Knowledge and Attitude Profile (WK)

- **WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

- **WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

- **WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

- **WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

- **WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

- **WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

- **WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

- **WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

- **WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Programme Outcomes

- **PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in **WK1 to WK4** respectively to develop solutions for complex engineering problems.
- **PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (**WK1 to WK4**)
- **PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society, and the environment as required. (**WK5**)
- **PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis and interpretation of data to provide valid conclusions. (**WK8**)
- **PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling, recognizing their limitations to solve complex engineering problems. (**WK2 and WK6**)
- **PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for their impact on sustainability with reference to economy, health, safety, legal framework, culture, and the environment. (**WK1, WK5, and WK7**)
- **PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international laws. (**WK9**)
- **PO8: Individual and Collaborative Team Work:** Function effectively as an individual, and as a member or leader in diverse and multidisciplinary teams.
- **PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
- **PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects in multidisciplinary environments.
- **PO11: Life-Long Learning:**
  Recognize the need for, and have the preparation and ability for:
  i) independent and life-long learning;
  ii) adaptability to new and emerging technologies; and
  iii) critical thinking in the broadest context of technological change. (**WK8**)

Course / Paper Group Codes:

ES: Engineering Science
BS: Basic Science
PC: Programme Core, that is course / paper offered in the discipline of the programme as a compulsory paper.
PCE: Programme Core Elective, that is elective course / paper offered in the discipline of the programme.
VAC: Value Added Course
AEC: Ability Enhancement Course
SEC: Skill Enhancement Course
SI: Summer Internship

Definitions:
Batch: The batch of the student shall mean the year of the first time enrolment of the students in the programme of study in the first semester. Lateral entry students admitted in the 3rd semester / 2nd year shall be designated as students admitted in the previous batch as they are admitted one year later. A student re-admitted in a programme of study in a lower/later batch shall be considered as the student of the original batch for calculation of the duration of the study.

Programme of study shall mean Bachelor of Technology.

Acronyms:
APC: Academic programme committee comprising all faculty of the institute.
L: Number of Lecture hours per week
P:Practical Hours per week
C: Number of credits assigned to a course / paper
COE: Controller of Examinations of the Examinations Division of the University.
SGPA/CGPA: Semester/Cumulative Grade Point Average.
NUES: No end term examination shall be held. The evaluation shall be conducted as per the scheme of examinations as described in the scheme of study.

Third Semester

Group	Paper Code	Paper Title	L	P	Credits
Theory Papers					
PC	AIDS201	Software Engineering	3	-	3
PC	AIDS203	Data Structures	3	-	3
PC	AIDS205	Computer Networks	3	-	3
PC	AIDS207	Probability and Statistics	3	-	3
SEC	AIDS209	Object Oriented Programming using Java	3	-	3
AEC	AIDS211	Accountancy for Engineers[#](NUES)	2	-	2
VAC	AIDS213	Optimization Techniques	2	-	2
Practical/Viva-Voce					
PC	AIDS253	Computer Networks Lab	-	2	1
SEC	AIDS255	Object Oriented Programming using Java Lab	-	2	1
PC	AIDS257	Data Structures	-	2	1
					22

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

Fourth Semester

New Group	Paper Code	Paper Title	L	P	Credits
Theory Papers					
PC	AIDS202	Database Management Systems	3	-	3
PC	AIDS204	Fundamentals of Machine Learning	3	-	3
PC	AIDS206	Operating System	3	-	3
PC	AIDS208	Introduction to Artificial Intelligence and Ethics	3	-	3
PC	AIDS210	Analysis and Design of Algorithm	3	-	3
AEC	AIDS212	Technical Writing[#](NUES)	2	-	2
Practical/Viva-Voce					
PC	AIDS252	Database Management Systems Lab	-	2	1
PC	AIDS254	Machine Learning Lab	-	2	1
PC	AIDS256	Operating System Lab	-	2	1
PC	AIDS258	Introduction to Artificial Intelligence Lab	-	2	1
PC	AIDS260	Analysis and Design of Algorithm Lab	-	2	1
					22

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

Students are supposed to enroll for Summer Internship (SI w.r.t. AIDS361) upon completion of 4th semester and whose evaluation will be performed towards the end of 5th Semester.

Paper Code : AIDS201	L	P	Credit
Paper Title : Software 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: Student will be able to understand the concepts of Software Engineering.[K1, K2, K3]
CO2: Capability to perform requirement analysis and project planning of software systems. [K2, K3]
CO3: Student will be able to meet and understand the design and reliability of software systems. [K1, K2, K4]
CO4: Student will be able to learn software testing techniques and software maintenance. [K2, K3,K4].

