UG COURSE STRUCTURE AND SYLLABUS

ALIGNED WITH NEP 2020

B.TECH. FIRST YEAR (SEMESTER 1 & SEMESTER 2)

(ALL BRANCHES OF ENGINEERING)

FOR ALL AFFILIATED INSTITUTIONS

(FROM ACADEMIC SESSION 2024-25)

APPROVED BY

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

JALUKBARI, GUWAHATI – 781013

ASSAM

(VIDE ACADEMIC COUNCIL RESOLUTION NO. AC-30/06/2024 (III), HELD ON 04/05/2024)

B.Tech 1st Year (Group A)

For the branches:

- **Civil Engineering (CE)**
- **Mechanical Engineering (ME)**
- **Chemical Engineering (ChE)**
- **Industrial and Production Engineering (IPE)**

B.Tech 1st Year (Group B)

For the branches:

- **Electrical Engineering (EE)**
- **Electronics and Communication Engineering (ECE)**
- **Electronics and Telecommunication Engineering (ETE)**
- **Instrumentation Engineering (IE)**
- **Power Electronics and Instrumentation (PEI)**
- **Electrical and Electronics Engineering (EEE)**
- **Computer Science and Engineering (CSE)**

NOTE: Three weeks Mandatory Induction Program need to be done before the commencement of the B.Tech 1st semester classes as per the AICTE mandate

Mandatory Induction Program

3 weeks duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

UG COURSE STRUCTURE IN ENGINEERING ALIGNED WITH NEP 2020

FOR FIRST YEAR

GROUP A

Semester 1

Sl No.	Category	Course Code	Course Title	L	T	P	Credit	CE	ESE
1	BSC	BS101	Physics	3	1	0	4	30	70
2	BSC	BS102	Mathematics - I	3	1	0	4	30	70
3	ESC	ES101	Basic Electrical Engineering	3	0	0	3	30	70
4	ESC	ES102	Engineering Graphics	1	0	4	3	30	70
5	HSMC	HS101	Technical Report Writing	1	0	2	2	30	70
6	BSC	BS103	Physics Lab	0	0	2	1	15	35
7	ESC	ES103	Basic Electrical Engineering Lab	0	0	2	1	15	35
8	ESC	ES104	Design Thinking	2	0	0	2	30	70
9	AU	AU101	IDEA Lab Workshop	0	0	4	0	-	P/NP*
10	ESC	ES105	Digital fabrication/ Workshop/ Manufacturing Practices	0	0	2	1	15	35
TOTAL							**21**		

Semester 2

Sl No.	Category	Course Code	Course Title	L	T	P	Credit	CE	ESE
1	BSC	BS201	Chemistry	3	1	0	4	30	70
2	BSC	BS202	Mathematics-II	3	1	0	4	30	70
3	BSC	BS203	Biology for Engineers	3	0	0	3	30	70
4	ESC	ES201	Programming for problem solving	2	0	2	3	30	70
5	ESC	ES202	Engineering Mechanics	2	0	2	3	30	70
6	HSMC	HS201	Universal Human Values	3	0	0	3	30	70
7	BSC	BS204	Chemistry Lab	0	0	2	1	15	35
8	AU	AU201	Sports and Yoga	0	0	2	0	-	P/NP*
TOTAL							**21**		

* Examination for Audit subjects should be conducted for 70 marks, with pass marks of 28 marks

GROUP B

Semester 1

Sl No.	Category	Course Code	Course Title	L	T	P	Credit	CE	ESE
1	BSC	BS201	Chemistry	3	1	0	4	30	70
2	BSC	BS102	Mathematics-I	3	1	0	4	30	70
3	BSC	BS203	Biology for Engineers	3	0	0	3	30	70
4	ESC	ES201	Programming for problem solving	2	0	2	3	30	70
5	ESC	ES202	Engineering Mechanics	2	0	2	3	30	70
6	HSMC	HS201	Universal Human Values	3	0	0	3	30	70
7	BSC	BS204	Chemistry Lab	0	0	2	1	15	35
8	AU	AU201	Sports and Yoga	0	0	2	0	-	P/NP*
TOTAL							**21**		

Semester 2

Sl No.	Category	Course Code	Course Title	L	T	P	Credit	CE	ESE
1	BSC	BS101	Physics	3	1	0	4	30	70
2	BSC	BS202	Mathematics -II	3	1	0	4	30	70
3	ESC	ES101	Basic Electrical Engineering	3	0	0	3	30	70
4	ESC	ES102	Engineering Graphics	1	0	4	3	30	70
5	HSMC	HS101	Technical Report Writing	1	0	2	2	30	70
6	BSC	BS103	Physics Lab	0	0	2	1	15	35
7	ESC	ES103	Basic Electrical Engineering Lab	0	0	2	1	15	35
8	ESC	ES104	Design Thinking	2	0	0	2	30	70
9	AU	AU101	IDEA Lab Workshop	0	0	4	0	-	P/NP*
10	ESC	ES105	Digital fabrication/ Workshop/ Manufacturing	0	0	2	1	15	35
TOTAL							**21**		

* Examination for Audit subjects should be conducted for 70 marks, with pass marks of 28 marks

BS101	Physics	3L:1T:0P	4 Credits

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

CO1	Acquire the basic concepts of Quantum Mechanics to solve related numerical problems.
CO2	Understand variety of materials including superconductors.
CO3	Relate the concept of Lasers, Fiber Optics and Acoustics to solve various relevant engineering problem.
CO4	Analyze the behavior of electric field in dielectrics and build basic concepts to solve numerical problems on Electromagnetism.
CO5	Apply the knowledge of Mechanics and low temperature Physics to solve variety of problems.

Module I: Quantum Mechanics **(5 Hours)**

Wave nature of particles, Uncertainty principle, Wave function and wave packets, Time dependent & time independent Schrodinger equation, Solution of Schrödinger's equation for one dimensional problem: Particle in a box.

