First Semester

Group	Paper Code	Paper Title	L	P	Credits
Theory Papers					
MDC	AR101	Engineering Mathematics-I	3	-	3
SEC	AR103	Programming for Problem Solving using C	3	-	3
DSC	AR107	Basics of Computer Organisation	3	-	3
DSC	AR109	Applied Engineering Materials	3	-	3
MSC	AR111	Basic Electrical Engineering	3	-	3
AEC	AR113	Design Thinking#(NUES)	1	-	1
VAC	AR115	Human Values and Ethics#(NUES)	2	-	2
Practical/Viva-Voce					
SEC	AR151	Programming for Problem Solving using C Lab	-	2	1
DSC	AR153	Applied Engineering Materials Lab	-	2	1
MSC	AR155	Basic Electrical Engineering Lab	-	2	1
AEC	AR157	Programming in Python Lab	-	2	1
					22

 # (NUES): Non-University Exam Subject, Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Second Semester

Group	Paper Code	Paper Title	L	P	Credits
Theory Papers					
DSC	AR102	Data Structures	3	-	3
DSC	AR104	Engineering Mathematics-II	3	-	3
MSC	AR114	Engineering Physics for Smart Systems	3	-	3
MDC	AR116	Environmental Studies	2	-	2
SEC	AR118	Analog Electronics	3	-	3
AEC	AR120	Communication Skills	2	-	2
Practical/Viva-Voce					
DSC	AR152	Data Structures Lab	-	2	1
MSC	AR160	Engineering Physics for Smart Systems Lab	-	2	1
MDC	AR162	Environmental Studies Lab	-	2	1
SEC	AR164	Electronics Lab / Workshop	-	2	1
VAC	AR166	Analytics and Dashboard Development Lab	-	4	2
					22

 # (NUES): Non-University Exam Subject, Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Important Notes:

1. a) The examinations, attendance criteria to appear in examinations, promotion and award of the degree shall be governed by the Ordinance 11 of the University.
   b) Grading System shall be as per Ordinance 11 of the University.
2. Minimum duration of the Bachelor of Technology programme and Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme shall be 4 years (N=4 years) (8 semesters) for the students admitted in the first year/ first semester of the degree programme.
3. Lateral entry students shall be admitted in the second year / third semester of the degree programme (will be considered effectively in the batch admitted in the first year in the previous academic session and shall be deemed to have been exempted from the courses/papers of the first year of the degree programme). No exemption certificate shall be issued in any case. The minimum exit time/year for lateral-entry students shall be the same as for the batch in which he/she is admitted as a lateral-entry student in the second year.
4. Maximum duration of the Bachelor of Technology programme shall be 7 years (N+3 years). After completion of N+3 years of study, no extension shall be given to the student for completing the requirements of the degree and the admission of the student shall stand cancelled.
5. (a) To earn an Honours degree, the student may enrol for 20 credits or more (over and above the total offered credits in the classroom) through SWAYAM / NPTEL MOOCs platform only. The acquisition of the credits should be completed before the 15th of July of the graduating year.
   (b) Honours degree shall be awarded if and only if at least 20 credits are acquired through MOOCs. To obtain Honours in the programme, the student must apply for the same to the school/institute/college in the fifth semester by 30th August. The school/institute/college shall inform the list of such students to the Examination Division of the University.
   (c) The specific courses through MOOCs shall be registered by the student only after approval of a sub-committee of the Academic Programme Committee (APC) approved by the Dean/Director/Principal of the school/institute/college. The APC shall approve the course if it is not already studied by the student or the student shall not study it in future and adds value to the major area of specialization of the degree. The result of the approved papers shall be submitted by the student to the school/institute/college to be forwarded to the Examination Division of the University.
   (d) The cost of taking the MOOC course is to be borne by the concerned student. Such courses shall be reflected as additional courses/papers for the student.
   (e) The papers through MOOCs for the Honours Degree shall not be part of the curriculum considered for the computation of the student's SGPA/CGPA.
   (f) No Honours shall be conferred if the degree requirements are not completed within the minimum duration.
   (g) If a student has qualified any subject, which is a component of another online/offline degree program offered by any other university in India or abroad, it shall not be counted towards the award of Honours degree.
   (h) No Honours shall be conferred if the student fails in any of the papers offered to the student, at the time of verification for the award of the honours degree. That is, the Honours degree shall be conferred only to students with full credits of total offered credits.

(i) No Honours shall be conferred if the student has taken any of the interim degrees (as per MEME guidelines of University).

(j) The Honours degree shall only be awarded if the CGPA of the student is 7.5 and above. In addition, the student should be eligible for the award of the degree after the immediate completion of the fourth year of the course.

6. Multiple Entry Multiple Exit (MEME) Option is as per guidelines of University (refer notification number: F.34 (11)(13)/2025/DAA/1448 dated:24.03.2026).

7. Credit Summary:
   a. The students shall undergo the group of Courses / Papers (Refer Table 1) as enumerated in the scheme (For the students admitted in the First Year / First Semester)

Table 1: Distribution of Credits

Year	**1**		**2**		**3**		**4**		**Total Credits**
Semester	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
DSC	7	7	7	13	12	16	14	20	96
MSC	4	4	4	4	8	6	6		36
MDC	3	3	3	3					12
AEC	2	2	2	2					8
SEC	4	4	4						12
VAC	2	2	2						6
SI					2		2		4
Total	22	22	22	22	22	22	22	20	**174****
	44		44		44		42		
Minimum Requirement	**40#**		**80##**		**120###**		**160***		

*Courses under AEC, VAC, and SI categories are compulsory. Research Seminar, Minor Project and Major Project are mandatory components of the programme whichever category/group they belong. NSS/NCC/DSW Clubs/Tech or Non-Tech Clubs/Societies of school/institute/college worth 2 credits to be earned over and above the minimum requirements.

For **B.Tech Honours, MOOCS of 20 credits are to be earned over and above the Total Credits offered.

Students intending to exit the programme after the completion of the first year as per MEME of university will obtain **Certificate in AIDS**, subject to earning 04 additional credits (over and above the minimum credit requirement prescribed) by doing domain-specific internship/ apprenticeship of minimum 8 weeks either in the University or in Industry that would help the candidates to acquire job-ready competencies required to enter the workforce.

