#NUES: Comprehensive evaluation of the students by the concerned coordinator of NCC / NSS / Cultural Clubs / Technical Society / Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester for students admitted in the first semester. Students admitted in the 2nd year (3rd semester) as lateral entry shall be for the period of 3rd semester to 6th semester only

Second Semester						
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**	**Mode**
ES BS	ES-102 BS-104	*Any one of the following: Programming in 'C' Applied Chemistry	3	-	3	Theory Theory
BS	BS-106	Applied Physics – II	3	-	3	Theory
ES BS	ES-108 BS-110	*Any one of the following: Electrical Science Environmental Studies	3	-	3	Theory Theory
BS	BS-112	Applied Mathematics – II	3	-	3	Theory
HS HS	HS-114 HS-116	**Group 1 or Group 2 shall be offered: Group 1: Communications Skills OR Group 2:	3 2	-	3 2	Theory
ES	ES-114	Engineering Mechanics	3	-	3	Theory
BS	BS-152	Physics-II Lab	-	2	1	Practical
ES BS	ES-154 BS-156	*Any of the following corresponding to the theory paper offered: Programming in 'C' Lab Applied Chemistry	- -	2	1	Practical Practical
ES	ES-158	Engineering Graphics-II	-	2	1	Practical
ES BS	ES-160 BS-162	*Any of the following corresponding to the theory paper offered: Electrical Science Lab Environmental Studies Lab	- -	2	1	Practical
ES	ES-164	Workshop Technology		2	1	Practical
Total			17/18	10	22/23	

*For a particular batch of a programme of study one out of these two papers shall be taught in the first semester while the other shall be taught in the 2nd semester. Students who have to re-appear can only reappear in the odd semester if originally offered to the student in the 1st semester and similarly for the students who study the paper in the second semester. The institution shall decide which paper to offer in which semester.

**For a particular batch of a programme of study either the paper on "Communications Skills" (Group 1), or Group 2: papers ("Human values and ethics") shall be taught in the first semester while the other group shall be taught in the 2nd semester. Students who have to re-appear can only reappear in the odd semester if originally offered to the student in the 1st semester and similarly for the students who study the paper(s) in the second semester. The institution shall decide which paper group to offer in which semester.

***NUES:** All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

BRIDGE COURSES FOR THE B.TECH LATERAL ENTRY STUDENTS

All the Lateral Entry students of B.Tech., who are directly admitted in the 2nd Year / 3rd Semester of the Progarmme of Study, have to pass the following bridge courses.

Paper Code	Paper Name	L/P
BC-181	Bridge Course in Mathematics	4
BC-183	Bridge Course in Programming in C	4

Implementation Rules for Bridge Courses:

1. The institutions are required to conduct the classes for the above bridge courses in the 3rd Semester alongwith the classes of the other courses.
2. These papers have to be qualified by the students.
3. For these papers examination shall be conducted by the concerned subject teacher as NUES, the same shall be transferred to Examination Division of the University.
4. The degree to be awarded to the student only subject to the acquiring qualifying grade/marks in the bridge courses and the minimum credits in the regular courses of the scheme of study as prescribed.
5. These Courses shall be qualifying in nature; they shall not be included for calculation of CGPA. The qualifying marks shall be 40 marks in each paper.
6. A separate marksheet will be issued by the Examination Division of the University for the Bridge Course.

Paper Code: ES-101 / ES-102	Paper: Programming in 'C'	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to develop simple algorithms for arithmetic and logical problems and implement them in 'C'
CO2	Ability to implement conditional branching, iteration and recursion and functions in 'C'
CO3	Ability to use arrays, pointers, union and structures to develop algorithms and programs in 'C'.
CO4	Ability to decompose a problem into functions and synthesize a complete program using divide and conquer approach in 'C'.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	2	1	1	-	-	-	2	1	1	3
CO2	3	3	2	1	1	-	-	-	2	1	1	3
CO3	3	3	3	1	1	-	-	-	2	1	1	3
CO4	3	3	3	1	1	-	-	-	2	1	1	3

Unit I

Introduction to Programming: Computer system, components of a computer system, computing environments, computer languages, creating and running programs, Preprocessor, Compilation process, role of linker, idea of invocation and execution of a programme. Algorithms: Representation using flowcharts, pseudocode.

Introduction to C language: History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types, I/O statements. Interconversion of variables.

Operators and expressions: Operators, arithmetic, relational and logical, assignment operators, increment and decrement operators, bitwise and conditional operators, special operators, operator precedence and associativity, evaluation of expressions, type conversions in expressions.

Unit II

Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements.
Arrays: Concepts, One dimensional array, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi-dimensional arrays.
Functions: User defined and built-in Functions, storage classes, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion.
Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions. .

Unit III

Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, functions returning pointers, Dynamic memory allocation. Pointers to functions. Pointers and Strings
Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, self-referential structures, unions, typedef, enumerations.
File handling: command line arguments, File modes, basic file operations read, write and append.
Scope and life of variables, multi-file programming.

Unit IV

Pre-processor Directives: #, ##, #define, #if, #indef, #ifdef, #if … #else. 'C' Standard Libraries: stdio.h, stdlib.h, assert.h, math.h, time.h, ctype.h, string.h, stdarg.h. C99 extensions.
Basic Algorithms: Finding Factorial, Fibonacci series, Linear and Binary Searching, Basic Sorting Algorithms-Bubble sort, Insertion sort and Selection sort. Find the square root of a number, array order reversal, reversal of a string

Textbooks:

1. *How to solve it by Computer* by R. G. Dromey, Prentice-Hall India EEE Series, 1982.
2. *The C programming language* by B W Kernighan and D M Ritchie, Pearson Education, 1988.

References:

1. *Programming Logic & Design* by Tony Gaddis, Pearson, 2nd Ed. 2016.
2. *Programming Logic and Design* by Joyce Farrell, Cengage Learning, 2015.
3. *Engineering Problem Solving With C* by Delores M. Etter, Pearson, 2013.
4. *Problem Solving and Program Design in C* by Jeri R. Hanly and Elliot B. Koffman, Pearson, 2016.
5. *Structure and Interpretation of Computer Programs* by Harold Abelson and Gerald Sussman with Julie Sussman, MIT Press, 1985.
6. *How to Design Programs* by Matthias Felleisen, Robert Bruce Findler, Matthew Flatt, and Shriram Krishnamurthi, MIT Press, 2018.
7. *ANSI/ISO 9899-1990, American National Standard for Programming Languages 'C'* by American National Standards Institute, Information Technology Industry Council, 1990 (C89).
8. *ISO/IEC 9899:1999. International Standard for Programming Languages – C (ISO/IEC 9899)* by American National Standards Institute, Information Technology Industry Council, 2000 (C99).
9. *INCITS/ISO/IEC 9899-2011.American National Standard for Programming Languages 'C'* by American National Standards Institute, Information Technology Industry Council, 2012 (C11).