Module II: Solid, Semiconductors and Superconductivity **(6 Hours)**

Kronig Penny Model (Qualitative), Origin of energy bands: Metals, Semiconductors and Insulators, Solar Cell, LED, Hall effect. (3 lectures)

Properties of Superconductors; Meissner effect, Critical Magnetic Field, Isotope effect, Persistent current, Magnetic levitation, Type-1 & Type-2 superconductors and their comparison, BCS theory of superconductivity (qualitative only). (3 lectures)

Module III: Lasers, Fiber Optics and Acoustics **(9 Hours)**

Induced absorption, spontaneous and stimulated emission, Einstein's coefficients, population inversion, pumping, meta-stable state, principle of LASER, characteristics of a laser beam, Gas (He-Ne) laser, Applications of lasers. (3 lectures)

Optical fibre -Principle and Structure, Propagation of light in optical fibres, Numerical aperture and angle of acceptance, Classification of optical fibres, Single mode and Multimode optical fibers, Step Index and Graded Index optical fibres, Optical fibre communication system (Block diagram only). (3 lectures)

Weber-Fetchner law, Reverberation & Reverberation time, Sabine's formula for reverberation time (Derivation not required), Absorption co-efficient, Factors affecting acoustics of buildings and their remedies, Acoustic design of a hall. (3 lectures)

Module IV: Electromagnetism and Dielectric Materials **(9 Hours)**

Non polar and Polar molecules, Dielectrics, Dielectric polarization and its types, Polarizability of a dielectric, Relation between $\vec{D}$, $\vec{P}$ and $\vec{E}$, Gauss law in dielectrics, Clausius-Mossotti relation, Frequency dependence of dielectric constant. (4 lectures)
Introduction to Gradient, Divergence and Curl, Laplace's and Poisson's equation for electrostatic potential. (2 lectures)

Continuity equation for current densities, Displacement current, Maxwell's equations withsignificance, Maxwell's equation in vacuum and non-conducting medium. (3 lectures)

Module V: Mechanics and Low Temperature Physics (11 Hours)

Elasticity, Relations among elastic constants, twisting couple on a wire, bending of beams with symmetric cross-section, Cantilever. (3 lectures)

Non-inertial frames of reference; Rotating co-ordinate system, Five-term acceleration formula, Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum. (4 lectures)

Joule-Thomson effect, Liquefaction of air: Linde process, Liquefaction of helium, Adiabatic demagnetization, He-3 Cryostat. (4 lectures)

Note: *The syllabus of Physics is designed as per the AICTE directives to teach different topics of Physics to different branches of Engineering to cater to their specific needs. However, in order to give the students a complete essence of Physics, the following topics may be taught in brief (maximum 6hours) in tutorial classes, or may be encouraged to learn these topics by using online resources e.g. NPTEL lectures etc. and assignments may be given to ensure their learning. These topics, however, are not to be included in end semester examinations:*

- *Central forces, conservative and non-conservative forces*
- *Fluid Mechanics*
- *Aberration in lenses*
- *Nanomaterials*
- *Smart Materials*
- *Atmospheric Physics*

Suggested Text/ Reference Books:

1. Applied Physics for Engineers, Neeraj Mehta, PHI Learning Private Limited.
2. Engineering Physics, V. Rajendran, Tata McGraw Hill.
3. A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar, T.V.S. Arun Murthy, S.Chand & Company Ltd.
4. Concepts of Modern Physics, Arthur Beiser, McGraw Hill Education.
5. Introduction to Electrodynamics, D. J. Griffiths, PHI Learning Private Limited.
6. Introduction to Classical Mechanics, P. S. Puranik, R. G. Takwale, Tata McGraw Hill.
7. Thermal Physics, A.B. Gupta and H. P. Roy, Books and Allied (P) Ltd.
8. Solid State Physics, R. K. Puri and V. K. Puri, S. Chand & Company Ltd.

BS102	Mathematics-I	3L:1T:0P	4 Credits

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

CO1	Understand the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
CO2	Interpret tool of power series and Fourier series for learning advanced Engineering Mathematics.
CO3	Apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
CO4	Deal with functions of several variables that are essential in most branches of engineering. Acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
CO5	Explain the differentiation and integration of vectors and apply to solve various engineering problems.

Module I: Single-variable Calculus (Differentiation): (6 Hours)

Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L'Hospital's rule.

Module II: Sequences and series: (9 Hours)

Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor theorem, Taylor and Maclaurin series, Fourier series and Half range series.

Module III: Basic Calculus: (7 Hours)

Curvature (both in Cartesian and polar co-ordinates), evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module IV: Multivariable Calculus: (10 Hours)

Partial derivatives, Euler's theorem, Total derivatives, Maxima, Minima and saddle points, Method of Lagrange multipliers, Double and Triple Integrals and its applications to find areas and volumes.

Module V: Vector Calculus: (8 Hours)

Differentiation of vectors, Gradient, Divergence and Curl, Directional Derivatives, Line, Surface and volume Integrals; Green, Gauss and Stokes Theorems (without proof) and their applications.

Suggested Text / Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. S. S. Sastry, Engineering Mathematics : Volume 1,2; Fourth Edition.
4. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006.
5. B. C. Das And B. N. Mukherjee, Differential Calculus, 55th edition, U. N. Dhur & Sons Pvt. Ltd.

ES101	Basic Electrical Engineering	3L:0T:0P	3 Credits

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

CO1	Identify and analyse network theorems/AC fundamentals and apply them to the solution of electrical engineering problems.
CO2	Gain a basic idea of electrical quantities, such as current, voltage, power, energy, phase, frequency, etc., and co-relate these concepts to various fields of electrical engineering.
CO3	Understand the principles of magnetic circuits and operation of different types of electrical machines.
CO4	Understand the basic principle of operation and use of different types of measuring instruments.
CO5	Get a concrete idea about electrical installations and the importance of the safety measures to be taken in this regard.

Module I: DC Circuits **(10 Hours)**

Basics of active, passive, linear, nonlinear circuit elements and networks. Overview of Ohm's Law, Kirchoff's laws, nodal & mesh analysis, voltage & current sources. Network theorems- Superposition, Thevenin's, Norton's and maximum power transfer theorems. Star-Delta Conversions.

Module II: AC Circuits **(12 Hours)**

Waveforms of alternating voltages and currents, instantaneous, average and RMS values, form factor & peak factor, forms of representation of alternating quantities, concept of phasor & phasor diagrams, reactance & impedance. AC circuits-resistive, inductive, capacitive, RL, RC & RLC series, parallel and series parallel combination, impedance triangle, admittance, active & reactive power & power factor. Concept of Resonance.
Concepts of 3-phase AC: connections, phase & line values in star & delta connections, solutions of simple 3-phase balanced circuits with resistive & reactive loads, 3-phase power and phase sequence.

