माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Centre for Artificial Intelligence

Syllabi

of all Departmental Core (DC) Courses of

B. Tech IV Semester

[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

for batch admitted in 2023-24

(under the flexible curriculum)

Centre for Artificial Intelligence

CALCULUS AND OPTIMIZATION TECHNIQUES
(3240421/3270421/3280421)

COURSE OBJECTIVES

- To understand the techniques of differential and integral calculus in engineering problems
- To illustrate the concept of ordinary differentiation equation
- To explore linear programming problem
- To understand numerical optimization

Unit 1:

Maclaurins's and Taylor's theorem, Partial differentiation, Euler's theorem, Jacobian, Maxima and Minima of one and two variables.

Unit 2:

Definite integral as limit of a sum, application in summation of series, Beta and Gamma function and its properties, transformation of Beta function, Gamma functions, transformation of Gamma function, relation between Beta and Gamma function, Legendre's duplication formula, double & triple integral, Change of order of integration, Length of the curves, Volumes and surfaces.

Unit 3:

Ordinary differential equations of first and higher order, Linear higher order differential equation with constant coefficients, Homogeneous linear differential equation and Simultaneous differential equations.

Unit 4:

Concept of optimization, constrained and unconstrained optimization, LPP formulation, Graphical method, Simplex method, Duality of LPP, Transportation and Assignment problems.

Unit 5:

Concept of numerical methods, methods for solving matrix problems and linear systems by LU decomposition: Crout & do little method, Gauss elimination, Gauss-Seidel, and Gauss Jacobi, Interpolation: finite differences, difference operators, Newton's interpolation formula, Newton's divided difference formula, Lagrange's interpolation formula, singular value decomposition.

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RECOMMENDED BOOKS

1. E. Kreyszig: Advance Engineering Mathematics, John Wiley & Sons, 10 th Edition (2011).
2. H. A. Taha: Operations Research an Introduction, Pearson, 9 th Edition (2014).
3. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt.Ltd, 5 th Edition (2016).
4. F. B .Hildebrand: Advanced Calculus for application, Englewood Cliffs, N. J. Prentice- Hall, 2 nd Edition (1980).
5. J. Nocedal and S. Wright: Numerical Optimization, Springer Series in Operations Research and Financial Engineering, 2006.
6. B.V. Ramanna: Higher Engineering Mathematics, McGraw Hill Education, 1 st Edition (2017).
7. Introduction to Linear Optimization by Bertsimas, Tsitsiklis. MIT Press (1997)

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: apply differential calculus in basic engineering problems

CO2: use integration techniques to determine the solution of various complex problems

CO3: solve the differential equations by various methods

CO4: find the optimal solution using various methods of linear programming problems.

CO5: evaluate the numerical techniques

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	1	2		1		1	1	3	2	2
CO2	3	3	3	3	2	3	1	2	1	1	1	3	2	2
CO3	3	3	3	3	3	1	1		1	1	1	3	2	1
CO4	3	3	3	3	3				2	2	3	3	2	2
CO5	3	3	3	3	3				2	2		3	2	1

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COMPUTER NETWORKS

(3240422)

COURSE OBJECTIVES

- Familiarize the student with the basic taxonomy and terminology of the computer networking.
- Provide detailed knowledge about various layers, protocols and devices that facilitate networking.
- Enable Students to deal with various networking problems such as flow control, error control and congestion control.

Unit 1:

Introduction: Computer Network, Types- LAN, MAN & WAN, Data Transmission Modes- Serial & Parallel, Simplex, Half Duplex & Full Duplex, Synchronous & Asynchronous Transmission, Transmission Medium- Guided & Unguided, Cables- Twisted Pair, Coaxial Cable & Optical Fiber, Networking Devices-Repeaters, Hub, Switch, Bridge, Router, Gateway and Modem, Performance Criteria- Bandwidth, Throughput, Propagation Time & Transmission Time, Network Standardization- OSI Reference Model & TCP/IP Reference Model.

Unit 2:

Physical Layer: Network Topologies- Bus, Ring, Star & Mesh, Switching- Circuit Switching, Message Switching & Packet Switching, Multiplexing: FDM – Frequency Division Multiplexing, WDM – Wavelength Division Multiplexing & TDM – Time Division Multiplexing.

