

INSTITUTE OF ENGINEERING & TECHNOLOGY,
Lucknow, Uttar Pradesh, India
(An Autonomous Constituent Institute of AKTU, Lucknow)



EVALUATION SCHEME AND SYLLABI
(I-Series)

For

B. Tech. 1st Year
Common to All Branches

Effective from the Session: 2023-24

B. Tech. First Year, Semester- I Structure
(All Branches effective from 2023-24)

3- WEEKS STUDENT INDUCTION PROGRAMME
in the beginning of the session

3- WEEKS STUDENT INDUCTION PROGRAMME													Evaluation Scheme	
SN	Subject Code	Subject Name	Type	Category	Period			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total	Credit	
					L	T	P	CT	TA					CT+TA
1.	IAS101/ IAS102	Engineering Physics/ Engineering Chemistry	T	BS	3	1	0	20	10	30	70	100	4	
2.	IAS103	Engineering Mathematics-I	T	BS	3	1	0	20	10	30	70	100	4	
3.	IEE101/ IEC101	Fundamentals of Electrical Engineering/ Fundamentals of Electronics Engineering	T	ES	2	1	0	20	10	30	70	100	3	
4.	ICS101/ IME101	Programming for Problem Solving/ Fundamentals of Mechanical Engineering	T	ES	2	1	0	20	10	30	70	100	3	
5.	IAS104/ IAS105	Environment and Ecology/ Soft Skills	T	BS/ HS	3	0	0	20	10	30	70	100	3	
6.	IAS151/ IAS152	Engineering Physics Lab/ Engineering Chemistry Lab	P	BS	0	0	3	-	50	50	50	100	1	
7.	IEE151/ IEC151	Basic Electrical Engineering Lab/ Basic Electronics Engineering Lab	P	ES	0	0	3	-	50	50	50	100	1	
8.	ICS151/ IAS155	Programming for Problem Solving Lab/ English Language Lab	P	ES/ HS	0	0	3	-	50	50	50	100	1	
9.	ICE151 / IWS151	Engineering Graphics & Design Lab/ Workshop Practice Lab	P	ES	0	1	3	-	50	50	50	100	2	
					13	5	12			350	550	900	22	

Abbreviation Used:

BS: Basic Science Course

ES: Engineering Science Course

HS: Humanities and Social Science Course

VA: Value Added Course

B. Tech. First Year, Semester- II Structure
(All Branches effective from 2023-24)

SN	Subject Code	Subject Name	Type	Category	Period			Evaluation Scheme						Credit
					L	T	P	Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total	Cr	
								CT	TA					
1.	IAS202/ IAS201	Engineering Chemistry / Engineering Physics	T	BS	3	1	0	20	10	30	70	100	4	
2.	IAS203	Engineering Mathematics-II	T	BS	3	1	0	20	10	30	70	100	4	
3.	IEC201/ IEE201	Fundamentals of Electronics Engineering /Fundamentals of Electrical Engineering	T	ES	2	1	0	20	10	30	70	100	3	
4.	IME201/ ICS201	Fundamentals of Mechanical Engineering/ Programming for Problem Solving	T	ES	2	1	0	20	10	30	70	100	3	
5.	IAS205/ IAS204	Soft Skills / Environment and Ecology	T	HS/ BS	3	0	0	20	10	30	70	100	3	
6.	IAS252/ IAS251	Engineering Chemistry Lab / Engineering Physics Lab	P	BS	0	0	3	-	50	50	50	100	1	
7.	IEC251/ IEE251	Basic Electronics Engineering Lab/ Basic Electrical Engineering Lab	P	ES	0	0	3	-	50	50	50	100	1	
8.	IAS255/ ICS251	English Language Lab / Programming for Problem Solving Lab	P	HS/ ES	0	0	3	-	50	50	50	100	1	
9.	IWS251/ ICE251	Workshop Practice Lab / Engineering Graphics & Design Lab	P	ES	0	1	3	-	50	50	50	100	2	
					13	5	12			350	550	900	22	
*Value Added Course														
	IVA251/ IVA252 #	Sports and Yoga / NSS #	P	VA	0	0	2	-	100	100		100	0	

Abbreviation Used:

- BS:** Basic Science Course
- ES:** Engineering Science Course
- HS:** Humanities and Social Science Course
- VA:** Value Added Course

Summer Internship (4-week) / NPTEL Course (4-week) during summer break after Semester-II and same will be assessed/evaluated in the Semester-III

List of all the Courses (B. Tech. 1st Year)

S. No.	Subject Dept.	Subject Code	Subject Name	Credit	Syllabus
1	ASD	IAS101 / IAS201	Engineering Physics	4	View
2	ASD	IAS151 / IAS251	Engineering Physics Lab	1	View
3	ASD	IAS102 / IAS202	Engineering Chemistry	4	View
4	ASD	IAS152 / IAS252	Engineering Chemistry Lab	1	View
5	ASD	IAS103	Engineering Mathematics-I	4	View
6	ASD	IAS203	Engineering Mathematics-II	4	View
7	ASD	IAS104 / IAS204	Environment and Ecology	3	View
8	ASD	IAS105 / IAS205	Soft Skills	3	View
9	ASD	IAS155 / IAS255	English Language Lab	1	View
10	EE	IEE101 / IEE201	Fundamentals of Electrical Engineering	3	View
11	EE	IEE151 / IEE251	Basic Electrical Engineering Lab	1	View
12	EC	IEC101 / IEC201	Fundamentals of Electronics Engineering	3	View
13	EC	IEC151 / IEC251	Basic Electronics Engineering Lab	1	View
14	CS	ICS101 / ICS201	Programming for Problem Solving	3	View
15	CS	ICS151 / ICS251	Programming for Problem Solving Lab	1	View
16	ME	IME101 / IME201	Fundamentals of Mechanical Engineering	3	View
17	ME	IWS151 / IWS251	Workshop Practice Lab	2	View
18	CE	ICE151 / ICE2511	Engineering Graphics & Design Lab	2	View
19		IVA251	Sports and Yoga	0	View
Total Credit in B. Tech. 1st Year				44	

DETAILED SYLLABI

IAS101 / IAS201: ENGINEERING PHYSICS

Content	Contact Hours
Unit-1: Quantum Mechanics	9
Inadequacy of classical mechanics, Planck's theory of black body radiation(qualitative), Compton effect, de-Broglie concept of matter waves, Davisson and Germer Experiment, Phase velocity and group velocity, Time-dependent and time-independent Schrodinger wave equations, Physical interpretation of wave function, Particle in a one-Dimensional box.	
Unit-2: Electromagnetic Field Theory	8
Basic concept of Stoke's theorem and Divergence theorem, Basic laws of electricity and magnetism, Continuity equation for current density, Displacement current, Maxwell equations in integral and differential form, Maxwell equations in vacuum and in conducting medium, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Plane electromagnetic waves in conducting medium, Skin depth.	
Unit-3: Wave Optics	10
Coherent sources, Interference in uniform and wedge shaped thin films, Colours of thin films, Necessity of extended sources, Newton's Rings and its applications (Wavelength and refractive index), Introduction to diffraction, Fraunhofer diffraction at single slit and double slit, Absent spectra, Diffraction grating, Spectra with grating, Maximum numbers of orders with grating, Absent spectra with grating, Dispersive power of grating.	
Unit-4: Fiber Optics & Laser	9
Fibre Optics: Principle and construction of optical fiber, Acceptance angle, Numerical aperture, Acceptance cone, Step index and graded index fibers, Fiber optic communication principle, Attenuation, Application of fiber. Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Population inversion, Einstein's Coefficients, Principles of laser action, Solid state Laser (Ruby laser) and Gas Laser (He-Ne laser), Laser applications.	
Unit-5: Superconductors and Nano-Materials:	8
Superconductors: Temperature dependence of resistivity in superconducting materials, Meissner effect, Temperature dependence of critical field, Persistent current, Type I and Type II superconductors, Properties and Applications of Super-conductors. Nano-Materials: Introduction and properties of nano materials, Basic concept of Quantum Dots, Quantum wires and Quantum well, Fabrication of nano materials -Top-Down approach (CVD) and Bottom-Up approach (Sol Gel), Properties and Applications of nano materials.	

