tackle social, business, design and production challenges.
PEO-3: To develop industry focused skills and leadership qualities to become successful engineers and entrepreneurs.
PEO-4: To enable students to acquire skills to communicate effectively with the society and the constituents which enable them to collaborate as team members and team leaders.
PEO-5: To develop professional work ethics and social responsibilities so as to tackle social, business, design and production challenges.
PEO-6: To encourage the students for developing life-long learning attitude with moral ethics and values and professional development through higher study, continuing education and independent research activities.

PSOs(Program Specific Objectives):

PSO 1: Specification, fabrication, testing, operation or documentation of basic Electrical systems/processes.

PSO 2: Analysis, design, development and implementation of more advanced Electrical systems or processes.

To establish the correlation between Cos & POs

Table 1

No. of Course Outcome (CO)	Course Outcome
CO UMA11B04.1	Use various convergence tests (geometric series test, divergence test, integral test, comparison tests, alternating series tests, ratio test, and root test) to determine convergence or divergence of series.
CO UMA11B04.2	Apply function of single variables in the field of engineering optimization, modelling etc.
CO UMA11B04.3	Use multivariable functions of real variables in engineering and physics, because observable physical quantities are real numbers

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	(with associated units and dimensions) and any one physical quantity will generally depend on a number of other quantities.
CO UMA11B04.4	Solve the basic application problems described by first order and higher order differential equations in orthogonal trajectories, electrical circuit, mechanical system, simple harmonic motion etc.
CO UMA11B04.5	Use Laplace Transform in signal processing. in the frequency domain. This can be a powerful tool to study a signal in the frequency domain.

Table 2

1: Slight(low), 2: Moderate(MEDIUM)
3: Substantial (HIGH) and for NO CORELATION-"-"

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO UMA11B04.1	2	2	-	1	1	-	-	-	-	-	2	-
CO UMA11B04.2	2	2	3	1	3	-	2	1	-	2	3	2
CO UMA11B04.3	2	2	3	1	3	1	2	-	1	1	3	2
CO UMA11B04.4	3	3	2	2	3	1	3	1	2	2	2	1
CO UMA11B04.5	2	2	2	-	1	2	1	-	-	2	-	1
Total	11	11	10	5	11	4	8	2	3	7	10	6
Average	2.2	2.2	2	1	2.2	0.8	1.6	0.4	0.6	1.4	2	1.2
Eq. Av Attainment	1.47											

*** It is not mandatory that every CO will match with all POs. Please keep blank where COs do not match POs. A table is provided below for easy reference.

To establish the correlation between Cos & PSOs

Table 3

CO	**PSO1**	**PSO2**
CO UMA11B04.1	3	1
CO UMA11B04.2	1	2
CO UMA11B04.3	2	2

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CO UMA11B04.4	1	2
CO UMA11B04.5	1	1
Total	8	8
Average	1.6	1.6
Eq. Av Attainment	1.6	

ENGINEERING MATHEMATICS-II

(UMA12B13)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Purpose of the inclusion of the subject:

Engineering Mathematics is a key area in the study of an engineering course. It is the study of numbers, structures, and associated relationships using rigorously defined literal, numerical and operational symbols. A sound knowledge of the subject develops analytical skills, thus enabling engineering graduates to solve numerical problems encountered in daily life, as well as apply mathematical principles to physical problems, particularly in the area of engineering.

Engineering Mathematics is the application of mathematics and computing of problems of modern engineering. Real world problems of direct engineering, scientific or industrial relevance are studied using mathematics. Research interests cover mathematics for tomorrow's technology, ranging from artificial intelligence (including fuzzy logic, computational intelligence, etc.) to applied mathematics.

Engineering Mathematics offers a balance of theory and practice, which is both intellectually stimulating and topical. Learning the craft of applying mathematics to real world problems will not only equip an engineering student with technical skills, but it will also enhance his/her ability to make sound judgements on the increasing important role played by science and technology in the modern world. Industry is well aware of acute skills shortage in various fields including applied mathematics and computing. These shortages are bound to persist in the near future, due to increasing demand from employers in line with the industrial growth.

Why we are teaching that subject in line of PO/PEOs?

Please list after brainstorming within the 3-4 faculty members of your specialization

1. Dr. Debasish Bhattacharya
2. Dr. Uttam Kumar Bera

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3. Dr. Paritosh Bhattacharya
4. Dr. Apu Kumar Saha
5. Dr. Baby Bhattacharya

Courses objectives:

The objectives of the course Engineering Mathematics-II are:

6. To identify algebraic eigen-value problems from practical areas and obtain the eigen solutions in certain cases.
7. To understand double and triple integration and enable them to handle integrals of higher orders.
8. To know the basics of vector calculus comprising of gradient, divergence & curl and line, surface & volume integrals along with the classical theorems involving them.
9. To understand analytic functions and their interesting properties.
10. To grasp the basics of complex integration and the concept of contour integration.

Course content:

Unit- 1

Matrices: Algebra of matrices, Vector spaces- linear dependence of vectors, basis, Linear Transformations, Rank and inverse of a matrix, Solution of algebraic equations, consistency conditions, Hermitian , skew-Hermitian and Unitary matrices, by-linear form, eigen value and eigen vectors. Cayley-Hamilton theorem .

Unit 2

Complex numbers : Exponential complex numbers and logarithm of a complex number, circular, hyperbolic and inverse circular functions of complex numbers.

Unit – 3

Function of a Complex Variable : Limit, continuity and differentiation, Analytic function, Cauchy-Riemann equations, Conjugate functions, Application to two dimensional problems, Taylor's and Laurent's expansions, Branch points, zeros, poles, residues, Cauchy's Integral theorem, simple problems on Contour Integration.

Unit – 4

Integral Calculus: Improper Integrals, Beta and Gamma function. Double and Triple Integrals, Jacobians and transformation of co-ordinates.

Unit – 5

Vectors: Scalar and vector triple product, space curves, Seret-Frenet formula, velocity and acceleration-simple problems, moment of force, work done, angular velocity, relative velocity-

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simple applications.Vector function of one variable, vector differentiation and integration, gradient, divergence and curl --- Applications. Stoke's theorem, Green's theorem, Gauss divergence theorem - simple applications to areas, Volumes and centre of Pressure.

Course outcome: At the end of the course, students will be able to

6. Use matrices to describe linear equations, keep tract of the coefficients of linear transformations, and record data that depend on multiple parameters. There are many applications of matrices in mathematics, viz., graph theory, probability theory, statistics, computer graphics, geometrical optics, etc.
7. Use complex numbers for finding the possible solutions of polynomial equations of degree more than one. Complex numbers are used in many applications, such as control theory, signal analysis, quantum mechanics, relativity, etc.
8. Determine whether a given function is differentiable, and if so find its derivative. Use differentiation rules to compute derivatives. Express complex-differentiable functions as power series. Use Cauchy's integral theorem and formula to compute line integrals. Identify the isolated singularities of a function and determine whether they are removable, poles, or essential. Compute innermost Laurent series at an isolated singularity, and determine the residue. Use the residue theorem to compute complex line integrals and real integrals.
9. Use beta and gamma functions in solving the integral of a given function. Perform basic calculations relating to double and triple integrals in Cartesian, polar and spherical coordinates.
10. Understand the basic theory of line and surface integrals and the theorems of Green, Stokes and Gauss. Perform basic calculations relating to line and surface integrals and apply the theorems of Green, Stokes and Gauss.