Unit 3:

Data Link Layer: Introduction, Design Issues, Services, Framing, Error Control, Flow Control, ARQ Strategies, Error Detection and Correction, Parity Bits, Cyclic Redundancy Code (CRC), Hamming Codes, MAC Sub Layer- The Channel Allocation Problem, Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE 802.3, IEEE 802.4 and IEEE 802.5.

Unit 4:

Network Layer & Transport Layer: Introduction, Design Issues, Services, Routing- Distance Vector Routing, Hierarchical Routing & Link State Routing, Shortest Path Algorithm- Dijkstra's Algorithm & Floyd–Warshall's Algorithm, Flooding, Congestion Control- Open Loop & Closed Loop Congestion Control, Leaky Bucket & Token Bucket Algorithm. Connection Oriented & Connectionless Service, IP Addressing.

Unit 5:

Presentation, Session & Application Layer: Introduction, Design Issues, Presentation Layer- Translation, Encryption- Substitutions and Transposition Ciphers, Compression- Lossy and Lossless. Session Layer – Dialog Control, Synchronization. Application Layer- Remote Login, File Transfer & Electronic Mail

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RECOMMENDED BOOKS

1. Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill.
2. Computer Networks, Andrew S. Tanenbaum, Pearson Education India.
3. Computer Networks and Internets, Douglas E. Comer, Pearson India.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1 explain the fundamental concepts of computer networks.
CO2 illustrate the basic taxonomy & terminologies of computer networks.
CO3 identify various parameters for affecting the performance of computer networks.
CO4 analyze the concepts of communication using various layers of the OSI model.
CO5 evaluate the performance of computer networks in congestion and the Internet.
CO6 design the network environment and applications for implementation of computer networking concepts.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	1	1			1	1		1	3	
CO2	3	3	3	2	2	1			1	1		1	3	
CO3	3	3	3	3	2	1			2	1		2	3	
CO4	3	3	3	3	1	2			2	1		2	3	2
CO5	3	3	3	3	3	3	2	1	3	1	2	2	3	2
CO6	3	3	3	3	3	3	3	2	3	2	3	2	3	3

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CONTROL SYSTEMS

(3240423)

COURSE OBJECTIVES

- To understand fundamental concepts of control systems and mathematical modeling of the system.
- To understand the concepts of time response and frequency response analysis of Control Systems.
- To understand the concepts of state variable models, controllability and observability as applicable to linear time invariant systems

Unit I

Introduction to Laplace Transformation, Differential equation. Control system modeling: Basic Elements of Control System, Open loop and Closed loop systems, Transfer function, Modelling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.

Unit II

Time response analysis: Standard test signals, time response of first order systems, Impulse and Step Response analysis of second order systems, time domain specifications, steady state response, steady state errors and error constants, effects of P, PI, PD and PID.

Unit III

Stability analysis: stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, effects of adding poles and zeros to G(s)H(s) on the root loci.

Unit IV

State variable analysis: State space representation of Continuous Time systems, State equations, Transfer function from State variable representation, Solutions of the state equations, canonical variable diagonalization, system analysis by transfer function and state space methods for continuous systems.

Unit V

Concept of controllability and observability, design of state feedback controllers, Pole placement by state feedback, set point tracking controller, Compensators – Lead, Lag, and Lead Compensators.

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RECOMMENDED BOOKS

1. Automatic control systems, Benjamin. C. Kuo, Prentice Hall of India.
2. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
3. Control Systems Engineering, I.J. Nagarath & M. Gopal, New Age Pub. Company.
4. Control System – Principles and Design, M. Gopal, Tata McGraw Hill.
5. Feedback and Control Systems, Schaum's Outline Series, Tata McGraw Hill.
6. Digital Control and State Variable Methods, M. Gopal, Tata Mcgraw Hill.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: determine the transfer function of electrical and electromechanical systems.

CO2: apply block diagram reduction and signal flow graph for simplification of system representation.

CO3: analyze the time response of the physical system.

CO4: evaluate the stability of a given system.

CO5: solve the state space model of a given system.

CO6: design control law for a given system.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	1	-	-	1	1	2	2	3	1
CO2	3	3	3	3	3	-	-	-	1	1	2	2	3	2
CO3	3	3	3	3	2	-	-	-	1	1	1	2	3	2
CO4	3	3	3	3	2	1	1	1	-	1	2	3	3	2
CO5	3	3	3	3	3	-	-	-	1	1	2	3	3	2
CO6	3	3	3	3	3	1	1	1	2	2	3	3	3	2

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DATABASE MANAGEMENT SYSTEM
(3240424)

COURSE OBJECTIVES

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modelling, relational, hierarchical and network models.
- To understand and use data manipulation language to query, update and manage a database.

