

GURU KASHI UNIVERSITY



Master of Science (Information Technology)
Session: 2026-2027

Faculty of Computing

Graduate Attributes of the Programme: -

Type of learning outcomes	The Learning Outcomes Descriptors
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/interdisciplinary areas of learning	Demonstrate advanced knowledge of programming, database systems, cloud computing, AI, machine learning, and cybersecurity.
	Apply scientific research methodology and software project management principles in IT-related research and development.
	Integrate concepts across domains such as data science, IoT, digital image processing, and blockchain to design innovative IT solutions.
	Design, develop, and evaluate complex software and data-driven systems using appropriate methodologies, tools, and modern computing platforms.
Generic learning outcomes	Communicate technical ideas clearly using oral, written, and visual forms.
	Exhibit critical thinking, ethical reasoning, and decision-making in professional settings.
	Develop entrepreneurial mindset, team collaboration skills, and adaptability to emerging technologies.

Programme Learning outcomes: Post Graduate Diploma in Information Technology (PGDIT) Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 4.5:

Program Specific Outcomes	Element of the Descriptor	Programme learning outcomes relating to PGDIT
The graduates should be able to demonstrate the acquisition of:		
PSO1	Knowledge and understanding	Understand core principles of programming, including languages like Python.
		Gain in-depth knowledge of database systems, data structures, software engineering, and computer architecture.
		Learn the fundamentals of digital electronics and computer networks.
		Develop awareness of web technologies and the Indian Knowledge System.
PSO2	General, technical and professional skills required to perform and accomplish tasks	Design and implement basic to intermediate software systems.
		Create and manage relational databases effectively.
		Develop websites using foundational web technologies.
PSO3	Application of knowledge and skills	Solve practical problems using appropriate programming languages and logic structures. Analyze and develop software applications integrating system components.
PSO4	Generic learning outcomes	Communicate effectively in professional and academic settings. Work independently and collaboratively in teams. Demonstrate problem-solving, planning, and analytical thinking abilities.

PSO5	Constitutional, humanistic, ethical, and moral values	Apply ethical standards in technology use and software development. Exhibit respect for cultural values and inclusiveness in computing environments. Develop awareness of environmental sustainability and responsible IT practices.
PSO6	Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Be prepared for roles such as junior software developer, database assistant, or web support executive. Demonstrate readiness to engage in entrepreneurial ventures or internships. Apply IT knowledge to small-scale professional environments or further studies.
PSO7	Credit requirements	A student will be allowed an exit option after passing first academic year of the M.Sc. IT Programme with requisite 46 credits.
PSO8	Entry requirements	All those candidates who have Passed any graduation degree of minimum 3 years' duration with Mathematics/Statistics/Business Mathematics/Business Statistics/ Quantitative Techniques as Compulsory/Optional/Additional Paper as one of the subjects either at 10+2 or graduation level. Having passed the BCA course of a minimum three year duration from any recognized University with at least 45% in the aggregate.

Program Structure of the Master of Science (Information Technology)

SEMESTER 1st									
Course Code	Course Title	Type of course							
			L	T	P	Credits	Int	Ext	Total Marks
MIT1400	Introduction to programming languages	Core	3	0	0	3	30	70	100
MIT1401	Relational Database Management Systems	Core	3	0	0	3	30	70	100
MIT1402	Computer System Architecture	Core	4	0	0	4	30	70	100
MIT1403	Software Engineering	Core	4	0	0	4	30	70	100
MIT1404	Introduction to programming languages Lab	Core	0	0	2	1	30	70	100
MIT1405	Relational Database Management Systems Lab	Core	0	0	2	1	30	70	100
IKS0021	Introduction to Indian Knowledge System	Indian Knowledge System	4	0	0	4	30	70	100
Discipline Elective I (Any one of the following)									
MIT1406	Data Warehousing and Data Mining	Discipline Elective I	4	0	0	4	30	70	100
MIT1407	IoT and Its Applications								
MIT1408	Software Project Management								
Total			22	0	4	24	240	560	800