Program Outcomes (POs):

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PEOs (Program Educational Objectives):

PEO-1: To empower students to identify, formulate and solve Electrical Engineering problems by applying their knowledge in the field of mathematics, Science, Communication and Computing skills and enabling them to understand specific problem areas and finding the optimum solutions for the same.

PEO-2: To widen the talents of the students to become effective collaborators and innovators, leading in efforts to tackle social, business, design and production challenges.
PEO-3: To develop industry focused skills and leadership qualities to become successful engineers and entrepreneurs.
PEO-4: To enable students to acquire skills to communicate effectively with the society and the constituents which enable them to collaborate as team members and team leaders.
PEO-5: To develop professional work ethics and social responsibilities so as to tackle social, business, design and production challenges.

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PEO-6: To encourage the students for developing life-long learning attitude with moral ethics and values and professional development through higher study, continuing education and independent research activities.

PSOs(Program Specific Objectives):

PSO 1: Specification, fabrication, testing, operation or documentation of basic Electrical systems/processes.

PSO 2: Analysis, design, development and implementation of more advanced Electrical systems or processes.

To establish the correlation between Cos & POs

Table 1

No. of Course Outcome (CO)	Course Outcome
CO UMA21B04.1	Use matrices to describe linear equations, keep tract of the coefficients of linear transformations, and record data that depend on multiple parameters. There are many applications of matrices in mathematics, viz., graph theory, probability theory, statistics, computer graphics, geometrical optics, etc.
CO UMA21B04.2	Use complex numbers for finding the possible solutions of polynomial equations of degree more than one. Complex numbers are used in many applications, such as control theory, signal analysis, quantum mechanics, relativity, etc.
CO UMA21B04.3	Determine whether a given function is differentiable, and if so find its derivative. Use differentiation rules to compute derivatives. Express complex-differentiable functions as power series. Use Cauchy's integral theorem and formula to compute line integrals. Identify the isolated singularities of a function and determine whether they are removable, poles, or essential. Compute innermost Laurent series at an isolated singularity, and determine the residue. Use the residue theorem to compute complex line integrals and real integrals.

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CO UMA21B04.4	Use beta and gamma functions in solving the integral of a given function. Perform basic calculations relating to double and triple integrals in Cartesian, polar and spherical coordinates.
CO UMA21B04.5	Understand the basic theory of line and surface integrals and the theorems of Green, Stokes and Gauss. Perform basic calculations relating to line and surface integrals and apply the theorems of Green, Stokes and Gauss.

Table 2

1: Slight(low), 2: Moderate(MEDIUM)
3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO UMA21B04.1	2	2	3	1	1	-	1	-	-	1	2	2
CO UMA21B04.2	3	2	3	2	2	1	-	1	1	1	2	1
CO UMA21B04.3	2	2	2	1	2	1	1	-	1	1	1	2
CO UMA21B04.4	2	2	1	1	-	1	-	1	1	1	2	1
CO UMA21B04.5	3	2	2	2	1	1	1	-	-	1	1	2
Total	12	10	11	7	6	4	3	2	3	5	8	8
Average	2.4	2	2.2	1.4	1.2	0.8	0.6	0.4	0.6	1	1.6	1.6
Eq. Av Attainment	1.32											

*** It is not mandatory that every CO will match with all POs. Please keep blank where COs do not match POs. A table is provided below for easy reference.

To establish the correlation between Cos & PSOs

Table 3

CO	PSO1	PSO2
CO UMA21B04.1	2	2
CO UMA21B04.2	1	3
CO UMA21B04.3	2	1
CO UMA21B04.4	1	1

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CO UMA21B04.5	3	2
Total	9	9
Average	1.8	1.8
Eq. Av Attainment	1.8	

LANGUAGE (PROFESSIONAL COMMUNICATION IN ENGLISH)
(UHU11B08)

Total Credit: 03 **Contact Periods: 03 (3L+0T+0P)**

Course Objective:

1. To introduce the important aspects of communication skills – speaking, reading, writing, listening and interpersonal communication.
2. To enrich the students with communicational tools.
3. To pursue their present and future academic as well as career goals – both inside and outside the classroom domain.
4. To train students in social and other situations in which they may be called upon to use English.
5. To enable the students to better their professional skills in terms of conducting meetings, making effective presentations etc.

Course Outcome:

1. Students would develop dynamic communication skills and determination to work as a team in future.
2. Students would have better confidence in themselves competing and co-operating with other Co-workers in their career.
3. Students would have the capability to connect with larger audiences and develop leadership qualities.
4. Students would make better decisions through processes of group discussions.
5. Students would obtain clear understanding of the process of inter-cultural communication in an environment of multi-cultural workforce.

Course Content:

Unit -1

Organizational Communication

Process of communication; Features of Successful Professional Communication; Importance of Communication; Purpose of Professional Communication; Different Forms of Communication; Communication Network in an Organization; Barriers to communication.

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Unit -2

Listening Skills

Listening is an art ; Listening vs. Hearing; Poor Listening vs. Effective Listening ; Important facts about listening; Advantages of Good Listening; Process of Listening ; Types of Listening; Intensive vs. Extensive Listening; Barriers to Effective Listening; Techniques for Effective Listening; Listening and Note Taking.

Unit -3

Effective Presentation Strategies

Introduction; Defining Purpose; Analyzing Audience and Locale; Organizing Contents; Preparing an Outline; Kinesics; Proxemics; Paralinguistic.

Unit -4

Oral Communication

Communication/ Public Speaking Skill, Features of Effective Speech-verbal; Group Discussion-principle and practice (the context of a GD, positive and negative roles played in a GD, different stages in a GD etc. and practice sessions), Interview skills and Non –verbal Communication using Audio-Visual aids, Studying Body Language, Distance and Positioning, Body Orientation, Pronunciation and Vocabulary extension.

Unit-5

Writing Skills

The Basics of Writing, The Process of Writing, Mind Mapping

Unit-6

Mechanics of Reading & Writing

Fundamentals of Grammar, One Word Substitution

Models of Technical Writing:

Notice Writing, Formal Letters, Email Writings, Job Applications, Reports, Essays, CV, Passages for Comprehension and Advertisements.

PEOs (Program Educational Objectives):

PEO-1: To empower students to identify, formulate and solve Electrical Engineering problems by applying their knowledge in the field of mathematics, Science, Communication and Computing skills and enabling them to understand specific problem areas and finding the optimum solutions for the same.

PEO-2: To widen the talents of the students to become effective collaborators and innovators, leading in efforts to tackle social, business, design and production challenges.

PEO-3: To develop industry focused skills and leadership qualities to become successful engineers and entrepreneurs.