Unit I

DBMS: Database Approach v/s Traditional File Approach, Advantages of Database System, Database Users and Administrator, Database System Environment, Application Architectures, Schemas, Instances, Data Independence, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, Comparison between Models. Entities and Relationship Model: Entity types, Entity sets, Attributes and Keys, Relationship Types and Sets, Constraints, Design issue, E-R Diagram, Weak Entity Sets.

Unit II

Relational Model: Structure of Relational Databases: Relation, Attribute, Domain, Tuples, Degree, Cardinality, Views, Database Relations, Properties of Relations, Attributes, Keys, Attributes of Relation, Domain Constraints, Integrity Constraints. Relational Algebra: Concepts and Operations: Select, Project, Division, Intersection, Union, Division, Rename, Join etc.

Unit III

SQL: Purpose of SQL, Data Definition Language (DDL) Statements, Data Manipulation Language (DML) Statements Update Statements & Views in SQL, Data Control Language (DCL), Triggers.

Unit IV

Relational Database Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependency, Process of Normalization, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition, Desirable Properties of Decomposition: Dependency Preservation, Lossless Join, Problems with Null Valued & Dangling Tuple, Multivalued Dependencies.

Unit V

Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability: Conflict and View Serializability, Concurrency Control: Lock-Based Protocol, Recovery: Log-Based Recovery.

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RECOMMENDED BOOKS

1. Database System Concepts, Abraham Silberschatz Henry F. Korth S. Sudarshan, McGraw-Hill 6th Edition.
2. Database Management System, Raghu Ramakrishnan Johannes Gehrke, McGraw Hill 3rd Edition.
3. Fundamentals of Database System, Elmasri & Navathe, Addison-Wesley Publishing, 5th Edition.
4. An Introduction to Database Systems, Date C. J, Addison-Wesley Publishing, 8th Edition.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	demonstrate the concepts of different types of database systems.
CO2	apply relational algebra concepts to design database systems.
CO3	make use of queries to design and access database systems.
CO4	analyze the evaluation of transaction processing and concurrency control.
CO5	determine the normal form of the relation.
CO6	design an ER diagram/database system for a real world application.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	2	2	1	1	1	1	3	2	1
CO2	3	3	3	3	3	3	2	1	1	2	1	3	3	1
CO3	3	3	3	3	3	3	2	2	2	1	2	3	1	2
CO4	3	3	3	3	3	3	3	3	3	2	3	3	2	2
CO5	3	3	3	3	3	3	3	2	2	2	2	3	2	2
CO6	3	3	3	3	3	3	3	3	3	2	3	3	3	3

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SENSOR TECHNOLOGY (3240425)

COURSE OBJECTIVES

- To provide a comprehensive understanding of Physical quantity measurement systems.
- To familiarize with sensors, data acquisition, and processing knowledge for careers in field of robotics and automation

Unit I

Functional elements of an instrument — Static and dynamic characteristics — Errors in measurement — Statistical evaluation of measurement data — Standards and calibration- Principle and types of analog and digital voltmeters, Ammeters.

Unit II

Methods of Measurement: Direct Methods, Indirect Methods, Evolution of Instruments, Classification of Instruments; Elements of data acquisition system: DAQ Devices: Standalone, PCI, USB, Ethernet; Signal conditioning, foundations of Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC), types and working of ADC and DAC.

Unit III

Transducers: Introduction, Classification:Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Capacitive transducers, Differential output transducers and LVDT, Temperature sensors: Thermocouples, RTDs, thermistors, Pressure sensors: Piezoelectric, strain gauge. Flow sensors: Electromagnetic, ultrasonic, turbine.

Unit IV

Actuators in Robotics: Introduction, Types and Principle of working; STORAGE AND DISPLAY DEVICES : Magnetic disk and tape — Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display — Data Loggers.

Unit V

The Robotic Sensors such as Light Sensors, Sound Sensor, Temperature Sensor, Contact Sensor, Proximity Sensor, Infrared (IR) Transceivers, Ultrasonic Sensor, Photoresistors, Distance Sensor, Lidar etc. understanding the Datasheet, Circuit interface within the simulation circuit and operational characteristics.