Module III: MAGNETIC Circuits **(12 Hours)**

Definitions of MMF, flux, flux density & reluctance, Comparison between Electric & magnetic circuits, series, parallel & series parallel circuits & their solutions, energy stored in a magnetic circuit, lifting magnets, electromagnetic induction, self & mutual inductance, hysteresis & eddy current losses.

Single Phase Transformers: Principle of operation, EMF equation, losses and efficiency.

DC machines: Electromechanical Energy Conversion, principle of operation, voltage, power and torque equations, Classification, characteristics and applications of various types of d.c. motors.

Induction Motors: Principle of operation of single phase and three phase induction motors, Application of Induction motors

Module IV: Instruments **(4 Hours)**

Classification of instruments, essentials of indicating type instruments- deflecting torque, controlling torque, damping torque; types of indicating instruments, MC & MI type ammeters & voltmeters, extension of range- use of shunt & multipliers.

Module V: Basics of Electrical Installations **(2 Hours)**

Basic knowledge of domestic wiring, types of cables (names only), types of wiring; circuit layouts- single phase AC mains to DB; 3 phase connections; accessories- main switch, ceiling rose, fuse, MCB etc. Earthing- purpose & methods.

Suggested Text / Reference Books:

1. Basic Electrical Engineering (3rd Edition): T.S Nagsarkar, M.S Sukhija, Oxford University Press, 2023
2. Basic Electrical Engineering (2nd Edition): V Mittle, Arvind Mittle, McGraw Hill Education
3. Basic Electrical Engineering (2nd Edition): D.C. Kulshreshtha, McGraw Hill,2019
4. Engineering Circuit Analysis (8th Edition): William H. Hayt, Jack Kemmerly, Steven M. Durbin, McGraw Hill Education, 2013
5. Textbook of ELECTRICAL TECHNOLOGY Volume 1: B.L.Thereja,A.K.Thereja, S.Chand Publishing House.

ES102	Engineering Graphics	1L:0T:4P	3 Credits

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

CO1	Explain the basic principles of Engineering Graphics.
CO2	Apply the principles of orthographic and isometric projections to represent simple Engineering objects.
CO3	Apply the principle of sectioning to represent different views of Right Angular Solids.
CO4	Create simple shapes like Circle, parabola, geometric solids etc. using CAD software.
CO5	Demonstrate team work spirit through creation of Engineering models and their presentations.

Module I: Introduction to Engineering Drawing (12 Hours)

i. Principles of Engineering Graphics and their significance, usage of d rawing instruments.

ii. Lettering: Single stroke letter – Vertical and inclined capital and small letter.

iii. Scales: Plain, Diagonal and Vernier Scales.

iv. Curves: Conic sections – Ellipse, Parabola, Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute.

Module II: Orthographic Projections (10 Hours)

i. Principles of Orthographic Projections- Conventions

ii. Projection of points: Introduction of projection, quadrants, 1st, 2nd, 3rd and 4th angle projection of points.

iii. Projection of lines (First angle only): Line parallel to both planes, line perpendicular to a plane, line inclined to one plane and parallel to other, line inclined to both planes.

iv. Projections of planes (First angle only): Plane perpendicular to one plane and parallel to other, plane perpendicular to both plane, plane inclined to one plane and perpendicular to other.

v. Projection of solids (First angle only): Axis perpendicular to one plane and parallel to other, axis parallel to both planes, axis inclined to one plane and parallel to other, axis inclined to both planes.

Module III: Sections and Sectional Views of Right Angular Solids (4 Hours)

Section of solids: Section plane parallel to one plane and perpendicular to other, section plane inclined to one plane and perpendicular to other.

Module IV: Isometric Projections (4 Hours)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

Module V: Introduction of Computer Graphics (6 Hours)

Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; applying dimensions to objects, applying annotations to drawings; Setting up and use of

Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines

(extend/lengthen); Drawing simple shapes such as circle, parabola, etc.; Drawing geometric solids; Drawing annotation, solid, surface, and wireframe models.

Module VI: Demonstration of simple team design (Students Project as group work)

(4 Hours)

Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids; meshed topologies for engineering analysis; Drawing of floor plans, front elevation and sectional elevation showing floor level to ceiling of a simple two storied building with doors and windows.

NOTE: Assessment of student based on above syllabus comprises of three parts

a. Theory examination covering Module 1 to Module 4
b. Practical Examination covering Module 5
c. Project covering Module 6

Suggested Text / Reference Books:

1. Bhat, N.D.& Panchal, V. M. & Ingle, P. R. (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & B.C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson Education.
3. Dhawan, R.K. (2007), A Text Book of Engineering Drawing, S. Chand Publications.
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
6. User manual of CAD software.

HS101	Technical Report Writing	1L:0T:2P	2 Credits

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

CO1	Utilize reading and writing techniques to form skilful writings.
CO2	Demonstrate knowledge of various aspects of technical report including its writing strategies.
CO3	Apply improved listening and speaking skills in interactions.
CO4	Design technical report efficiently.
CO5	Apply skills to give effective presentation.

Module I: Enhancing Writing Skill: A Step to Writing Effective Technical Report (3 Hours)

1.1. Building vocabulary with prefixes, suffixes, antonyms, synonyms and phrases and idioms.
1.2. Basic grammar- sentence patterns, punctuation, articles, prepositions and active and passive voice
1.3. Identifying common errors in subject-verb agreement, noun-pronoun agreement and misplaced modifiers.
1.4. Essentials for effective writing- unity of thought, coherence, relevance, uses of examples and comparisons and effective introduction and conclusion in writing and SQ3R reading technique- survey, question, read, recite and review.