PEO-4: To enable students to acquire skills to communicate effectively with the society and the constituents which enable them to collaborate as team members and team leaders.

PEO-5: To develop professional work ethics and social responsibilities so as to tackle social, business, design and production challenges.

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PEO-6: To encourage the students for developing life-long learning attitude with moral ethics and values and professional development through higher study, continuing education and independent research activities.

PSOs (Program Specific Objectives):

PSO 1: Specification, fabrication, testing, operation or documentation of basic Electrical systems/processes.

PSO 2: Analysis, design, development and implementation of more advanced Electrical systems or processes.

To establish the correlation between Cos & POs

Table 1

Table 2

No. of Course Outcome (CO)	Course Outcome
CO UHU11BO1.1	Handle all aspects of that experience with a professional demeanor; interacting with team members responsibly, meeting deadlines, preparing and presenting effectively.
CO UHU11BO1.2	Display competence in oral, written, and visual communication.
CO UHU11BO1.3	Possess skills to effectively deliver formal and informal oral presentations
CO UHU11BO1.4	Respond effectively to cultural communication differences.
CO UHU11BO1.5	Overcoming communication barriers, understanding the nuances of organizational set up by acting positively through group communication.

1: Slight (low), 2: Moderate (MEDIUM)
3: Substantial (HIGH) and for NO CORELATION-"-"

co	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO UHU11BO1.1	--	2	--	--	--	--	2	1	3	3	--	2
CO UHU11BO1.2	--	2	--	--	--	--	2	1	3	2	--	3
CO UHU11BO1.3	--	2	1	--	--	--	2	--	3	3	--	2
CO UHU11BO1.4	--	3	--	--	--	--	2	--	3	2	--	3
CO UHU11BO1.5	--	--	1	--	--	--	2	2	2	2	--	2
Total	--	9	2	--	--	--	10	4	14	12	--	12
Average	--	1.8	0.4	--	--	--	2	0.8	2.4	2.4	--	2.4
Eq Av Attainment	-	2	0.4	-	-	-	2	1	2	2	-	2

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References:

Mishra Sunita and Murali Krishna C. *Communication Skills for Engineers*, (2nd Edition), Thane: Pearson India Education Services Pvt. Ltd., 2019.
Mitra, Barun. *Personality Development and Soft Skills*.Oxford University Press, 2012.
Raymond Murphy. *Intermediate English Grammer.* (II Edition) Cambridge University Press, 2011.
Rizvi Ashrf M. *Effective Technical Communication*, (II Edition), Chennai: Mc Graw Hill Education, 2018.
Raman Meenakshi and Sangeeta Sharma. *Technical Communication; Principles and Practice*, (II Edition), Oxford University Press, 2011.
Sharma RC and Mohan Krishna. *Business Correspondence and Report Writing* :*Practical Approach to Business and Technical Communication*, (V Edition), Chennai: Mc Graw Hill Education, 2018.

INTRODUCTION TO PROGRAMMING

(UCS11B08)

Total Credit: 03 **Contact Periods: 03 (3L+0T+0P)**

Purpose of the inclusion of the subject : Developing Knowledge of computer fundadmental and inhance the programming skils.
Why we are teaching that subject in line of PO/PEOs?
To develop appropriate knowledge skill, entrepreneurship capacity in the field of Computer Science and Engineering and develop attitude to contribute to research for the benefit of society.

Courses objective:

The purpose of this course is to making the students understand and learn the basics of computer system and introduce to students to the field of programming using C language. The students will be able to enhance the analyzing and problem solving skills and use the same for writing programs in C.

Course content :

BASICS OF COMPUTERS:
Computer fundamentals: Bits and Bytes, CPU, Memory, Input and output devices, I/O devices, Operating systems, Application software's. Number system – Decimal, Binary, Octal, Hexadecimal.
Need for high level languages, Program design using flow charts
C LANGUAGE PRELIMINARIES:
C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants. Pre-processor commands: #include, #define, #ifdef Input-Output: getchar,

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putchar, scanf, printf, gets, puts. Operators and expressions: Arithmetic, unary, assignment, logical, conditional, and bit-wise operators.
Control statements: if else, for, while, do-while, switch, break, continue; nested loops
Storage types: Automatic, external, register and static variables.
Functions: Defining and accessing, passing arguments, Function prototypes, Recursion,
Library functions, Static functions.Makes students gain a broad perspective about the uses of computers in engineering industry
Arrays: Defining and processing, Passing arrays to a function, Multi-dimensional arrays.
Pointers: Basic concepts, malloc, pointers and arrays, simple singly linked list examples.

Course outcome:

CO1.Know the basic components of the computer and working of each device along with a broad perspective about the uses of computers in engineering industry

CO2.Understand the representation of data in computer and number system conversion

CO3. To know the role of Operating system in computer system and the fundamentals of Computer Networking.
CO4.Know the difference between Assembly and High level programming Languages. And the concept of Arithmetic operators, relational and logical operators, type.
CO5.Design Algorithms and Flowcharts to know the concepts of problem solving and understand and use the common data structures in C programs:- arrays and strings

Program Outcomes (POs): Sl 1 to Sl 12

PO 1.Engineering Knowledge: Apply knowledge of mathematics and science, with fundamentals of Computer Science & Engineering to be able to solve complex engineering problems related to CSE.
PO 2.Problem Analysis: Identify, Formulate, review research literature and analyze complex engineering problems related to CSE and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3. **Design/Development of solutions**:Design solutions for complex engineering problems related to CSE and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural societal and environmental considerations.
PO4. Conduct Investigations of Complex problems: Use research–based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, Select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to computer science related complex engineering activities with an understanding of the limitations

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PO6. The Engineer and Society: Apply Reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the CSE professional engineering practice.

PO7.Environment and Sustainability: Understand the impact of the CSE professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply Ethical Principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9. Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary Settings

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large such as able to comprehend and with write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments

PO12 Life-Long Learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning the broadest context of technological change

To establish the correlation between Cos & Pos

1: Slight(low), 2: Moderate(MEDIUM) 3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	1	-	-	-	-	1	-	-	-
CO.2	3	3	3	2	-	-	-	-	1	-	-	-
CO.3	3	3	3	2	-	-	-	-	1	-	-	-
CO.4	3	3	3	1	-	-	-	-	1	-	-	-
Total	12	12	12	6					4			
Average	3	3	3	1.5					1			
Eq. Av Attainment												

Text Books:

1. Introduction to Computer Science - ITL Education solutions limited, Pearson Education.
2. The C Programming Language by Dennis Ritchie And Brian Kernighan, PHI.

Reference Books:

1. An introduction to Computing & C Language-by Dr. P.N. Basu, New Light.
2. C How to Program - 5th Edition by Deitel, PHI.
3. Computer Science: A Structured Programming Approach Using C by Behrouz A.
4. Computer Basics and C Programming by V. Rajaraman, PHI.
5. Let's C- YashwantKanetkar, Allied Publishers.
6. Programming in C- ReemaThareja, Oxford.