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RECOMMENDED BOOKS

1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. D.V.S. Murthy: "Transducers and Instrumentation", 2nd Edition, PHI Ltd., 2014
3. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Macrobiotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
4. Jacob Fraden, "HandBook of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.
5. A . K. Sawhney: " A Course In Electrical And Electronic Measurements And Instrumentation". Dhanpat Rai & CO. ,2020

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	explain the fundamentals of sensors and their characteristics.
CO2	select the physical principles of sensing based on sensor signals and systems
CO3	explain the sensor interfacing with various electronics circuits.
CO4	utilizes the practical approach in design of technology based on different sensors.
CO5	list various sensor materials and technology used in designing sensors.
CO6	Interpret sensor signal conditioning, noise attenuation, amplification, and filtering.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3			3		2			3	2	
CO2	3	3	3	3		2		2		3				1
CO3	3	3	3	3	3		1				2		3	2
CO4	3	3	3	3	3	1		1	3	1	2	2		
CO5	3	3	3	3	2	2			2			3		
CO6	3	3	3	3			2	2		2	1		2	2

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THEORY OF COMPUTATION
(3270422/3280422)

COURSE OBJECTIVES

- To understand computability, decidability, and complexity through problem solving.
- To analyze and design abstract model of computation & formal languages
- To understand and conduct mathematical proofs for computation and algorithms.

Unit I

Introduction of Automata Theory: Examples of automata machines, Finite Automata as a language acceptor and translator, Moore machines and mealy machines, composite machine, Conversion from Mealy to Moore and vice versa.

Unit II

Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, conversion of NDFA to DFA, minimization of automata machines, regular expression, Arden's theorem. Meaning of union, intersection, concatenation and closure, 2 way DFA.

Unit III

Grammars: Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, killing null and unit productions. Chomsky normal form and Greibach normal form.

Unit IV

Push down Automata: example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petri Net model.

Unit V

Turing Machine: Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable languages, undecidable languages, Halting problem of Turing machine & the post correspondence problem.

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RECOMMENDED BOOKS

1. Introduction to Automata Theory Language & Computation, Hopcroft & Ullman, Narosa Publication.
2. Element of the Theory Computation, Lewis & Christors, Pearson.
3. Theory of Computation, Chandrasekhar & Mishra, PHI.
4. Theory of Computation, Wood, Harper & Row.
5. Introduction to Computing Theory, Daniel I-A Cohen, Wiley.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1	explain the basic concepts of switching and finite automata theory & languages.
CO2	relate practical problems to languages, automata, computability and complexity.
CO3	construct abstract models of computing and check their power to recognize the languages.
CO4	analyze the grammar, its types, simplification and normal form.
CO5	interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO6	develop an overview of how automata theory, languages and computation are applicable in engineering applications.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	3	2	2	2			2	2	3	3	3
CO2	2	3	3	2	3	3	3	2		3	3	3	3	3
CO3	3	3	3	3	3	3	3		2	2	2	2	2	2
CO4	3	2	3	3	2	3	3		3	3	2	3	3	2
CO5	3	2	2	3	3	3	2	2		2	3	3	3	3
CO6	3	2	2	3	2	2	2	2				2	2	2

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SOFTWARE ENGINEERING

(3270423/3280423)

COURSE OBJECTIVES

- To understand the process of software development and software life cycle models.
- To understand project management and risk management associated with various types of projects.
- To know the familarize with the concept of software testing, quality assurance and configuration management process.

Unit - I

Introduction to Software Engineering: Definition, Software Engineering-Layered Technology, Software Characteristics and Components, Software Model: Software Development of Life Cycle Model (SDLC), The Waterfall Model, Iterative Waterfall Model, Prototyping Model, Spiral Model, RAD Model. Selection Criteria of Model: Characteristics of Requirements, Status of Development Team, Users Participation, Type of Project and Associated Risk.

Unit - II

Requirement Engineering: Definition, Requirement Engineering Activity , Types of Requirement- Functional and Nonfunctional Requirements, User and System Requirements, Requirement Elicitation Methods, Requirement Analysis Methods, Requirement Documentation (SRS), Requirement Validation, Requirement Management.

Unit - III

Design Concept, Principle and Methods: Design Fundamentals, Design Principles, Effective Modular Design, Design Representations, Architectural Design, Procedural Design, Data Directed design, Real Time Design, Object Oriented Design, Coupling and Cohesion.