Module II: Introduction to Technical Report (2 Hours)

1.1. Concept
1.2. Significances
1.3. Objectives
1.4. Categories and types of reports
1.5. General Characteristic
1.6. Formats of Technical Report

Module: III: Prewriting or preliminary steps to writing a report (2 Hours)

1.1. Understanding the purpose and Scope
1.2. Analysing the audience
1.3. Investigating the sources of Information
1.4. Organizing the material
1.5. Making an outline

Module IV: Writing different parts of a report (Manuscript format) and its finalization (5 Hours)

1.1. Prefatory parts
1.2. Main Text
1.3. Supplementary parts
1.4. First draft
1.5. Revising, editing and proofreading

Module V: This module involves practice sessions in Language Lab (6 Hours)

Oral and Written Communication

1.1. Listening Comprehension
1.2. Pronunciation, Silent Letters, Intonation, Stress and Rhythm
1.3. Common Everyday Situations: Conversations and Dialogues
1.4. Writing and presenting on technical report

Suggested Readings:

1. *AICTE's Prescribed Textbook: English* (with Lab Manual), Kulbhushan Kumar, Khanna Book Publishing Co, 2023.
2. *Effective Technical Communication.* M Ashraf Rizvi. Tata McGraw-Hill, 2006.
3. *Technical Communication: Principles and Practice*. 2nd edition. Meenakshi Raman and Sangeeta Sharma. OUP.
4. *Practical English Usage.* Michael Swan. OUP. 1995.
5. *Remedial English Grammar.* F.T. Wood. Macmillan.2007.
6. *On Writing Well.* William Zinsser. Harper Resource Book. 2001.
7. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
8. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
9. *Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
10. *Effective Communication Skills.* Kul Bhushan Kumar, Khanna Book Publishing, 2022.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_hs56/preview
2. https://onlinecourses.swayam2.ac.in/cec24_lg01/preview
3. https://freevideolectures.com/course/3430/communication-skills

Software:

ITELL

BS103	Physics Lab	0L:0T:2P	1 credit

Course outcomes: After successful completion of the course, a student will be able to

CO1	Infer the correctness of relevant theories in certain mechanical systems by determination of the corresponding parameters in an experimental set up.
CO2	Infer the correctness of relevant theories in certain optical systems by determination of the corresponding parameters in an experimental set up.
CO3	Infer the correctness of relevant theories in certain thermal systems by determination of the corresponding parameters in an experimental set up.
CO4	Infer the correctness of relevant theories in certain electrical & magnetic systems by determination of the corresponding parameters in an experimental set up.
CO5	Infer the correctness of relevant theories in certain semiconductor systems by determination of the corresponding parameters in an experimental set up.

List of Experiments:

1. To find the Young's Modulus of Elasticity of the material of a wire by Searle's apparatus.
2. To find the value of the modulus of rigidity of the material of a rod by using: Vertical Twisting apparatus / Horizontal Twisting apparatus.
3. To find the value of the acceleration due to gravity by using: Bar Pendulum /Kater's Pendulum.
4. To find the Moment of Inertia of a given body.
5. To determine the value of Mechanical Equivalent of heat, J using Joule's Calorimeter.
6. To find the specific heat of a given liquid by the method of cooling.
7. To find the Horizontal component of the Earth's magnetic field by using magnetometers.
8. To find the refractive index of the material of a prism using a spectrometer (by finding the angle of the prism and the angle of minimum deviation of the prism).
9. To determine the numerical aperture and acceptance angle of an optical fiber.
10. To determine the dielectric constant of a material.
11. To draw the characteristics curves of a Semiconductor Diode (p-n junction diode).
12. To study resonance phenomena in LCR circuit.
13. To determine the Planck's constant.
14. To determine the band-gap of a semiconductor material.

Suggested Text / Reference Books:

1. A Text Book on Practical Physics – K.G. Mazumdar and B. Ghosh (Sreedhar Publishers).
2. A Text book of Practical Physics - Samir Kumar Ghosh (New Central Book Agency).

ES103	Basic Electrical Engineering Lab	0L:0T:2P	1 Credit

Course outcomes: After successful completion of the course, a student will be able to

CO1	Be familiar with switching on and taking precautionary measures while handling electrical equipment.
CO2	Apply the knowledge of different types of electrical circuits, components and instruments to relate theoretical concepts with experimentation.
CO3	Organize and write a technical report including graphs and tables after performing an experiment.

List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions, Introduction and use of measuring instruments.
2. Calibration of measuring instruments.
3.Verification of Thevenin's Theorem.
4.Verification of Maximum Power Transfer Theorem.
5.Measurement of power in a single phase AC circuit using Wattmeter.
6.Measurement of circuit parameters under steady - state condition for RLC circuits.
7. Demonstration of cut - out sections of Electrical Machines.
8. Characteristics of incandescent lamp.
9. Study of balanced three phase circuits.
10. Demonstration of layout of house wiring.
11. Demonstration of measurement of insulation resistance.

Suggested Text / Reference Books:

1. D. P. Kothari and I. J. Nagrath, —Basic Electrical Engineering||, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, —Basic Electrical Engineering||, McGraw Hill, 2009.
3. L. S. Bobrow, —Fundamentals of Electrical Engineering||, Oxford University Press, 2011.
4. E.Hughes, —Electrical and Electronics Technology||, Pearson, 2010.
5. V. D. Toro, —Electrical Engineering Fundamentals||, Prentice Hall India, 1989.
6. B. L. Theraja, A. K. Theraja, —A Text Book of Electrical Technology Vol I, II, IV||, S.Chand & Co., 2015.
7. Abhijit Chakrabarti, Sudipta Nath and Chandan Kumar Chanda, —Basic Electrical Engineering||, Tata McGraw - Hill, 2017

ES104	Design Thinking	2L:0T:0P	2 Credits

Course outcomes: After successful completion of the course, a student will be able to

CO1	Understand creative thinking and learn the innovation cycle.
CO2	Choose appropriate frameworks, strategies, techniques during prototype development with real-time innovative engineering product designs.
CO3	Apply design thinking process for developing innovative products.

Module I: Basics of Design Thinking **(2 Hours)**

Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test, Understanding Creative thinking process, Understanding Problem Solving

Module II: Process of Product Design **(2 Hours)**

Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design

Module III: Prototyping & Testing **(1 Hour)**

What is Prototype? Why Prototype? Rapid Prototype Development process, Address "ergonomic challenges, testing.