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7. C – programming By-E.Balagurusamy, TMH.
8. How to Solve it by Computer- G. Dromey, Prentice-Hall Inc.

COMPUTER PROGRAMMING LABORATORY

(UCS12P08)

Total Credit: 01 **Contact Periods: 02 (0L+0T+2P)**

Purpose of the inclusion of the subject : Developing Knowledge of computer fundamentals and enhancing the programming skills.

Why we are teaching that subject in line of PO/PEOs?

To develop appropriate knowledge skill, entrepreneurship capacity in the field of Computer Science and Engineering and to develop attitude to contribute to research for the benefit of the society.

Course content:

Expt No	Description	Duration (hrs)
1	• C "Hello, World!" Program • C program for Input/output of Integer, Character and Floating point numbers C Program to Add Two Integers • C Program to Find ASCII Value of a Character • C Program to Compute Quotient and Remainder • C Program to Swap Two Numbers using and without using third variable	02 hrs
2	• C Program to find area of a triangle, square, circle. • C program to find square root of a number using sqrt function • C Program to calculate gross salary of a person. • Where DA is 12% of basic Salary, HR is 7% of basic Salary and TA is 5% of Basic Salary. .	02 hrs
3	• C Program to Check Whether a Number is Even or Odd • C Program to Check Whether a Character is Vowel or Consonant • C Program to Find the Largest Number Among Three Numbers • C Program to Check Leap Year.	02 hrs
4	• Write a C program to check whether a character is uppercase or lowercase alphabet. • Write a C program to find all roots of a quadratic equation.	02 hrs

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	• Write a C program to input month number and print number of days in that month.	
5	• Write a C program to input marks of five subjects Physics, Chemistry, Biology, Mathematics and Computer. Calculate percentage and grade. • Write a C program to input basic salary of an employee and calculate its Gross salary	02 hrs
6	• Write a C program to find maximum between two numbers using conditional operator. • Write a C program to check whether a number is even or odd using conditional operator. • Write a C program to check whether character is an alphabet or not using conditional operator.	04 hrs
7	• C Program to Calculate the Sum of Natural Numbers • C Program to print all the even number up to n • C Program to Find Factorial of a Number • C Program to Generate Multiplication Table	04 hrs
8	• C Program to Display Fibonacci Sequence • C Program to print list of all Prime Number up to a certain Limit. • C Program to find sum of prime numbers	02 hrs
9	• C program to print right triangle star pattern series * * * * * * * * * * • C program to print equilateral triangle or pyramid star pattern * * * * * * * * * * * * * • C program to print Floyd's triangle 1 2 3	02 hrs

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	4 5 6 7 8 9 10 .	
10	• C Program to Reverse a Number • Program to find exponential without using pow() method • C Program to Check Whether a Number is Palindrome or Not • C Program to Check Armstrong Number	02 hrs
11	• C Program to Display Factors of a Number • C Program to find weather a character is vowel or consonant. • C Program to Make a Simple calculator. • C program to find number of days in a month using switch case	02 hrs
12	• C Program to Copy a String • C program to sort an integer array in ascending order. • C program to find the sum of all the elements in a matrix.	02 hrs
13	• C Program to check prime and Armstrong number by making functions • C Program to find the sum of natural numbers using recursion • C Program to find the G.C.D using recursion	02 hrs
Revision of all Experiments		02 hrs
Lab Exam		06 hrs
Total		**38 hrs**

Course outcome:

Table 1

No. of Course Outcome (CO)	Course Outcome
CO1	Students will have a basic understanding of computers, compiler and the concept of algorithm and algorithmic thinking.
CO2	Develops the ability to analyze a problem and design an algorithm to solve it.
CO3	Develops the use of the C programming language to implement various algorithms, and gathers the knowledge about the basic concepts and terminology of programming in general.
CO4	Introduces the more advanced features of the C language like array, structure, union and their applications.

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Program Outcomes (POs):

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

To establish the correlation between Cos & Pos

Table-2

1: Slight(low), 2: Moderate(MEDIUM)
3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	-	-	-	1	-	-	-
CO2	3	3	3	2	3	-	-	-	1	1	-	-
CO3	3	2	3	1	1	-	-	-	1	2	-	-
CO4	3	3	3	3	3	-	-	-	1	1	-	-

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Total	**11**	**9**	**10**	**7**	**8**				**4**	**4**		
Average	**3**	**2**	**3**	**2**	**2**				**1**	**1**		
Eq. Av Attainment												

Text Books:

1. The C Programming Language by Dennis Ritchie And Brian Kernighan PHI.

Reference Books:

1. C How to Program - 5th Edition by Deitel published by PHI.
2. Programming With C - by Gottfried, Byron S, Publisher: TMH
3. Computer Science: A Structured Programming Approach Using C by Behrouz A.
4. Let's C- YashwantKanetkar, Allied Publishers.
5. Computer Basics and C Programming by V. Rajaraman, PHI.
6. Programming in C- ReemaThareja, Oxford.
7. C – programming By-E.Balagurusamy, TMH.

BASIC ELECTRICAL ENGINEERING

(UEE11B12)

Total Credit: 03 **Contact Periods: 03 (3L+0T+0P)**

Purpose of the inclusion of the subject:

The course aims to provide knowledge about basic electrical engineering by means of which fundamental concept of electrical engineering may be acquired. The course covers fundamental concepts of electrical circuits, instruments and measurement of the basic electrical quantities like voltage, current and power. It covers the basic analysis of both ac and dc circuits. Finally it also provides an elemental knowledge of some important electrical machines like motor, generator and transformer.

Why we are teaching that subject in line of PO/PEOs?

This course is taught to develop basic **Engineering knowledge**, **Problem analysis ability** of students in the field of Electrical Engineering. The course enables the students to **Design/develop solution** of basic electrical circuits using both ac/dc energy sources. **This course helps students to perform investigation by applying** different mathematical techniques to determine basic electrical quantities like *voltage, current and power*. The course is obviously a **Life-long learning** for students in the field of electrical engineering.

Course content :

Unit- 1

Basic circuit analysis methods: Kirchhoff's laws, mesh and nodal analysis.

Unit 2

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Network Theorems: Superposition theorem, Thevenin-Norton theorem, maximum power-transfer theorem, star-delta transformation.

Unit – 3

AC circuit analysis: AC fundamentals, phasor diagrams, Power in ac circuits, Series AC circuit and parallel AC circuit, Resonance, Network analysis methods, Poly-phase circuit.

Unit – 4

Basics of Electrical Machines: Basic principle of generator and motor, emf induced in a coil, concept of rotating magnetic field, introduction to transformer.

Course outcome:

Table 1

No. of Course Outcome (CO)	Course Outcome
CO.1	**To understand the fundamental concept of basic electrical components: resistors, energy sources, capacitors and inductors.**
CO.2	**To study various circuit analysis methods and network theorems to facilitate solution of complicated electrical networks.**
CO.3	**To obtain basic engineering knowledge to analyse and solve problems of ac circuit by investigating, interpreting and synthesizing given data.**
CO.4	**To study the working principles of some fundamental electrical machines.**

Program Outcomes (POs):

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PEOs (Program Educational Objectives):

PEO-1: To empower students to identify, formulate and solve Electrical Engineering problems by applying their knowledge in the field of mathematics, Science, Communication and Computing skills and enabling them to understand specific problem areas and finding the optimum solutions for the same.