Course Outcomes:

On completion of course the students are able:		
CO	CO Statement	Bloom's Level
CO1	To explain the distribution of energy in black body radiation and to understand the difference in particle and wave nature with explanation of Compton effect and Schrodinger wave equation.	Understanding, Apply
CO2	To understand the concept of displacement current and consistency of Ampere's law and also the properties of electromagnetic waves in different medium with the use of Maxwell's equations.	Understanding, Analyze
CO3	To understand the behavior of waves through various examples/applications of interference and diffraction phenomenon and the concept of grating and resolving power.	Apply
CO4	To know the functioning of optical fiber and its properties and applications. To understand the concept, properties and applications of Laser.	Understanding, Apply
CO5	To know the properties and applications of superconducting materials and nano materials.	Understanding

Reference Books:

1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Optics - Brijlal & Subramanian (S. Chand)
3. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
4. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
5. Engineering Physics-Malik HK and Singh AK (Mc Graw Hill)

[List of Courses](#)

IAS102 / IAS202: ENGINEERING CHEMISTRY

Course Objectives:

1. To enable the students to understand about the Chemistry of Atomic and Molecular structure, Chemistry of advanced Materials like Liquid crystals, Nano materials, Graphite & fullerenes and Green Chemistry.
2. To enable the students to understand and apply the detailed concepts of spectroscopic techniques and stereochemistry to identify the compounds, element etc.
3. To enable the students to understand and apply the concepts related to Electrochemistry, Batteries, Corrosion and Chemistry of Engineering Materials like cement.
4. To enable the students to understand and apply detailed concepts of water source, water impurities, hardness of water and boiler troubles used in industry as well as analysis of coal & determination of calorific values.
5. To enable the students to understand detailed concepts related to polymers, Polymerization, Polymer Blends and Polymer Composites.

Content	Contact Hours
Unit-1:	8
<p>Solid State Chemistry; Introduction, Crystal Imperfections; Stoichiometric Defects and Nonstoichiometric Defects.</p> <p>Chemistry of Advanced Materials:</p> <p>Liquid Crystals; Introduction, Types and Applications of liquid crystals, Industrially important materials used as liquid crystals.</p> <p>Graphite and Fullerene; Introduction, Structure and applications.</p> <p>Nanomaterials; Introduction, Preparation, characteristics of nanomaterials and applications of nanomaterials, Carbon Nano Tubes (CNT),</p> <p>Green Chemistry: Introduction, 12 principles and importance of green Synthesis, Green Chemicals, Synthesis of typical organic compounds by conventional and Green route (Adipic acid and Paracetamol), Environmental impact of Green chemistry on society.</p>	
Unit-2:	8
<p>Spectroscopic Techniques and Applications: Elementary idea and simple applications of UV, IR and NMR, Numerical problems.</p> <p>Stereochemistry: Optical isomerism in compounds without chiral carbon, Geometrical isomerism, Chiral Drugs.</p>	
Unit-3:	8
<p>Named Reaction their Mechanism and Industrial Applications; Beckmann Reaction, Diel's Alder Reaction, Cannizzaro Reaction, Aldol Condensation, Reimer Tiemann reaction, Hofmann Reaction and Friedel Craft Reaction.</p> <p>Catalysis; Introduction; Characteristics of catalyst, Types of catalyst, Theories of catalysis, Positive and Negative catalyst, Catalytic promoters and Inhibitors, Autocatalyst, Enzyme catalyst and Industrial catalyst.</p> <p>Corrosion: Introduction to corrosion, Types of corrosion, Cause of corrosion, Corrosion prevention and control, Corrosion issues in specific industries (Power generation, Chemical processing industry, Oil & gas industry and Pulp & paper industries).</p> <p>Chemistry of Engineering Materials: Cement; Constituents, manufacturing, hardening and setting, deterioration of cement, Plaster of Paris (POP).</p> <p>Cement; Constituents, manufacturing, hardening and setting, deterioration of cement, Plaster of Paris (POP).</p>	

Unit-4	8
<p>Water Technology: Sources and impurities of water, Hardness of water, Boiler troubles, Techniques for water softening (Lime-Soda, Zeolite, Ion Exchange and Reverse Osmosis process), Determination of Hardness and alkalinity, Numerical problems.</p> <p>Fuels and Combustion: Definition, Classification, Characteristics of a good fuel, Calorific Values, Gross & Net calorific value, Determination of calorific value by Bomb Calorimeter, Theoretical calculation of calorific value by Dulong's method, Ranking of Coal, Analysis of coal by Proximate and Ultimate analysis method, Numerical problems, Chemistry of Biogas production from organic waste materials and their environmental impact on society.</p>	
Unit-5	
<p>Materials Chemistry: Polymers; Classification, Polymerization processes, Thermosetting and Thermoplastic Polymers, Polymer Blends and Composites, Conducting and Biodegradable polymers, Preparation, properties, industrial applications of Teflon, Lucite, Bakelite, Kelvar, Dacron, Thiokol, Nylon, Buna-N and Buna-S and their environmental impact on society, Speciality polymers.</p> <p>Organometallic Compounds: General methods of preparation and applications of Organometallic compounds (CH_3MgBr and LiAlH_4).</p>	

Course Outcomes:

Upon completion of the course the student should be able to:

Units	Course Outcomes	Bloom'S Taxonomy Level
U-1	Get an understanding of the theoretical principles of solid state chemistry, Chemistry of advanced materials (liquid crystals, Nanomaterials, Graphite & Fullerene) as well as the Principles of Green Chemistry.	K3
U-2	Apply the fundamental concepts of determination of structure with various spectral techniques and stereochemistry.	K4
U-3	Apply the concepts related to Application of named organic reactions, Catalysis, and categorize the reasons for corrosion and study methods to control corrosion and develop understanding of Chemistry of Engineering materials (Cement).	K3
U-4	Develop understanding of the sources, impurities and hardness of water, apply the concepts of determination of calorific values and analyze the coal.	K4
U-5	Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials. Understanding the applications of specific polymers and Chemistry applicable in industrial process.	K3

Textbooks/Reference Books:

1. Engineering Chemistry by Rath & Singh, 1st Edition, Cengage Learning India Pvt Ltd Delhi, ISBN: 9789355735560 (2023).
2. Engineering Chemistry by SS Dara, S Chand & Co Ltd, ISBN: 978-8121903592 (2004).
3. Engineering Chemistry 17th Edition by Jain & Jain, Dhanpat Rai Publishing Comp, New Delhi, ISBN: 978-9352165728 (2022).
4. Engineering Chemistry by K. Sessa Maheswaramma, Pearson India Education, ISBN: 978-93-325-7118-1 (2016).
5. Engineering Chemistry 2nd Edition by OG Palanna, Mc Graw Hill Education, New Delhi, ISBN: 978-93-5260-577-4 (2017).
6. Engineering Chemistry by Shashi Chawala, Dhanpat Rai Publishing Comp, New Delhi, ISBN: 978-8177000986 (2017).
7. University Chemistry, 4th Edition by BH Mahan, Pearson Education India, 978-8131729571 (2009).
8. University General Chemistry by CNR Rao, Laxmi Publication, New Delhi, ISBN: 978-0333900130 (2015).