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

Course Content	No of Lectures
Unit I **Introduction**: Software Engineering Paradigms. Software processes and its models (waterfall, Increment Process Models, Prototype Model, RAD, Spiral Model, Rational Unified Process) Agile Development model, plan driven vs agile model of development, agile methods and development techniques (user stories, refactoring, test first development, pair programming, agile project management (SCRUM agile method).	[8]
Unit II **Software Requirement Analysis and Specification:** Software Requirement Process, Functional and non-functional requirements, Quantifiable and Quality Requirements, System and software Requirements, requirement elicitation methods, requirement analysis and validation, requirement review or requirement change, SRS document. System modelling: Interaction models: Use case diagram, sequence diagrams, Structural models: class diagrams, generalization, aggregation, Behavioural models: ER diagrams, Data flow diagrams, data dictionaries. Software Project Planning: Software Size, LOC and Function point, cost and effort estimation, COCOMO Model.	[9]
Unit III **Software Metrics:** Project Metrics, Product Metrics and Process Metrics. Information flow Model Software Design: Architectural views and patterns, Modularity (cohesion and coupling), Information hiding, Functional independence, Function Oriented Design, Object Oriented Design, User Interface Design. Software Reliability : Failure and Faults, Reliability Models: Basic Model, Logarithmic Model	[7]

Unit IV **Software Testing:** Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: Path testing, Data flow and mutation testing, unit testing, integration and system testing, User testing (alpha, beta and acceptance testing), Regression Testing, Stress Testing, Debugging, Testing Tools & Standards. Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Software maintenance: Maintenance prediction, Re-Engineering, Refactoring. Software Configuration Management: Change Requirements, Version Control, Change Management. Case study of software Engineering	[8]
Text Books **[T1]** Pressman, R. S. (2023). Software engineering a practitioner's approach. Palgrave macmillan. **[T2]** Aggarwal, K. K. (2024). Software engineering. 4th Edition New Age International. **[T3]** Sommerville, I. (2026). Software Engineering 10th Edition (International Computer Science). Essex, UK: Pearson Education, 1-808.	
Reference Books **[R1] S**ommerville, I. (2011). Software Engineering, 9/E. Pearson Education India. **[R2]** Jalote, P. (2012). An integrated approach to software engineering. Springer Science & Business Media. **[R3]** Bruegge, B., & Dutoit, A. H. (2009). Object–oriented software engineering. using uml, patterns, and java. Learning, 5(6), 7.	

Paper code: AIDS203	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	-	-	-	1	-	2
CO3	3	3	3	2	2	-	-	1	-	-	2
CO4	3	3	2	2	3	-	-	1	1	-	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 : AIDS205	L	P	Credit
Paper Title : Computer Networks	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: To Understand the basic concepts of Computer Network. [K1, K2]
CO2: Apply data link layer concepts including framing, error detection, flow control mechanisms, MAC protocols, and Ethernet standards in network design and analysis[K1, K2, K3]
CO3: To Analyze the different Routing Techniques and IP Addressing Schemes and wireless/ad hoc routing protocols such as AODV. [K4]
CO4: Evaluate transport and application layer protocols, campus networks, IoT, and UAV-based communication systems.[K3, K4].

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

Course Content	No of Lectures
Unit I **Introduction:** Introduction to data communication; concept of layering; OSI reference model and TCP/IP protocol stack; comparison of OSI and TCP/IP models. Data and signals; digital and analog transmission techniques. Bandwidth utilization techniques.Switching techniques: circuit switching, packet switching and virtual circuit switching	[8]
Unit II **Data Link Layer:** Functions of the data link layer; Framing techniques; Error detection and Correction Techniques; Introduction to flow control, stop and wait protocol, sliding window protocol. Medium Access Control (MAC) protocols. Ethernet (IEEE 802.3) standards and Ethernet bridging.	[9]

Unit III **Network Layer:**Functions of the network layer; routing algorithms and protocols including shortest path routing, flooding, distance vector routing and link state routing. Fragmentation. IP addressing: IPv4 addressing and CIDR notation. IP support protocols: ARP, DHCP and ICMP. Network Address Translation (NAT). **Introduction to Wireless Networks:**Wireless LAN (IEEE 802.11) overview, characteristics of wireless networks, challenges in wireless routing. **Ad hoc Routing Protocol:**Ad hoc On-Demand Distance Vector (AODV) routing protocol – concept, route discovery, route maintenance, advantages and limitations.	[8]
Unit IV **Transport Layer:**Transport layer services: flow control and congestion control; User Datagram Protocol (UDP); Transmission Control Protocol (TCP); Multiplexing and Demultiplexing, socket programming concepts. **Application Layer:** Application layer protocols: Domain Name System (DNS), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP); electronic mail architecture.	[7]
Text Books **[T1]** Forouzan, B. A. (2017). Data communications and networking (5th ed.). McGraw-Hill Education. **[T2]** Kurose, J. F., & Ross, K. W. (2021). Computer networking: A top-down approach (8th ed.). Pearson Education. **[T3]** Tanenbaum, A. S., & Wetherall, D. J. (2021). Computer networks (6th ed.). Pearson Education.	
Reference Books **[R1]** Peterson, L. L., & Davie, B. S. (2022). Computer networks: A systems approach (6th ed.). Morgan Kaufmann. **[R2]** Comer, D. E. (2019). Internetworking with TCP/IP: Principles, protocols, and architecture (Vol. 1, 6th ed.). Pearson Education. **[R3]** Stallings, W. (2014). Data and computer communications (10th ed.). Pearson Education. **[R4]** Lammle, T. (2020). CCNA 200-301 official cert guide, volume 1. Wiley.	