Paper Code: BS-103 / BS-104	Paper: Applied Chemistry	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to use fuels and perform energy conversion calculations.
CO2	Understand the phase rule and its applications. Also, to understand the properties and industrial applications of polymers.
CO3	Ability to analyse water and use technologies to purify it.
CO4	Understand the chemical aspects of corrosion and its prevention. Also, to understand the basics of Green Chemistry and Nano-chemistry.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	1	1	-	1	1	-	1

Unit I

Fuels: Classification and Characteristics of fuels, Calorific values, Comparison between solid, liquid and gaseous fuels, calorific values of fuels, determination of calorific values using Bomb calorimeter, Boy's calorimeter, theoretical calculation of calorific value using Dulong formula and numericals of Calorific values. Types of fuels: - Solid: Coal, proximate and ultimate analysis of coal and numericals, carbonisation of coal in Otto-Hoffman oven with recovery of by-products, metallurgical coke; Liquid: Petroleum products --- refining, cracking-thermal and catalytic, knocking characteristics, Octane and Cetane rating; Gaseous: Natural Gas (NG), CNG, LPG, Coal gas, Oil gas, Producer gas, Water gas; Combustion of fuels numericals. [9Hrs] [T1]

Unit II

Phase rule: Terms used in Gibb's Phase rule, phase diagram and its applications for study of one-component systems: Water and Sulphur and two-component systems: Lead-Silver and Zinc-Magnesium.

Polymers: Classification, functionality and their types; Plastics: Synthesis (reactions) and properties of Polyethylene Plastics (Addition polymers) ---low-density polyethene (LDPE), high-density polyethylene(HDPE), linear low density polyethylene(LLDPE) and ultra-high molecular weight polyethylene (UHMWPE); Vinyl Plastics (Condensation polymers) -Nylons, Phenol-formaldehyde resins(Bakelite) and Glyptal; Speciality Polymers: Engineering thermoplastics, Conducting polymers, Electroluminescent polymers, liquid crystalline polymers and biodegradable polymers. [9Hrs][T1, T2]

Unit III

Water: Introduction, water quality standards, physical, chemical and biological characteristics; hardness of water, disadvantages of hardness, determination of hardness (EDTA method) and related numerical questions. Alkalinity and its determination; Boiler problems with hard water and their prevention: Scale and sludge formation, boiler corrosion, caustic embrittlement, priming and foaming, boiler water treatment –internal or in-situ: carbonate and phosphate conditioning, colloidal and Calgon conditioning; external treatment: (a) Lime soda process and related numericals (b) Zeolite process and numericals, (c) Ion-exchange process. Municipal water supply – its treatment and disinfection using break -point chlorination. Desalination, Reverse Osmosis, Electrodialysis and defluoridation of water. [9Hrs][T1, T2]

Unit IV

Corrosion and its Control: Definition, effects, theory (mechanisms): dry/chemical, wet/electrochemical corrosion, Pilling-Bedworth ratio; Types of corrosion: Galvanic corrosion, Soil corrosion, Pitting corrosion, Concentration cell or Differential Aeration corrosion, Stress corrosion; Mechanism of rusting of iron, Passivity. Factors influencing corrosion; protective measures: galvanization, tinning, cathodic protection, sacrificial anodic protection; electroplating and prevention of corrosion through material selection and design.

Green Technology and Green Chemistry

Twelve Principles of Green Chemistry, Zero Waste Technology, Atom economy, Use of alternative feedstock, innocuous reagents, alternative solvents, designing alternative reaction methodology, minimising energy consumption.

Nano Chemistry: Nanomaterials: Properties, synthesis and surface characterization techniques BET and TEM and applications. [9Hrs][T1, T2]

Textbooks:

1. Applied Chemistry by Achyutananda Acharya and Biswajit Samantray, Pearson, 2017.
2. *Engineering Chemistry: Fundamentals and Applications* by Shikha Agarwal, Cambridge University Press, 2019.

References:

1. *Applied Chemistry: A Textbook of Engineers and Technologists* by O. V. Roussk and H. D. Gesser, Springer, 2013.
2. Engineering Chemistry by Raghupati Mukhopadhyay and Sriparna Datta, New Age Int. (P0 Ltd., 2007.
3. *Engineering Chemistry* by K. Shesha Maheswaramma and Mridula Chugh, Pearson, 2017.
4. *Basic Engineering Chemistry* by S.S. Dara, A. K.Singh, and Abhilasha Asthana, S. Cand and Co., 2012.
5. Engineering Chemistry by K. N. Jayaveera, G.V. Subba Reddy, and C. Ramachandraiah, McGraw Hill, 2016.
6. *Engineering Chemistry* by O. G. Palanna, McGraw-Hill, 2017.
7. *Textbook of Engineering Chemistry* by Jaya Shree Anireddy, Wiley, 2017.
8. *Engineering Chemistry* byE.R. Nagarajan and S. Ramalingam, Wiley, 2017.

Paper Code: BS-105	Paper: Applied Physics – I	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand thermodynamic principles.
2:	To understand and model oscillations and waves.
3:	To understand and model interference, diffraction and polarization phenomenon.
4:	To understand and appreciate relativistic systems and Lasers.

Course Outcomes (CO):

CO1	Ability to apply thermodynamic principles to solution of engineering problems.
CO2	Ability to understand and model oscillations and waves.
CO3	Ability to understand and model interference, diffraction and polarization phenomenon.
CO4	Ability to understand and appreciate relativistic systems and Lasers.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*P O 0 2*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	2
CO2	2	2	3	3	2	-	-	-	1	1	-	2
CO3	2	2	3	3	2	-	-	-	1	1	-	2
CO4	2	2	3	3	2	-	-	-	1	1	-	2

Unit I

Introduction to Thermodynamics: Fundamental Ideas of Thermodynamics, The Continuum Model, The Concept of a "System'", "State", "Equilibrium", "Process'". Equations of state, Heat, Zeroth Law of Thermodynamics, Work, first and second laws of thermodynamics, entropy [8Hrs]

Unit II

Waves and Oscillations: Wave motion, simple harmonic motion, wave equation, superposition principle. Introduction to Electromagnetic Theory: Maxwell's equations. work done by the electromagnetic field, Poynting's theorem, Momentum, Angular momentum in electromagnetic fields, Electromagnetic waves: the wave equation, plane electromagnetic waves, energy carried by electromagnetic waves [8Hrs]

Unit III

Interference: Interference by division of wave front (Young's double slit experiment, Fresnel's biprism), interference by division of amplitude (thin films, Newton's rings, Michelson's interferometer), Coherence and coherent sources

Diffraction: Fraunhofer and Fresnel diffraction; Fraunhofer diffraction for Single slit, double slit, and N-slit (diffraction grating), Fraunhofer diffraction from a circular aperture, resolving power and dispersive power of a grating, Rayleigh criterion, resolving power of optical instruments

Polarization: Introduction to polarization, Brewster's law, Malu's law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half shade polarimeter. [12Hrs]

Unit IV

Theory of relativity: The Michelson-Morley Experiment and the speed of light; Absolute and Inertial frames of reference, Galilean transformations, the postulates of the special theory of relativity, Lorentz transformations, time dilation, length contraction, velocity addition, mass energy equivalence. Invariance of Maxwell's equations under Lorentz Transformation.

Introduction to Laser Physics: Introduction, coherence, Einstein A and B coefficients, population inversion, basic principle and operation of a laser, the He-Ne laser and the Ruby laser [12Hrs]

Textbooks:

1. *Concepts of Modern Physics (SIE)*by Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury, McGraw-Hill, 2017.
2. *Physics for Scientists and Engineers* by Raymond A. Serway and John W. Jewett, 9th Edition , Cengage, 2017

References:

1. *Modern Physics* by Kenneth S. Krane, Wiley, 2020.
2. *Principles of Physics* by Robert Resnick, Jearl Walker and David Halliday, Wiley, 2015.
3. *Optics* by Ajoy Ghatak, McGraw Hill, 2020.