PEO-2: To widen the talents of the students to become effective collaborators and innovators, leading in efforts to tackle social, business, design and production challenges.
PEO-3: To develop industry focused skills and leadership qualities to become successful engineers and entrepreneurs.
PEO-4: To enable students to acquire skills to communicate effectively with the society and the constituents which enable them to collaborate as team members and team leaders.
PEO-5: To develop professional work ethics and social responsibilities so as to tackle social, business, design and production challenges.
PEO-6: To encourage the students for developing life-long learning attitude with moral ethics and values and professional development through higher study, continuing education and independent research activities.

PSOs (Program Specific Objectives):

PSO 1: Specification, fabrication, testing, operation or documentation of basic Electrical systems/processes.

PSO 2: Analysis, design, development and implementation of more advanced Electrical systems or processes.

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To establish the correlation between Cos & POs

Table 2

1: Slight(low), 2: Moderate(MEDIUM) 3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO.1	3	3	3	2	-	-	-	-	-	-	-	-
CO.2	3	2	3	3	-	-	-	-	-	-	-	-
CO.3	3	3	2	3	-	-	-	-	-	-	-	-
CO.4	3	3	3	3	-	-	-	-	-	-	-	-
Total	12	11	11	11	-	-	-	-	-	-	-	-
Average	3	2.75	2.75	2.75	-	-	-	-	-	-	-	-
Eq. Av Attainment												

To establish the correlation between Cos & PSOs

Table 3

CO	PSO1	PSO2
CO.1	3	-
CO.2	3	-
CO.3	3	-
CO.4	3	-
Total	12	-
Average	3	-
Eq. Av Attainment		

BASIC ELECTRICAL ENGINEERING LABORATORY

(UEE11P07)

Total Credit: 01 **Contact Periods: 02 (0L+0T+2P)**

Purpose of the inclusion of the subject:

The course aims to provide knowledge about basic electrical components like rheostats, capacitors and inductors along with energy sources like voltage source, current source, DC source, AC source etc. The course covers fundamental concepts of electrical circuits, instruments and measurement

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of the basic electrical quantities like voltage, current and power. Finally it also provides an elemental knowledge of some important electrical machines like motor, generator and transformer.

Why we are teaching that subject in line of PO/PEOs?

This course is taught to develop practical **Engineering knowledge about basic electrical components, sources and machineries.** The course enables the students to **Design/develop solution** of basic electrical circuits using both ac/dc energy sources. This course helps students to perform verificationof different mathematical techniques to determine basic electrical quantities like *voltage, current and power*. The course is obviously a **Life-long learning** for students in the field of electrical engineering.

Course content :

Expt No	Description	Duration (hrs)
1	Study of different Electrical sources. i) To draw the characteristics of ideal voltage & current sources. ii) To draw the characteristics of non- ideal voltage & current sources. iii) Conversion of Voltage to Current source.	02 hrs
2	Verification of Thevenin's theorem.	02 hrs
3	Verification of Norton's theorem.	02 hrs
4	Verification of Maximum power transfer theorem.	02 hrs
5	Verification of Superposition theorem.	02 hrs
6	Extension of meter range. i) To convert a galvanometer into an ammeter ii) To convert a galvanometer into a voltmeter	04 hrs
7	Study of characteristics of Fluorescent lamp and Incandescent Lamp**.** i. To draw the voltage vs. current characteristic of lamp and choke coil in a fluorescent lamp and Incandescent Lamp. ii. To determine the striking voltage and extinguishing voltage of a fluorescent lamp. iii. To observe the effect of connecting a capacitor parallel with a fluorescent lamp.	04 hrs
8	Characteristics of R-L circuit, R-C circuit, R-L-C series circuit with AC source.	02 hrs
9	Determination of insulation resistance by using Megger.	02 hrs
10	Study of different transformer connections.	02 hrs

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11	Transformer testing	02 hrs
12	Starting of induction motor	02 hrs
Revision of all Experiments		02 hrs
Lab Exam		06 hrs
Total		**36 hrs**

Course outcome:

Table 1

No. of Course Outcome (CO)	Course Outcome
CO.1	Students will have a working knowledge of the basic electrical engineering components like resistors, inductor, capacitor etc.
CO.2	Students will gain knowledge and handling capacity of the basic electrical sources.
CO.3	Students will understand the working principle of some basic electrical instruments and their usage.
CO.4	Students will understand the working principle of some basic electrical machineries which includes transformers, motors, generators etc.

Program Outcomes (POs):

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PEOs (Program Educational Objectives):

PEO-1: To empower students to identify, formulate and solve Electrical Engineering problems by applying their knowledge in the field of mathematics, Science, Communication and Computing skills and enabling them to understand specific problem areas and finding the optimum solutions for the same.

PEO-2: To widen the talents of the students to become effective collaborators and innovators, leading in efforts to tackle social, business, design and production challenges.
PEO-3: To develop industry focused skills and leadership qualities to become successful engineers and entrepreneurs.
PEO-4: To enable students to acquire skills to communicate effectively with the society and the constituents which enable them to collaborate as team members and team leaders.
PEO-5: To develop professional work ethics and social responsibilities so as to tackle social, business, design and production challenges.
PEO-6: To encourage the students for developing life-long learning attitude with moral ethics and values and professional development through higher study, continuing education and independent research activities.

PSOs(Program Specific Objectives):

PSO 1: Specification, fabrication, testing, operation or documentation of basic Electrical systems/processes.

PSO 2: Analysis, design, development and implementation of more advanced Electrical systems or processes.

To establish the correlation between Cos & Pos Table-2

1: Slight(low), 2: Moderate(MEDIUM)
3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

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CO.1	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO.2	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO.3	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO.4	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
Total	**12**	**12**	**12**	**6**					**4**			
Average	**3**	**3**	**3**	**1.5**					**1**			
Eq. Av Attainment												

To establish the correlation between Cos & PSOs

Table 3

CO	**PSO1**	**PSO2**
CO.1	3	-
CO.2	3	-
CO.3	3	-
CO.4	3	-
Total	12	
Average	3	
Eq. Av Attainment		

BASIC ELECTRONICS

(UEC11B12)

Total Credit: 03 **Contact Periods: 03 (3L+0T+0P)**

Course Objective:

1) To introduce the students to the fundamental of Semiconductor Physics, classification of semiconductors and energy band formation.
2) To explain the concept of Fermi energy level and features of Fermy function.
3) To provide a comprehensive understanding of semiconductor devices like p-n diode, Zener diode and to study the application of p-n diode as Rectifiers, Clippers and Clampers.
4) To analyze the operation, different characteristics and biasing of BJT and FET.
5) To familiarize the students with basic of Operational amplifier and its application.