Paper Code : AIDS207	L	P	Credit
Paper Title : Probability and Statistics	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 basic probability concepts and random variables[K1, K2, K3]
CO2: Ability of students to understand basic expectation, variance, and discrete probability distributions used in engineering problems [K2, K3]
CO3: Ability of students to understand continuous probability distributions and joint distributions [K1,K2]
CO4: Ability of students to learn confidence intervals and hypothesis testing and apply in various engineering applications [K1, K2]

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

Course Content	No of Lectures
Unit I **Probability Theory:** Basic concept of probability, Probability axioms, Sample space and Events, Independent and mutually exclusive events, Law of addition and multiplication of probabilities, Conditional probability, Law of total probability, Bayes' theorem, Random variables: Discrete and continuous with their basic properties, probability mass function and probability distribution function, Cumulative distribution function, Conditional PDF	[8]
Unit II **Statistics and Discrete Distributions:** Independent random variables, Expectation and variance of random variables, Skewness and kurtosis, Covariance between random variables, Spearman's rank correlation coefficient, Moment generating function, Chebyshev's inequality, Discrete distributions: Discrete uniform, Bernoulli, Binomial, Poisson.	[9]
Unit III **Continuous distributions, Central limit theorem and Joint distributions:** Continuous uniform, Normal, standard normal, exponential, t-distribution, chi-squared distribution. Sample mean, Central Limit Theorem, Sample variance, Joint probability mass function and joint probability density function, Expectation of two-dimensional random variables, Conditional mean and conditional variance.	[8]

Unit IV **Confidence Interval and Hypothesis testing:** Confidence interval for population mean when variance is (i) known (ii) unknown, Confidence interval for variance of a normal distribution, Confidence interval for difference in means. Hypothesis testing: tests for means of normal distribution when variance is (i) known (ii) unknown. Testing the equality of means of two normal populations	[7]

Text Books

[T1] Ross, S. M. (2020). Introduction to probability and statistics for engineers and scientists. Academic press.

[T2] Montgomery, D. C., & Runger, G. C. (2019). Applied statistics and probability for engineers. Wiley.

[T3] Gupta, S. C., and Kapoor, V.K. (2020). Fundamentals of mathematical statistics. Sultan Chand & Sons.

Reference Books

[**R1]** Hines, W. W., Montgomery, D. C., & Borror, D. M. G. C. M. (2008). Probability and statistics in engineering. John Wiley & Sons.

[R2] Ravichandran J. (2023). Probability and Statistics for Engineers. Wiley.

[R3] Miller I. and Miller M. (2013). Mathematical statistics with applications. Pearson India.

Paper Code : AIDS209	L	P	Credit
Paper Title : Object Oriented Programming using Java	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 how to implement Object Oriented concepts through Java.[K2]
CO2: Understand Inheritance and apply the basics of Java 8 Constructs in inheritance.[K2]
CO3: Identify and apply the Java Exception handling to program Java applications. [K2, K3]
CO4: Identify and apply the Java thread model to program Java applications.[K2, K3]

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

Course Content	No of Lectures
Unit I **Object Oriented Paradigm:** Procedural vs. object-oriented development, basic concepts of object-oriented programming, applications and benefits of OOP. **Java Basics:** Java as Object-oriented Programming Language History of Java, Features of Java, Difference between Java and C++, Java Architecture (JDK, JVM, JRE), Java Tokens. **Basics of Java programming:** Data types, Literals, Variables, Scope and lifetime of variables, Operators. Control Structures including selection, Looping, Arrays.	[8]
Unit II **Introducing Classes:** Creating a Class: properties, methods and constructors. Object Access modifiers, this keyword, Static (variable, method, block), final keyword, String class and methods. **Inheritance:** Types, Super keyword, method overriding, covariant return type, abstract class. Interfaces and Packages: Creation and implementing an interface, difference between abstract class and interface, Packages, and importing a package. **Polymorphism:** Dynamic binding, Generic programming, Casting objects, Instance of operator, Method Overloading.	[9]

Unit III **Using I/O:** Elementary concepts of Input/Output, using the byte streams, reading and writing using byte streams, automatically closing a file, using the character-based streams, File I/O using character streams (using a File Writer and using a File Reader). **Exception Handling:** Exception Class, built-in checked and unchecked exceptions, user defined exceptions, use of try, catch, throw, throws, finally**.**	[8]
Unit IV **Multi-threaded programming:** Multithreading fundamentals, Thread class, and Runnable interface, the life cycle of thread, creation of single and multiple threads, implementation of Thread methods, Synchronization (using Synchronized methods, synchronized statement).	[7]
Text Books **[T1]** Schildt, H. (2019). Java: The Complete Reference (11th ed.). McGraw Hill Education. **[T2]** Sierra, K., & Bates, B. (2005). Head First Java (2nd ed.). O'Reilly Media.	
Reference Books **[R1]** Balagurusamy, E. (2019). Programming with Java: A Primer (6th ed.). McGraw Hill Education. **[R2]** Horstmann, C. S. (2000). Computing Concepts with Java 2 Essentials (2nd ed.). John Wiley & Sons.	