Paper Code: ES-107 / ES-108	Paper: Electrical Science	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to understand and use Kirchpff's Laws to solve resistive circuit problems.
CO2	Ability to analyse resistive, inductive and capacitive circuits for transient and steady state sinusoidal solutions.
CO3	Understand the first order filters and magnetic circuits.
CO4	Understand the design of electrical machines.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	-	-	-	1	1	1	2
CO2	3	3	3	3	3	-	-	-	1	1	1	2
CO3	3	3	3	3	3	-	-	-	1	1	1	2
CO4	3	3	3	3	3	-	-	-	1	1	1	2

Unit - I

DC Circuits: Passive circuit components, Basic laws of Electrical Engineering, Temperature Resistance Coefficients. voltage and current sources, Series and parallel circuits, power and energy, Kirchhoʾffs Laws, Nodal & Mesh Analysis, delta-star transformation, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem. Time domain analysis of first Order RC & LC circuits. [9Hrs] [T1]

Unit – II

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections. [9Hrs] [T1]

Unit - III

D. C. Generators & Motors: Principle of operation of Generators & Motors, Speed Control of shunt motors, Flux control, Rheostatic control, voltage control, Speed control of series motors.
A. C. Generators & Motors: Principle of operation, Revolving Magnetic field, Squirrel cage and phase wound rotor, Starting of Induction motors, Direct on line and Star Delta starters, Synchronous machines. [9Hrs [T1]]

Unit - IV:
Transformers: Construction and principle of operation, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.
Measuring Instruments: Electromagnetism, Different Torques in Indicating instruments, Moving Iron Instruments: Construction & Principle, Attraction and Repulsion type; Moving Coil instruments: Permanent Magnet type; Dynamometer type Instruments. [9Hrs] [T1]

Textbooks:
1. *Electrical Engineering Fundamentals* by Vincent Del Toro, PHI (India), 1989

References:
1. *An Introduction to Electrical Science* by Adrian Waygood, Routledge, 2nd Ed. 2019.
2. *Electrical Circuit Theory and Technology* by John Bird, Elsevier, 2007.
3. *Principles and Applications of Electrical Engineering* by Giorgio Rizzoni, MacGraw-Hill, 2007.
4. *Electrical Engineering* by Allan R. Hambley, Prentice-Hall, 2011.
5. *Hughes Electical & Electronic Technology* by Edward Hughes revised by Hohn Wiley, Keith Brown and Ian McKenzie Smith, Pearson, 2016.
6. *Electrical and Electronics Technology* by E. Hughes, Pearson, 2010.
7. Basic Electrical Engineering by D.C. Kulshrestha, McGraw-Hill, 2009.
8. Basic Electrical Engineering by D. P. Kothai and I.J. Nagrath, McGraw-Hill, 2010.

Paper Code:BS-109 / BS-110	**Paper: Environmental Studies**	**L**	**P**	**C**
		3	**-**	**3**

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Environmental Studies course will provide necessary information and knowledge about the various aspects of environment, ecosystems and related biodiversity.
CO2	Students will be able to learn and understand about the availability and sustainable use of resources, environmental problems and their short term and long term impacts to humans.
CO3	Course will help them to learn about environmental policies and protocols, social issues and role of human in conservation and protection of environment.
CO4	Overall, course will help students to develop skills and ability of understanding environment-human relationship.

Course Outcomes (CO to Programme Outcomes (PO)) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	***PO01***	***PO02***	***PO03***	***PO04***	***PO05***	***PO06***	***PO07***	***PO08***	***PO09***	***PO10***	***PO11***	***PO12***
CO1	-	1	1	-	-	3	3	2	1	1	1	1
CO2	-	1	1	-	-	3	3	2	1	1	1	1
CO3	-	1	1	-	-	3	3	2	1	1	1	1
CO4	-	1	1	-	-	3	3	2	1	1	1	1

Unit I

Fundamentals: The Multidisciplinary nature of environmental studies: Definition, components, scope and importance, need for public awareness; Natural Resources.

Ecosystems: Concept, Structure and function of an ecosystem, Types, Functional Components, Different ecosystems, biogeochemical cycles.

Biodiversity: Introduction to biodiversity, biogeographical classification, India as a mega diversity nation, endangered and endemic species of India, threats to biodiversity and conservation of biodiversity. Bioprospecting and Biopiracy. [10Hrs] [T1,T2]

Unit III

Environmental Pollution: (a) Air Pollution: Source, Types, effects on biosphere and Meterology, Air Quality, Control. (b) Water Pollution: Types and Sources. (c) Soil Pollution: Types and Control. (d) Noise Pollution: Effect, Control (e) Thermal Pollution. (f) Radiation Pollution (g) Solid waste Management, (h) Pollution Prevention, (i) Disaster Management [10Hrs][T1,T2]

Unit III

Social Issues and Environment: Concept of Sustainable Development; Urban problem related to energy; Water Conservation; Wasteland reclamation; Resettlement and Rehabilitation; Climate Change; Nuclear Accidents; Consumerism and Waste Products; Laws related to Environment, Pollution, Forest and Wild life; Environmental Impact Assessment. [8Hrs] [T1,T2]

Unit IV

Human Population and Environment: Population Growth, Human Rights, Family Welfare Programmes, Environment and Human Health, HIV/AIDS, Women and Child Welfare, Role of IT. [8Hrs] [T1,T2]

Textbooks:

1. *Environmental Studies* by Anindita Basak, Pearson, 2009.
2. *Environmental Studies*: Simplified by Benny Joseph, McGraw-Hill, 2017.

References:

1. *Environmental Studies* by D. L. Manjunath, Pearson, 2007.
2. *Environmental Studies* by Anil Kumar De and Arnab Kumar De, New Age Int. (P) Ltd, Publishers, 2005.
3. *Companion to Environmental Studies*edited by Coel Castree, Mike Hulme, and James D. Proctor, Routledge, 2018.
4. *Environmental Studies* by Deepa Sharma and Bhupendra Singh Chabbra, New Age Int. (P) Ltd, Publishers, 2007.
5. *Environmental Studies: Simplified* by Raj Kumar Singh, McGraw-Hill, 2012.
6. *Basics of Environmental Studies* by U. K. Khare, McGraw-Hill, 2014.

Paper Code: BS-111	Paper: Applied Mathematics – I	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to use series, differential and integral methods to solve formulated engineering problems.
CO2	Ability to use Ordinary Differential Equations to solve formulated engineering problems.
CO3	Ability to use linear algebra to solve formulated engineering problems.
CO4	Ability to use vector calculus to solve formulated engineering problems.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*P O 0 2*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	3	3	3	1	-	-	-	-	-	1	2
CO2	2	3	3	3	1	-	-	-	-	-	2	2
CO3	2	3	3	3	1	-	-	-	-	-	2	2
CO4	2	3	3	3	1	-	-	-	-	-	2	2

Unit I

Partial derivatives, Chain rule, Differentiation of Implicit functions, Exact differentials. Maxima, Minima and saddle points, Method of Lagrange multipliers. Differentiation under Integral sign, Jacobians and transformations of coordinates. [8Hrs][T2]

Unit II

Ordinary Differential Equations (ODEs): Basic Concepts. Geometric Meaning of y' = f(x, y). Direction Fields, Euler's Method, Separable ODEs. Exact ODEs. Integrating Factors, Linear ODEs. Bernoulli Equation. Population Dynamics, Orthogonal Trajectories. Homogeneous Linear ODEs with Constant Coefficients. Differential Operators. Modeling of Free Oscillations of a Mass–Spring System, Euler–Cauchy Equations. Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters.