[List of Courses](#)

IAS103 : ENGINEERING MATHEMATICS-I

Course Objectives:

The objective of this course is to familiarize the graduate engineers with techniques in matrix, calculus, multivariate analysis and vector calculus. It aims to equip the students with standard concepts and tools from intermediate to advanced level that will enable them to tackle more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

- The essential tools of matrices, Eigen values and its application in a Comprehensive-manner.
- To apply the knowledge of differential calculus in the field of engineering.
- To deal with functions of several variables that is essential in optimizing the results of real life problems.
- To apply integral calculus in various field of engineering and have a basic understanding of Beta and Gamma functions and application of Dirichlet's integral.
- To deal with vector calculus that is required in different branches of Engineering to graduate engineer.

Content	Contact Hours
Unit-1: Matrices	8
Elementary transformations, Inverse of a matrix, Rank of matrix, Solution of system of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Linear Dependence and Independence of vectors, Eigen values and Eigen vectors, Complex Matrices, Hermitian, Skew-Hermitian and Unitary Matrices, Applications to Engineering problems.	
Unit-2: Differential Calculus- I	8
Successive Differentiation (nth order derivatives), Leibnitz theorem, Curve tracing, Partial derivatives, Euler's Theorem for homogeneous functions, Total derivative, Change of variables.	
Unit-3: Differential Calculus-II	8
Expansion of functions by Taylor's and Maclaurin's theorems for functions of one and two variables, Maxima and Minima of functions of several variables, Lagrange's method of multipliers, Jacobians, Approximation of errors.	
Unit-4: Multiple integration	8
Double integral, Triple integral, Change of order of integration, Change of variables, Beta and Gamma function and their properties, Dirichlet's integral and its applications to area and volume, Liouville's extensions of Dirichlet's integral.	
Unit-5: Vector Calculus	8
Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives.	
Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem and Stoke's theorem (without proof) and their applications.	

Course Outcomes:

	Course Outcome (CO)	Bloom's Level
	At the end of this course, the students will be able to:	
CO 1	Understand the concept of complex matrices, Eigen values, Eigen vectors and apply the concept of rank to evaluate linear simultaneous equations	K2 & K5
CO 2	Remember the concept of differentiation to find successive differentiation, Leibnitz Theorem, and create curve tracing, and find partial and total derivatives	K1, K6 & K5
CO 3	Applying the concept of partial differentiation to evaluate extrema, series expansion, error approximation of functions and Jacobians	K3 & K5
CO 4	Remember the concept of Beta and Gamma function; analyze area and volume and Dirichlet's theorem in multiple integral	K1 & K4
CO 5	Apply the concept of Vector Calculus to analyze and evaluate directional derivative, line, surface and volume integrals.	K3, K4 & K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Text Books:

1. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House 2002.

Reference Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.
6. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, McGraw-Hill; Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson Education.
8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.

[List of Courses](#)

IAS203: ENGINEERING MATHEMATICS-II

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations, Laplace transform, sequence and series, Fourier series and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The basic knowledge of Laplace transform and its applications in solving differential equations.
- The tool for convergence of series and expansion of function using Fourier series for learning advanced Engineering Mathematics.
- The tools of differentiation of functions of complex variables that are used in various techniques dealing with engineering problems.
- The tools of integration of functions of complex variables that are used in various techniques dealing with engineering problems.

Content	Contact Hours
Unit -1: Ordinary Differential Equation of Higher Order	8
Linear differential equation of nth order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Method of variation of parameters, Cauchy-Euler equation, Application of differential equations in solving engineering problems.	
Unit-2: Laplace Transform	10
Laplace transform, Existence theorem, Properties of Laplace Transform, Laplace transform of derivatives and integrals, Unit step function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem. Application of Laplace Transform to solve ordinary differential equations and simultaneous differential equations.	
Unit-3: Sequence and Series	8
Definition of Sequence and series with examples, Convergence of series, Tests for convergence of series, Ratio test, D' Alembert's test, Raabe's test, Comparison test. Fourier series, Half range Fourier sine and cosine series.	
Unit-4: Complex Variable–Differentiation	8
Functions of complex variable, Limit, Continuity and differentiability, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Milne's Thompson Method, Conformal mapping, Mobius transformation and their properties.	
Unit-5: Complex Variable –Integration	8
Complex integration, Cauchy- Integral theorem, Cauchy integral formula, Taylor's and Laurent's series, singularities and its classification, zeros of analytic functions, Residues, Cauchy's Residue theorem and its application.	

Course Outcomes:

	Course Outcome (CO)	Bloom's Level
At the end of this course, the students will be able to:		
CO 1	Remember the concept differentiation to evaluate LDE of nth order with constant coefficient and LDE with variable coefficient of 2nd order.	K1 & K5
CO 2	Understand and apply the concept of Laplace Transform to evaluate differential equations	K2, K3 & K5
CO 3	Understand the concept of convergence to analyze the convergence of series and expansion of the function for Fourier series.	K2 & K4
CO 4	Apply the concept of analyticity, Harmonic function and create the image of function applying conformal transformation	K3, K6 & K3
CO 5	Apply the concept of Cauchy Integral theorem, Cauchy Integral formula, singularity and calculus of residue to evaluate integrals	K3 & K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Text Books:

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Publishing -House, 2002

Reference Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-McGraw-Hill
6. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veeraranjan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Differential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi.
13. Laplace Transforms by Schaum's series, 2005 Edition, Spiegel Publication.

[List of Courses](#)

IAS104 / IAS204: ENVIRONMENT AND ECOLOGY

Course Objectives:

1. Aims and objectives of environmental education emphasize the relationship between man and the environment and educate young people about the importance of nature and the environment.
2. Environmental education aims to **impart ecological knowledge** and promote environmentally conscious behavior towards nature.
3. It encourages young minds to take **responsibility for protecting** the natural environment protection through information and knowledge and to develop environmental awareness.
4. Incidentally, promoting awareness and a sense of respect for nature leads to a comprehensive understanding of the environment and a reasonable attitude towards protecting it.
5. The main focus of environmental education is Awareness, Knowledge, Attitude, Skills, Capacity Building and Participation.

Topics	Contact Hours
Unit-1	8
<p>Environment: Definition, Types of Environment, Components of environment, Segments of environment, Scope and importance, Need for Public Awareness.</p> <p>Ecosystem: Definition, Types of ecosystem, Structure of ecosystem, Food Chain, Food Web, Ecological pyramid. Balance Ecosystem.</p> <p>Effects of Human Activities such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment, Environmental Impact Assessment, Sustainable Development.</p>	
Unit-2	8
<p>Natural Resources: Introduction, Classification.</p> <p>Water Resources; Availability, sources and Quality Aspects, Water Borne and Water Induced Diseases, Fluoride and Arsenic Problems in Drinking Water.</p> <p>Mineral Resources; Material Cycles; Carbon, Nitrogen and Sulfur cycles.</p> <p>Energy Resources; Conventional and Non-conventional Sources of Energy.</p> <p>Forest Resources; Availability, Depletion of Forests, Environment impact offorest depletion on society.</p>	
Unit-3	8
<p>Pollution and their Effects; Public Health Aspects of Environmental; Water Pollution, Air Pollution, Soil Pollution, Noise Pollution, Solid wastemanagement.</p>	
Unit-4	8
<p>Current Environmental Issues of Importance; Global Warming, Green House Effects, Climate Change, Acid Rain, Ozone Layer Formation and Depletion, Population Growth and Automobile pollution, Burning of paddy straw.</p>	

Unit-5	8
Environmental Protection; Environmental Protection Act 1986, Initiatives by Non-Governmental Organizations (NGO's), Human Population and the Environment: Population growth, Environmental Education, Women Education.	