Module IV: Standards and Standardization **(3 Hours)**

Introduction to Standardization: Objective of Standardization, Importance of Standardization in society and Industry.
Bureau of Indian Standards (BIS): Objectives, roles and functions of BIS; Bureau of Indian Standards Act: roles and functions of BIS, marking and certification of products and processes. Case discussion through expert lectures.

Module V: Innovative Product Design **(7 Hours)**

Final Presentation – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution".

Suggested Text / Reference Books:

1. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.

2. SO/IEC Guide 59, BIS Standards Formulation Manual 2022

AU101	IDEA Lab Workshop	0L:0T:4P	0 Credit

Course outcomes: After successful completion of the course, a student will be able to

CO1	Learn all the skills associated with the tools and inventory associated with the IDEA Lab.
CO2	Build useful and standalone system/ project with enclosures.
CO3	Create print and electronic documentation for the system/project.

Unit	Topics	
1	Electronic component familiarization, Understanding electronic system design flow. Schematic design and PCB layout and Gerber creation using EagleCAD. Documentation using Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT.	Introduction to basic hand tools - Tape measure, combination square, Vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits,
2	Familiarization and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output) Circuit prototyping using (a) breadboard, (b) Zero PCB (c) 'Manhattan' style and (d) custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines.	Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboard a Box.
3	Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input. Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging.	3D printing and prototyping technology - 3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering. Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers. Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab

4	Discussion and implementation of a mini project.
5	Documentation of the mini project (Report and Video).

Laboratory Activities:

Sl No.	List of lab activities and experiments
1	Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2	Machining of 3D geometry on soft material such as soft wood or modeling wax.
3	3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4	2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5	2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6	Familiarity and use of welding equipment.
7	Familiarity and use of normal and wood Lathe.
8	Embedded programming using Arduino and/or Raspberry Pi
9	Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.

ES-105	Digital Fabrication/ Workshop/Manufacturing Practices	0L:0T:2P	1 Credit

Course outcomes: After successful completion of the course, a student will be able to

CO1	Fabricate components with do-it-yourself approach.
CO2	Relate practical knowledge of the dimensional accuracies and dimensional tolerances with different manufacturing processes.
CO3	Assemble different components for creating small device(s) of interest.

Module I: Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

Module II: CNC machining, Additive manufacturing.

Module III: Fitting operations & power tools.

Module IV: Electrical & Electronics.

Module V: Carpentry.

Module VI: Plastic moulding, glass cutting.

Module VII: Metal casting.

Module VIII: Welding (arc welding & gas welding), brazing.

BS201	Chemistry	3L:1T:0P	4 Credits

Course Outcome: After successful completion of the course, a student will be able to

CO1	Understand and further apply quantum and molecular orbital theory along with electronic configuration to the stability, reactivity, and reaction mechanism of organometallic compounds.
CO2	Analyse the water quality parameters such as hardness, pH etc, and understand the remedial techniques using chemical equations.
CO3	Apply the fundamental principles of various analytical techniques to evaluate the various parameters/separate various components of a given chemical compound.
CO4	Synthesize fine chemicals/ drug molecules by applying an organic reaction.
CO5	Analyze /evaluate the importance of chemical kinetics in understanding various reactions involved in chemical reactions.

Module I: Atomic and molecular Structure and Organometallic Chemistry: (12 Hours)

Schrodinger equation. Properties of wave functions, Normalized and Orthogonal wave functions, Operators. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals, Plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Pi-molecular orbitals of butadiene and benzene and aromaticity. Band structure of solids and the role of doping on band structures.

Organometallic: Definition, classification, and reactivity, 18 electron rule, mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co, and Ni. Zeise Salt Preparation, properties, and Structure. Organic metallics in Catalysis: Triethylaluminium in polymerization (**Ziegler Natta catalyst**), Hydrogenation reaction (**Willkinson Catalyst**), Hydroformylation, and **Monsanto Acetic Acid.**

Module II: Water and its Treatment (4 Hours)

Composition of water, Analysis of water (Alkalinity, Dissolved oxygen, Dissolved Carbon dioxide, free Chlorine, Hardness) Soft and Hard water, Units of hardness, Disadvantages of hard water Estimation of hardness of water by EDTA Method. Softening Method for Hard Water

Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Corrosion and treatments.

Specification of drinking water, Bureau of Indian Standards (BIS) and World Health Organization (WHO) standards, Purification of drinking water, reverse osmosis (RO), and electrodialysis treatment processes.

Desalination of brackish water: Electrodialysis and Reverse osmosis.

Module III: Spectroscopic techniques and applications (9 Hours)

Principles of spectroscopy and selection rules. electromagnetic radiation, width, and intensity of the transitions. Basic principles, instrumentation, and applications: IR, UV-Visible and NMR spectroscopy; magnetic resonance imaging (MRI). Atomic absorption spectroscopy – basic principles, instrumentation, applications.

Chromatographic Techniques: Types of chromatography and their principles – paper chromatography, column chromatography, thin layer chromatography, ion exchange chromatography, gel permeable chromatography, gas chromatography, and high-performance liquid chromatography. Application in separation of metal ions, components of organic mixtures.

Module IV: Organic Reactions and synthesis of simple drug molecules (8 Hours)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, and cyclization (mechanism excluded), Synthesis of commonly used drug molecules (Aspirin, Paracetamol, and Ibuprofen)

Macromolecules: Structure, properties, and applications of Polylactic acid, Polyhydroxyalkanoates, Polyacetylene, Aramid.

Nanomaterials: Structure, properties, and Applications (Fullerene, Carbon nanotubes, Graphene Quantum Dots)

Fine Chemicals: Introduction, Applications of Biopharmaceuticals: (Vaccine, Insulin) Agrochemicals (Biopesticides, Plant Growth Regulators)

Module V: Chemical kinetics and Corrosion (7 Hours)

Kinetics of complex reactions, Steady state approximation, Consecutive, Opposing Parallel Chain Reactions, Theory of reaction rates. Activated Complex Theory, Lindemann Theory of unimolecular reaction, Potential Energy Surfaces.

Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electroless plating (Nickel and Copper).