Power Series Method for solution of ODEs: Legendre's Equation. Legendre Polynomials, Bessel's Equation, Bessels's functions Jn(x) and Yn(x), Hermite equation, Hermite functions, Laguerre's Equation, Laguerre's

Polynomials. Gamma Function, Beta Function. Recurrence Relations for thesespecial functions. Their Properties. [12Hrs][T1]

Unit III

Linear Algebra: Matrices and Determinants, Gauss Elimination, Linear Independence. Rank of a Matrix. Vector Space. Solutions of Linear Systems and concept of Existence, Uniqueness, Determinants. Cramer's Rule, Gauss–Jordan Elimination. The Matrix Eigenvalue Problem.

Determining Eigenvalues and Eigenvectors, Symmetric, Skew-Symmetric, and Orthogonal Matrices. Eigenbases. Diagonalization. Quadratic Forms. [10Hrs][T1]

Unit IV

Vector Calculus: Vector and Scalar Functions and Their Fields. Derivatives, Curves. Arc Length. Curvature. Torsion, Gradient of a Scalar Field. Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Stokes Theorem. Divergence Theorem of Gauss.
[10Hrs][T1]

Textbooks:

1. *Advanced Engineering Mathematics* by Erwin Kreyszig, John Wiley, 10th Ed., 2011.
2. *Mathematical Methods for Physics and Engineering*, by K. F. Riley, M. P. Hobson and S. J. Bence, CUP, 2013. (for Unit I)

References:

1. *Engineering Mathematics* by K.A. Stroud withDexter J. Booth, Macmillan, 2020.
2. *Advanced Engineering Mathematics* by Larry Turyn, Taylor and Francis, 2014.
3. *Advanced Engineering Mathematics* by Dennis G. Zill, Jones & Bartlett Learning, 2018.
4. *Advanced Engineering Mathematics with MATLAB* by Dean G. Duffy, Taylor and Francis, 2017.
5. *Advanced Engineering Mathematics* by Merle C. Potter, Jack L. Lessing, and Edward F. Aboufadel, Springer (Switzerland), 2019.

Paper Code:HS-113 / HS-114	Paper: Communications Skills	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to Communicate as an Individual and in a Group.
CO2	Ability to learn new words, differentiate between Indian, British and American English.
CO3	Ability to write business letters and make speeches.
CO4	Improved grammar and sentence structure.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	3

Unit I

Role and Importance of Communications, Attributes of Communications, Verbal and Non-Verbal Communications, Verbal Communications Skills, Non-verbal Communication Methods, Body Language, Barriers to Communications, Socio-psychological barriers, Inter-Cultural barriers, Overcoming barriers, Communication Mediums: Characterization and Choice of medium, Effective Communication: Correctness, Clarity, Conciseness, Courtesy, Group Communication: Meetings (types, purpose), Group Discussions, Conduct of Meeting, Participant Role, Making Presentations. [8Hrs][T1]

Unit II

Spoken and Written English: Attributes of spoken and written communication, Formal & Informal Communication, Variation in between Indian, British and American English. Etiquette and Manners: Personal Behaviour, Greetings, Introductions, Telephone Etiquette. Vocabulary Development: Dictionaries and Thesaurus, Words often confused, generally used one word substitutions, Comprehension. [8Hrs][T1]

Unit III

Letter writing: Planning the message, Planning Content, Structure, Language use, Layout, enquires and replies, asking for or giving quotations, Bargaining letters, Seller's reply, etc.; Complaints and Replies; Memos, Circulars and notices;

Papragraph Writing, Writing Scientific and Technical Reports: Types, Structure, Drafting and Delivering a Speech: Understanding the Environment, Understanding the Audience, Text preparing, Composition, Practicing, Commemorative Speeches, Welcome and Introduction, Farewell and Send-offs, Condolence

[8Hrs][T1]

Unit IV

Articles: Indefinite, Definite; Tenses: Present, Past, Future, Perfect (Present, Past and Future), Tenses in conditional sentences; Active and Passive Voice: Formation, conversion; Direct and Indirect Speech, Degrees of Comparison, Common errors, Concepts of Learning and Listening [8Hrs][T1]

Textbooks:

1. *English Language Communication Skills* by Urmilla Rai, Himalaya Publishing House, 10th Ed., 2010.

References:

1. *Technical Communication: Principles and Practice* byMeenakshi Raman and Sangeeta Sharma, Oxford University Press, 2015.
2. *Communication Skills for Engineers* by C. Muralikrishna and Sunita Mishra, Pearson, 2011.
3. *Effective Technical Communication* by M. Ashraf Rizvi, McGraw-Hill, 2018.
4. *Business Communication: Skills, Concepts, and Applications* by P.D. Chaturvedi and Mukesh Chaturvedi, Pearson, 2013.
5. *Business Correspondence and Report Writing* by R.C. Sharma and Krishan Mohan, McGraw-Hill, 2016.
6. *English for Technical Communications* by Aysha Viswamohan, Tata McGraw-Hill, 2008.

Paper Code: HS-115/HS-116	Paper: Human Values and Ethics	L	P	C
		2	-	2

Marking Scheme:
This is an NUES paper, the examinations are to be conducted by the concerned teacher out of 100.

Course Outcomes (CO):

CO1	Realize the importance of human values.
CO2	Understand that excessive desires of the mind make a person unethical and restless, while fewer desires lead to peace and professional progress
CO3	Assess different types of risks involved in unethical practices. Know various means of protesting against unethical practices.
CO4	Assess the benefits of restraining from unethical practices like bribery, extortion, nepotism, nexus between politicians and industrialists.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	3	-	3	1	1	-	1
CO2	-	-	-	-	-	3	-	3	1	1	-	1
CO3	-	-	-	-	-	3	-	3	1	1	-	1
CO4	-	-	-	-	-	3	-	3	1	1	-	1

Unit I

Human Values: Morals, Values, Ethics, Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place, Spirituality [8Hrs]

Unit II

Engineering Ethics: Senses of engineering ethics, Variety of moral issues, Types of inquiries, Moral dilemma, Moral autonomy, Moral development (theories), Consensus and controversy, Profession, Models of professional roles, Responsibility, Theories about right action (Ethical theories), Self-control, Self-interest, Customs, Religion, Self-respect, Case study: Choice of the theory

Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, Industrial standards, A balanced outlook on law, Case study: The challenger [10Hrs]

Unit III

Safety definition, Safety and risk, Risk analysis, Assessment of safety and risk, Safe exit, Risk-benefit analysis Sefety lessons from 'the challenger', Case study: Power plants, Collegiality and loyalty, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Human rights, Employee rights, Whistle blowing, Intellectual property rights. [8Hrs]

Unit IV

Globalization, Multinational corporations, Environmental ethics, Computer ethics, Weapons development, Engineers as managers, Consulting engineers, Engineers as expert witness, Engineers as advisors in planning

and policy making, Moral leadership, Codes of ethics, Engineering council of India, Codes of ethics in Business Organizations [8Hrs]

Textbooks:

1. *A Textbook on Professional Ethics and Human Values*, by R. S. Naagarazan, New Age Publishers, 2006.

References:

1. *Professional Ethics and Human Values* by D. R. Kiran, McGraw-Hill, 2014.
2. *Engineering Ethics, by Charles E Harris and Micheal J Rabins, Cengage Learning Pub., 2012.*
3. *Ethics in Engineering, Mike Martin and Roland Schinzinger, McGraw Hill Pub., 2017.*
4. *Unwritten laws of Ethics and Change in Engineering by The America Society of Mechanical Engineers, 2015.*
5. *Engineering Ethics by Charles B. Fleddermann, Pearson, 2014.*
6. *Introduction to Engineering Ethics* by Mike W. Martin and Roland Schinzinger, McGraw-Hill, 2010.
7. *Engineering Ethics: Concept and Cases* by Charles E. Harris, Michael S. Pritchard and Michael J.Rabins, Cengage, 2009.
8. *Ethics in Engineering Practiceand Research* by Caroline Whitbeck, Cambridge University Press, 2007.