Unit - IV

Software Metrics, Project Management and Estimation: Metrics in Process and Project Domains, Software Measurement, Software Quality Metrics, Project Management- Basics-People, Product, Process, Project, Estimation- Software Project Estimation, Decomposition Techniques- Function Point Estimation, Line of Code (LOC) Based estimation, Empirical Estimation, COCOMO Model, Project Scheduling Techniques.

Unit - V

Software Testing: Definitions, Software Testing Life Cycle (STLC), Test Case Design, Strategic Approach to Software Testing- Verification & Validation , Strategic Issues, Criteria for Completion of Testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Black Box Testing Techniques, White Box Testing Techniques, Acceptance Testing.

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RECOMMENDED BOOKS

1. Software Engineering, Sommerville, Pearson.
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, McGraw Hill.
3. Software Engineering, K.K. Agrawal & Yogesh Singh, New Age Publication.
4. Software Engineering, Rajib Mall, PHI.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. explain the concepts of software engineering.

CO2. analyze and design software for real world problems.

CO3. compare the techniques for software project management & estimation.

CO4. choose an appropriate software development model for a real-life software project.

CO5. design software using modern tools and technologies.

CO6. test the software through different approaches.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	1	1	2	1	2	1		3	2	1
CO2	3	3	3	3	3	2	3	2	2	1	2	3	3	1
CO3	3	3	3	3	3	2	2	1	1	1	1	3	1	2
CO4	3	3	3	3	3	3	3	1	3	2	2	2	2	2
CO5	3	3	3	3	3	3	3	3	2	2	3	3	2	2
CO6	3	3	3	3	3	3	3	3	3	2	3	3	2	2

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CLOUD COMPUTING AND VIRTUALIZATION

(3270424/ 3280424)

COURSE OBJECTIVES

- To understand Cloud Computing concepts, technologies, architecture and applications.
- To understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization.
- To understand different cloud programming platforms and tools to develop and deploy applications on cloud.

Unit- I

Cloud Architecture and Model: Technologies for Network-Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics, Cloud Services, Cloud models (IaaS, PaaS, SaaS), Public vs Private Cloud, Cloud Solutions Cloud ecosystem, Service management, Computing on demand.

Unit- II

Virtualization: Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices. Virtual Clusters and Resource management, Virtualization for Data-center Automation.

Unit- III

Cloud Infrastructure: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources.

Unit -IV

Programming Model: Parallel and Distributed Programming Paradigms- MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache, Google App Engine (GAE), Amazon Web Service (AWS), Smart Cloud, Public Clouds and Service Offerings, Microsoft Windows Azure. Mapping Applications, Programming Support, Cloud Software Environments, Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.

Unit -V

Security in the Cloud: Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control.

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RECOMMENDED BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W. Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
4. Kumar Saurabh, "Cloud Computing — insights into New-Era Infrastructure", Wiley India,2011
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
6. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. describe cloud computing fundamentals.

CO2. explain architecture, infrastructure and delivery models.

CO3. apply suitable virtualization concepts based on problem characteristics.

CO4. choose appropriate programming models for a specific cloud computing application.

CO5. analyze various security issues in cloud computing.

CO6. create a secure and efficient cloud computing environment.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	2	1			1	2	1	2	1	1
CO2	3	3	2	1	2		1		1	1	1	2	2	2
CO3	3	3	3	2	3	1			2	1	2	3	3	3
CO4	3	3	3	3	3				1	1	2	3	3	3
CO5	3	3	2	2	3	3	1	2	1	2	1	3	2	3
CO6	3	3	3	3	3	3	2	2	2	2	3	3	3	3

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INFORMATION SECURITY
(3270425/ 3280425)

COURSE OBJECTIVES

- To provide conceptual understanding of information security principles, issues, challenges and mechanisms.
- To understand encryption techniques for securing data in transit across data networks.

Unit-I

Security: Principles and Attacks, Basic Number Theory, Fundamentals of Cryptography, Steganography, Cryptanalysis, Code Breaking, Block Ciphers and Steam Ciphers, Substitution Ciphers, Transposition Ciphers, Caesar Cipher, Play-Fair Cipher, Hill Cipher

Unit-II

Cryptography: Symmetric Key Cryptography, Public Key Cryptography, Principles of Public Key Cryptosystem, Classical Cryptographic Algorithms: RC4, RSA, Distribution of Public Keys and Key Management, Diffie-Hellman Key Exchange.