Course Outcomes (CO):

Upon completion of the course, the student will be able to:

	Course Outcomes	Bloom's Level
CO-1	Gain in-depth knowledge on natural processes that sustain life, and govern Economy.	K2
CO-2	Estimate and Predict the consequences of human actions on the web of life, global Economy and quality of human life.	K3
CO-3	Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and Sustainable development.	K4
CO-4	Acquire values and attitudes towards understanding complex environmental- economic Social challenges, and participate actively in solving current Environmental problems and preventing the future ones.	K3
CO-5	Adopt sustainability as a practice in life, society and industry.	K3

Reference Books:

1. Environment and Ecology by Dave, Katewa & Singh, 1st Edition, Cengage Learning India Pvt Ltd Delhi, ISBN: 9789355735553 (2023).
2. Environmental Studies by S Deswal, Dhanpat rai & Co. ISBN: 9788177000023 (2016).
3. Environmental Studies 2nd Edition by VK Ahluwalia, TERI Press, ISBN: 9788179935712 (2020).
4. Environmental Studies 3rd Edition by R Rajgopalan, Oxford University Press, ISBN: 978-0-19-945975-9 (2016).
5. Environment & Ecology by Singh & Malviya, Acme Learning, ISBN: 978-8190710497 (2009).

[List of Courses](#)

IAS105 / IAS205: SOFT SKILLS

Course Objectives:

1. Students will be enabled to **understand** the correct usage of grammar.
2. Students will be able to **converse** well with effective speaking and listening skills in English.
3. Students will be able to **create** substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading and writing
4. Student will be able to **equip** with basics of communication skills and will **apply** it for practical and oral purposes by being honed up in presentation skills and voice-dynamics.
5. Students will be able **build up** personal traits that will make the transition from institution to workplace smoother and help them to excel in their jobs.

Content	Contact Hours
Unit-1 Work Place Communication:	8
<p>Professional Vocabulary: Antonyms, Synonyms, Homophones, Homonyms. Business Correspondence: Letter Agenda, Notices, Minutes of Meeting, CV and Résumé, G.D., Interview.</p> <p>Assignments/Activity:</p> <ul style="list-style-type: none"> • Students will be asked to do Group discussion activity by using professional vocabulary. • Students will be given task to design Resume. • Students will be given a task to attend a meeting and write minutes of meeting. • 	
Unit-2: Public Speaking & Presentation Skills:	8
<p>Introduction to oral communication and Non- verbal Communication, Nuances and Modes of Speech Delivery, Pre requisites of Individual Speaking: confidence, clarity, and fluency &How to Pitch an idea: Process, Preparation, and Structure</p> <p>Assignments/Activity :</p> <ul style="list-style-type: none"> • Students have to give a presentation on the topics (group/ individual). 	
Unit-3: Critical Thinking and Emotional Intelligence:	8
<p>Critical Thinking: Analysis, Interpretation, Inference, Explanation, Self –Regulation, Open – Mindedness and Problem Solving. Emotional Intelligence: Self Awareness, Self-regulation, Empathy, Motivation, Social Skills,</p> <p>Assignments/Activity :</p> <ul style="list-style-type: none"> • Students have to write a critical assessment / review for the Case based studies. 	
Unit-4: Leadership Skills:	8
<p>Qualities: Integrity, Capability, Passion. Importance of Leadership communication: Aligned Employees with Strategic Goals, Trust, Transparency, Collaborative, Accessible, and Workplace Culture. Listening and Responding.</p> <p>Assignments/Activity :</p> <ul style="list-style-type: none"> • Students will be asked to conduct Podcast session/ interview of the personality whom they admire the most. 	

Unit-5: Mental Health and Stress Management:	8
<p>Mental health at Work Place: Definition and Factors, How to Manage Stress; Techniques: Application of 4 A's; Avoid; Alter; Access; Adapt, Value based Reading: A Select Reading.</p> <p>Assignments/Activity :</p> <ul style="list-style-type: none"> Students will be asked to present poster presentation on the given subjects. 	

Course Outcomes:

Unit 1- Students will be able to converse well with effective LSRW skills in English.

Unit 2- Students will be able to apply the fundamental inputs of communication skills in making speech delivery, individual conference, and group communication.

Unit 3- Students will be able to apply logical and ethical awareness on their performance as a professional and in obtaining professional excellence at the workplace.

Unit 4- Students will be able to utilize their teamwork and their interpersonal communication skills to survive and excel at their work-place.

Unit 5- Students will be able to build up personal traits that will make the transition from institution to workplace smoother and help them to excel in their jobs.

Prescribed Books:

1. The Ace of Soft Skills, Gopaldaswamy Ramesh, Mahadevan Ramesh Pearson, New Delhi 2018.
2. Soft Skills: Key To Success In Work Place And Life, MeenakshiRaman ,ShaliniUpadhyay, Cengage, 2016.
3. Personality Development, Harold R. Wallace et. al, Cengage Learning India Pvt. Ltd; New Delhi 2006
4. Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, New Delhi, 2012.
5. Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. Communication Skills for Engineers and Scientists:Sangeeta Sharma et. al., THI Learning Pvt Ltd, New Delhi, 2011.
7. Public Speaking, William S. Pfeiffer, Pearson, Delhi, 2012.

Web References:

8. <https://www.bizlibrary.com/soft-skills-assessment/?authuser=0>
9. <https://www.youtube.com/watch?v=onfqNMRsQZE&authuser=0>
10. <https://www.cambridgeenglish.org/test-your-english/>
11. <https://learnenglish.britishcouncil.org/english-levels/online-english-level-test>

[List of Courses](#)

IAS151 / IAS251: ENGINEERING PHYSICS LAB

List of Experiments

Any ten experiments (at least four from each group).

Group A

1. To determine the wavelength of sodium light by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To determine the specific rotation of cane sugar solution using polarimeter.
4. To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the focal length of combination of lenses.
5. To measure attenuation in an optical fiber.
6. To determine the wavelength of He-Ne laser light using single slit diffraction.
7. To study the polarization of light using He-Ne laser light.
8. To determine the wavelength of sodium light with the help of Fresnel's bi-prism.
9. To determine the coefficient of viscosity of a given liquid.
10. To determine the value of acceleration due to gravity (g) using compound pendulum.

Group B

1. To determine the energy band gap of a given semiconductor material.
2. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To verify Stefan's law by electric method.
5. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
6. To study the resonance condition of a series LCR circuit.
7. To determine the electrochemical equivalent (ECE) of copper.
8. To calibrate the given ammeter and voltmeter by potentiometer.
9. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
10. To measure high resistance by leakage method.

Course outcomes:

At the end of the course, students will be able to		
CO	CO Statement	Bloom's Level
CO-1	Apply the principle of interference and diffraction to find the wavelength of monochromatic and polychromatic light.	Apply
CO-2	Compute and analyze various electrical and electronic properties of a given material by using various experiments.	Analyze
CO-3	Verify different established laws with the help of optical and electrical experiments.	Apply
CO-4	Determine and calculate various physical properties of a given material by using various experiments.	Apply
CO-5	Study and estimate the performance and parameter of given equipment by using graphical and computational analysis.	Apply

Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar & Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta (Krishna Prakashan Meerut)

[List of Courses](#)

IAS152 / IAS252 : ENGINEERING CHEMISTRY LAB

Course Objectives:

1. To enable the students to understand about the fundamental concepts of analytical instruments
2. To enable the students to understand about the analysis of chloride content, hardness, alkalinity of water.
3. To enable the students to understand about the measure of pH, surface tension and viscosity of a liquid.
4. To enable the students to understand about the preparation of different resins.
5. To enable the students to understand about the synthesis of organic compounds such as adipic acid and paracetamol by conventional and green route.