Students intending to exit the programme after the completion of the second year as per MEME of university will obtain **Diploma in AIDS**, subject to earning 04 additional credits (over and above the minimum credit requirement prescribed) by doing domain-specific internship/ apprenticeship of minimum 8 weeks either in the University or in Industry that would help the candidates to acquire job-ready competencies required to enter the workforce. The student upon rejoining for third year may not require to apply for additional summer internship (if any such course requirement exists for fifth semester), his internship to meet exit condition as per prescribed guideline of MEME, may be considered for evaluation of such course.

Students intending to exit the programme after the completion of the third year as per MEME of university will get **Bachelor of Science (BSc) in AIDS,** subject to fulfillment of minimum requirement as prescribed in MEME of university.

b. The students admitted as Lateral Entry shall undergo Courses / Papers as enumerated in the scheme after third semester need to earn minimum 120* credits for completion of degree (i.e., first year is exempted from Table 1) and guidelines of MEME of University shall be followed for any interim degree. For B.Tech Honours, MOOCS of 20 credits are to be earned over and above the Total Credits offered.

8. Only after qualifying for the award of the degree of Bachelor of Technology, the student may be allowed to proceed to the Master in Technology part of the Bachelor / Master of Technology (Dual Degree)%.
9. The scheme and syllabi of the Master of Technology part of the Bachelor / Master of Technology (Dual Degree) is notified separately%.

NOTE: % Points 8 and 9 apply to USS-USAR only.

DETAILED SYLLABUS FOR 1st SEMESTER

Paper code : AR101	L	P	Credit
Paper Title : Engineering Mathematics-I	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Ability of students to apply basic calculus [K1, K2, K3]
CO2: Ability of students to apply vector calculus to solve engineering problems [K1, K2, K3, K4]
CO3: Ability of students to understand complex analysis [K1,K2]
CO4: Ability of students to understand laplace transforms and fourier analysis [K1, K2, K3]

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

Course Content	**No of Lectures**
Unit I **Calculus I:** Extreme values of a continuous function, mean value theorem, Solving definite and improper integrals: Area between two curves, Integration by parts and method of partial Fractions, Partial differentiation, Chain rule.	[8]
Unit II **Calculus II**: Total derivative, Directional derivatives and the gradient, divergence and curl, series, Taylor series (in one and two variables), maxima and minima of functions, Method of Lagrange multiplier, line and surface integrals, applications of Gauss, Stokes and Green's theorem.	[8]
Unit III **Complex Analysis:** Complex numbers, polar form of complex numbers, Analytic functions Cauchy-Riemann Equations, Cauchy's Integral Theorem, Cauchy's Integral Formula, Taylor and Maclaurin Series, Laurent Series, Singularities and zeros, Residue Integration method.	[8]
Unit IV **Laplace Transform:** Basic definition, Linearity of Laplace transform, first shifting theorem (s-shifting), Transforms of derivatives and integrals, Using Laplace transform to solve ODE with initial value problems. **Fourier Series and Transform:** Basic definition of fourier series, Half range expansions, Fourier Cosine and sine transforms	[8]

Text Books

[T1] Strauss, M. J., Bradley, G. L., & Smith, K. J. (2024). Calculus (15th ed.). Pearson. (Use the latest edition prescribed by Pearson for your institution, if different.)

[T2] Kreyszig, E. (2025). Advanced engineering mathematics (11th Indian adaptation ed.). Wiley India

Reference Books

[R1] Weir, M. D., Hass, J., Heil, C., & Bogacki, P. (2024). Thomas' calculus (15th ed.). Pearson.

[R2] Zill, D. G. (2022). Advanced engineering mathematics (7th ed.). Jones & Bartlett Learning**.**

Paper code : AR103	L	P	Credit
Paper Title : Programming for Problem Solving using C	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Understand the basic structure of C programming, number systems, and the compilation process of a C program. [K1]
CO2: Apply programming constructs like operators, loops, conditionals, and arrays in C to solve problems. [K2]
CO3: Analyze and implement advanced programming constructs such as functions, recursion, strings, and pointers. [K1,K2]
CO4: Develop and implement programs involving structures, unions, and file handling. [K2]

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

Course Content	**No of Lectures**
Unit I **Introduction to Programming:** 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:** Basic structure of C programs, process of compiling and running a C program, tokens, keywords, identifiers, constants, strings, special symbols, variables, data types, I/0 statements. Interconversion of variables.	[8]
Unit II **Basics of Number Systems:** Introduction to Number Systems, Types of Number Systems (Binary, Decimal, Octal, Hexadecimal), Conversion Between Number Systems, Signed and Unsigned Numbers: Representation of negative numbers (Sign-magnitude, 1's complement, 2's complement) **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. **Control structures:** Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements.	[8]

Unit III **Arrays:** 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.	[8]
Unit IV **Pointers:** Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers/ 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.	[8]
Text Books **[T1]** Balagurusamy, E. (2019). Programming in ANSI C (8th ed.). McGraw Hill Education. **[T2]** Kanetkar, Y. (2018). Let Us C (17th ed.). BPB Publications. **[T3]** Kernighan, B. W., & Ritchie, D. M. (1988). The C Programming Language (2nd ed.). Prentice Hall. (Known as K&R, the classic authoritative book on C)	
Reference Books **[R1]** Engineering Problem Solving With C by Delores M. Etter, Pearson, 2013. Problem Solving and **[R2]** Program Design in C by Jeri R. Hanly and Elliot B. Koffman, Pearson, 2016. **[R3]** Venugopal, K. R., & Prasad, S. R. (2007). Mastering C. Tata McGraw Hill. **[R4]** Das, S. (2008). The C Programming Language. BPB Publications. **[R5]** Morris Mano, M. (2017). Digital Logic and Computer Design (4th ed.). Pearson Education. **[R6]** Rajaraman, V. (2010). Fundamentals of Computers (5th ed.). PHI Learning. **[R7]** Gottfried, B. S. (1996). Programming with C (2nd ed.). Schaum's Outline Series, McGraw-Hill. **[R8]** Kochan, S. G. (2005). Programming in C (3rd ed.). Sams Publishing.	