Unit-III

Hash Functions: Hash Functions, One Way Hash Function, SHA (Secure Hash Algorithm). Authentication: Requirements, Functions, Kerberos, Message Authentication Codes, Digital Signatures, Digital Certificates.

Unit -IV

IP Web Security Overview: SSL (Secure Socket Layer), TLS (Transport Layer Security), SET (Secure Electronic Transaction). IDS (Intrusion detection system), Firewalls: Types, Functionality and Polices.

Unit -V

Phishing: Attacks and its Types, Buffer Overflow Attack, Session Hijacking, Hacker: Hacking and Types of Hackers, FootPrinting, Scanning: Types: Port, Network, Vulnerability), Sniffing in Shared and Switched Networks, Sniffing Detection Prevention, Spoofing.

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RECOMMENDED BOOKS

1. Cryptography and Network Security, William Stallings, Pearson Education.
2. Cryptography and Network Security, Atul Kahate, McGraw Hill Education.
3. Incident Response and Computer Forensics, Kevin Mandia, Chris Prosise, Tata McGraw Hill.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1: determine symmetric and public key cryptography, classical algorithms, and basic number theory.

CO2: explain the working of various cryptographic algorithms.

CO3. apply firewall, IDS, and security protocols like SSL, TLS, and SET.

CO4: build secure systems using digital signatures, message authentication, and certificates.

CO5: examine the strengths and weaknesses of IP and web security.

CO6: select strategies for detecting and preventing attacks like sniffing, spoofing, and hacking.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	3	1			1	1	2	2	3	2
CO2	3	3	2	2	3				1	1	2	2	3	2
CO3	3	3	3	2	3	1	1	1	2	2	2	3	3	3
CO4	3	3	3	3	3	2		1	1	2	2	3	3	3
CO5	3	3	2	2	3	2	1	1		2	2	3	3	3
CO6	3	3	3	3	3	3	1	1	1	2	3	3	3	3

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Centre for Artificial Intelligence

Experiment list/ Lab manual/ Skill Based Mini-Project List

of

Laboratory Courses offered

for

B. Tech IV Semester

[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

for batch admitted in 2023-24

(under the flexible curriculum)

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DATABASE MANAGEMENT SYSTEM
(3240424)
LIST OF PROGRAMS

While creating tables, databases the name should have a prefix of your roll number.

Ex. If your roll number is 55 then every table name must start with 55 TABLE_NAME. 1. Write program name 2. Write description of command used for executing the query. 3. Write commands in bold letters. 4. Take the screenshot of the output.

1. Implementation of DDL commands of SQL with suitable examples.
   a. Create table
   b. Alter table
   c. Drop Table
2. Implementation of DML commands of SQL with examples.
   a. Insert
   b. Update
   c. Delete
3. Implementation of different type of function with suitable example
   a. Number function
   b. Aggregate function
   c. Character function
   d. Conversion function
   e. Data function
4. Implementation of different types of operators in SQL.
   a. Arithmetic operators
   b. Logical operators
   c. Set operator
   f. Comparison Operator
   g. Special operator
5. Implementation of type of joins.
   a. Inner Join
   b. Outer Join
   c. Natural Join etc.
6. Study and implementation of
   a. Group by & having clause
   b. order By clause
   c. Indexing
7. Study of Implementation of
   a. Sub queries
   b. Views
8. Study & implementation of different type of constraints.
9. Study & implementation of database backup & recovery command. Study & implementation of Rollback, commit, savepoint.
10. Creating Database /Table Space
    a. Managing Users: Create User, Delete User
    b. Managing roles: Grant, Revoke.

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COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. construct a database schema for a given problem domain.

CO2. apply integrity constraints on a database schema using a state-of-the-art RDBMS.

CO3. apply SQL queries using DDL and DML to design and access database systems.

CO4. make use of operators and functions used in query.

CO5. distinguish Tables and Views for database systems.

CO6. develop a small project for a real world scenario.

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DATABASE MANAGEMENT SYSTEM
(3240424)
LIST OF SKILL BASED MINI PROJECT

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Design ER-Diagram, Create Schema and insert at least 5 records for each table. Add appropriate database constraints

Mini Skill Project 1

Consider the following schema for a Library Database:
BOOK (Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS (Book_id, Author_Name)
PUBLISHER (Name, Address, Phone)
BOOK_COPIES (Book_id, Programme_id, No-of_Copies)
BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date)
LIBRARY_PROGRAMME (Programme_id, Programme_Name, Address)

Write SQL queries to:

1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
5. Create a view of all books and its number of copies that are currently available in the Library.