Suggested Text / Reference Books:

1. (a) Quantum Chemistry R.K Prasad, New Age Internationals, (b) Quantum Chemistry B.K Sen, Kalyani Publishers
2. (a) Huheey J.E., Keiter R.L., Inorganic Chemistry: Principles of structure and reactivity, Pearson Education, (b) Selected Topics in Inorganic Chemistry-Wahid U. Malik, G. D. Tuli and R. D. Madan. (S. Chand & Co. Ltd.)
3. (a) Inorganic Chemistry J.D. Lee,(Wiley India Edition)
4. Organic Chemistry – J. Clayden, N. Greeves, S. Warren (Oxford)
5. Morrison R. T., Boyd R.N and Bhattacharjee S.K., Organic Chemistry, Pearson Education.
6. (a) Reactions, Rearrangements and Reagents in Organic Chemistry by R.K. Bansal (New Age International Publishers) (b) A Text Book of Organic Chemistry by B.S. Bahl and Arun Bahl (Sultan Chand & Sons)

7. Fundamentals of Molecular Spectroscopy, by C.N. Banwell, McGraw Hill
8. Fine Chemicals Manufacture Technology and Engineering- A. Cybulski, J.A. Moulijn, M.M. Sharma, R.A. Sheldon (Elsevier)
9. Polymer Science Gowariker V.R, Viswanathan N.V and Sreedhar J., Polymer Science, New Age International (P) Limited
10. Nanotechnology: An Introduction to Synthesis Properties and Applications of Nanomaterials- Thomas Varghese, K.M. Balakrishna(Atlantic)
11. (a)Physical Chemistry- P. Atkins, J. Paula, J. Keeler Oxford publications, (b) A Text Book of Physical Chemistry, A.S Negi and S.C Anand, New Age International publishers
12. Engineering Chemistry Dr.Rajshree Khare, Katson Books
13. A text Book of Engineering Chemistry, Uppal M.M, Jain and Jain, Dhanpat Rai Publications, New Delhi, 20th Edition.
14. Engineering Chemistry, K. Sesha Maheswaramma, Mridula Chugh, Pearson

BS202	Mathematics-II	3L:1T:0P	4 Credits

Course Outcome: After successful completion of the course, a student will be able to

CO1	Understand the essential tool of matrices and linear algebra in a comprehensive manner.
CO2	Apply effective mathematical tools for the solutions of differential equations that model physical processes.
CO3	Apply tools of differentiation of functions of a complex variable that are used in various techniques dealing engineering problems.
CO4	Apply the concept of complex integration to solve problems in various engineering fields.
CO5	Explain Residue theorem and apply it to solve problems in various domains.

Module I: Linear Algebra **(10 Hours)**

Linear Systems of Equations; Linear Independence; Rank of a Matrix; Determinant, Inverse of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem.

Module II: Ordinary differential equations: **(8 Hours)**

Exact, linear and Bernoulli's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second order linear differential equations with variable coefficients: Euler-Cauchy equations, solution by variation of parameters

Module III: Ordinary differential equations of higher orders: **(8 Hours)**

Power series solutions: Legendre's equations and Legendre polynomials, Frobenius method, Bessel's equation and Bessel's functions of the first kind and their properties.

Module IV: Complex Analysis – Differentiation: **(6 Hours)**

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module V: Complex Analysis – Integration: **(8 Hours)**

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Text / Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. S. S. Sastry, Engineering Mathematics : Volume 1,2; Fourth Edition.
4. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006.
5. B. C. Das And B. N. Mukherjee, Differential Calculus, 55th edition, U. N. Dhur & Sons Pvt. Ltd.

BS203	Biology for Engineers	3L:0T:0P	3 Credits

Biology for Engineers

CO1	To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry
CO2	Taxonomy to be studied as a part of Biology alongside its morphological, biochemical and ecological aspects
CO3	To understand the underlying mechanism of Mendel's laws
CO4	To understand life forms as the manifestations of same building blocks of biomolecules and catalytic processes
CO5	To understand the role of DNA as genetic material and concept of genetic code

Module I: Introduction

Fundamental differences between science and engineering with examples: comparison between eye and camera, bird flying and aircraft, aspects of biology as an independent scientific discipline, biological observations of 18th Century that lead to major discoveries, Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.

Module Il: Classification of organisms

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- cellular organelles (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion — aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- concept of five kingdom classification system. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A.Thaliana, M. musculus

Module Ill: Genetics

"Genetics is to biology what Newton's laws are to Physical Sciences". Mendel's laws: Concepts of recessiveness and dominance, Concept of segregation and independent assortment. Epistasis, single gene disorders in humans like cystic fibrosis.

Module IV: Biomolecules

Molecules of life: sugars, starch, cellulose, amino acids and proteins, nucleotides and DNA/RNA, lipids

Module V: Enzymes

Enzymology: Concept of biological catalysts, enzyme classification, mechanism of enzyme action, enzyme kinetics; Michelis –Menten equation

Module VI: Information Transfer

DNA as genetic material: organization of genetic material, Concept of genetic code, universality and degeneracy of genetic code. DICOM Image formats, concept of recombinant DNA Technology, its application Regulation Bill, 2019

Books referred

1. **Biology For Engineers Book By s Thyagarajan, MacGraw Hill Education**
2. Biology for Engineers by G K Suraishkumar (Oxford University Press)
3. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Verma and Agarwal (S Chand publication)
4. Lehninger, Principle of Biochemistry, 4th Edition

ES201	Programming for Problem Solving	2L:0T:2P	3 Credits

Course Outcomes: After successful completion of the course, a student will be able to

CO1	Translate the algorithms to programs and to test, execute the programs and able to correct syntax and logical errors.
CO2	Implement conditional branching, iteration and recursion.
CO3	Decompose a problem into functions and synthesize it.
CO4	Use arrays, and structures to formulate algorithms and programs. And to apply programming to solve matrix addition and multiplication problems, and searching and sorting problems.
CO5	Apply programming to solve simple numerical problems, namely rot finding of function, differentiation of function and simple integration.

Module I: Introduction to Programming (6 Hours)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.
Arithmetic expressions and precedence.

Module II: Conditional Branching and Loops (11 Hours)
Writing and evaluation of conditionals and consequent branching. Iteration and loops.
Arrays, Arrays (1-D, 2-D), Character arrays and Strings.