SEMESTER 2nd									
Course Code	Course Title	Type of course							
			L	T	P	Credits	Int	Ext	Total Marks
MIT2450	Data Structures	Core	3	0	0	3	30	70	100
MIT2451	Programming Using Python	Core	3	0	0	3	30	70	100
MIT2452	Digital Electronics	Core	4	0	0	4	30	70	100
MIT2453	Computer Networks	Core	4	0	0	4	30	70	100
MIT2454	Data Structures Lab	Core	0	0	2	1	30	70	100
MIT2455	Programming Using Python Lab	Core	0	0	2	1	30	70	100
MIT2456	Web Technologies I	Employability & Entrepreneurship Skill	0	0	4	2	30	70	100
Discipline Elective II (Any one of the following)									
MIT2457	Machine Learning	Discipline Elective II	4	0	0	4	30	70	100
MIT2458	Data Visualization								
MIT2459	Natural Language Processing								
Total			18	0	8	22	240	560	800

Programme Learning outcomes: Master of Science (Information Technology) degree is awarded to students who have demonstrated the achievement of the outcomes located at level 4.5:

Program Specific Outcomes	Element of the Descriptor	Programme learning outcomes relating to M.Sc. IT
The graduates should be able to demonstrate the acquisition of:		
PSO1	Knowledge and understanding	Acquire comprehensive knowledge of programming languages (Python, JavaScript), databases, AI, ML, cloud computing, cybersecurity, and software engineering.
		Understand theoretical and practical aspects of computer architecture, networks, data mining, data science, and advanced computing paradigms.
		Gain insight into research methodology, digital technologies, and interdisciplinary domains like blockchain, IoT, and ethical hacking.
		Gain a comprehensive understanding of the principles of network administration, research methodology, and mobile application development to support enterprise and research-oriented computing environments.
PSO2	General, technical and professional skills required to perform and accomplish tasks	Design, develop, and maintain software systems using C++, Python, Java, and web technologies.
		Analyze and optimize algorithms and data handling techniques.
		Employ software project management and research skills in real-world scenarios.
PSO3	Application of knowledge and skills	Apply advanced programming and design principles to solve real-world computing problems. Create data-driven applications and intelligent systems by integrating machine learning, data mining, and AI techniques.
PSO4	Generic learning outcomes	Prepare comprehensive documentation and technical reports adhering to industry standards. Exhibit teamwork, communication, and

		leadership abilities through collaborative projects and presentations.
PSO5	Constitutional, humanistic, ethical, and moral values	Understand and uphold ethical, legal, and social responsibilities in computing practices. Respect diversity, cultural heritage, and sustainable development values as reflected in the Indian Knowledge System course and societal-oriented project work.
PSO6	Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Be well-prepared for careers in software development, system analysis, data science, IT consultancy, and research. Acquire skills in project management, research, innovation, and product development. Foster an entrepreneurial mindset with the ability to identify opportunities and build solutions.
PSO7	Credit requirements	90 credits
PSO8	Entry requirements	Bachelor Degree with Honours / Honours with Research in Information Technology or Computer Applications as a major course or BCA with Honors/Honours with Research (4 years) OR 1 year PG Diploma in Computer Applications/Information Technology with at least 45% marks or Equivalent CGPA in aggregate, after 3 years Bachelor Degree.