Paper Code: ES-119	Paper: Manufacturing Process	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Understand casting process.
CO2	Understand joining process.
CO3	Understand forging and sheet metal work.
CO4	Basic understanding of powder metallurgy and manufacturing of plastic components.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*P O 0 2*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	1	1	1	2	-	-	-	-	-	1	1
CO2	2	1	1	1	2	-	-	-	-	-	1	1
CO3	2	1	1	1	2	-	-	-	-	-	1	1
CO4	2	1	1	1	2	-	-	-	-	-	1	1

Unit I

Definition of manufacturing, Importance of manufacturing towards technological and social economic development, Classification of manufacturing processes, Properties of materials.

Metal Casting Processes: Sand casting, Sand moulds, Type of patterns, Pattern materials, Pattern allowances, Types of Moulding sand and their Properties, Core making, Elements of gating system. Description and operation of cupola.

Working principle of Special casting processes - Shell casting, Pressure die casting, Centrifugal casting. Casting defects. [10Hrs]

Unit II

Joining Processes: Welding principles, classification of welding processes, Fusion welding, Gas welding, Equipments used, Filler and Flux materials. Electric arc welding, Gas metal arc welding, Submerged arc welding, Electro slag welding, TIG and MIG welding process, resistance welding, welding defects. [10Hrs]

Unit III

Deformation Processes: Hot working and cold working of metals, Forging processes, Open and closed die forging process. Typical forging operations, Rolling of metals, Principle of rod and wire drawing, Tube drawing. Principle of Extrusion, Types of Extrusion, Hot and Cold extrusion.

Sheet metal characteristics -Typical shearing operations, bending and drawing operations, Stretch forming operations, Metal spinning. [10Hrs]

Unit IV

Powder Metallurgy: Introduction of powder metallurgy process, powder production, blending, compaction, sintering

Manufacturing Of Plastic Components: Types of plastics, Characteristics of the forming and shaping processes, Moulding of Thermoplastics, Injection moulding, Blow moulding, Rotational moulding, Film blowing, Extrusion, Thermoforming. Moulding of thermosets- Compression moulding, Transfer moulding, Bonding of Thermoplastics. [10Hrs]

Textbooks:

1. *Manufacturing Technology: Foundry, Forming and Welding Volume 1*, P. N Rao, , McGrawHill, 5e, 2018.
2. *Elements of Workshop Technology Vol. 1 and 2* by Hajra Choudhury, Media Promoters Pvt Ltd.,2008.

References:

1. *Manufacturing Processes for Engineering Materials*, by Serope Kalpajian and Steven R.Schmid, Pearson Education, 5e, 2014.
2. *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems* by Mikell P. Groover, John Wiley and Sons, 4e, 2010 .
3. *Production Technology* by R.K.Jain and S.C. Gupta, Khanna Publishers. 16th Edition, 2001.

Paper Code: BS-151	Paper: Applied Physics - I Lab.	L	P	C
		-	2	1

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:
1. The course objectives and course outcomes are identical to that of (Applied Physics - I) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students

1. To determine the wavelength of sodium light by Newtonʾs Rings.
2. To determine the wavelength of sodium light by Fresnel's biprism.
3. To determine the wavelength of sodium light using diffraction grating.
4. To determine the refractive index of a prism using spectrometer.
5. To determine the dispersive power of prism using spectrometer and mercury source.
6. To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
7. To find the wavelength of He-Ne laser using transmission diffraction grating.
8. To determine the numeral aperture (NA) of an optical fibre.
9. To plot a graph between the distance of the knife-edge from the center of the gravity and the time period of bar pendulum. From the graph, find (a) The acceleration due to gravity (b) The radius of gyration and the moment of inertia of the bar about an axis.
10. To determine the velocity of ultrasound waves using an ultrasonic spectrometer in a given liquid (Kerosene Oil).
11. To verify inverse square law.
12. To determine Planckʾs constant.

Note: Teacherʾs may use the prescribed books to choose the practicals in addition to above. Total 8 practicals minimum shall be performed by the students, they may be asked to do more. Atleast 4 experiments must be from the above list.

Textbook:
1. *B.Sc. Practical Physics* by C. L. Arora, S.Chand & Co., 2020.
2. *Practical physics* by R. K. Shukla and A. Srivastava, New Age Int. (P) Ltd., 2006.

Paper Code: ES-153 / ES-154	Paper: Programming in 'C' Lab.	L	P	C
		-	2	1

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:
1. The course objectives and course outcomes are identical to that of "Programming in 'C'" as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the office of the Head of Department / Institiution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students

1. Write a program to find divisor or factorial of a given number.

2. Write a program to find sum of a geometric series

3. Write a recursive program for tower of Hanoi problem

4. Write a recursive program to print the first m Fibonacci number

5. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices

   a. Addition of two matrices

   b. Subtraction of two matrices

   c. Finding upper and lower triangular matrices

   d. Transpose of a matrix

   e. Product of two matrices.

6. Write a program to copy one file to other, use command line arguments.

7. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.

8. Write a program to perform the following operators on Strings without using String functions

   a. To find the Length of String.

   b. To concatenate two string.

   c. To find Reverse of a string.

   d. To copy one string to another string.

9. Write a Program to store records of a student in student file. The data must be stored using Binary File.Read the record stored in "Student.txt" file in Binary code.Edit the record stored in Binary File.Append a record in the Student file.

10. Write a programmed to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of text File.

Note:
1. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above.

2. In addition Two Mini Projects based on the skills learnt shall be done by the students. Teachers shall create the mini projects so that the same is not repeated every year. These mini projects may be done in a group not exceeding group size of 4 students.
3. Usage of IDE like Visual Studio Community Edition, Codeblocks, etc. are recommended.

Paper Code: BS-155 / BS-156	Paper: Applied Chemistry Lab.	L	P	C
		-	2	1

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:
1. The course objectives and course outcomes are identical to that of "Applied Chemistry" as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the office of the Head of Department / Institiution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students

1. Determination of alkalinity of water sample.
2. Determination of hardness of water sample by EDTA method.
3. Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.
4. Determine the amount of oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.
5. Determine the amount of copper in the copper ore solution, provided hypo-solution (Iodometric Titration).
6. Determine the amount of chloride ions present in water using silver nitrate (Mohr's Precipitation Method).
7. Determine the strength of MgSO4 solution by Complexometric titration.
8. Determine the surface tension of a liquid using drop number method.
9. Determine the viscosity of a given liquid (density to be determined).
10. Determine the cell constant of conductivity cell and titration of strong acid/strong base conductometrically.
11. To determine (a) λ max of the solution of KMnO4. (b) Verify Beer's law and find out the concentration of unknown solution by spectrophotometer.
12. Determination of the concentration of iron in water sample by using spectrophotometer.
13. Determination of the concentration of Iron (III) by complexometric titration.
14. Proximate analysis of coal.
15. Determination of eutectic point and congruent melting point for a two component system by method of cooling curve.