Module III: Basic Algorithms (6 Hours)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (noformal definition required)

Module IV: Function (10 Hours)

Functions (including using built in libraries), Parameter passing in functions,call by value, Passing arrays to functions: idea of call by reference

Recursion, use of recursion in solving problems. Example programs: such as Finding Factorial, Fibonacci series, Ackerman function etc.

Module V: Structures and Array of Structures (7 Hours)
Idea of pointers, Defining pointers, Use of Pointers in self-referentialstructures, notion of linked list. Application of simple problem solving

Name of the Experiments

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series, average of series etc.
5. 1D Array manipulation
6. Matrix problems (addition, multiplications etc.), String operations
7. Simple functions
8. Solving Numerical problems
9. Use of Recursive functions in a program
10. Structures, array of structures, numerical and strings related problem solving

Suggested Text / Reference Books

1. AICTE's Prescribed Textbook: Programming for Problem Solving, Khanna Book Publishing Co.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall ofIndia.

ES202	Engineering Mechanics	2L:0T:2P	3 Credits

Course Outcomes: After successful completion of the course, a student will be able to

CO1	Analyze rigid bodies subjected to a system of forces with or without friction, applying principles of equilibrium and virtual work.
CO2	Analyze structures by the method of joints, sections and graphically.
CO3	Apply the concepts of C.G. and M.O.I. to find the C.G. and M.O.I. of simple and composite bodies.
CO4	Solve dynamics problems involving particle and rigid body applying D'Alembert's, work-energy, and impulse-momentum principles.
CO5	Analyze the behavior of harmonic oscillators, including simple, damped (over-damped, critically damped, under-damped), and forced oscillations to predict their motion.

Module I: Equilibrium of Rigid Bodies **(12 Hours)**

Free body diagram (FBD), types of supports and their reactions, system of forces, resultant of coplanar concurrent forces and non-concurrent force systems, Conditions of equilibrium, (i) concurrent forces in space (ii) non-concurrent forces in space.
Coulomb's Law of Friction, equilibrium of bodies involving dry friction; inclined plane, ladder friction, wedge friction.
Virtual Work: Introduction, virtual displacement, principle of virtual work, application of virtual work.

Module II: Analysis of Structures **(5 Hours)**

Method of joint, method of sections, graphical methods.

Module III: Centre of Gravity and Moment of Inertia **(6 Hours)**
(i) Centre of gravity and centroid; location of centroid and centre of gravity (ii) Moment of inertia of plane area, parallel axis theorem, perpendicular axis theorem, mass moment of inertia, polar moment of inertia, radius of gyration, product of inertia, M.O.I. of simple and composite bodies. Principal axes and Principal Moments of Inertia

Module IV: Kinetics of particles and rigid bodies **(6 Hours)**
Newton's 2nd law, D Alembert's principle, impulse and momentum (linear and angular), impulse momentum principle, work-energy principle.

Module 5: Harmonic motion **(5 Hours)**
Harmonic Oscillator, damped harmonic motion – over - damped, critically damped and under damped oscillators; forced oscillation and resonance

List of Experiments to be conducted:

1. To verify the law of polygon of forces for a number of coplanar forces in equilibrium.

2. Parallel Forces Apparatus:
A. To show experimentally the inverse relationship between reactive forces at support and the distance of the point of application of loads from supports.
B. To find the reactive forces at the supports using:
(i) Experimentally, (ii) Analytical method

3. To verify the Law of Moments by using a Bell Crank Lever.

4. To determine the co-efficient of friction between the slider and the inclined plane.
(sliding friction)

5. Find the Centre of Gravity of a given section both experimentally and theoretically.

Text Books:

1. Engineering Mechanics: Statics and Dynamics by R.C. Hibbler, Pearson
2. Engineering Mechanics: Statics and Dynamics, J.L. Meriam, L.G Kraige, Wiley.

Reference Books:

1. Engineering Mechanics by S. Timoshenko and D.H. Young, McGraw Hill Int.
2. Engineering Mechanics by R.K. Bansal, Laxmi Publication (P) Ltd.
3. Engineering Mechanics by K.L. Kumar, McGraw Publishing Co.
4. Engineering Mechanics by D.P Sharma, Pearson.
5. Engineering Mechanics Statics and Dynamics by A Nelson, McGraw Hill.
6. Engineering Mechanics – Statics and Dynamics by IH Shames

HS201	Universal Human Values	3L:0T:0P	3 Credits

Course Outcomes: After successful completion of the course, a student will be able to

CO1	Understand more about self, and their surroundings (family, society, nature).
CO2	Develop self to become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3	Develop critical ability to find right estimation.
CO4	Build self to become sensitive to their commitment towards what they have understood and enrich their professional ethics towards values, relationship and society.
CO5	Apply what has been learnt to their own self in different day-to-day settings in real life.

Module I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education (8 Hours)

1.1 Purpose and motivation for the course, recapitulation from Universal Human Values-I

1.2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, G.H. Mead interpretation on self.

1.3. Continuous Happiness and Prosperity- A look at basic Human Aspirations

1.4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

1.5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.

Module II: Understanding Harmony in the Human Being - Harmony in Myself! (8 Hours)

2.1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

2.2 Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

2.3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

2.4. Understanding the characteristics and activities of 'I' and harmony in 'I'

2.5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

Module III: Understanding Harmony in the Family and Society- Harmony in Human, Human Relationship (8 Hours)

3.1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and mutual happiness.

3.2. Understanding the meaning of Trust; Difference between intention and competence

3.3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

3.4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.

3.5. Understanding family- Is family universal? Visualizing harmonious order in society-undivided society, universal order from family to world family.

Module IV: Understanding Human Capital Formation (8 Hours)

4.1. Introduction, Significance of Human capital, various ways to develop human capital.
4.2. Problems of human capital formation, Growth of knowledge and skill formation, their relationship with human values (Professional ethics)
4.3. Productivity and its concepts, factors affecting productivity, human values and productivity.