Paper Code : AIDS211	L	P	Credit
Paper Title : Accountancy for Engineers#(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)] for Accountancy for Engineers
CO1: Ability of students to understand the objectives, nature, principles, concepts, conventions, and functions of accounting along with its relationship with other disciplines [K1, K2, K3, K4]
CO2: Ability of students to prepare journal entries, ledger accounts, cash book, subsidiary books, and trial balance using accounting procedures and bookkeeping techniques [K1, K2, K3, K4, K5]
CO3: Ability of students to prepare and analyze final accounts, including Trading Account, Profit & Loss Account, and Balance Sheet, along with understanding Green Accounting, Social Responsibility Accounting, and Accounting Ethics [K2, K3, K4, K5]
CO4: Ability of students to understand the concept and methods of depreciation and apply depreciation accounting techniques using the Straight Line Method and Written Down Value Method [K1, K2, K3, K4, K5]

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

Course Content	No of Lectures
Unit I Objectives and Nature of Accounting, Definitions and Functions of Accounting, Bookkeeping and Accounting, Interrelationship of Accounting with other Disciplines, Branches, and Limitations. Accounting Principles, Accounting Concepts, and Conventions.	[5]
Unit II Journal entries, Compound Journal Entries, Opening Entry, Ledger Posting, and Trial Balance, Preparation of Ledger, Posting, Cash Book, Sales and Purchase Book, and Trial Balance.	[5]
Unit III **P**reparation of Final Accounts with Adjustment, Trading Account, Profit and Loss Account, Balance Sheet. Green Accounting, Social Responsibility Accounting, and Accounting Ethics.	[5]
Unit IV Concept of Depreciation, Causes and Features of Depreciation, Depreciation Accounting, Fixation of Depreciation Amount, Methods of Depreciation: Straight line method and written down value method.	[5]

Text Books

[T1] Maheshwari, S. N., Maheshwari, S. K., & Maheshwari, S. K. (2023). Financial accounting for BBA (3rd ed.). Vikas Publishing House.

Reference Books

[Rl] Chakraborty, S., & Roy, N. S. (2016). Accounting and finance for engineers. Lawpoint Publications.
[R2] Singh, Y. P. (2007). Accounting and financial management for I.T. professionals. New Age International.
[R3] Tulsian, P. C. (2002). Financial accounting. Pearson Education.

Paper Code : AIDS213	L	P	Credit
Paper Title : Optimization Techniques	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: Ability of students to translate the problem given in descriptive form into a mathematical model. [K1, K2, K3, K4]
CO2: Ability of students to solve unconstrained optimization problems using line search and gradient based methods. [K1, K2, K3, K4,K5]
CO3: Ability of students to solve constrained optimization problems through various numerical techniques. [K1, K2, K3, K4,K5]
CO4:Ability of students to solve multi objective optimization models. [K1, K2, K3, K4,K5]

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

Course Content	No of Lectures
Unit I **Line Search Methods for Unconstrained Optimization:** Single variable optimization problems (Necessary and sufficient conditions), Unimodal functions, Line search methods: Golden Section Rule: theory, algorithm, and numerical examples, Fibonacci Search Method: theory, algorithm, and comparison with Golden Section rule	[5]
Unit II **Gradient-Based Unconstrained Optimization Methods:** Multivariable unconstrained optimization problems (Necessary and sufficient conditions), Steepest Descent Method, Newton's Method, Conjugate Gradient method: formulation, algorithm, and numerical examples of all methods	[5]
Unit III **Numerical Techniques for Constrained Optimization:** Constrained optimization problems: formulation and challenges, Penalty function methods: Motivation, algorithm, and numerical examples, Barrier Function Method, Comparison of penalty and barrier approaches	[5]

Unit IV **Multi-Objective Optimization Techniques:** Introduction to multi-objective optimization problems, Conflicting objectives and trade-off, Concept of efficient (Pareto optimal) solutions, Efficient Frontier, Weighted Sum Approach	[5]
Text Books **[T1]** Chandra, S, Jayadeva, & Mehra, A. (2009). Numerical optimization with applications. Alpha Science International. **[T2]** Bazaraa, M. S., Sherali, H.D., & Shetty, C. M. Shetty. (2013). Nonlinear programming: theory and algorithms. John Wiley & Sons. **[T3]** Fletcher, R. (2013). Practical methods of optimization. John Wiley & Sons.	
Reference Books **[R1]** Nocedal, J., & Stephen, J. W. (1999). Numerical optimization. Springer. **[R2]** Taha, Hamdy A. (2003). Operations research: An introduction. Pearson. **[R3]** Dhillon, J.S. & Dhillon, D.S. (2023). Optimization Algorithms for Engineers: Principles and Concepts. Ane Books Pvt. Ltd.	