LIST OF EXPERIMENTS

1. Calibration of Analytical Equipment and apparatus.
2. Determination of Hardness of water sample by EDTA method.
3. Determination of Alkalinity of water sample.
4. Determination of pH by titrimetric method.
5. Determination of surface tension of given liquid.
6. Determination of Viscosity of a given liquid by viscometer.
7. Determination of the strength of Ferrous ammonium sulfate using external indicator.
8. Determination of the strength of Potassium dichromate using internal indicator.
9. Determination of available chlorine in bleaching powder.
10. Determination of chloride content in water sample.
11. Preparation of Phenol formaldehyde (PF) resin.
12. Preparation of Urea formaldehyde (UF) resin.
13. Preparation of Adipic acid / Paracetamol.
14. Determination of Cell Conductance of a solution.
15. Determination of Rate constant of hydrolysis of esters.
16. Element detection and identification of functional groups in organic compounds.

NOTE: Instructor may choose any 10 experiments from above and may also change any two of the above..

Course Outcomes:

Upon completion of the course the student should be able to:

	Course Outcomes	Bloom's Level
CO-1	Get an understanding of the use of different analytical instruments.	K3
CO-2	Measure the molecular / system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in the water.	K3
CO-3	Measure the hardness and alkalinity of the water.	K3
CO-4	Know the fundamental concepts of the preparation of phenol formaldehyde & urea formaldehyde resin, adipic acid and Paracetamol.	K3
CO-5	Estimate the rate constant of reaction.	K3

IAS155 / IAS255 : ENGLISH LANGUAGE LAB

Course Objectives:

1. To facilitate software based learning to provide the required English Language proficiency to students.
2. To acquaint students with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
3. To train students to use the correct and error-free writing by being well versed in rules of English grammar.
4. To cultivate relevant technical style of communication and presentation at their work place and also for academic uses.
5. To enable students to apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics.

Professional Communication Lab shall have two parts:

1. Interactive Communication Skills:

Students should practice the language with variety of activities and exercises based on employability skills. Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication, based on International Phonetic Alphabets (I.P.A.)

LIST OF PRACTICALS

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic/Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ proposals based on proper Stress and Intonation Mechanics
5. Official/Public Speaking practice sessions based on suitable Rhythmic Patterns.
6. Theme Presentation/ Keynote Presentation based on correct methodologies of argumentation
7. Individual Speech Delivery/Conferencing with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practical's on a model Audio
10. Startup presentations, Video portfolio, Extempore, Role play, Just a Minute (JAM) etc.

2. Computer assisted software based Language Learning:

Software based self-guided learning to provide the required English language proficiency to students from an employability and career readiness standpoint. The software should align to Common European Framework of Reference for Languages (CEFR) and deliver a CEFR level – B2 upon completion.

Course Outcome:

1. Students will be enabled to understand the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
2. Students would be able to create substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.
3. Students will apply it at their work place for writing purposes such as Presentation/official drafting/administrative communication and use it for document/project/report/research paper writing.
4. Students will be made to evaluate the correct and error-free writing by being well-versed in rules of English grammar and cultivate relevant technical style of communication & presentation at their work place and also for academic uses.
5. Students will apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing interpersonal communication skills and positive attitude leading to their professional competence.

Suggested Softwares:

- *Oxford Achiever* by Oxford University Press.
- *Cambridge English Empower* by Cambridge University Press.
- *MePro*. by Pearson India Education Services Pvt. Ltd.
- *New Interactions* by McGraw-Hill India.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi
3. Practical Communication Process & Practice, LU.B. Pandey: A.I.T.B.S. Pub. India Ltd KrishnaNagar, Delhi, 2013.
4. English Grammar and Usage by R.P. Sinha, Oxford University Press, 2005, New Delhi.
5. English Grammar, Composition and Usage by N.K.Agrawal & F.T.Wood, Macmillan India Ltd., New Delhi.
6. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
7. English Grammar & Composition by Wren & Martin, S.Chand & Co. Ltd., New Delhi.
8. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd, 2011, New Delhi.
9. Personality Development, Harold R. Wallace & L. Ann Masters, Cengage Learning, New Delhi
10. Personality Development & Soft Skills, Barun K.Mitra, Oxford University Press, 2012 New Delhi.
11. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, TataMcGraw Hill & Co. Ltd., 2001, New Delhi.
12. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
13. Spoken English- A manual of Speech and Phonetics by R.K.Bansal & J.B.Harrison, Orient Blackswan, 2013, New Delhi.
14. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi

[List of Courses](#)

IEE101 / IEE201: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Course Content	Contact Hours
<p>Unit -1: DC Circuit Analysis Types of Elements and Networks, Kirchhoff's law, Ideal and practical voltage and current sources, Mesh and Nodal analysis, Source transformation, Star delta transformation. Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (Independent and ideal sources based numerical, Source transformation not expected for superposition theorem, Mesh and Nodal analysis.)</p>	8
<p>Unit-2: Analysis of Single-Phase AC Circuits Representation of Sinusoidal waveforms – Average and effective values, Form-factor, and peak factors. Analysis of single-phase AC Circuits consisting of R-L-C combination (Series and Parallel) Apparent, active, reactive power, Power factor. Concept of Resonance in series & parallel circuits, bandwidth and quality factor.</p>	8
<p>Unit-3: Three-Phase AC Circuits: Three-phase balanced circuits, voltage and current relations in star and delta connections and related numerical.</p> <p>Magnetic Circuits: Concept of MMF, flux, flux density, reluctance, permeability, field strength, and their units.</p> <p>Transformers: Principle of working, EMF equation, Ideal and practical transformers, equivalent circuits, losses and efficiency in transformers. (Numerical problems related to transformer)</p>	8
<p>Unit-4: Electrical machines DC Machines: Principles and Construction, EMF equation of Generator, Classification of DC Generator: Self-excited, Separately excited, shunt and series generator. Principle of DC motor, Torque equation of motor, Series and Shunt motors (simple numerical problems). Three-Phase Induction Motor: Principle & Construction and Applications. Working principle of Three-Phase Alternator.</p>	10
<p>Unit-5: Measuring Instruments: Definition and Types of electrical measuring instruments, Construction and working principle of PMMC type, MI type and Dynamometer type instruments.</p> <p>Electrical Installations: Introduction of Switch Fuse Unit (SFU), MCB, ELCB, MCCB, ACB. Types of Wires, Cables. Earthing and its types, Safety Precautions to avoid shock.</p>	8

Text Books:

1. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House.
2. P.V. Prasad, S. Sivanagaraju, "Electrical Engineering: Concepts and Applications" Cengage.
3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
3. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India.