Paper code : AR107	L	P	Credit
Paper Title : Basics of Computer Organization	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units, as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Understand number systems, Boolean algebra, and design basic combinational and sequential logic circuits. [K2]
CO2: Analyze and design digital components such as adders, multiplexers, flip-flops, and counters used in CPUs. [K4]
CO3: Describe the structure and functioning of a computer system including instruction sets, CPU, memory, and I/O. [K2]
CO4: Evaluate memory organization and performance enhancement techniques like pipelining and caching. [K5]

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

Course Content	**No of Lectures**
Unit I **Digital Logic Fundamentals** **Number Systems & Codes:** Binary, octal, decimal, hexadecimal, Signed numbers: 1's and 2's complement, BCD, ASCII, Gray code. **Boolean Algebra and Logic Gates:** Postulates and theorems, Truth tables, Basic and universal logic gates, SOP and POS forms, Karnaugh Maps (K-Map) for 2 to 4 variables. **Combinational Logic Design:** Adders (Half, Full), Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Comparators.	[8]
Unit II **Sequential Logic & Digital Building Blocks** **Sequential Logic Basics:** Flip-Flops (SR, D, T, JK) – operation and timing, Registers, Shift registers, Counters – asynchronous and synchronous. **Memory Elements:** Basics of RAM, ROM, PROM, EPROM, Static vs Dynamic RAM, Timing diagrams and read/write operations. **CPU Control Logic Introduction:** Difference between combinational and sequential circuits, Concept of FSM (Finite State Machines), Brief introduction to control logic in CPU.	[8]

Unit III **Computer Organisation & I/O Systems:** **Basic Functional Blocks of a Computer:** CPU, memory, I/O subsystems, control unit, Instruction execution cycle, RTL interpretation, Addressing modes and instruction set architecture, **I/O System Organisation:** Program-controlled, interrupt-driven and DMA, Peripheral devices: characteristics and interfacing, Privileged vs non-privileged instructions, Software interrupts, traps, and process transitions	[8]
Unit IV **Advanced Memory and Performance Techniques:** **Performance Enhancement Techniques:** Pipelining: basic concepts, stages, Pipeline hazards: structural, data, and control, Throughput and speedup **Memory Hierarchy:** Cache memory: mapping techniques – direct, associative, set-associative, Cache replacement policies: FIFO, LRU, random, Write policies: write-through and write-back, Memory interleaving, Concept of hierarchical memory organisation	[8]
Test Books **[T1]** Mano, M. M. (2007). Computer system architecture (3rd ed.). Prentice Hall of India. **[T2]** Hamacher, C., Vranesic, Z. G., & Zaky, S. G. (2002). Computer organization (5th ed.). McGraw-Hill. **[T3]** Patterson, D. A., & Hennessy, J. L. (2020). Computer organization and design: The hardware/software interface (6th ed.).	
Reference Books **[R1]** Stallings, W. (2006). Computer organization and architecture: Designing for performance (7th ed.). Pearson/Prentice Hall. **[R2]** Gaonkar, R. S. (2002). Microprocessor architecture, programming, and applications with the 8085 (5th ed.). Prentice Hall. **[R3]** Carpinelli, J. D. (2001). Computer systems organization and architecture. Pearson Education. **[R4]** Hennessy, J. L., & Patterson, D. A. (2019). Computer architecture: A quantitative approach (6th ed.). Morgan Kaufmann. **[R5]** Roth, C. H., Jr., & Kinney, L. L. (2020). Fundamentals of logic design (8th ed.). Cengage Learning.	

Paper code : AR109	L	P	Credit
Paper Title : Applied Engineering Materials	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : As per University norms

- There should be 9 questions in the end term examination question paper
- Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- Apart from Question No. 1, the rest of the paper shall consist of four units.
- As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Ability of students to understand the basic concepts of engineering materials, their structure and properties. [K2, K3]
CO2: Ability of students to understand and analyze the properties and applications of metals. [K2,K3,K4]
CO3: Ability of students to understand and analyze the properties and applications of nonmetals, composites and smart materials. [K2,K3,K4]
CO4: Ability of students to understand about the characterization techniques and their implications to analyze the materials to be applied in different fields. [K2,K3,K4,K5]

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

Course Content	No of Lectures
Unit I **Introduction to Engineering Materials:**Types of Materials: Metals, ceramics, polymers, semiconductors and composites and their structure, properties, and typical applications. Bonding and Structure: Metallic, covalent, ionic, and van der Waals bonds; implications for material behaviour. Crystallography: Study unit cell configurations, crystal lattices, grain boundaries, and common defects like vacancies and dislocations. Mechanical Behaviour: study of stress-strain curves, modulus of elasticity, yield and tensile strength, ductility, hardness, brittleness, toughness and fatigue; Nanomaterials: Properties at the nanoscale, top-down vs. bottom-up fabrication.	[8]
Unit II **Metals and Alloys:** Metals, Phase diagrams, Gibb's phase rule, Unary and binary phase diagrams, Fe-Fe3 C phase diagram; ferrous metals: cast irons, effect of alloying element on iron, relationship between the phase diagrams and properties of alloys, Time temperature transformation (TTT) diagram, heat treatment of steels: annealing, normalizing, hardening, tempering, case hardening, high strength low alloy steel (HSLA), non-ferrous metal alloys: aluminium alloys, brasses, bronzes etc. Shape Memory Alloys.	[8]

Unit III **Non-metals, Composites and Smart Materials:** Ceramics: properties, classification, and applications, Glasses: composition, characteristics, and engineering uses; Polymers: thermoplastics, thermosets, elastomers; basic properties and applications. Composites: Matrix and reinforcement, classification of composites: particle-reinforced, fiber-reinforced, hybrid composites, metal matrix composites, ceramic matrix composites, polymer matrix composites, carbon-carbon composites and nano-composites. Smart materials: Piezoelectric, thermoelectric, and optoelectronic materials, thermochromic, electrochromic, and photochromic materials.	[8]
Unit IV **Characterization of Materials:** Microscopy Techniques: Principles, magnification, resolution limits of Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM). Spectroscopy Techniques: Energy Dispersive X-ray Spectroscopy (EDS/EDX): Elemental composition in conjunction with SEM; Infrared Spectroscopy (IR) and UV-Visible Spectroscopy; X-ray Diffraction (XRD); Mechanical and surface characterization: Hardness, tensile and impact testing, surface roughness and wettability.	[8]
Text Books **[T1]** Shackelford, J. F. (2023). Introduction to materials science for engineers (9th ed.). Pearson Education. **[T2]** Callister, W. D., & Rethwisch, D. G. (2018). Materials science and engineering: An introduction (10th ed.). Wiley. **[T3]** Budinski, K. G., & Budinski, M. K. (2016). Engineering materials: Properties and selection (9th ed.). Pearson Education. **[T4]** Smith, W., & Hashemi, J. (2023). Foundations of materials science and engineering (7th ed.). McGraw Hill.	
Reference Books **[R1]** Ashby, M. F., & Jones, D. R. H. (2012). Engineering materials 1: An introduction to properties and design (4th ed.). Elsevier. **[R2]** Kaur, H. (2020). Instrumental methods of chemical analysis (13th ed.). Pragati Prakashan**.** **[R3]** Kumar, U., & Sonkar, P. K. (2024). Smart materials for science and engineering. Wiley.	