References:
1. *Vogel's Text Book of Quantitative Chemical Analysis* by G.H. Jefferey, J. Bassett, J. Mendham, and R.C. Denney, Logmaan Scientific & Technical, 1989
2. *Essentials of Experimental Engineering Chemistry* by S. Chawla, Dhanpat Rai & Co., 2008.
3. Experiments in Applied Chemistry by S. Ratan, S.K. KAtaria & Sons, 2003.
4. *Practical Chemistry* by O.P.Pandey, D. N. Bajpai and S. Giri, S.Chand & Co., 2005.
5. *Engineering Chemistry with Laboratory Experiments* by M. S. Kaurav, PHI Learning Pvt. Ltd., 2011.
6. *Laboratory Manual on Engineering Chemistry* by S. K. Bhasin, and Sudha Rani, Dhanpat Rai &Co., 2006.

Note:
1. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above.

Paper Code: ES-157	**Paper: Engineering Graphics-I**	**L**	**P**	**C**
		-	**2**	**1**

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Course Outcomes (CO):

CO1	To understand the theory of projections and projection of points.
CO2	Ability to do line projections.
CO3	Ability to do plane projections.
CO4	Ability to do solid projections and development of surfaces

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	***PO01***	***P O 0 2***	***PO03***	***PO04***	***PO05***	***PO06***	***PO07***	***PO08***	***PO09***	***PO10***	***PO11***	***PO12***
CO1	3	3	3	3	2	-	-	-	1	2	1	2
CO2	3	3	3	3	2	-	-	-	1	2	1	2
CO3	3	3	3	3	2	-	-	-	1	2	1	2
CO4	3	3	3	3	2	-	-	-	1	2	1	2

Unit I
Introduction: Engineering Graphics/Technical Drawing, Introduction to drawing equipments and use of instruments, Conventions in drawing practice. Types of lines and their uses, BIS codes for lines, technical lettering as per BIS codes, Introduction to dimensioning, Types, Concepts of scale drawing, Types of scales
Theory of Projections: Theory of projections, Perspective, Orthographic, System of orthographic projection: in reference to quadrants, Projection of Points, Projection in different quadrants, Projection of point on auxiliary planes. Distance between two points, Illustration through simple problems.

Unit II
Projection of Lines: Line Parallel to both H.P. and V.P., Parallel to one and inclined to other, Other typical cases: three view projection of straight lines, true length and angle orientation of straight line: rotation method, Trapezoidal method and auxiliary plane method, traces of line.

Unit III
Projection of Planes: Projection of Planes Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, Plane oblique to reference planes, traces of planes.
Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points and lines lying in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.

Unit IV

Projection of Solids: Projection of solids in first or third quadrant, Axis parallel to one and perpendicular to other, Axis parallel to one inclined to other, Axis inclined to both the principal plane, Axis perpendicular to profile plane and parallel to both H.P. and V.P., Visible and invisible details in the projection, Use of rotation and auxiliary plane method.

Development of Surface: Purpose of development, Parallel line, radial line and triangulation method, Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, Development of surface.

Note: The sheets to be created shall be notified by the concerned teacher.

Textbooks:

1. *Engineering Drawing* by N.D. Bhatt, 53rd Ed., Charotar Publishing House Pvt. Ltd., Gujarat,2017.

References:

1. *Engineering Drawing* by P.S. Gill, S.K Kataria & Sons, New Delhi, 2013.
2. *Technical Drawing with Engineering Graphics* by Frederick E. Giesecke, Shawna Lockhart, Marla Goodman, and Cindy M. Johnson, 15th Ed., Prentice Hall, USA, 2016
3. *Engineering Drawing* by M.B. Shah and B.C. Rana, 3rd Ed., Pearson Education, New Delhi, 2009.

Paper Code: ES-159 / ES-160	**Paper: Electrical Science Lab.**	**L**	**P**	**C**
		-	**2**	**1**

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of "Electrical Science" as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the office of the Head of Department / Institiution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students

1. To Design the circuit for a given load and selection of its various Components and instruments from the safety point of view

   OR

   To study different types of symbols and standard currently being used inelectrical engineering.

2. Study and applications of CRO for measurement of voltage, frequencyand phase of signals.

3. Connection of lamp by(1)Single Switch Method.(2) Two-way Switch Method.

   OR

   Performance comparison of fluorescent Tube & CFL Lamp.

3. To Verify Thevenin's & Norton's Theorem

   OR

   To Verify Superposition &Reciprocity Theorem.

   OR

   To Verify Maximum Power Transfer Theorem.

4. To Measure Power & Power Factor in a Single-Phase A.C Circuit usingThree Ammeters or three Voltmeters.

5. To Measure Power & Power Factor in a Balanced Three Phase Circuitusing Two Single Phase Wattmeters.

6. To study of Resonance in a series R-L-C or Parallel R-L-C Circuits.
7. To perform open circuit and short circuit test on 1-phase transformer.
8. Starting, Reversing and speed control of DC shunt Motor
9. Starting, Reversing and speed control of 3-phase Induction Motor
10. To Study different types of Storage Batteries & its charging system.
11. To Study different types of earthing methods including earth leakagecircuit breaker (GFCI)

Note:

1. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above.

Paper Code: BS-161 /BS-162	Paper: Environmental Studies Lab.	L	P	C
		-	2	1

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:
1. The course objectives and course outcomes are identical to that of "Environmental Studies" as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the office of the Head of Department / Institiution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students

1. Determination of pH, conductivity and turbidity in drinking water sample.
2. Determination of pH and conductivity of soil/sludge samples.
3. Determination of moisture content of soil sample.
4. Determination of Total Dissolved Solids (TDS) of water sample.
5. Determination of dissolved oxygen (DO) in the water sample.
6. Determination of Biological oxygen demand (BOD) in the water sample.
7. Determination of Chemical oxygen demand (COD) in the water sample.
8. Determination of Residual Chlorine in the water sample.
9. Determination of ammonia in the water sample.
10. Determination of carbon dioxide in the water sample.
11. Determination of nitrate ions or sulphate ions in water using spectrophotometer.
12. Determination of the molecular weight of polystyrene sample using viscometer method.
13. Base catalyzed aldol condensation by Green Methodology.
14. Acetylation of primary amines using eco-friendly method.
15. To determine the concentration of particulate matter in the ambient air using High Volume Sampler.

Note:
1. For better understanding of various aspects of environment visits to local areas, depending upon easy access and importance may be planned to any nearby river, forest, grassland, hills and students should write a report based on their observations.
2. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above

References:
1. *Vogel's Text Book of Quantitative Chemical Analysis* by G.H. Jefferey, J. Bassett, J. Mendham, and R.C. Denney, Logmaan Scientific & Technical, 1989.
2. dst.gov.in/green-chem.pdf (monograph of green chemistry laboratory experiments).
3. *Essentials of Experimental Engineering Chemistry* by S. Chawla, Dhanpat Rai & Co., 2008.
4. Experiments in Applied Chemistry by S. Ratan, S.K. KAtaria & Sons, 2003.

5. *Principles of Environment Science: Enquiry and Applications* by W. Cunningham and M. A. Cunningha, Tata McGraw Hill, 2003.
6. *Perspectives in Environment Studies* by A. Kaushik and C. P. Kaushik, New Age Int. (P) Pub., 2013.