Course Outcomes		<i>KL/ BL</i>
Upon the completion of this course, the student will be able to:		
CO1	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.	3
CO2	Analyse the characteristics of single-phase AC electrical circuits and resonance in AC circuits.	4
CO3	Describe the load connection on three-phase AC circuits. Also, identify the application areas of a single-phase transformer and calculate their efficiency.	2
CO4	Understand the working principles of induction motors, synchronous machines, and DC machines and employ them in different areas of applications.	2
CO5	Describe the switches of low-voltage electrical installations and safety precautions. Also, able to understand different electrical measuring instruments.	2

[List of Courses](#)

IEE151 / IEE251: FUNDAMENTALS OF ELECTRICAL ENGINEERING LAB

Course Outcomes		KL/ BL
Upon the completion of this course, the student will be able to:		
CO1	Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.	3
CO2	Demonstrate the characteristics of AC circuits connected to the single-phase AC supply and measure power in single-phase electrical circuits.	4
CO3	Measure the voltage ratio of a single-phase transformer.	3
CO4	Identify the type of DC and AC machines based on their construction.	2
LIST OF EXPERIMENTS		
<p>Note: A minimum of ten experiments from the following should be performed.</p> <p>(A) Hardware-based experiments</p> <ol style="list-style-type: none"> 1. Verification of KCL and KVL. 2. Verification of Thevenin's theorem and Norton's theorem. 3. Verification of Superposition theorem. 4. Measurement of power and power factor in a single phase ac series inductive circuit. 5. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency. 6. Connection and measurement of power consumption of a fluorescent lamp (tube light). 7. Measurement of power in 3-phase circuit by two-wattmeter method and determination of its power factor for star and/or delta connected load. 8. Determination of parameters of ac single phase series RLC circuit. 9. Determination of the Voltage ratio and polarity test of a single-Phase Transformer. 10. Demonstration of cut-out sections of machines: dc machine, single-phase induction machine. <p>(B) Experiments available on virtual lab</p> <ol style="list-style-type: none"> 1. Kirchhoff's laws. Virtual lab link: http://vlab.amrita.edu/?sub=3&brch=75&sim=217&cnt=2 2. Thevenin Theorem. Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=313&cnt=1 3. RLC series resonance. Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=330&cnt=1 4. Determination of parameters of ac single phase series RLC circuit. Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=332&cnt=1 		

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IME101 / IME201: FUNDAMENTAL OF MECHANICAL ENGINEERING

Unit	Course Content	Contact Hours
I	<p>INTRODUCTION TO MECHANICS OF SOLID</p> <p>Force moment and couple, principle of transmissibility, Varignon's theorem. Resultant of force system- concurrent and non-concurrent coplanar forces, Types of supports (Hinge, Roller) and loads (Point, UDL, UVL), free body diagram, equilibrium equations and Support Reactions.</p> <p>Normal and shear Stress, strain, Hooke's law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety.</p>	8
II	<p>BASICS OF THERMODYNAMICS</p> <p>Introduction, microscopic and macroscopic approaches, Concept of continuum, control volume and surfaces, thermodynamic properties, path, process and cycle, thermodynamic equilibrium, Quasistatic process, Energy and its forms, work and heat, gas laws, Ideal gas, Zeroth law of thermodynamics</p> <p>First law of thermodynamics: Joules' experiment, Internal energy and enthalpy, PMM-I.</p> <p>Second law of thermodynamics: Heat engines, Efficiency, Heat pump, refrigerator, Kelvin Planck statement, Clausius statement, PMM-II.</p>	10
III	<p>INTRODUCTION TO FLUID MECHANICS</p> <p>Fluid's properties: pressure, density, dynamic and kinematic viscosity. Surface tension, vapor pressure, cavitation, Newtonian and Non-Newtonian fluid, Pascal's Law, continuity equation.</p> <p>Flow Measurement devices</p> <p>Simple Manometer, U-Tube manometer, Bourdon tube, Venturi meter, Pitot tube and Orifice meter</p>	8
IV	<p>I.C ENGINE & ELECTRIC VEHICLES</p> <p>IC Engine: basic definition of engine and components, construction and working of two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; difference between two-stroke and four stroke IC engines and SI and CI Engines.</p> <p>Electric vehicles and hybrid vehicles: components of an EV, EV batteries, chargers, drives, transmission and power devices. Advantages and disadvantages of EVs. Hybrid electric vehicles, HEV drive train components, advantages of HV.</p>	8
V	<p>INTRODUCTION TO MECHATRONICS</p> <p>Introduction to Mechatronic Systems: Evolution, Scope, advantages and disadvantages, industrial applications, introduction to autotronics, bionics, and avionics and their applications. Sensors and transducers: types of sensors, types of transducers and their characteristics. Overview of mechanical, hydraulic and pneumatic actuation systems</p> <p>Concept of Measurement, Error in measurements, Calibration, strain (Bonded and Unbonded Strain Gauge), temperature sensor (Thermocouple and Optical Pyrometer), force (Proving Ring) and torques (Prony Brake Dynamometer); Concepts of accuracy, precision and resolution</p>	8

Course Outcomes:

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

COs	Statement
CO1	Analysis of forces under different structural loading conditions and comprehend the fundamentals of stress and strain
CO2	Recognize the laws of thermodynamics and their application to thermal systems
CO3	Understand the basics of fluid mechanics to apply in flow measurement devices
CO4	Comparative analysis of the design and working of I.C. engines versus electric vehicles
CO5	Utilize mechatronics devices for real life application

Reference Books:

1. Basic Mechanical Engineering, G Shanmugam, S Ravindran, McGraw Hill
2. Basic Mechanical Engineering, M P Poonia and S C Sharma, Khanna Publishers
3. Mechatronics: Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
4. Mechatronics, As per AICTE: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S.Balasundaram, Wiley India
5. Mechanical Measurements & Control, Dr. D. S. Kumar. Metropolitan Book Company
6. Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India

[List of Courses](#)

IWS-151 / IWS-251 WORKSHOP PRACTICE LAB

S. No.	Contents
1	Introduction to Mechanical workshop material, tools and machines
	To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc.) used in workshop.
	To study and use of different types of tools, equipment, devices & machines used in fitting, sheet metal and welding section.
	To determine the least count of vernier caliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.
2	Machine shop
	Demonstration of working, construction and accessories for Lathe machine
	Perform operations on Lathe - Facing, Plane Turning, step turning, taper turning, threading, knurling and parting.
3	Fitting shop
	1. Practice marking operations. 2. Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling, Grinding.
4	Carpentry Shop
	Study of Carpentry Tools, Equipment and different joints.
	Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint
5	Welding Shop
	Introduction to BI standards and reading of welding drawings. Practice of Making following operations Butt Joint Lap Joint TIG Welding MIG Welding
6	Moulding and Casting Shop
	Introduction to Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes Demo of mould preparation and Aluminum casting Practice – Study and Preparation of Plastic mould
7	CNC Shop
	Study of main features and working parts of CNC machine and accessories that can be used. Perform different operations on metal components using any CNC machines
8	To prepare a product using 3D printing

Course Outcomes:

At the end of this course, the students will be able to

COs	Statement
CO1	Use various engineering materials, tools, machines and measuring equipment.
CO2	Perform machine operations in lathe and CNC machine.
CO3	Perform manufacturing operations on components in fitting and carpentryshop.
CO4	Perform operations in welding, moulding, casting and gas cutting.
CO5	Fabricate a job by 3D printing manufacturing technique

Reference Books:

1. Workshop Practice, H S Bawa, McGraw Hill
2. Mechanical Workshop Practice, K C John, PHI
3. Workshop Practice Vol 1, and Vol 2, by Hazra Choudhary, Media promoters and Publications
4. CNC Fundamentals and Programming, By P. M. Agrawal, V. J. Patel, Charotar Publication.

[List of Courses](#)

IEC101/ IEC201: FUNDAMENTALS OF ELECTRONICS ENGINEERING

Course Objective: Students undergoing this course are expected to:

1. Understand the V-I Characteristic of PN diode & Zener Diode and it's operation in forward and reverse resistance. Know the characteristics of Half wave and Full wave rectifier with and without filters.
2. Know the characteristics of BJT and JFET & MOSFET.
3. Understand characteristic of operational amplifier in Inverting and Non-inverting mode.
4. Understand the implementation of Boolean function using logic gates. Learn about verification of truth tables of various logic gates.
5. Learn about Fundamentals of Communication Engineering & Fundamental and Overview of wireless communication and cellular communication.