Paper code : AR111	L	P	Credit
Paper Title : Basic Electrical Engineering	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : As per University norms

- There should be 9 questions in the end term examination question paper
- Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- Apart from Question No. 1, the rest of the paper shall consist of four units.
- As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Ability of students to understand the fundamental concepts of core electrical engineering especially direct current and circuit theory with network theorems. [K1, K2, K3]
CO2: Ability of students to provide knowledge about single phase and three phase electrical circuits. [K2, K3, K4]
CO3: Ability of students to understand the basics of magnetic circuits and electrical transformers. [K1, K2]
CO4: Ability of students to basic understanding of electrical rotating DC and AC machines. [K1, K2]

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

Course Content	No of Lectures
Unit I **D.C. Circuits:** Active and passive elements, Voltage and current sources, dependent and independent sources, Source conversion, Ohm's Law, Kirchhoff's Law, Superposition theorem, Thevenin's theorem, Norton theorem, Maximum Power Transfer Theorem and their application for analysis of series and parallel resistive circuits, Power & Energy in such circuits. Mesh & nodal analysis, Star-Delta transformation & circuits.	[8]
Unit II **AC Circuits:** 1- phase AC Circuits: Generation of sinusoidal AC voltage, definition of average value, R.M.S. value, form factor and peak factor of AC quantity, Concept of phasor, Concept of Power factor, Concept of impedance and admittance, Active, reactive and apparent power, analysis of R-L, R-C, R-L-C series & parallel circuit. **3-phase AC Circuits:** Necessity and advantages of three phase systems, Relationship between line and phase values for balanced star and delta connections, Power in balanced & unbalanced three-phase system.	[8]

Unit III **Magnetic Circuits:** Basic definitions, magnetization characteristics of Ferromagnetic materials, self-inductance and mutual inductance, energy in linear magnetic systems, coils connected in series, AC excitation in magnetic circuits, magnetic field produced by current carrying conductor, Force on a current carrying conductor. Induced voltage, laws of electromagnetic Induction, direction of induced E.M.F. Single phase transformer: General construction, working principle, e.m.f. equation, equivalent circuits, phasor diagram, voltage regulation, losses and efficiency, open circuit and short circuit test.	[8]
Unit IV **Electrical Machines:** Construction, Classification & Working Principle of DC machine and 1-Phase induction machine. Working principle of 3-Phase induction motor, Concept of slip in 3- Phase induction motor, Torque-slip characteristics of 3-Phase induction motor. Types of losses occurring in electrical machines. Applications of DC machine and induction machine.	[8]
Text Books **[T1]** Kothari, D. P., & Nagrath, I. J. (2019). Basic electrical engineering (4th ed.). McGraw Hill Education. **[T2]** Singh, S. N. (2013). Basic electrical engineering. PHI Learning. **[T3]** Wadhwa, C. L. (2007). Basic electrical engineering (4th ed.). New Age International. **[T4]** Theraja, B. L., & Theraja, A. K. (2024). A textbook of electrical technology: Volume I: Basic electrical engineering (24th ed.). S. Chand Publishing	
Reference Books **[R1]** Muthusubramanian, R., & Salivahanan, S. (2025). Basic electrical and electronics engineering (2nd ed.). McGraw Hill Education . **[R2]** Lal Seksena, S. B., & Dasgupta, K. (2017). Fundamentals of electrical engineering. Cambridge University Press.	

Paper code : AR113	L	P	Credit
Paper Title : Design Thinking#(NUES)	1	0	1

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University norms

- ➢ There should be 9 questions in the end term examination question paper.
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Explain the fundamentals of Design Thinking, Universal Design, and Sustainability. [K2]
CO2: Analyze user needs and sustainability challenges using empathy-based approaches. [K4]
CO3: Apply ideation techniques to develop innovative and inclusive solutions. [K3]
CO4: Evaluate design solutions with respect to sustainability and SDG requirements. [K5]

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

Course Content	No of Lectures
Unit I **Introduction to Design Thinking:** What is Design Thinking?, Understanding Universal Design Principles and their implication, Design Thinking vs. Traditional Problem Solving, Identify and Analyze the needs of diverse and differently-abled populations.	[2]
Unit II **Understand the SDGs and their applicability:** What are the Sustainable Development Goals, Importance of adoption in Engineering and Innovation, Methods and Areas of Applicability, Sustainable and Inclusive Design.	[3]
Unit III **Empathy and User Research Problem Definition:** Understanding Users and Stakeholders, Observation Techniques through Interviews and Surveys, Empathy Mapping - Synthesizing User Insights, Writing Problem Statements	[3]
Unit IV **Ideation and Creativity:** Brainstorming– alternative thinking**,** Mind Mapping and creating Storyboards**,** Generate and evaluate multiple solution concepts, Concept Selection.	[4]

Text Books

[T1] Brown, T., & Katz, B. (2019). Change by design: How design thinking transforms organizations and inspires innovation (Vol. 20091). New York, NY: HarperBusiness.

[T2] Norman Donald, A. (2013). The design of everyday things. MIT Press.

[T3] Elliott, J. (2012). An introduction to sustainable development. Routledge.

Reference Books

[R1] Manzini, E. (2015). Design, when everybody designs: An introduction to design for social innovation. MIT press.

[R2] Department of Economic. (2020). The Sustainable Development Goals Report 2020. Stylus Publishing, LLC.