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Course Content:

Module 1
Basics of conductor, semiconductor and insulator, formation of energy band, elemental and compound semiconductor, Intrinsic and extrinsic semiconductor, p-type and n-type semiconductor, Direct and indirect band gap Semiconductor, Fermi function and its characteristics.

Module 2
Introduction to p-n junction, Depletion layer, V-I characteristics of p-n diode, diode rating (average current, PIV), Avalanche breakdown and Zener breakdown, V-I characteristics of Zener diode and its application as voltage regulator.

Module 3
PN junction diode as half wave rectifier, center tap full wave rectifier, full wave bridge rectifier. Positive and negative unbiased and biased Clipper, positive and negative clamper.

Module 4
Basic construction and working principle of BJT, Common Emitter (CE), Common Base (CB) and Common Collector configuration of BJT, Input and output characteristics of BJT in CB and CE mode. Biasing of BJT, DC Load line and operating point, BJT as amplifier and switch, FET, Basic construction and operation of JFET, Drain characteristics of JFET, Fixed and self-biasing of JFET amplifier

Module 5
Operation and ideal characteristics of OP-AMP, Application of OP-AMP as inverting and non-inverting, Adder and subtractor, Differentiator and Integrator. Introduction to IC-555, Operation of Monostable, Astable and Bistable multivibrators using BJT. Optoelectronic devices –LED, LCD, Photo diode, LDR, photo transistor, seven segment display, optoisolator

Text/References:

1. **"Integrated Electronics"**, Jacob Millman, Christos Halkias
2. **"Electronic Devices and Circuit Theory"**, Robert L.Boylestad
3. **"Electronic Devices and Circuits"**, David A.Bell, Prentice Hall of India
4. **"Electronics Fundamentals and Applications"**, D.Chattopadhyay and P.C. Rakshit, New Age International Publishers

Course Outcome:

CO1: Understand the fundamental of Semiconductor Physics and energy band formation**.**

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CO2: Comprehend the concept of Fermi energy and its characteristics.

CO3: Understand the basics of semiconductor devices and their applications.

CO4: Be familiar with different characteristics and biasing techniques to operate BJTand FET in different modes.

CO5: Perceive the basic knowledge of operational amplifier and its application .

CO-PO-PSO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO 1	3	3	2	2	1	1	1	-	2	2	-	3	3	3
CO 2	3	3	2	2	1	1	1	-	2	2	-	3	2	2
CO 3	3	3	3	2	2	3	2	-	3	3	-	3	3	3
CO 4	3	3	3	3	2	2	1	-	3	3	-	3	3	3
CO 5	3	3	3	3	2	3	2	-	3	3	-	3	2	3
Avg .	**3**	**3**	**2.6**	**2.4**	**1.6**	**2**	**1.4**	**-**	**2.6**	**2.6**	**-**	**3**	**2.6**	**2.8**

BASIC ELECTRONICS LABORATORY

(UEC12P07)

Total Credit: 01 **Contact Periods: 02 (0L+0T+2P)**

LIST OF EXPERIMENTS		
1.	• Identification, specifications, testing of R, L, C components (Color Codes), potentiometers, switches (SPDT, DPDT and DIP), coils, Gang condensers, relays, bread boards, PCBs, identification, specifications and testing of active devices, diodes, BJTs, Low power JFETs, MOSFETs, power transistors, LEDs, LCDs, optoelectronic devices, SCR, UJT,DIACs.	

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	• Familiarization of various equipments – DSO, SIGNAL GENERATOR, DIGITAL MULTIMETER, DC REGULATED POWER SUPPLY	
2.	To plot Volt-Ampere Characteristics of PN Junction Diode and Zener Diode and find out • Cut-in Voltage for P-N Junction diode. • Static and dynamic resistances for P-N Junction diode. • Breakdown voltage for Zener Diode	
3.	To study Rectifier Circuits with and without filters and calculate: • Ripple Factor • Efficiency • PIV	
4.	To study • Positive and negative biased clipper (STUDENTS CAN CARRY OUT EITHER POSITIVE OR NEGATIVE BIASED CLIPPER) • Positive clamper circuits.	
5.	To study Zener Diode as Voltage Regulator • By varying load resistance by keeping input voltage constant (load regulation). • By Varying input voltage by keeping load resistance constant (line regulation	
6.	To study the input and output characteristics of a Bipolar Junction Transistor (BJT) in Common Emitter mode and determine transistor parameters.	
7.	To study the following linear applications of op-amp • Inverting amplifier • Non – inverting amplifier	
8.	To study the following linear applications of op-amp • Summing Amplifier • Differential Amplifier	

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9.	To verify the operation of all Logic gates: OR gate, AND gate, NOT gate, NOR gate, NAND gate and Ex-OR gate	
10.	Implementation of the Given Boolean Function using Logic Gates • $S= A \oplus B \oplus C$ • $C= A.B + A.C + B.C$ • $M=A'B'I_0+A'BI_1+A\ B'I_2+ABI_3$	

Program Educational Objective(s)

After graduation and few years of graduation, the Electronics & Telecommunication Engineering graduates would

PEO 1 Core Competency: Graduates will provide engineering solutions with strong base of science and mathematics, subject domain knowledge for challenging problems in Electronics and allied disciplines.

PEO 2 Career Building: Graduates will fulfill professional responsibilities effectively by synergizing theoretical and practical skills.

PEO 3 Technical Proficiency: Graduates will practice analytical, creative, innovative skills for higher education, research, industrial development.

PEO 4 Managerial Skills: Graduates will perform cohesively in group using moral, ethical practice, managerial, entrepreneurial skills for welfare of society with global outlook.

Programme Outcomes (PO's)

Programme Outcomes describe what students are expected to know or be able to do by the time of graduation from the programme. The POs for Under Graduate Course in Electronics and Telecommunication Engineering are able to

1. Apply knowledge of mathematics, science and technical fundamentals for solutions of domain problems
2. Identify, formulate, review the literature, and analyze the complex engineering problems

3. Design and implement the systems‟ components and processes serving the needs of safety, environment and society

4. Perform experiment, analyze and interpret results

5. Use modern tools and technical skills necessary for electronic system development

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6. Understand the impact of electronics in modern era

7. Explore the needs of society for sustainable development and human values

8. Understand professional, ethical and legal responsibilities

9. Work effectively in diverse and multidisciplinary tasks, to accomplish common goal

10. Communicate effectively

11. Engage in continuing educational / professional, entrepreneurship development

12. Apply electronics engineering and management principles / skills, as a member and leader in a team to solve social and industrial problems

Course Overview:

i) This course provides the basic knowledge over the construction and functionality of the basic electronic devices such as diodes and transistors, Op-Amps and digital ICs.
ii) It also provides the information about the uncontrollable and controllable electronic switches and the flow of current through these switches in different biasing conditions.
iii) This course is intended to describe the different configurations and modes of controllable switches and how these electronic devices can be configured to work as rectifiers, clippers, clampers, oscillators, amplifiers, combinational circuits.