Paper Code: BS-106	Paper: Applied Physics - ll	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Understand and appreciate the quantum nature of reality.
CO2	Understand quantum statistics and its significance.
CO3	Understand Crystalline Structure.
CO4	Understand the band theory of solids and properties and characteristics of diodes.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

Unit I

Quantum Mechanics: Introduction: Wave particle duality, de Broglie waves, the experiment of Davisson and Germer, electron diffraction, physical interpretation of the wave function, properties, the wave packet, group and phase velocity, the uncertainty principle . The Schrödinger wave equation (1D), Eigen values and Eigen functions, expectation values, simple Eigen value problems – solutions of the Schrödinger's equations for the free particle, the infinite well, the finite well, tunneling effect, the scanning electron microscope, the quantum simple harmonic oscillator (qualitative), zero point energy. [12Hrs][T1,T2]

Unit II

Quantum Statistics: The need for statistics , statistical distributions: Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics, their comparisons, Fermions and Bosons, Applications of quantum statistics: 1. Molecular speed and energies in an ideal gas; 2. The Black body spectrum, the failure of classical statistics to give the correct explanations – Bose-Einstein statistics applied to the Black Body radiation spectrum; Fermi-Dirac distribution, free electron theory, electronic specific heats, Fermi energy and average energy; Dying stars. [12Hrs][T1,T2]

Unit III

Crystal Structure: Types of solids, Unit cell, Types of crystals, Translation vectors, Lattice planes, Miller indices, Simple crystal structures, Interplaner spacing, Crystal structure analysis: Bragg's law, Laue method, Point defects: Schottcky and Frankel defects. [8Hrs][T1,T2]

Unit IV

Band Theory of Solids: Origin of energy bands in solids, motion of electrons in a periodic potential – the Kronig–Penny model (Qualitative). Brillouin zones, effective mass, metals, semi-conductors and insulators and their energy band structures. Extrinsic and Intrinsic semiconductors, doping – Fermi energy for doped and undoped semiconductors, the p-n junction (energy band diagrams with Fermi energy), the unbiased diode, forward and reverse biased diodes – tunnel diodes, zener diode, photo diode its characteristics, LED [10Hrs][T1,T2]

Textbooks:

1. *Concepts of Modern Physics (SIE)*by Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury, McGraw – Hill, 2017.
2. *Modern Physics* by Kenneth S. Krane, Wiley, 2020.

References:

1. *Physics for Scientists and Engineers* by Raymond A. Serway and John W. Jewett, 9th Edition , Cengage, 2017
2. *Principles of Physics* by Robert Resnick, Jearl Walker and David Halliday, Wiley, 2015.
3. *Solid State Electronic Devices ,by* Streetman and Ben G Prentice Hall India Learning Private Limited; 2006

Paper Code: BS-112	Paper: Applied Mathematics – II	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

CO1	Ability to use Complex series methods.
CO2	Ability to use Complex analysis to solve formulated engineering problems
CO3	Ability to use Fourier and Laplace methods to solve formulated engineering problems
CO4	Ability to solve specific formulated engineering problems using PDE methods.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*P O 0 2*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	3	3	3	1	-	-	-	-	-	1	2
CO2	2	3	3	3	1	-	-	-	-	-	2	2
CO3	2	3	3	3	1	-	-	-	-	-	2	2
CO4	2	3	3	3	1	-	-	-	-	-	2	2

Unit I

Complex Analysis – I : Complex Numbers and Their Geometric Representation, Polar Form of Complex Numbers. Powers and Roots, Derivative. Analytic Function, Cauchy–Riemann Equations. Laplaceʾs Equation, Exponential Function, Trigonometric and Hyperbolic Functions. Eulerʾs Formula, deʾMoivreʾs theorem (without proof), Logarithm. General Power. Principal Value**.** Singularities and Zeros. Infinity, Line Integral in the Complex Plane, Cauchyʾs Integral Theorem, Cauchyʾs Integral Formula, Derivatives of Analytic Functions, Taylor and Maclaurin Series. [10Hrs]

Unit II

Complex Analysis – II: Laurent Series, Residue Integration Method. Residue Integration of Real Integrals, Geometry of Analytic Functions: Conformal Mapping, Linear Fractional Transformations (Möbius Transformations), Special Linear Fractional Transformations, Conformal Mapping by Other Functions, Applications: Electrostatic Fields, Use of Conformal Mapping. Modeling, Heat Problems, Fluid Flow. Poissonʾs Integral Formula for Potentials [10Hrs]

Unit III

Laplace Transforms: Definitions and existence (without proof), properties, First Shifting Theorem (s-Shifting), Transforms of Derivatives and Integrals and ODEs, Unit Step Function (Heaviside Function). Second Shifting Theorem (t-Shifting), Short Impulses. Dirac's Delta Function. Partial Fractions, Convolution. Integral Equations, Differentiation and Integration of Transforms. Solution of ODEs with Variable Coefficients, Solution of Systems of ODEs. Inverse Laplace transform and its properties.

Fourier Analysis: Fourier Series, Arbitrary Period. Even and Odd Functions. Half-Range Expansions, Sturm–Liouville Problems. Fourier Integral, Fourier Cosine and Sine Transforms, Fourier Transform. Usage of fourier analysis for solution of ODEs. Inverse Fourier transform and its properties. [12Hrs]

Unit IV

Partial Differential Equations (PDEs): Basic Concepts of PDEs. Modeling: Vibrating String, Wave Equation. Solution by Separating Variables. Use of Fourier Series. D'Alembert's Solution of the Wave Equation. Characteristics. Modeling: Heat Flow from a Body in Space. Heat Equation:Solution by Fourier Series. Steady Two-Dimensional Heat Problems. Dirichlet Problem. Heat Equation: Modeling Very Long Bars. Solution by Fourier Integrals and Transforms. Modeling: Membrane, Two-Dimensional Wave Equation. Rectangular Membrane. Laplacian in Polar Coordinates. Circular Membrane. Laplace's Equation in Cylindrical and Spherical Coordinates. Potential. Solution of PDEs by Laplace Transforms. [10Hrs]

Textbooks:

1. *Advanced Engineering Mathematics* by Erwin Kreyszig, John Wiley, 10th Ed., 2011.

References:

1. *Engineering Mathematics* by K.A. Stroud withDexter J. Booth, Macmillan, 2020.
2. *Advanced Engineering Mathematics* by Larry Turyn, Taylor and Francis, 2014.
3. *Advanced Engineering Mathematics* by Dennis G. Zill, Jones & Bartlett Learning, 2018.
4. *Advanced Engineering Mathematics with MATLAB* by Dean G. Duffy, Taylor and Francis, 2017.
5. *Advanced Engineering Mathematics* by Merle C. Potter, Jack L. Lessing, and Edward F. Aboufadel, Springer (Switzerland), 2019.
6. *Mathematical Methods for Physics and Engineering*, by K. F. Riley, M. P. Hobson and S. J. Bence, CUP, 2013.

Paper Code: ES-114	Paper: Engineering Mechanics	L	T/P	C
		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 12 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 12.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Outcomes (CO):

CO1	Ability to solve problems pertaining to force systems, equilibrium and distributed systems.
CO2	Ability to solve problems of friction and engineering trusses.
CO3	Ability to deal with the problems of kinematics and kinetics of particle
CO4	Ability to deal with the problems of kinematics and kinetics of rigid bodies.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*P O 0 2*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	2	-	-	-	1	1	1	2
CO2	3	3	3	3	2	-	-	-	1	1	1	2
CO3	3	3	3	3	2	-	-	-	1	1	1	2
CO4	3	3	3	3	2	-	-	-	1	1	1	2

Unit I

Force System: Introduction, force, principle of transmissibility of force, resultant of a force system, resolution of a force, moment of force about a line, Varigon's theorem, couple, resolution of force into force and a couple, properties of couple and their application to engineering problems.

Equilibrium: Force body diagram, equations of equilibrium and their applications to engineering problems, equilibrium of two force and three force members.

Distributed Forces: Determination of center of gravity, center of mass and centroid by direct integration and by the method of composite bodies, mass moment of inertia and area moment of inertia by direct integration and composite bodies method, radius of gyration, parallel axis theorem, polar moment of inertial. [10Hrs]

Unit II

Structure: Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section and graphical method.