[R3] Cross, N. (2023). Design thinking: Understanding how designers think and work. Bloomsbury Publishing.

[R4] Chick, A. (2012). Design for social innovation: Emerging principles and approaches. Iridescent, 2(1), 78-90.

Paper code : AR115	L	P	Credit
Paper Title : Human Values and Ethics#(NUES)	2	0	2

Marking Scheme:
Teachers Continuous Evaluation: 100 marks
This is an NUES paper, the examinations are to be conducted by the concerned teacher.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Demonstrate ethical values, professional integrity, and responsible behavior in personal and professional life. [K2, K3]
CO2: Analyze engineering ethics, professional responsibilities, and ethical dilemmas in engineering practice using ethical principles. [K2, K3]
CO3: Evaluate safety, risk, and professional responsibilities to support ethical decision-making in engineering practice. [K4, K5]
CO4: Evaluate ethical, environmental, and professional issues in global engineering practice and leadership. [K5]

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

Course Content	**No of Lectures**
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 workplace, Spirituality.	[5]
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.	[5]

Unit III **Professional Safety, Risk Management, and Engineering Responsibility:** Safety definition, Safety and risk, Risk analysis, Assessment of safety and risk, Safe exit, Risk-benefit analysis Safety 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.	[5]
Unit IV **Globalization, Professional Ethics, and Ethical Leadership:** 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.	[5]
Text Books **[T1]** Naagarazan, R. S. (2006). A textbook on professional ethics and human values. New Age International. **[T2]** Harris, C. E., Pritchard, M. S., & Rabins, M. J. (2012). Engineering ethics (5th ed.). Cengage Learning.	
Reference Books **[R1]** Martin, M. W., & Schinzinger, R. (2017). Ethics in engineering (4th ed.). McGraw Hill Education. **[R2]** Fleddermann, C. B. (2014). Engineering ethics (4th ed.). Pearson. [**R3**] Martin, M. W., & Schinzinger, R. (2010). Introduction to engineering ethics. McGraw-Hill. **[R4]** Harris, C. E., Pritchard, M. S., & Rabins, M. J. (2009). Engineering ethics: Concepts and cases (4th ed.). Cengage Learning. **[R5]** Whitbeck, C. (2007). Ethics in engineering practice and research. Cambridge University Press.	

Paper code : AR157	L	P	Credit
Paper Title : Programming in Python Lab	0	2	1

Marking Scheme:
Internal Evaluation: As per university examination norms from time to time.
End Term Practical Examination: As per university examination norms from time to time.

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: The students will learn Programming in the Python Language. [K2]
CO2: The students will learn the usage of language implemented data structures. [K3]
CO3: The students shall learn the object-oriented features of the Python Language. [K4]
CO4: The students will learn the usage of the NumPy. [K5]

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

Course Content	**No of Lectures**
Unit I **Python Basics:** Identifiers, keywords, statements & expressions, variables, operators, precedence & associativity, data types, indention, comments, console I/O, type conversion. Control flow statements (if family; while & for loops; continue & break statements), exception handling. Functions, command line argument.	[6]
Unit II **Python Data Structures:** String management & usage, Lists, Dictionaries, Tuples & Sets. The operations on these data structures. Filter, Map, and Reduce Function.	[6]
Unit III **Object Oriented Programming:** Properties/attributes, methods, inheritance, class variables & functions, static methods, delegation, abstract base classes, and Generic functions.	[6]
Unit IV **Numpy:** Dtypes, Multidimensional Arrays, Slicing, Numpy Array & Memory, Array element-wise operations, Numpy Data I/O, floating point numbers. Pandas: Using series and Dataframes, Indexing & Reindexing, Deleting and merging items, Common operations, Memory usage and dtypes, Pipes, Displaying dataframes.	[6]

Text Books
[T1] Gowrishankar, S., & Veena, A. (2019). Introduction to Python programming. CRC Press.
[T2] Unpingco, J. (2021). Python programming for data analysis. Springer Nature.

Reference Books
[R1] Parker, J. R. (2016). Python: An introduction to programming. Mercury Learning & Information.
[R2] Sharma, V. K., Kumar, V., Pathak, S., & Pathak, S. (2021). Python programming: A practical approach. CRC Press.

DETAILED SYLLABUS FOR 2nd SEMESTER

Paper code : AR102	L	P	Credit
Paper Title : Data Structures	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Understand data structures, algorithm analysis, searching, and sorting techniques. [K2]
CO2: Apply linear data structures such as arrays, linked lists, stacks, and queues in solving computational problems. [K3]
CO3: Evaluate tree-based data structures and balancing techniques for efficient storage, searching, and sorting. [K5]
CO4: Analyze graph traversal methods, disjoint data structures, and hashing techniques for efficient problem solving. [K4]

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

Course Content	**No of Lectures**
Unit I **Introduction to Data Structures:** Overview of Data Structures, Data types – primitive and non-primitive, Basics of Algorithms Analysis, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Asymptotic Notations, Types of Data Structures- Linear & Non Linear Data Structures, Concept of Abstract Data Types. Sorting – Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Sequential (Linear) Search and Binary Search	[9]
Unit II **Linear Data Structures:** Array: Representation of arrays, Applications of arrays: sparse matrix and its representation, polynomials and polynomials arithmetics; Linked List: Singly Linked List, Doubly Linked list, Circular linked list; Applications of linked list: Stack-Definitions & Concepts, Operations On Stacks, Linked List vs Array implementation of Stack; Applications of Stacks: Prefix, Infix and Postfix Expressions; Queue: Representation Of Queue, Operations On Queue, Linked List vs Array implementation of Queue, Circular Queue, Priority Queue.	[8]

Unit III **Trees:** Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees, Balanced trees: AVL trees, Height Balanced Tree, B Tree, B+ Tree; Introduction to Heap, Heap Sort.	[7]
Unit IV **Fundamentals of Graphs & Hashing:** Disjoint Data Structures, Union-Find Algorithm, Representation Of Graphs, Graph Traversals: Breadth First Search and Depth First Search; Hashing: Hashing Functions, Collision Resolution Techniques.	[8]
Text Books **[T1]** Horowitz, E., Sahni, S., & Mehta, D. P. (2008). Fundamentals of Data Structures in C++ (2nd ed.). Universities Press (India). **[T2]** Langsam, Y., Augenstein, M. J., & Tenenbaum, A. M. (2015). Data Structures Using C and C++ (2nd ed.). Pearson Education India. **[T3]** Tremblay, J. P., & Sorenson, P. G. (2012). An Introduction to Data Structures with Applications. Tata McGraw Hill. **[T5]** Gilberg, R. F., & Forouzan, B. A. (2011). Data Structures: A Pseudocode Approach with C (2nd ed.). Cengage Learning India Pvt. Ltd.	
Reference Books **[R1]** Cormen, T. H., Leierson, C. E., Riest, R. L., & Stein, C. (2022). Introduction to algorithms. MIT press. **[R2]** Weiss, M. A. (2014). Data Structures and Algorithm Analysis in C++ (4th ed.). Pearson Education.	