Module V: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence (8 Hours)
5.1. Understanding the harmony in the Nature
5.2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature
5.3. Understanding Existence as Co-existence of mutually interacting units in all pervasive space.
5.4. Ethical human conduct, competence in professional ethics.
5.5. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Suggested Readings:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Alternative Study Materials:
1. FDP handouts on UHV

BS204	Chemistry Lab	0L:0T:2P	1 Credit

Course Outcomes: After successful completion of the course, a student will be able to

CO1	Discuss and demonstrate safe and proper laboratory practices.
CO2	Synthesize polymer/drug molecules through organic reactions.
CO3	Apply basic laboratory techniques in volumetric analysis, gravimetric analysis, and instrumental methods for the determination of various important parameters of the given sample.
CO4	Estimate the composition of a given sample quantitatively.
CO5	Interpret and analyze experimental data using appropriate calculations and graphical methods and relate laboratory findings to engineering applications of chemistry.

List of Laboratory Experiments

1. Demonstration and discussion of Safety protocols of the wet chemistry laboratory. Safety and Introduction to Laboratory Equipment: Introduction to laboratory safety rules, basic laboratory equipment, and proper handling techniques.
2. Estimation of Water Hardness by EDTA. (Complexometric titration)
3. Determination of Dissolved oxygen (BOD, COD) in water.
4. Determination of Strength of acid (HCl) by titrating against a base (NaOH) (Conductometric titration).
5. Determination of equivalent conductance of a strong electrolyte like NaCl and hence verify the Debye-Huckel-Onsagar equation.
6. Determination of surface tension of a given liquid by drop number method using a stalagmometer.
7. Determination of coefficient of viscosity and to determine the composition of an unknown sample using the calibration curve.
8. Determination of strength of acid pH-metrically by titrating against a base. (pH-metric titration)
9. Determination of rate constant of hydrolysis of ester (methyl acetate) catalysed by hydrogen ions at room temperature.
10. Estimation of Iron by titrating against a standard $KMnO_4$ solution. (Redox Titration)
11. Chromatographic Separation of a given sample.
12. Preparation of an Inorganic Complex: sodium trioxalatoferrate (III), Na_3 [Fe $(C_2O_4)_3$].$9H_2O$, Trioxalatochromate (III), Preparation of Tetraaminecopper (II) sulphate.
13. Preparation of Mohr's salt ferrous ammonium sulphate; $FeSO_4$ $(NH_4)_2SO_4.6H_2O$} and characterisation by spectroscopic method.
14. Determination of saponification value of given oil sample.
15. Synthesis of a polymer/drug molecule such as aspirin and characterization.

16. Determination of the partition coefficient of a substance between two immiscible liquids.

18. To determine the rate-constant (K) value for hydrolysis of ethyl acetate catalyzed by hydrochloric acid.

19. Study of oxidation of iodide ions by hydrogen peroxide as an iodine clock reaction.

20. Quantitative Estimation of a given dye spectroscopically using the standard calibration curve

AU201	SPORTS and YOGA	0L:0T:2P	0 Credit

Course Outcomes: At the end of the course, the student will be able to

CO1	Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
CO2	Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
CO3	Learn breathing exercises and healthy fitness activities
CO4	Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
CO5	Perform yoga movements in various combination and forms.

Module I: Introduction to Physical Education

- o Meaning & definition of Physical Education
- o Aims & Objectives of Physical Education
- o Changing trends in Physical Education

Module II: Olympic Movement

- o Ancient & Modern Olympics (Summer & Winter)
- o Olympic Symbols, Ideals, Objectives & Values
- o Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

Module III: Physical Fitness, Wellness & Lifestyle

- o Meaning & Importance of Physical Fitness & Wellness
- o Components of Physical fitness
- o Components of Health related fitness
- o Components of wellness
- o Preventing Health Threats through Lifestyle Change
- o Concept of Positive Lifestyle

Module IV: Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga

- o Define Anatomy, Physiology & Its Importance
- o Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)

Module V: Kinesiology, Biomechanics & Sports

- o Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
- o Newton's Law of Motion & its application in sports.
- o Friction and its effects in Sports.

Module VI: Postures

- o Meaning and Concept of Postures.
- o Causes of Bad Posture.
- o Advantages & disadvantages of weight training.
- o Concept & advantages of Correct Posture.

o Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
o Corrective Measures for Postural Deformities

Module VII: Yoga

o Meaning & Importance of Yoga
o Elements of Yoga
o Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas
o Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana)
o Relaxation Techniques for improving concentration - Yog-nidra

Module VIII: Yoga & Lifestyle

o Asanas as preventive measures.
o Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.
o Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.
o Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
o Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.
o Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

Module IX: Training and Planning in Sports

o Meaning of Training
o Warming up and limbering down
o Skill, Technique & Style
o Meaning and Objectives of Planning.
o Tournament – Knock-Out, League/Round Robin & Combination.

Module X: Psychology & Sports

o Definition & Importance of Psychology in Physical Edu. & Sports
o Define & Differentiate Between Growth & Development
o Adolescent Problems & Their Management
o Emotion: Concept, Type & Controlling of emotions
o Meaning, Concept & Types of Aggressions in Sports.
o Psychological benefits of exercise.
o Anxiety & Fear and its effects on Sports Performance.
o Motivation, its type & techniques.
o Understanding Stress & Coping Strategies.

Module XI: Doping

o Meaning and Concept of Doping
o Prohibited Substances & Methods
o Side Effects of Prohibited Substances

Module XII: Sports Medicine

- o First Aid – Definition, Aims & Objectives.
- o Sports injuries: Classification, Causes & Prevention.
- o Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

Module XIII: Sports / Games

Following subtopics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.

- o History of the Game/Sport.
- o Latest General Rules of the Game/Sport.
- o Specifications of Play Fields and Related Sports Equipment.
- o Important Tournaments and Venues.
- o Sports Personalities.
- o Proper Sports Gear and its Importance.

LIST OF EXIT COURSES (For exit after 1st Year)

Sl No.	Course Name	Credit	Remark
1	Social Internship	2	Mandatory for all the exit students
2	Skill based Certificate Course (Practical only) 1. Welding 2. Machining 3. Fitting 4. Surveyor 5. Draftsmanship 6. Electrical Wiring 7. Home appliances repairing 8. Automobile mechanic 9. Solar Panel installation and maintenance 10. Composting 11. Water quality testing 12. Chemical Equipment operator 13. Office Automation and data processing 14. Computer hardware and networking maintenance 15. Computer maintenance and repairing 16. UPS maintenance 17. Circuit handling in electronic repairing 18. Certificate courses run by NSDC (National Skill Development Corporation)	2	Choose anyone from the list