Friction: Static and Kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, frictional lock, friction in flat pivot and collar bearing, friction in flat belts. [10Hrs]

Unit III

Kinematics of Particles: Rectilinear motion, plane curvilinear motion, rectangular coordinates, normal and tangential coordinates.

Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work-energy equation, conservation of energy, concept of impulse and momentum, conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact. [10Hrs]

Unit IV

Kinematics of Rigid Bodies: Concept of rigid body, types of rigid body motion, absolute motion, introduction to relative velocity, relative acceleration (Including Coriolis's component) and instantaneous center of zero velocity, Velocity and acceleration.

Kinetics of Rigid Bodies: Equation of motion, translatory motion and fixed axis rotation, application of work energy principles to rigid bodies conservation of energy.

Beam: Introduction, types of loading, methods for the reactions of a beam, space diagram, types of end supports, beams subjected to couple. [10Hrs]

Textbooks:

1.*Engineering Mechanics* by A.K.Tayal, Umesh Publications.

References:

1. *'Engineering Mechanics'* by K. L. Kumar, Tata Mc-Graw Hill
2. 'Engineering Mechanics' by S. Timoshenko, D. H. Young, J. V. Rao, Tata Mc-Graw Hill
3. 'Engineering Mechanics-Statics and Dynamics' by Irwing H. Shames, PHI.
4. 'Engineering Mechanics' by Basudev Bhattacharya, Oxford University Press.

Paper Code: BS-152	Paper: Applied Physics - II Lab.	L	P	C
		-	2	1

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:
1. The course objectives and course outcomes are identical to that of (Applied Physics - I) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institiution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students

1. To determine the e/m ratio of an electron by J.J. Thomson method.
2. To measure the frequency of a sine-wave voltage obtained from signal generator and to obtain lissajous pattern on the CRO screen by feeding two sine wave signals from two signal generators.
3. To determine the frequency of A.C. mains by using Sonometer.
4. To determine the frequency of electrically maintained tuning fork by Melde's method.
5. Computer simulation (simple application of Monte Carlo): Brownian motion, charging & discharging of a capacitor.
6. To study the charging and discharging of a capacitor and to find out the time constant.
7. To study the Hall effect.
8. To verify Stefan's law.
9. To determine the energy band gap of a semiconductor by four probe method/or by measuring the variation of reverse saturation current with temperature.
10. To study the I-V characteristics of Zener diode.
11. To find the thermal conductivity of a poor conductor by Lee's disk method.
12. To study the thermo emf using thermocouple and resistance using Pt. Resistance thermometer.

Note: Teacher's may use the prescribed books to choose the practicals in addition to above. Total 8 practicals minimum shall be performed by the students, they may be asked to do more. Atleast 4 experiments must be from the above list.

Textbook:
1. *B.Sc. Practical Physics* by C. L. Arora, S.Chand & Co., 2020.
2. *Practical physics* by R. K. Shukla and A. Srivastava, New Age Int. (P) Ltd., 2006.

Paper Code: ES-158	Paper: Engineering Graphics-II	L	P	C
		-	2	1

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Course Outcomes (CO):

CO1	Ability to draw sectional diagrams of solids
CO2	Ability to draw 3S projections (isometric and oblique).
CO3	Ability to draw perspective projections.
CO4	Understand and use a CAD tool (AutoCAD).

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	2	-	-	-	1	2	1	2
CO2	3	3	3	3	2	-	-	-	1	2	1	2
CO3	3	3	3	3	2	-	-	-	1	2	1	2
CO4	3	3	3	3	2	-	-	-	1	2	1	2

Unit I
Section of Solids: Definition of Sectioning and its purpose, Procedure of Sectioning, Illustration through examples, Types of sectional planes-application to few examples.

Unit II
Isometric Projection: Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and drawing, Isometric projection of solids such as cube, prism, pyramid and cylinder.
Oblique Projection: Principle of oblique projection, difference between oblique projection and isometric projection, receding lines and receding angles, oblique drawing of circle, cylinder, prism and pyramid.

Unit III
Perspective Projection: Principle of perspective projection, definitions of perspective elements, visual ray method, vanishing point method.
Conversion of 3D to 2D figures.

Unit IV
Introduction to CADD: Interfacing and Introduction to CAD Software, Coordinate System, 2D drafting: lines, circles, arc, polygon, etc., Dimensioning, 2-D Modelling, Use of CAD Software for engineering drawing practices.

Note: The sheets to be created shall be notified by the concerned teacher.

Textbooks:
1. *Engineering Drawing* by N.D. Bhatt, 53rd Ed., Charotar Publishing House Pvt. Ltd., Gujarat,2017.

References:
1. *Engineering Drawing* by P.S. Gill, S.K Kataria & Sons, New Delhi, 2013.

2. *Technical Drawing with Engineering Graphics* by Frederick E. Giesecke, Shawna Lockhart, Marla Goodman, and Cindy M. Johnson, 15th Ed., Prentice Hall, USA, 2016
3. *Engineering Drawing* by M.B. Shah and B.C. Rana, 3rd Ed., Pearson Education, New Delhi, 2009.
4. *AutoCAD 2017 for Engineers & Designers* by Sham Tickoo,, Dreamtech Press 2016.

Paper Code: ES-164	Paper: Workshop Technology	L	P	C
		-	2	1

Marking Scheme:
1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:
1. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Institution in which the paper is being offered.

Course Objectives:

1:	The students will learn basics of safety precautions to be taken in lab. / workshop
2:	The students will have an overview of different machines used in workshop and the operations performed on these machines.
3:	The students will have understanding of various welding processes.
4:	The students will have understanding of sheet metals hop and fitting shop

Course Outcomes (CO):

CO1	Ability to safely work in a Lab./workshop.
CO2	Ability to use machines (lathe, mill, shaper, planer, grinder, drill).
CO3	Ability to weld.
CO4	Ability to use sheet metal tools and fitting shop tools.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*P O 0 2*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	1	2	2	3	3	-	-	-	-	-	2
CO2	2	1	2	2	3	1	-	-	-	-	-	2
CO3	2	1	2	2	3	1	-	-	-	-	-	2
CO4	2	1	2	2	3	1	-	-	-	-	-	2

Unit I

Safety, precautions and maintenance: Safety in shop, safety devices, safety and precautions - moving machine and equipment parts, electrical parts and connections, fire, various driving systems like chain, belt and ropes, electrical accidents, an overview of predictive, preventive and scheduled maintenance, standard guidelines to be followed in shop.

Unit II

Introduction to machine shop: Introduction to Lathe, Milling, shaper, Planer, grinder, drilling and overview of operations performed on these machines by making some jobs.

Unit III

Introduction to welding shop: Welding, types of welding, tools and applications, gas welding and arc welding, edge preparation, various joints formation by gas welding and electric arc welding.

Unit IV

Introduction to sheet metal shop: Sheet metal tools and operations, formation of a box using sheet.
Introduction to fitting shop: Introduction to fitting, tools and applications, some jobs in fitting shop.

Textbooks:

1. *Workshop Technology Vol. 1 and Vol. 2*, Hajra Choudhary and Roy, Media Promoters and Publishers, 2018.

References:

1. *A course in Workshop Technology Vol.1 and Vol. 2*, B. S. Raghuvanshi, Dhanpat Rai and Compnay, 2015.
2. *Workshop Technology (Manufacturing Processes)*, Khurmi and Gupta, S. Chand Publication, 2010.