Paper code : AR104	L	P	Credit
Paper Title : Engineering Mathematics-II	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : As per University norms

- There should be 9 questions in the end term examination question paper
- Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Ability of students to understand, apply and analyze the basic concepts of linear algebra and matrix theory [K1,K2,K3,K4]
CO2: Ability of students to solve system of linear equations, determine eigenvalue, eigen vectors and apply them to real world problems [K1, K2, K3]
CO3: Ability of students to solve ordinary differential equations to solve engineering problems [K1,K2, K3]
CO4: Ability of students to solve some important partial differential equations like wave, heat and laplace equation [K1, K2, K3, K4]

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

Course Content	No of Lectures
Unit I **Linear Algebra I:** Vector space, subspaces, linear dependence and independence of vectors, bases, and dimension, matrices, Rank and nullity of a matrix, rank -nullity theorem (without proof), Projection matrix, symmetric, skew-symmetric matrix, Orthogonal and unitary matrix, Idempotent matrix, Partition matrix	[8]
Unit II **Linear Algebra II:** Solution of systems of linear equations, Gaussian elimination, Eigenvalues and Eigenvectors with applications, Algebraic and geometric multiplicity, Determinant and its properties, Projections, LU decomposition, Singular value decomposition, Quadratic forms	[8]
Unit III **Ordinary Differential Equations:** First order linear and nonlinear differential equations: : Separable ODEs, exact ODEs and integrating factor, Bernoulli equations. Homogeneous linear ODEs of second (and higher) order with constant coefficients, Euler-Cauchy equations, Wronskian, Solution of non homogeneous linear ODEs: : method of undetermined coefficients, Method of variation of parameters	[8]

Unit IV **Partial Differential Equations:** Basic concepts of PDEs, heat, wave, and Laplace equation and their solution by method of separating variables, D'Alembert's solution of wave equation.	[8]
Text Books **[T1]** Kreyszig, E. (2025). Advanced engineering mathematics (11th Indian adaptation ed.). Wiley India. **[T2]** Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). Linear algebra (5th ed.). Pearson.	
Reference Books **[R1]** Stroud, K. A., & Booth, D. J. (2020). Engineering mathematics (8th ed.). Macmillan International Higher Education. **[R2]** Zill, D. G. (2022). Advanced engineering mathematics (7th ed.). Jones & Bartlett Learning.	

Paper code : AR114	L	P	Credit
Paper Title : Engineering Physics for Smart Systems	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Ability to understand and apply the concept of semiconductor physics, their transport dynamics and various practical applications. [K1, K2, K3, K4]
CO2: Ability to understand, apply and distinguish interference and diffraction phenomena and understand the laser systems. [K1, K2, K3, K4]
CO3: Ability to apply Maxwell's equations to solve electromagnetic field and wave propagation problems.[K1, K2, K3, K4
CO4: Understand and apply the concepts of quantum mechanics. [K1, K2, K3, K4]

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11
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

Course Content	No of Lectures
Unit I **Semiconductor Physics and Electronic Materials:** Overview of classification of materials: Conductors, Semiconductors, Insulators. Intrinsic and Extrinsic Semiconductors: their energy bands, Fermi Level and carrier concentration. Carrier Transport in semiconductors: Drift and diffusion currents, Mobility and conductivity, Generation and Recombination of carriers; Hall Effect Phenomenon, Working Principle and Practical Applications- Classification of materials, Determination of material type, and Calculation of material parameters	[8]
Unit II **Optics:** Interference: Division of Wavefront -Young's Double Slit Experiment and Division of Amplitude - Newton's Rings Experiment, Michelson Interferometer. **Diffraction:** Introduction, single slit diffraction, analyzing the intensity pattern, central maxima, and minima, Diffraction grating (qualitative overview). **LASER:** Coherence, population inversion and basic principles, Construction, the He-Ne laser, the Ruby laser and their applications.	[8]

Unit III **Electromagnetics:** Maxwell's Equations: Differential and Integral form and their interpretation, Boundary conditions, work done by the electromagnetic field and Poynting Vector. **Electromagnetic waves:** the wave equation, plane electromagnetic waves, energy carried by electromagnetic waves, skin depth.	[8]
Unit IV **Quantum Mechanics and its applications:** Wave-Particle Duality, De-Broglie hypothesis, Davisson-Germer Experiment. **Schrodinger Wave Equation:** Time Dependent and time-Independent forms; particle in a 1D infinite potential box. **Practical applications of Quantum mechanics:** IV-Characteristics of tunnel diode, Overview of Carbon Nanotubes and Graphene.	[8]
Text Books **[T1]** Serway, R. A., & Jewett, J. W. (2017). Physics for scientists and engineers (9th ed.). Cengage Learning. **[T2]** Beiser, A., Mahajan, S., & Choudhury, S. R. (2017). Concepts of modern physics (SIE ed.). McGraw-Hill Education. **[T3]** Kittel, C., & McEuen, P. (2018). Introduction to solid state physics. John Wiley & Sons.	
Reference Books **[R1]** Ghatak, A. (2024). Optics (8th ed.). McGraw Hill Education. **[R2]** Sze, S. M., & Ng, K. K. (2008). Semiconductor devices: Physics and technology (3rd ed.). Wiley. **[R3]** Pillai, S. O. (2006). Solid state physics. New Age International.	