Mini Skill Project 2

Consider the following schema for Order Database:
SALESMAN (Salesman_id, Name, City, Commission)
CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
Write SQL queries to:
1. Count the customers with grades above Bangalore's average.
2. Find the name and numbers of all salesman who had more than one customer.
3. List all the salesman and indicate those who have and do not have customers in their cities (Use UNION operation.)
4. Create a view that finds the salesman who has the customer with the highest order of a day.

5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

Mini Skill Project 3

Consider the schema for Movie Database:
ACTOR (Act_id, Act_Name, Act_Gender)
DIRECTOR (Dir_id, Dir_Name, Dir_Phone)
MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST (Act_id, Mov_id, Role)
RATING (Mov_id, Rev_Stars)

Write SQL queries to:

1. List the titles of all movies directed by 'Hitchcock'.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and in a movie after 2015 (use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by 'Steven Spielberg' to 5.

Mini Skill Project 4

Consider the schema for College Database:
STUDENT (USN, SName, Address, Phone, Gender)
SEMSEC (SSID, Sem, Sec)
CLASS (USN, SSID)
COURSE (Subcode, Title, Sem, Credits)
IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to:

1. List all the student details studying in the fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
If FinalIA = 17 to 20 then CAT = 'Outstanding'
If FinalIA = 12 to 16 then CAT = 'Average'
If FinalIA< 12 then CAT = 'Weak'
Give these details only for 8th semester A, B, and C section students.

Mini Skill Project 5

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Consider the schema for Company Database:
EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)
DLOCATION (DNo,DLoc)
PROJECT (PNo, PName, PLocation, DNo)
WORKS_ON (SSN, PNo, Hours)

Write SQL queries to:

1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department.
4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).
5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

Mini Skill Project 6

A university registrar's office maintains data about the following entities:
(a)courses, including number, title, credits, syllabus, and prerequisites;
(b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom;
(c) students, including student-id, name, and program; and
(d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled.
Construct an E-R diagram forthe registrar's office. Document all assumptions that you make about the mapping constraints.

Mini Skill Project 7

Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents.

Mini Skill Project 8

Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted.

Mini Skill Project 9

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Design an E-R diagram for keeping track of the exploits of your favorite sports team. You should store the matches played, the scores in each match, the players in each match and individual player statistics for each match. Summary statistics should be modeled as derived attributes.

Mini Skill Project 10

Consider a database used to record the marks that students get in different exams of different course offerings.

a. Construct an E-R diagram that models exams as entities, and uses a ternary relationship, for the above database.

b. Construct an alternative E-R diagram that uses only a binary relationship between students and course-offerings. Make sure that only one relationship exists between a particular student and course-offering pair, yet you can represent the marks that a student gets in different exams of a course offering.

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JAVA PROGRAMMING LAB

(3240426/3270426/ 3280426)

COURSE OBJECTIVES

- To learn how to implement object oriented design concepts with java.
- To understand java language components and how they work together in applications.
- To design and program stand-alone java applications.

Unit I

Introduction – history, features, versions, java programming environment (JDK, JVM, JRE, compiler, interpreter, applet-viewer, debugger), java as an OOP language- object, class, encapsulation, inheritance, polymorphism, abstract classes and methods, interfaces, packages.

Unit II

Strings, Exception Handling, File and Streams, Visibility, Constructors, - Data Structures: Introduction, Type-Wrapper Classes for Primitive Types, Dynamic Memory Allocation, Generic Classes, Collections: Interface Collection and Class Collections.

Unit III

Multithreading: Thread States, Priorities and Thread Scheduling, Life Cycle of a Thread, Thread Synchronization, Creating and Executing Threads, Multithreading with GUI, Exception handling.

Unit IV

Input/Output: Exploring Java I/O., Directories, -streamclasses TheBytestream:Inputstream, outputstream, file input stream, file output stream, print stream, Random_access file, the character streams, Buffered reader, buffered writer, print writer, JDBC.

Unit V

Java Networking: exploring java. Net package Networking Basics: Socket, Client server, reserved sockets, servers, Internet addressing, TCP sockets, UDP sockets.