Course Outcomes:
Upon the completion of Basic Electronics practical course, the student will be able to:

1. Analyze the diode and transistor characteristics.
2. Understand the principles of rectifier circuits using diodes and implement them using hardware.
3. Design the biasing circuits like self biasing, fixed biasing.
4. Design various Linear Integrated Circuits.
5. Understand the concepts of Digital ICs,
6. Understand the concepts of Combinational Circuits.

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ENGINEERING MECHANICS

(UME12B11)

Total Credit: 04 **Contact Periods: 04 (3L+1T+0P)**

Course Objective:

1. Solve for the resultants of any force systems & Differentiates between different force systems
2. Draw the FBD and find the internal and external forces acting on a body for coplanar and non coplanar force system
3. Differentiate between centroid and centre of gravity & calculate the CG for a given object.
4. Analysis of the force(s) that causes motion and also analyze for the friction& Truss problems.
5. To calculate the moment of inertia for area and solids.
6. Analysis of Rectilinear & Curvilinear Translation.
7. Analysis of Rotation of Rigid Body about a fixed axis.
   Analyze the effects of Stress, strain and Hooks law.

Course Content:

UNIT I: FORCE SYSTEMS AND EQUILIBRIUM

Force moment and couple principle of transmissibility, Varignon's theorem. Resultant of force system- concurrent and non-concurrent coplanar forces, free body diagram, equilibrium equations and their uses in solving elementary engineering problems.

UNIT II : PROPERTIES OF SURFACE & SOLIDS

Centroid & Centre of Mass-Centroid of lines and areas using Standard formulas. Theorem of Pappus. Area moment of Inertia of plane figures. Hollow section by using Standard formula-Parallel axis theorem and Perpendicular axis theorem-Principle axes of inertia -Mass moment of Inertia for prismatic cylindrical and spherical solids from first principle- Relation to area moments of Inertia

UNIT III: PLANE TRUSSES

Analysis of plane trusses and plane frames (Analytical Method), Method of joints, Method of sections.

UNIT IV: DYNAMICS OF PARTICLES

Displacement, Velocity and acceleration, their relationship -Relative motion -Curvilinear motion- Newton's Law of motion-Work Energy Equation-Impulse and Momentum -Impact of elastic bodies, Simple stress strain for deformable body, Hooke's Law.

UNIT V: FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

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Friction force- Laws of friction- equilibrium analysis of simple systems with sliding friction, Translation and Rotation of Rigid Bodies -Velocity of Acceleration-General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

Text Book:

ENGINEERING MECHANICS REVISED 5th Edition by S. Timoshenko, D.H. Young, et al.

Mapping with the POs/ PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UME11B05/ UME22B05	**ENGINEERING MECHANICS**											
UME11B05/ UME22B05/CO1	3	2	1	1	-	-	-	-	1	1	-	2
UME11B05/ UME22B05/CO2	3	2	1	1	-	-	-	-	1	1	-	2
UME11B05/ UME22B05/CO3	3	2	1	1	-	-	-	-	1	1	-	2
UME11B05/ UME22B05/CO4	3	2	1	1	-	-	-	-	1	1	-	2
UME11B05/ UME22B05/CO5	3	2	1	1	-	-	-	-	1	1	-	2
UME11B05/ UME22B05/CO6	3	2	1	1	-	-	-	-	1	1	-	2
Average	3	2	1	1	-	-	-	-	1	1	-	2

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ENGINEERING GRAPHICS

(UME12P03)

Total Credit: 02 **Contact Periods: 03 (1L+0T+2P)**

Courses objective:

1) To understand techniques of drawings in various fields of engineering.
2) The course is aimed at developing Basic Graphic skills.
3) To Develop Skills in Preparation Of Basic Drawings.
4) To provide skills in Reading and Interpretation of Engineering Drawings.

Course content:

UNIT I: Drawing Instrument and their uses, lines, lettering and dimensioning, various types of curves used in engineering practice.
UNIT II: Orthographic projection and convention, projection of points and lines, illustrative examples.
UNIT III: Projection of lamina and solids including sectional solids, end view concept.
UNIT IV: Isometric projection of solids.

Text/Reference Books:

1. N. D. Bhatt, *Elementary Engineering Drawing (Plane and solid geometry).*
2. R. B Gupta, *A text Book of Engineering Drawing*.
3. K.Venugopal, *A text Book of Engineering Drawing*.
4. N. D. Bhatt, *Machine Drawing.*
5. R. K. Dhawan, A text Book of Machine Drawing (In first angle projection)

Mapping with the POs/ PEOs: Matrix formation for attainments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and for No Correlation "-"

CO	PO1	PO 2		PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
UME11P06		ENGINEERING GRAPHICS											
UME21P06.1	3	-		-	-	-	-	-	3	-	-	-	2
UME21P06.2	3	-		-	-	-	-	-	-	-	-	-	-
UME21P06.3	3	2		-	-	-	-	-	-	-	-	-	-
UME21P06.4	3	-		2	3	-	-	-	-	-	-	-	-
UME21P06.5	3	-		-	-	-	-	-	-	-	3	-	-
UME21P06.6	3	-		-	-	-	-	-	-	-	-	-	2
Average	3	2		2	3	-	-	-	-	-	3	-	2

DISASTER MANAGENT

First Year Co-ordinator
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(UCE11B11/UCE21B08)

Total Credit: 02 **Contact Periods: 02 (2L+0T+0P)**

Courses objective:

1. To improve the understanding of disaster risk, hazards, and vulnerabilities through structural, non-structural and financial measures, as well as comprehensive capacity development.

2. To give the idea for making different earthquake resistant buildings along with various earthquake parameters.

3. To learn how to recognize areas which are more prone to landslides and mitigation measures to reduce the effects of landslides.

4. To make a safe workplace and preventing fires including fire safety training. With proper training workers can eliminate fire hazards and respond quickly and efficiently if a fire breaks out.

5. To reduce the vulnerability to flood hazards in order to protect the life, health, safety and welfare of the community's residents and visitors.

6. To learn the cause of cyclones and how to recognize areas which are more prone to cyclones and mitigation measures to reduce the effects of cyclones.

Course content:

Unit1

Elements of Engineering Seismology, Earthquake occurrence in the world, Causes of Earthquake, Plate tectonics, Earthquake mechanism, Seismic zoning map of India and its use.

Unit2

Earthquake phenomenon, Focus, Epicenter, Seismic waves, Magnitude, Intensity scale its co-relation assessment, Do's, and Don'ts for protection of life and property during disaster.

Unit3

Landslides, Geo-technical aspects of landslides and control of landslide hazard.

Unit4

Flood, Flood control as a measure of disaster management and mitigation.

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Unit5

Cyclone and Fire, Cyclone Disaster Mitigation and ensuring wind and fire hazard safety during disaster.

Course outcome:.