Paper code : AR116	L	P	Credit
Paper Title : Environmental Studies	2	0	2

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: The course is designed to impart basic knowledge of the environment and its components. [K2, K3]
CO2: The course deals with creating awareness about the environmental resources, their sustainable management, current environmental problems faced by the world and their probable solutions.[K1, K2,K3,K4]
CO3: A detailed understanding of the cause, effect and controlling measures of environmental pollution, waste management and related case studies. [K2,K3,K4]
CO4: To understand and explore different approaches, government initiatives for protecting the environment, conserving ecosystems, and maintaining sustainability for the benefit of society. [K1, K2,K3]

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

Course Content	No of Lectures
Unit I **Fundamentals**: **The Multidisciplinary nature of environmental studies:** Definition, components, scope, and importance, need for public awareness; **Ecosystems:** Concept, Structure and function of an ecosystem, energy flow in ecosystems, food chain, food web, ecological pyramids, ecological succession; Introduction to types, characteristics features, structure and function of different ecosystems including forest, grassland, desert and aquatic ecosystem; **Biodiversity:** Introduction to biodiversity- definition, genetics, species, ecosystem diversity, bio-geographical classification of India, value of biodiversity-consumptive uses, productive, social, ethical, aesthetic and option values, India as a mega diversity nation, hot spots of biodiversity, threats to biodiversity– habitat loss, poaching of wild life, man wildlife conflicts and conservation of biodiversity-in-situ and ex-situ conservation.	[5]

Unit II **Water Resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems **Forest resources:** Use and over-exploitation, deforestation, Timber extraction, mining, dams, and their effects on forest and tribal people, case studies. **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **Sustainable management:** Energy, water, air, infrastructure, mobility, greenhouse effects.	[5]
Unit III **Environmental Pollution and waste management:** **Air Pollution:** Types of pollutants, source, effects, sink & control of primary pollutants CO, NOX, HC, SOx, and particulates; **Water Pollution:** Classification of Pollutants, their sources, wastewater treatment (domestic and industrial); **Soil Pollution:** Composition of soil, classification, and effects of solid pollutants and their control; **Marine Pollution:** Causes, effects, and control of marine pollution, coastal zone management; **Thermal pollution:** Causes, effects, and control of marine pollution, coastal zone management. **Waste Management:** **Solid Waste Management:** Classification, waste treatment and disposal methods; composting, sanitary land filling, thermal processes, recycling and reuse methods; **Hazardous wastes:** Classification, radioactive, biomedical & chemical, treatment and disposal- Physical, chemical and biological processes. **E-Waste and Battery Waste:** Classification, sources and characteristics of e-waste and battery waste, environmental impacts, collection and segregation, recycling, resource recovery, treatment and disposal – physical, chemical and biological processes, Extended Producer Responsibility (EPR), and sustainable management practices.	[7]
Unit IV **Environmental Policies, Human Population, and Environment:** Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, case studies; Some important Environmental laws, issues involved in enforcement of environment legislations, Green bench; carbon footprint, Montreal and Kyoto Protocol, The Chemical Weapons Convention, Environment Impact Assessment; population growth and variation among nations; Role of government and non-government organizations in public awareness and environment improvement. **Disaster Management:** Floods, earthquakes, cyclones, and landslides.	[5]
Text Books **[T1]** Gadi, R., Rattan, S., & Mohapatra, S. (2024). A textbook of environmental studies (5th ed.). S. K. Kataria & Sons **[T2]** Meenakshi, P. (2012). Elements of environmental science and engineering (2nd ed.). PHI Learning Pvt. Ltd. **[T3]** Kaushik, A., & Kaushik, C. P. (2010). Basics of environment and ecology. New Age International Publishers.	
Reference Books **[R1]** Mishra, D. D. (2023). Fundamental concepts in environmental studies for undergraduate students: NEP 2020 (Revised ed.). S. Chand Publishing. **[R2]** Bharucha, E. (2025). Textbook of environmental studies for undergraduate courses (4th ed.). Universities Press. **[R3]** Joseph, B. (2017). Environmental studies (3rd ed.). McGraw Hill Education. (The 3rd edition is the latest widely available edition.)	

Paper code : AR118	L	P	Credit
Paper Title : Analog Electronics	3	0	3

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University norms

- ➢ There should be 9 questions in the end term examination question paper
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- ➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Understanding the basics of Diodes and designing biasing schemes for transistor circuits. [K1, K2, K3]
CO2: Analyzing the description of JFET and MOSFET devices. [K1, K2, K3]
CO3: Apply operational amplifier (Op-Amp) characteristics to design and analyze various linear and non-linear Op-Amp circuits. [K1, K2, K3]
CO4: Foundational understanding of power amplifiers, filters, and multivibrators for effective signal processing and waveform generation. [K1, K2, K3, K4]

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

Course Content	No of Lectures
Unit I **P-N Junctions:** Junction diode theory, forward bias and reverse bias, reverse-bias breakdown, Diode applications- clippers, clampers, half wave & full wave rectification, Special purpose diodes - Zener diode, Light Emitting Diode. **Bipolar Junction Transistor:** BJT basics, Configurations, DC operating Point, variation and its stability, BJT characteristics and parameters, BJT as an amplifier and as a switch, Biasing circuits, Single stage BJT amplifiers.	[8]
Unit II **FET:** Introduction to Junction Field Effect Transistor, Characteristics of JFET, Merits and demerits of JFETs. **MOSFET Circuits:** Fundamentals of MOS structure, FET Types, n & p-type Depletion-type and Enhancement-type MOSFET structures, I-V characteristics, MOSFET as a switch.	[8]

Unit III **Operational Amplifiers:** Ideal op-amp: Definition, Block diagram, Operation, Characteristics, μA 741 pin diagram, Output offset voltage, input bias current, input offset current, CMRR, slew rate, gain bandwidth product, Inverting and Non-inverting amplifiers, Differentiator, integrator,Op-amp voltage adder, Square-wave and Triangular-wave generators, Log and Antilog amplifier.	[8]
Unit IV **Power amplifiers:** Class A amplifier, Class B Push-Pull amplifier, Class C Tuned amplifier. **Filters:** Definition, working Passive: low pass, high pass, and band pass filters. **Multivibrators:** Block Diagram and Internal Architecture of 555 Timer, Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator.	[8]
Text Books **[T1]** Sedra, A. S., Smith, K. C., Carusone, T. C., & Gaudet, V. (2020). Microelectronic circuits (8th ed.). Oxford University Press. **[T2]** Boylestad, R. L., & Nashelsky, L. (2017). Electronic devices and circuit theory (11th ed.). Pearson Education. **[T3]** Salivahanan, S., Suresh Kumar, N., & Vallavaraj, A. (2018). Electronic devices and circuits (3rd ed.). McGraw Hill Education.	
Reference Books **[R1]** Neamen, D. A. (2009). Microelectronics: Circuit analysis and design (4th ed.). McGraw-Hill Education. **[R2]** Bell, D. A. (2008). Electronic devices and circuits (5th ed.). Oxford University Press.	