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JAVA PROGRAMMING LAB (3240426/3270426/ 3280426)

RECOMMENDED BOOKS

1. "The Complete Reference Java", Naughton & Schildt, McGraw Hill.
2. "Java-How to Program:" TataMcGraw Hill.2.Deitel , PearsonEducation,Asia.
3. "CoreJava2" (Vol I & II) , Horstmann & Cornell , SunMicrosystems
4. "Java2.0" IvanBayross, BPB publications.
5. "BeginningJava2", Ivor Horton, WileyIndia.
6. "Java Programming for the absolute beginners", Russell, PHI Learning

List of Programs

1. Write a program to display text on screen.
2. Write a program to show concept of class in JAVA
3. Write a program to show Type Casting in JAVA
4. Write a program to show How Exception Handling is in JAVA
5. Write a program to demonstrate the use of string in JAVA.
6. Write Programs to show Inheritance and Polymorphism.
7. Write a program to show Interfacing between two classes
8. Write a program to demonstrate AWT.
9. Write a program to demonstrate multithreading using Java.
10. Write a Program to show Database Connectivity Using JAVA.
11. Create a network TCP/UDP socket.

Course Outcomes of Lab:

After completion of the course students will be able to:

CO1: organize the programs as per the basic structure and model of Java programming language.

CO2: identify the use of various operators and methods in Java.

CO3: illustrate the effective use of object-oriented programming paradigm.

CO4: assess user requirements and technically map applications accordingly.

CO5: compare various approaches for implementing multithreading and network programming.

CO6: develop real world applications and softwares using Java Programming.

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JAVA PROGRAMMING LAB (3240426/3270426/ 3280426)

List of Skill based Projects

List of Micro Projects:

1. Design a web based interface for converting currency from one to another.
2. Design a game of guessing the correct number in a given range of numbers.
3. Develop an E-commerce website of your choice.
4. Design a grading system for marking students in respective courses.
5. Design a supermarket billing system for fast servicing of users.

List of Macro Projects:

1. Design a simple banking application to perform routine transactions.
2. Design a system to count the number of words in a given paragraph.
3. Design a web based CGPA calculator application in java.
4. Design a system to identify patterns in supermarket dataset in terms of nature of sale.
5. Design a To-Do list application to manage your daily tasks.

List of Mini Projects:

1. Design brick breaker game in java.
2. Design an attendance management system for your department.
3. Design a tic-tac-toe gaming application using GUI.
4. Design an ATM simulation system for handling personal financial transactions.
5. Design a smart city system that acts as city guide to the new visitors.
6. Design a flappy bird game using a swing component.
7. Develop a Stock Market Analysis and Prediction system.
8. Design an online book recommendation system.
9. Build a simple search engine to facilitate web users.
10. Design a Virtual Private Network for an office.

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CLOUD COMPUTING AND VIRTUALIZATION

(3270424/ 3280424)

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavors of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Implement a procedure to transfer the files from one virtual machine to another virtual machine.
7. Implement a procedure to launch virtual machine using trystack (Online Openstack)
8. Install Hadoop single node cluster and run simple applications like word count.

Course Outcomes of Lab:

After completion of the course students will be able to:

CO1: configure virtualization software.

CO2: develop and run programs in a virtualized environment.

CO3: develop web applications using Python or Java, employing GAE Launcher.

CO4: simulate cloud scenario using CloudSim.

CO5: analyse data within virtual environments.

CO6: create a virtual machine using OpenStack Trystack.

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CLOUD COMPUTING AND VIRTUALIZATION

(3270424/ 3280424)

SKILL BASED MINI PROJECTS

1. Develop a system that allows users to create, manage, and monitor virtual machines in a cloud environment. Include features such as starting, stopping, and resizing VMs. You can use a platform like OpenStack or VMware.
2. Implement a simple load balancer that distributes incoming network traffic across multiple servers. This can be applied to a cloud environment to ensure optimal resource utilization and performance.
3. Create an auto-scaling system that automatically adjusts the number of resources (virtual machines) based on the demand. Use metrics like CPU utilization or network traffic to trigger scaling actions.
4. Build a serverless application using platforms like AWS Lambda or Azure Functions. Develop a function that responds to a specific event and showcase the advantages of serverless architecture.
5. Design a microservices architecture using Docker containers. Each microservice should perform a specific function, and communication should happen through APIs. Deploy the microservices on a cloud platform.