DETAILED SYLLABUS FOR 4th SEMESTER

Paper Code : AIDS202	L	P	Credit
Paper Title : Database Management 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 of students to understand the basic concepts of Database Management System [K2]
CO2: Ability of students to the design database schemas and ER Model [K6]
CO3: Ability of students to understand the concept of transaction management [K1,K2]
CO4: Ability of students to compare different types of NoSQL Databases and RDBMS with different NoSQL databases [K4].

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

Course Content	No of Lectures
Unit I **Introduction of Database Management Systems**. Database System Applications, Database System vs. File System. Database Models, Database Architecture, Database Structure, Data Model Schema and Instances, Data Independence and Database languages, Various Users of Database Management Systems.	[8]
Unit II **Introduction to the Relational Model** – Integrity Constraint Over relations –Integrity constraints Entity Relationship Diagram Issues weak entity sets, Codd rules, relational schemas, Introduction to Unified Modeling Language, Relational Algebra: Introduction, selection and projection, set operation, joins division, Relational Comparison.	[8]
Unit III **Normalization & Transactions Management:** Normalization(1NF,2NF,3NF,BCNF), Transaction Management: Atomicity Consistency Isolation Durability properties, Serializability and concurrency control, Lock based Concurrency control (2-Phase Locking,Deadlock) Time Stamping Methods, Failure Classification, Database Recovery Management, Log based Recovery Technique.	[9]

Unit IV **Distributed Database Systems:** Introduction to distributed databases; features of distributed databases vs centralized databases, Distributed database design: framework for distributed database design, Overview, Challenges and History of NoSQL Databases, Four Types of NoSQL Database, Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, Databases: Replication and sharding, MapReduce on databases**.**	[7]
Text Books **[T1]** Sadalage, P . J., & Fowler, M. (2013). NoSQL distilled: a brief guide to the emerging world of polyglot persistence. Pearson Education. **[T2**] Silberschatz, A., Korth, H. F., & Sudarshan, S. (2002). Database system concepts (Vol. 5). New York: McGraw-Hill. **[T3]** Elmasri, R., & Navathe, S. B. (2000). Fundamentals of database systems (3rd ed.). Addison-Wesley.	
Reference Books **[R1]** Date, C. J. (2004). An Introduction to Database Systems. 8-th ed. **[R2]** Ullman, J. D. (1983). Principles of database systems. Galgotia publications. [**R3**] Bipin C. Desai. (1990). An Introduction to Database Systems. West Publishing Co.	

Paper Code : AIDS204	L	P	Credit
Paper Title : Fundamentals of Machine Learning	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 basics concepts of machine learning and Data Science [K1, K2]
CO2: Ability of students to apply and analyze various classification algorithms [K2,K3,K4]
CO3: Ability of students to apply and analyze various regression analysis and clustering techniques [K2,K3,K4]
CO4: Ability of students to understand the basic concept of deep neural networks and evaluating performance of machine learning algorithms [K2, K4].

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

Course Content	No of Lectures
Unit I **Introduction to Data Science Concepts:** Data Science Terminology, Process, Data Science toolkit, Types of data, Source of Data, data Collection & APIs, Exploring & Fixing Data, Data Storage & Management, Big Data, Big Data Technologies, Stages of Data Analytics. **Introduction to Machine Learning:** Learning Theory, Hypothesis & Target Class, Inductive Bias & Bias Variance Tradeoff, Occam's razor, approximation & estimation error, empirical & expected risk, ERM.	[7]
Unit II **Supervised learning for classification:** Choosing a classification algorithm, implementing perceptron learning rules, modeling class probabilities via logistic regression, maximum margin classification with support vector machine, decision tree learning, k-nearest neighbor algorithm, Bayesian learning, Ensemble learning-majority voting classifier, bagging and boosting classifier, random forest classifier.	[9]

Unit III **Predicting continuous target variables with regression analysis:** Introducing a simple linear regression model, evaluating the performance of linear regression model, using regularized methods for regression, turning a linear model into a curve - polynomial regression, Non-linear regression model-support vector, decision tree and random forest regressor. **Unsupervised Learning:** Clustering-K Means, K Means++, Hierarchical and Density Based, Mixture Models, Expectation Maximization, Non-Parametric Density Estimation.	[9]
Unit IV **Evaluation:** Performance evaluation metrics-accuracy score, precision, recall, F1-score, ROC curves, mean squared error, r2-score. Validation methods, Bias variance decomposition, confusion matrix, model complexity. **Introduction to Deep Networks:** Deep Feed Forward networks, convolutional neural networks, stacking, striding and pooling.	[7]
Text Books **[T1]** Sebastian Raschka,Vahid Mirjalili, (2019), Python Machine Learning - Third Edition, Pact Publisher. **[T2]** Tom M. Mitchell, (1997). Machine Learning, McGraw-Hill **[T3]** Duda, R. O. & Hart, P. E. (2006). Pattern Classification. John Wiley & Sons.	
Reference Books **[R1]** Bishop, C. M. & Nasarabadi, N. M. (2006). Pattern Recognition & Machine Learning (Vol. 4). New York: Springer.	