Paper Code: AR120	L	P	Credit
Paper Title: Communication Skills	2	-	2

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University norms

- ➢ There should be 9 questions in the end-term examination question paper.
- ➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
- ➢ Apart from Question No. 1, the rest of the paper shall consist of four units As per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
- ➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: Understand foundational grammar and vocabulary for technical/professional contexts [K1, K2]
CO2: Apply writing principles for professional documents (e.g., emails, resumes, reports) [K3, K4]
CO3: Demonstrate verbal and non-verbal communication in workplace scenarios [K3,K6]
CO4: Critically analyze and interpret spoken/written material for effective communication[K4, K5]

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

Course Content	**No of Lectures**
Unit I **Language Basics and Functional Grammar :**Parts of Speech, Sentence Structure, Subject-Verb Agreement, Tense and Voice.	[5]
Unit II **Writing for the Workplace :** Professional Email Writing, Resume Writing and Cover Letters , Notice, Circular, Memo, Summarizing and Paraphrasing	[5]
Unit III **Speaking and Presentation Skills:**Group Discussion Techniques, Body Language, Voice Modulation and Presentation Basics, Verbal vs. Non-Verbal Communication, Barriers to Effective Communication and Remedies	[5]
Unit IV **Textual and Visual Comprehension + Practical Integration:** Reading Comprehension: 2 passages from speeches/articles (e.g., Spielberg's speech at Harvard Commencement 2016 https://www.youtube.com/watch?v=Ty0toDunfu0) Audio-Visual Analysis: (Reference: Johan Rockstrom's TED Talk; key takeaways discussion Let the Environment Guide our Development) http://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development), Cultural Sensitivity and Inclusivity: Brief on UN gender-neutral language (United Nations https://www.un.org/en/gender-inclusive-language/index.shtml)	[5]

Text Books

[T1] Wren, P. C., & Martin, H. (2010). High school English grammar and composition. S. Chand & Company Ltd.
[T2] Raman, M. (2015). Technical communication: Principles and practice (3rd ed.). Oxford University Press.

Reference Books/Readings

[R1] Eastwood, J. (2020). Be grammar ready. Oxford University Press.
[R2] Kumar, S., & Lata, P. (2018). Communication skills: A workbook. Oxford University Press.
[R3] Tyagi, K., & Mishra, P. (2012). Basic technical communication. PHI Learning.

Paper code : AR166	L	P	Credit
Paper Title : Analytics and Dashboard Development Lab	0	4	2

Marking Scheme:
Internal Evaluation: As per university examination norms from time to time.
End Term Practical Examination: As per university examination norms from time to time.

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1: The ability of students to apply advanced spreadsheet techniques using Excel for data entry, manipulation, formula creation, functions, lookups, conditional analysis, and worksheet management. [K3]
CO2: The ability of students to Analyze and summarize data using Excel tools such as charts, Pivot Tables, Power Query, Data Validation, Analysis ToolPak, and data visualization techniques. [K4]
CO3: The ability of students to develop interactive business intelligence solutions using Power BI by creating data models, reports, dashboards, visualizations. [K6]
CO4: The ability of students to design and implement effective data visualizations and dashboards using Tableau, including data preparation, calculations, mapping, and visualization. [K6]

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

Course Content	No of Lectures
Unit I **Excel Fundamentals, Formulas, and Data Analysis:** Introducing Excel, exerting and editing worksheet data- exploding, modifying, performing best worksheet operations, working with excel ranges and tables, formatting worksheet, understanding excel files and templates, printing your work, customizing the excel user interface, working with formulas and functions- array, math, dates. Using formulas to manipulate text, conditional analysis, matching, LookUps.	[12]
Unit II **Advanced Excel Data Visualization and Analytical Tools:** Getting started with excel charts, advanced charting techniques, creating graphics, managing and analysing data, data validation, linking and consolidating worksheet, pivot tables, analyzing data with pivot tables, analysis toolPak, protecting your work, internal data model, power query, summarizing data using data visualization, power view and 3D maps.	[10]
Unit III **Power BI for Data Modeling, Reporting, and Dashboarding:** Getting started with Power BI, uploading data, introducing natural language queries, quick insight, reports, visual interactions, decorating, saving report, pinning, filtering, sharing the dashboard, understanding data refresh, using Power BI Desktop, getting data from services and content packs, building a data model, improving power BI reports, getting data from existing system, integrating Power Bi with office, managing security to access data, extending and customising power BI.	[10]

Unit IV **Tableau for Data Preparation, Visualization, and Dashboard Design:** Tableau Introduction, creating Worksheet,dashboard, connecting tableau to your data, measure name and values, tableau concepts, exporting data to other devices. Getting your data ready, tableau prep builder, all about data-joins, blends, data structure, table calculations, data densification, cubes and big data, level of detail calculations, beyond the basic chart types, mapping, tableau for presentations, visualization best practices and dash board design.	[10]

Text Books

[T1] Winston, W. (2021). Microsoft Excel data analysis and business modeling (Office 2021 and Microsoft 365). Microsoft Press.

[T2] Ferrari, A., & Russo, M. (2016). Introducing Microsoft Power BI. Microsoft Press.

[T3] Meier, M., & Baldwin, D. (2021). Mastering Tableau 2021: Implement advanced business intelligence techniques and analytics with Tableau. Packt Publishing Ltd.

Reference Books

[R1] Alexander, M., & Kusleika, D. (2025). Microsoft Excel 365 Bible. John Wiley & Sons.

[R2] Machiraju, S., & Gaurav, S. (2018). Power Bi data analysis and visualization. DeG Press.

[R3] Jackson, A., & Stanke, L. (2021). Tableau Strategies. " O'Reilly Media, Inc