Topics	Contact Hours
Unit-1	8
<p>Semiconductor Diode: Ideal and practical Diodes V-I characteristics,,Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche) Diode Application: Diode Applications, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits Special Purpose two terminal Devices: Light-Emitting Diodes, Photo Diodes, Varactor Diodes, Tunnel Diodes.</p>	
Unit-2	8
<p>Bipolar Junction Transistor: Transistor Construction and Characteristic, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration. Field Effect Transistor: Construction and Characteristic of JFETs. Transfer Characteristic. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer Characteristic.</p>	
Unit-3	8
<p>Operational Amplifiers: Introduction, Op-Amp basic, Practical Op-Amp Circuits Inverting Amplifier, Non-inverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator</p>	
Unit-4	8
<p>Digital Electronics: Number system & representation, Code Conversion, Binary arithmetic, Introduction of Basic and Universal Gates, using Boolean algebra simplification of Boolean function. K Map Minimization.</p>	

Unit-5	8
<p>Fundamentals of Communication Engineering: Basics of signal representation and analysis, Electromagnetic spectrum. Elements of a Communication System. Need of modulation and typical applications. Fundamentals of amplitude modulation and demodulation techniques.</p> <p>Introduction to Wireless Communication: Fundamental and Overview of wireless communication and cellular communication. Different generations and standards in cellular communication systems</p>	

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Describe the concept of PN Junction and devices.
2. Explain the concept of BJT, FET and MOSFET.
3. Apply the concept of Operational amplifier to design linear and non-linear applications.
4. Perform number systems conversions, binary arithmetic and minimize logic functions.
5. Describe the fundamentals of communication Engineering.

Text Books:

1. Robert L. Boylestand / Louis Nashelsky “Electronic Devices and Circuit Theory”, Pearson Education.
2. George Kennedy, “Electronic Communication Systems”, McGraw Publication
3. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press.
4. Jacob Millman, C.C. Halkias, StayabrataJit, “Electronic Devices and Circuits”, McGraw Hill.
5. A. Anand Kumar, “Fundamental of Digital Circuits,” PHI 4th edition, 2018.

[List of Courses](#)

IEC151 / IEC251: BASIC ELECTRONICS ENGINEERING LAB

Course Objective: Students undergoing this course are expected to:

6. Understand the working principle of CRO, Function Generator and Digital Multimeter.
7. Learn about the testing of components and understand the PN diode operation in forward and reverse bias.
8. Know the characteristics of Half wave and Full wave rectifier with and without filters.
9. Understand V-I Characteristic of Zener Diode and it's forward and reverse resistance.
10. Know the characteristics of transistors in Common Emitter configuration.
11. Understand characteristic of operational amplifier in Inverting and Non-inverting mode.
12. Learn about verification of truth tables of various logic gates.
13. Understand the implementation of Boolean function using logic gate

Part A:

Suggestive List of Experiments

1. Study of various types of Active & Passive Components based on their ratings.
2. Identification of various types of Printed Circuit Boards (PCB) and soldering Techniques.
3. PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB
4. Soldering shop:
 - (i) Soldering and disordering of Resistor in PCB.
 - (ii) Soldering and disordering of IC in PCB.
 - (iii) Soldering and disordering of Capacitor in PCB

Part B:

1. Study of Lab Equipment: CRO, Multimeter, and Function Generator, Power supply-
2. Study of Components Active, Passive Components and Bread Board.
3. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
4. Applications of PN Junction diode: Half & Full wave rectifier - Measurement of V_{rms} , V_{dc} , and ripple factor.
5. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.
6. Characteristic of BJT: BJT in CE configuration.
7. Characteristic of FET: FET in CS configuration.
8. To study Operational Amplifier as Adder and Subtractor
9. Verification of Truth Table of Various Logic Gate.
10. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

Part (C):

Part A	PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB	This practical is not possible by virtual lab. It will be conducted only in physical mode
Part B	Study of Lab Equipment's and Components: CRO, Multi meter, Function Generator, Power supply- Active, Passive Components Bread Board.	NA, These test equipment can be Demonstrated online from any lab of ECE department or physical mode is only option.

(D) Experiments available on virtual lab

Experiment Description	Link
PN Junction on diode: Characteristics of PN Junction diode-Static and dynamic resistance measurement from graph.	http://vlabs.iitkgp.ernet.in/be/exp5/index.html
Applications of PN Junction diode: Half & Full wave rectifier- Measurement of V_{rms} , V_{dc} , and ripple factor.	http://vlabs.iitkgp.ernet.in/be/exp6/index.html http://vlabs.iitkgp.ernet.in/be/exp7/index.html
Characteristics of Zener diode: V-I characteristics of Zener diode, Graphical measurement of forward and reverse resistance.	http://vlabs.iitkgp.ernet.in/be/exp10/index.html
Characteristic of BJT: BJT in CE configuration.	http://vlabs.iitkgp.ernet.in/be/exp11/index.html
To study Operational Amplifier as Adder and Subtractor	http://vlabs.iitkgp.ernet.in/be/exp17/index.html http://vlabs.iitkgp.ernet.in/be/exp18/index.html
Verification of Truth Table of Various Logic Gate	https://de-iitr.vlabs.ac.in/digital-electronics-iitr/exp/truth-table-gates/
Implementation of the given Boolean function using logic gates in both SOP and POS forms.	https://de-iitr.vlabs.ac.in/digital-electronics-iitr/exp/realization-of-logic-functions/

Course outcomes

S. No.	Course outcomes according to Bloom's cognitive Level
1	CO1 L1: Knowledge- recalls the basic concept of basic components - digital Multimeter, CRO and other device components.
2	CO2 L2: Understand- Understand the working principle of PN Diode.
3	CO3 L3: Applying- develop the concept of Half wave and full wave rectifiers and its application like clipper, clampers etc.
4	CO4 L4: Analysing - study the V-I Characteristic of Zener Diode.
5	CO5 L5: Observed- analyze the characteristic of BJT in CE configuration.
6	CO6 L6: Study- of Operational Amplifier.
7	CO7 L7: Verification- of different digital logic gates
8	CO8 L8: Implementation of Boolean function

[List of Courses](#)

ICS 101 / ICS 201: PROGRAMMING FOR PROBLEM SOLVING

CONTENT	CONTACT HOURS
Unit -1:	08
<p>Introduction to Components of a Computer System: Memory, Processor, I/O Devices, Storage, Operating System, Concept of Assembler, Compiler, Interpreter, Loader and Linker.</p> <p>Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo Code with Examples, From Algorithms to Programs, Source Code.</p> <p>Programming Basics: Structure of C Program, Writing and Executing the First C Program, Syntax and Logical Errors in Compilation, Object and Executable Code. Components of C Language. Standard I/O in C, Fundamental Data types, Variables and Memory Locations, Storage Classes.</p>	
Unit-2:	08
<p>Arithmetic Expressions and Precedence : Operators and Expression Using Numeric and Relational Operators, Mixed Operands, Type Conversion, Logical Operators, Bit Operations, Assignment Operator, Operator precedence and Associativity.</p> <p>Conditional Branching: Applying if and Switch Statements, Nesting if and Else and Switch.</p>	
Unit-3:	08
<p>Iteration and Loops: Use of While, do While and for Loops, Multiple Loop Variables, Use of Break and Continue Statements.</p> <p>Arrays: Array Notation and Representation, Manipulating Array Elements, using Multi Dimensional Array. Character Arrays and Strings, Structure, union, Enumerated Data types, Array of Structures, Passing Arrays to Functions.</p>	
Unit-4:	08
<p>Functions: Introduction, Types of Functions, Functions with Array, Passing Parameters to Functions, Call by Value, Call by Reference, Recursive Functions.</p> <p>Basic of searching and Sorting Algorithms: Searching & Sorting Algorithms (Linear Search , Binary search , Bubble Sort, Insertion and Selection Sort)</p>	
Unit-5:	08
<p>Pointers: Introduction, Declaration, Applications, Introduction to Dynamic Memory Allocation (Malloc, Calloc, Realloc, Free), String and String functions , Use of Pointers in Self-Referential Structures, Notion of Linked List (No Implementation)</p> <p>File Handling: File I/O Functions, Standard C Preprocessors, Defining and Calling Macros and Command-Line Arguments.</p>	