Paper Code : AIDS206	L	P	Credit
Paper Title : Operating System	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: To learn and understand the basic concepts of Operating System and process management [K1,K2]
CO2: To apply the concept of memory management[K3]
CO3: To describe the concept of device management [K2]
CO4: To understand the concept of virtualization [K2]

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

Course Content	No of Lectures
Unit I **Introduction:** Introduction: What is an Operating System, Evolution of Operating Systems-Simple Batch Systems, Multiprogrammed Batch systems, TimeSharing Systems, Personal-Computer systems, Parallel systems, Distributed Systems, Real-Time Systems, Functions of Operating System, Operating System – A Resource Manager. **Process Management**: Process definition, Process states, Process Control Block (PCB), Interrupts, Interprocess Communication(IPC), Context Switching, Threads, Thread states and operations, Threading Models, Types of Schedulers (long-term, short-term, medium-term), preemptive vs nonpreemptive scheduling, scheduling criteria, objective, scheduling algorithms (FCFS, SJF, RR, Priority Scheduling), demand scheduling, real time scheduling, Process Synchronization: Cooperating processes and race condition, Mutual exclusion, software solution to Mutual exclusion problem, hardware solution to Mutual exclusion problem, semaphores, Critical section problems. Case study on Dining philosopher problem.	[8]
Unit II **Memory Organization & Management:** Memory Organization, Memory Hierarchy, Locality of Reference, Memory Management Strategies, Contiguous Vs Non- Contiguous memory allocation, Fragmentation, Partition Management Techniques, Logical versus Physical Address space, swapping, Paging, Segmentation, Segmentation with Paging **Virtual Memory**: Demand Paging, Page Replacement, Page-replacement Algorithms(FIFO, LRU, LFU), Performance of Demand Paging, Thrashing, Demand Segmentation, and Overlay Concepts.	[7]

Unit III **Deadlocks:** Examples of deadlock, Resource concepts, Necessary conditions for deadlock, deadlock solution, deadlock prevention, deadlock avoidance with Bankers algorithms, deadlock detection, deadlock recovery. **Device Management:** Disk Scheduling Strategies, Rotational Optimization, System Consideration, Caching and Buffering **File System:** Introduction, File Organization, Logical File System, Physical File System, File Allocation strategy, Free Space Management, File Access Control, Data Access Techniques, Data Integrity Protection.	[9]
Unit IV **Virtualization :** Introduction to Virtualization, Virtual Machine, Type of virtualization, Hypervisors **Introduction to Linux:** Linux history and philosophy, Linux distributions and their features, Linux file system hierarchy, Basic Linux commands and shell scripting **Linux System Administration:** User and group management, File and directory permissions, System startup and shutdown, Package management and updates.	[7]
Text Books **[T1]** Deitel, H. M. (2007). An introduction to operating systems. 3rd Edition Addison-Wesley Longman Publishing Co., Inc. [**T2**] Silberschatz, A., Galvin, P. B., & Gagne, G. (2023). Operating system concepts. John Wiley & Sons **[T3]** Portnoy, M. (2023). Virtualization essentials (Vol. 19). 3rd Editions John Wiley & Sons.	
Reference Books **[R1]** Tannenbaum (2000).Operating Systems. PHI, 4th Edition. **[R2]** Godbole, A. S. (2005). Operating systems. Tata McGraw-Hill Education. **[R3]** Dhamdhere, D. M. (2006). Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education.	

Paper Code : AIDS208	L	P	Credit
Paper Title : Introduction to Artificial Intelligence and Ethics	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 basics concepts of AI [K1,K2]
CO2:To understand the impact of AI on society, environment and planet [K1,K2]
CO3:Ability of students to apply and analyze various search strategy in real life applications[K2,K3,K4]
CO4:Ability of students to examine various knowledge representation techniques[K1,K2,K3]

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

Course Content	No of Lectures
Unit I **Introduction to Artificial Intelligence:** AI problems. Foundation of AI and history of AI, Intelligent agents: Agents & Environments.The concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation, Hard and Easy problem in AI, Problem characteristics and production system.	[8]
Unit II **Searching**: Searching for solutions, Uninformed search strategies- Breadth First search, depth first search, depth first iterative deepening, bi directional search. Heuristic search strategy-Hillclimbing, best first search, A*, AO* algorithms. Game Playing-Adversarial search, Games,Mini-max algorithm,alpha-beta pruning.Local search algorithms and optimization problems.	[9]