1. Students will be able to prevent disasters and achieve substantial reduction of disaster risk and losses in lives, livelihoods, health, and assets (economic, physical, social, cultural and environmental)
2. Students will be able to learn different prospective of earthquake including its mitigative measures.
3. Students will be able to learn causes, effects and preventive measures of landslide hazard.
4. Students will be able to understand how to mitigate the effects of flood hazard in flood prone areas by knowing its root causes.
5. Having the knowledge of fire proof construction students will make themselves enable for future fire disaster.
6. Students will be able to understand the effects of cyclone by knowing their underlying causes.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UAD12B14.1	Students will be able to prevent disasters and achieve substantial reduction of disaster risk and losses in lives, livelihoods, health, and assets (economic, physical, social, cultural and environmental)
UAD12B14.2	Students will be able to learn different prospective of earthquake including its mitigative measures.
UAD12B14.3	Students will be able to learn causes, effects and preventive measures of landslide hazard.
UAD12B14.4	Students will be able to understand how to mitigate the effects of flood hazard in flood prone areas by knowing its root causes.
UAD12B14.5	3e Having the knowledge of fireproof construction students will make themselves enable for future fire disaster.

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UAD12B14.6	Students will be able to understand the effects of cyclone by knowing their underlying causes.

References:

Sl. No.	Name of Book	Author	Publisher
1.	Engineering and General Geology for B.E (civil, Mining, Metallurgy) B.Sc (pass) and A.M.I.E	Parbin Singh	KATSON Books.
2	Disaster Management Paperback – 2019	P Kumar	Oak Bridge.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UAD12B14.1	3	2	-	1	-	2	3	-	-	1	-	3
UAD12B14.2	3	2	-	1	-	2	3	-	-	1	-	3
UAD12B14.3	3	2	-	1	-	2	3	-	-	1	-	3
UAD12B14.4	3	2	-	1	-	2	3	-	-	1	-	3
UAD12B14.5	3	2	-	1	-	2	3	-	-	1	-	3
UAD12B14.6	3	2	-	1	-	2	3	-	-	1	-	3
Total	18	12	0	6	0	12	15	0	0	6	0	18
Average	3.00	2.00	0.00	1.00	0.00	2.00	3.00	0.00	0.00	1.00	0.00	3.00
Equivalent Avg. attainment	3	2	0	1	0	2	3	0	0	1	0	3

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UAD12B14.1	**3**	**2**
UAD12B14.2	**3**	**2**
UAD12B14.3	**3**	**2**
UAD12B14.4	**3**	**2**
UAD12B14.5	**3**	**2**
UAD12B14.6	**3**	**2**

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TOTAL	**18**	**12**
AVERAGE	**3**	**2**
Equivalent Avg. Attainment	**3**	**2**

WORKSHOP PRACTICE

(UME22P08)

Total Credit: 01 **Contact Periods: 02 (0L+0T+2P)**

Course Objectives:

1. Introduction to basic manufacturing process like welding, fitting, machining, sheet metal, smithy, forging, carpentry, pattern and casting works .
2. Familiarization of basic manufacturing hand tools and equipment's like files, hacksaw, spanner, chisel, hammers, etc
3. Familiarization of various measuring devices like vernier height gauge, vernier caliper, steel rule etc.

Syllabus Content

1. Fitting Shop

a) Introduction of hand Tools.
b) Job No. 01:- Making of Square bar from round bar of mild steel by metal wearing process.
c) Job No.02:- Making of V-Groove on Mild Steel Flat by metal cutting process.

2. Carpentry Shop

a) Introduction of Hand Tools.
b) Job No.01:- Making of wooden End half lap joint.
c) Job No.02:- Making of wooden T-Joint.

3. Smithy Shop

a) Introduction of Hand Tools
d) Job No.01:- To make square bar from round bar of Mild Steel by heating& hammering.
e) Job No.02:- To make Hexagonal bar from round bar of Mild Steel by heating& hammering.

4. Machine Shop

a) Introduction of operation of Machine Tools.
b) Job No. 01:- Facing and Turning operation by using Lathe machine.
c) Job No. 02:- Step turning operation by using Lathe machine.

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5. Welding Shop

a) Introduction to Welding Machines and related Tools.
b) Job No.01:- Lap joining of two metal plates by arc welding process.
c) Job no.02:- Butt joining of two metal plates by arc welding process.

6. Forging Shop

a) Introduction of forging process and related tools.
b) Job No.01:- Making of mild steel ring by forging process.
c) Job NO.02:- Making of Square punch from round Mild Steel Bar.

7. Pattern Shop

a) Introduction of wood working Machine Tools.
b) Job No.01:- Making of wooden Knuckle Joint.
c) Job No.02:- Making of wooden Halving Joint.

8. Sheet Metal Shop

a) Introduction of machine tools & hand tools.
b) Job No. 01:- Metal sheet single seam joining.
c) Job No. 02:- Metal sheet joining by riveting.

9. Casting Shop

a) Introduction of Casting process & related tools.
b) Job No. 01:- metal casting using a pattern of Knuckle Joint.

Contents beyond Syllabus (If any):

Text Books:

i. Fundamentals of Manufacturing Processes, G.K. Lal and S.K. Choudhury
ii. J.S. Campbell: Principles of Manufacturing Materials and Process, McGraw Hill.

Reference Books:

1. Materials Science & Engineering, G.S. Upadhyaya and A. Upadhyaya
2. Fundamentals of Modern Manufacturing, M.P. Groover
3. Materials & Processes in Manufacturing, E. P. DeGarmo, J.T. Black and R. Kohser
4. Manufacturing Engineering and Technology, S. Kalpakjian

Course Outcomes

CO-No.	Course Outcome (5 to 6)	Module Covered
1	At the end of this lab course student will be able to discuss about various manufacturing process like smithy, carpentry, pattern, welding, casting and different machines.	**All**

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2	Students are able to select the appropriate tools required for specific operation and the safety measures required to be taken while using these tools.	**All**
3	Students are able to demonstratethe various hand tools used in the basic mechanical engineering workshop sections-smithy, carpentry, pattern,welding etc. based on application.	**All**
4	Student are be able to identify and distinguish various trades.	**All**

Mapping of CO's & PO's

POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO 1	PSO 2
CO 1	2	1	1	1	3	1	3	-	1	3	1	2	2	-
CO 2	2	-	2	1	3	3	3	3	3	2	-	2	3	-
CO 3	2	-	2	1	3	1	1	2	2	2	-	-	3	-
CO 4	2	-	1	-	2	2	-	2	-	2	-	3	2	-

Program Outcomes for all B.Tech Program

PO	**Graduate Attributes**	**Program Outcomes (PO)**
PO1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization in to the solution of complex engineering problems.
PO2	Problem Analysis	Identify, formulate, study literature, and analyze complex problems in Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design and Development of solution	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct Investigation of Complex problem	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex Engineering Problems.
PO5	Modern tools usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and Sustainability	Understand the impact of the Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Lifelong learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

NSS/NCC

(UAD11P04)

Total Credit: 00 **Contact Periods: 03 (0L+0T+3P)**

Students have to appear the classes of NSS/NCC and need to pass the examination for course completion.

Selective number of students are allowed to join NCC under NIT Agartala.

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