Course Outcome:

Course Outcome (CO)		Bloom's Level
At the end of course , the Student will be Able to Understand		
CO 1	To develop simple Algorithms for Arithmetic and Logical Problems.	K2, K3
CO 2	To translate the Algorithms to programs & execution (in C Language).	K3
CO 3	To implement Conditional Branching, Iteration and Recursion.	K3
CO 4	To decompose a Problem into Functions and Synthesize a Complete Program Using Divide and Conquer Approach.	K4
CO 5	To use Arrays, Pointers and Structures to develop Algorithms and Programs.	K2, K3

K1– Remember, K2– Understand, K3– Apply, K4– Analyze, K5– Evaluate, K6– Create

Text Books:

1. Schaum's Outline of Programming with C by Byron Gottfried , McGraw–Hill
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .
3. Computer Basics and C Programming by V. Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
5. Computer Science– A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning – 2007.
6. Let Us C By Yashwant P. Kanetkar.
7. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison–Wesley, 2006.
8. Programming in C by Kochan Stephen G. Pearson Education – 2015.
9. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
12. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication

[List of Courses](#)

ICS 151 / ICS 251: PROGRAMMING FOR PROBLEM SOLVING LAB

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula $C/5=(F-32)/9$.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
Between 90-100% ----- Print 'A'
80-90%----- Print 'B'
60-80%----- Print 'C'
Below 60%----- Print 'D'
11. WAP that takes two operands and one operator from the user, perform the operation, and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in an array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.

- 26.** WAP to add and multiply two matrices of order $n \times n$.
- 27.** WAP that finds the sum of diagonal elements of a $m \times n$ matrix.
- 28.** WAP to implement `strlen()`, `strcat()`, `strcpy ()` using the concept of Functions.
- 29.** Define a structure data type `TRAIN_INFO`. The type contain Train No.: integer type Train name: string Departure Time: aggregate type `TIME` Arrival Time: aggregate type `TIME` Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:
- a. List all the trains (sorted according to train number) that depart from a particular section.
 - b. List all the trains that depart from a particular station at a particular time.
 - c. List all the trains that depart from a particular station within the next one hour of a given time.
 - d. List all the trains between a pair of start station and end station.
- 30.** WAP to swap two elements using the concept of pointers.
- 31.** WAP to compare the contents of two files and determine whether they are same or not.
- 32.** WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

[List of Courses](#)

ICE 151 / ICE 251: ENGINEERING GRAPHICS & DESIGN LAB

Content	Contact Hours
Unit-1: Introduction to Engineering Drawing and Orthographic Projections	8
Principles of Engineering Graphics and their significance. Dimensioning, Lettering. Scales: Plain, Diagonal and Engineering Scales. Orthographic Projection, Projection of Point, Projection of Lines: Projection of straight lines; Projection of lines inclined to one plane and both planes.	
Unit-2: Projection of Planes and Solids	8
Projection of polygonal surface and circular lamina located in first quadrant inclined to one or both reference planes. Classification of solids, Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.	
Unit-3: Sections of Regular Solids and development of Surfaces	8
Sections of Solids: Right regular solids and Auxiliary views for the true shape of the sections such as Prism, Cylinder, Pyramid, and Cone. Development of surfaces for various regular solids such as Prism, Cylinder, Pyramid and Cone.	
Unit-4: Isometric Projection	8
Isometric Projection: Isometric scales, Isometric projections of simple and combination of solids. Perspective Projection: Orthographic representation of perspective views – Plane figures and simple solids – Visual Ray Method. Conversion of pictorial view into orthographic Projection.	
Unit-5: Introduction to Computer Aided Design	8
Introduction to AutoCAD: Basic commands for 2D drawing: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc. Transformation of Projections: Conversion of Isometric Views to Orthographic Views and Vice-Versa in AutoCAD. Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form.	

Course Outcome:

After completion, of course students will be able to:

CO 1: Use scales and draw projections of objects.

CO 2: Explain views of solids and their sectional surfaces.

CO 3: Analyze and draw isometric projections of objects.

CO 4: Demonstrate orthographic representation of perspective views using modern tools.

CO 5: Apply AutoCAD software for creation of engineering drawing and models

Suggested Text/ Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
4. Engineering Graphics & Design, A.P. Gautam & Pradeep Jain, Khanna Publishing House
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. (Corresponding set of) CAD Software Theory and User Manuals

List of Courses

IVA251: SPORTS AND YOGA

Objective of the Course:

- To maintain mental and physical wellness upright and develop ability in the students to cope up with the stress arising in the life.
- To create space in the curriculum to nurture the potential of the students in sports/games/yoga etc.
- To introduce a practice oriented introductory course on the subject. More involved / advanced course may come up in subsequent years of study

Syllabus/ Guidelines

Part A: Sports/Games

Some form of Athletics would be compulsory for all students, unless restricted due to medical / physical reasons. In addition to this, student has to opt for at least one game out of the remaining mentioned below.

A fair theoretical knowledge and a reasonable amount of field / site practice of the chosen games will be essential.

- | | |
|-----------------|-------------------|
| 1. Athletics | Compulsory |
| 2. Volleyball | |
| 3. Basketball | |
| 4. Handball | |
| 5. Football | |
| 6. Badminton | |
| 7. Kabaddi | |
| 8. Kho-kho | |
| 9. Table tennis | |
| 10. Cricket | |

Part B: Yoga

a. Introduction of Yoga

Introduction of Yoga, Origin of Yoga, Aims and Objective of Yoga, Patanjali Yoga darshan, Hathyoga, Gheranda Samhita, Karmyoga, Gyanyoga.

b. Asanas, Pranayam and Meditation Practices

Meaning of Asanas, Objective of Asanas, rules and regulations of Asanas and Pranayams, Types of Yogasana

Yogic postures: Standing Posture, Sitting posture, Supine posture, Prone posture, balancing Postures, Pranayam according to Patanjali and Hath Yoga, Mediation Mudras

c. Science of Yoga

Physiological effects of Asanas- Paranayama and meditation, stress management and yoga, Mental health and yoga practice, Health and Personality Development.

General Guidelines.

1. Institutes must assign minimum of three periods in the Time Table for the activities of Sports/Yoga.
2. Institutes must provide field/facility and offer a minimum of five choices of the Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.
4. Student must be made familiar with the terminologies, rules/regulations, dimension/ marking of the play field/area and general knowledge of national/ international level facts/figures related to the chosen game.

Assessment:

The Institute must assign coordinator/ subject teacher for the subject, for every batch/group of the students, who would be responsible for coordinating the required activities and keep watch on the level of student's participation in the chosen game.

Coordinator/mentor would be responsible for the award of the sessional marks based upon following components.

1. Level of understanding and general awareness (20 %)
2. Involvements in the Practice Sessions (50 %)
3. Regularity, Sincerity and Discipline (20 %)
4. Participation in University level / District level / State level / National Level events (10 %)

List of Courses