Unit III **Knowledge Representation:** Approaches in knowledge representation, Issues in knowledge representation, Predicate logic, propositional logic, Procedural versus declarative knowledge, Logic programming, forward versus backward reasoning, resolution. **Symbolic reasoning under uncertainty**:Non monotonic reasoning, Logic for non monotonic reasoning **Statistical reasoning:** Certainty factors& rule-based systems, Probability & Bayes' theorem, Bayesian networks, Dempster-Shafer-Theory **Advanced topics in Artificial Intelligence:** Introduction to neural network, Fuzzy logic and Expert systems, Genetic algorithms, Introduction to Natural Language Processing (NLP), Introduction to nature inspired computing-ACO, ABC algorithms.	[8]
Unit IV **Introduction to Ethics:** Background of the Field, AI & Robotics, Review on Policy, Privacy & Surveillance, Manipulation of Behavior,Opacity of AI Systems, Bias in Decision Systems, Human-Robot Interaction, Deception & Authenticity Robotics case studies, The Effects of Automation on Employment, Autonomous Systems, Autonomous Vehicles, Autonomous Weapon, Ethics for AI & Robotics,Responsibility for Robots, Rights for Robots, **Singularity:** Singularity and Superintelligence, Existential Risk from Superintelligence, Controlling Superintelligence.	[7]
Text Books **[T1]** Russell, S., & Norvig, P. (2022). Artificial intelligence: A modern approach (2nd ed.). Pearson Education. [**T2]** Liao, S. M. (Ed.). (2020). Ethics of artificial intelligence. Oxford University Press. **[T3]** Bartneck, C., Lütge, C., Wagner, A., & Welsh, S. (2021). An introduction to ethics in robotics and AI. Springer Nature.	
Reference Books [**R1]** Nilsson, N. J. (2014). Principles of artificial intelligence. Morgan Kaufmann. **[R2]** Sivanandam, S. N., & Deepa, S. N. (2018). Principles of soft computing (3rd ed.). Wiley India. **[R3]** Boddington, P. (2017). Towards a Code of ethics for artificial intelligence. Springer.	

Paper Code: AIDS210	L	P	Credit
Paper Title : Analysis and Design of Algorithm	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 and evaluate the concepts complexity of algorithm and types of sorting algorithm [K1, K5].
CO2: Ability of students to understand and apply the concept of Dynamic Programming [K2, K3].
CO3: Ability of students to analyze the Greedy Algorithms [K4].
CO4: Ability of students to understand the concept of NP-Complete Problem [K2].

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

Course Content	No of Lectures
Unit I **Introduction:** Asymptotic Notations for time and space complexity, Big-Oh notation, Θ notation, Ω notation, the little-oh notation, the little-omega notation, Properties of Asympototic Notations, Recurrence Relations: Iteration Method, recursion tree method, substitution method, master method, divide and conquer methods: Merge Sort, Quick sort, Strassen's algorithm for Matrix Multiplications.	[8]
Unit II **Dynamic Programming:** Ingredients of Dynamic Programming, emphasis on optimal substructure, overlapping substructures, memorization. Matrix Chain Multiplication, Longest common subsequences, 0-1 knapsack problem, Floyd Warshall algorithm.	[9]
Unit III **Greedy Algorithms:** Elements of Greedy strategy, overview of local and global optima, Activity selection problem, Fractional Knapsack problem, Huffman Codes, A task scheduling problem. Minimum Spanning Trees: Kruskal's and Prim's Algorithm, Single source shortest path: Dijkstra and Bellman Ford Algorithm (with proof of correctness of algorithms).	[8]

Unit IV **Tractable and Intractable Problems :** NP-Complete Problem: Polynomial-time verification, NP-Completeness and Reducibility, NP-Completeness Proof, NP –hard, Case study of NP-Complete problems (vertex cover problem, clique problem).	[7]
Text Books **[T1]** Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2022). Introduction to algorithms. MIT press. **[T2]** Kleinberg, J., & Tardos, E. (2006). Algorithm design. Pearson Education India.	
Reference Books **[R1]** Baase, S. (2009). Computer algorithms: introduction to design and analysis. Pearson Education India	

Paper Code :AIDS210	L	P	Credit
Paper Title : Fundamentals of Robotics	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 concepts of ETL, data pipelines, data sources, data quality, data cleaning, schema enforcement and target data architectures. [K1, K2]
CO2: Ability of students to build and containerize Python-based ETL applications using Docker images, Dockerfiles, volumes, networking and Docker Compose. [K2, K3]
CO3: Ability of students to deploy, scale and manage containerized data pipeline components on Kubernetes using Pods, Services, Deployments, StatefulSets, PVCs, ConfigMaps and Secrets. [K2, K3, K4]
CO4: Ability of students to design and implement distributed, automated and cloud-native data pipelines using Apache Spark/PySpark, Airflow, Kafka and MLOps workflow tools such as Kubeflow or Argo Workflows. [K3, K4, K5]

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

Course Content	No of Lectures
Unit I **Introduction:** Fundamentals of Robotics, Robot Kinematics: Position Analysis, Dynamic Analysis and Forces. Components of Robotic Systems such as Sensors, Actuators, Controllers, End-Effectors, and Power Systems; Degrees of Freedom (DOF), Robot Configurations, Workspace, and Performance Characteristics; Robot Programming Concepts; Applications of Robotics in Manufacturing, Healthcare, Agriculture, Logistics, Defense.	[7]
Unit II **Industrial Robots:** Robot Classification, including Industrial, Service, Mobile, Humanoid, and Collaborative Robots; medical robots, Robot Specification, kinematic representations and transformations, dynamics techniques; trajectory planning and control. **Robot Programming languages & systems:** Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.	[9]

Unit III **Robotics and Its applications:** DDD concept, Intelligent robots, Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot-Speed of Robot, Robot joints and links-Robot classifications Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system	[9]
Unit IV **Introduction AI&ML in Robotics:** Supervised, Unsupervised, and Reinforcement Learning Techniques; Deep Learning for Robotic Perception and Decision-Making; Computer Vision and Natural Language Processing Applications in Robotics; Human–Robot Interaction and Collaborative Robotics; Cloud Robotics, Edge AI, and Digital Twin Technologies; Swarm Robotics and Multi-Agent Systems; Generative AI and Foundation Models for Robotics; Ethical, Safety, Security, and Future Trends in Intelligent Robotic Systems.	[7]

Text Books

[T1] Niku, S. B. (2020). Introduction to robotics: Analysis, control and applications (3rd ed.). Wiley.
[T2] Groover, M. P. (2020). *Automation, production systems, and computer-integrated manufacturing* (5th ed.). Pearson.
[T3] Kamal, R. (2024). *Internet of Things: Architecture and design principles* (3rd ed.). McGraw-Hill Education.
[T4] Gilchrist, A. (2025). *Industry 4.0: The Industrial Internet of Things* (2nd ed.). Apress.

Reference Books

[R1] Craig, J. J. (2018). *Introduction to robotics: Mechanics and control* (4th ed.). Pearson.
[R2] Siciliano, B., Sciavicco, L., Villani, L., & Oriolo, G. (2022). *Robotics: Modelling, planning and control*. Springer.
[R3] Lamb, F. (2021). *Industrial automation: Hands-on* (2nd ed.). McGraw-Hill Education.
[R4] Uckelmann, D., Harrison, M., & Michahelles, F. (2021). *Architecting the Internet of Things*. Springer.
[R5] Thrun, S., Burgard, W., & Fox, D. (2005). *Probabilistic robotics*. MIT Press.

Paper code: AIDS212	L	P	Credit
Paper Title: Technical Writing#(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.

Course Outcomes [Bloom's Knowledge Level (KL)]:
CO1:Ability to identify different types of Writings and apply evidence based Arguments. [K1,K2,K3,K5]
CO2:Ability to interpret, list, assemble and formulate the writing process. [K1,K3, K6]
CO3:Ability to remember, evaluate and design technical documents. [K1,K5,K6]
CO4:Ability to classify and develop reference lists and research papers. [K2,K6]

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

Course Content	**No of Lectures**
Unit I **Writing Skills:** Descriptive, Narrative, Argumentative and Discursive, Reflective and Literary- Evaluative Writing. Technical Writing: Definition, Purpose, Characteristics of Technical Writing.	[5]
Unit II **The Technical Writing Process:** Prewriting Stage, Writing Stage and the Post-writing stage. Technical Writing Skills: Researching, Summarizing and Outlining, Visual Aids. Definition, Description, Set of Instructions.	[5]
Unit III **Formal Formatting:** Arrangement of Formal Elements. Font Material. Format Devices in the Body of Formal Report-Heading, Pagination, End Material-Citations References and Bibliography. Appendix. In IEEE, APA style sheet and Latex.	[5]
Unit IV Technical Writing Applications Memorandums, Formal and Informal Letter Format, Recommendations and Feasibility Reports. Proposals, Progress Reports. Analysis Reports and Job Applications, Presentation and Meetings**.**	[5]

Text Books
[T1] Meenakshi, R., & Sharma, S. (2017). Technical Communication: Principles and Practice, Oxford University Press, New Delhi.
[T2] Forsyth, Sandy and Lesley Hutchison (1981), *Practical Composition*, Edinburgh: Oliver and Boyd.
Web Page Link
Overleaf. (n.d.). *Learn LaTeX in 30 minutes*. Overleaf. Retrieved June 11, 2026, from https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes

Reference Books
[R1] Side, Charles H. (1999), *How to Write and Present Technical Information*, Cambridge University Press.
[R2] Guffey, Mary Ellen (2000), *Business Communication*, Cincinnati: South-Western College Publishing.