SEMESTER 3rd									
Course Code	Course Title	Type of Course							
			L	T	P	Credits	Int	Ext	Total Marks
MIT3500	Artificial Intelligence	Core	3	0	0	3	30	70	100
MIT3501	Cloud Computing	Core	3	0	0	3	30	70	100
MIT3502	Artificial Intelligence Lab	Core	0	0	2	1	30	70	100
MIT3503	Cloud Computing Lab	Core	0	0	2	1	30	70	100
MIT3504	Web Technologies II	Employability & Entrepreneurship Skill	0	0	4	2	30	70	100
Discipline Elective III (Any one of the following)									
MIT3505	Information Security	Discipline Elective III	4	0	0	4	30	70	100
MIT3506	Ethical Hacking								
MIT3507	Theory of Computation								
Discipline Elective IV (Any one of the following)									
MIT3508	Big Data	Discipline Elective IV	4	0	0	4	30	70	100
MIT3509	Data Science								
MIT3510	Blockchain Technology								
Discipline Elective V (Any one of the following)									
MIT3511	Software Testing & Quality Assurance	Discipline Elective V	4	0	0	4	30	70	100
MIT3512	Digital Image Processing								
MIT3513	Neural Networks								
Total			18	0	8	22	240	560	800

SEMESTER 4th									
Course Code	Course Title	Type of course	L	T	P	Credits	Int	Ext	Total Marks
MIT4550	Research Methodology	Core	4	0	0	4	30	70	100
MIT4551	Network Administration	Employability and Entrepreneurship Skills	0	0	4	2	30	70	100
MIT4552	Dissertation	Research Skills	0	0	0	12	30	70	100
Discipline Elective VI (Any one of the following)									
MIT4553	Data Network & Security	Discipline Elective VI	4	0	0	4	30	70	100
MIT4554	Wireless Networks								
MIT4555	E-Commerce								
Total			8	0	4	22	120	280	400
Grand Total			66	0	24	90	840	1960	2800

SEMESTER-I

Course Title: Introduction to programming languages	L	T	P	Cr.
Course Code: MIT1400	3	0	0	3

Total Hours: 45

Learning Outcomes: After the Completion of this course the learner will able to

- CO1. Describe all the basic concepts of C++ and its features such as composition of objects, Operator overloading.
- CO2. the various access modifiers in C++ programs.
- CO3. Analyze inheritance with the understanding of early binding and late binding.
- CO4. Analyze and explore various Stream classes, I/O operations and exception handling.

Course Content**UNIT I****10 Hours**

Programming Basics: Introduction to Programming, Programming Paradigms, Programming Languages and Types. Basic Program Structure, Execution flow charts of Program, Directives, Basic Input /Output, Advantages, Applications, Data Types, Control Structures, Operators and Expressions.

Introduction Structure, Execution flow, Classes and Objects, Access modifiers, Data Members, Member Functions, Inline Functions, passing parameters to a Function (pass by Value, Pass by Address, Pass by Reference), Function with default arguments, Function Overloading, Object as a Parameter, Returning Object Static data members and functions, Constant Data members and functions

Constructors- Default, Parameterized, Copy, Constructor Overloading, Destructors Arrays, Array as a Class Member, Array of Objects, Strings String Class.

UNIT II**13 Hours**

Operator Overloading and Pointers: Operator Functions-Member and Non Member Functions, Friend Functions Overloading Unary operators Overloading binary operators(Arithmetic, Relational, Arithmetic Assignment, equality), Pointer and Address of Operator, Pointer to an Array and Array of Pointers, Pointer arithmetic, Pointer to a Constant and Constant Pointer, Pointer Initialization, Types of Pointers(void, null and dangling), Dynamic Memory Allocation, Advantages and Applications of pointers .

UNIT III**12 Hours**

Inheritance and Polymorphism: Inheritance Concept, protected modifier, Derivation of Inheritance- Public, Private and Protected,

Types of Inheritance-Simple, Multilevel, Hierarchical, Multiple, Hybrid, Constructors and Inheritance, Function Overriding and Member hiding Multiple Inheritance,

Multipath inheritance – Ambiguities and solutions Polymorphism, Static and Dynamic Binding, Virtual Functions, Pure Virtual Functions, Virtual destructors, Abstract Classes, Interfaces

UNIT IV

10

Hours

Streams and Exceptions: Files, Text and Binary Files, Stream Classes, File IO using Stream classes, File pointers, Error Streams, Random File Access, Manipulators, Overloading Insertion and extraction operators Error handling, Exceptions, Throwing and catching exceptions, Custom Exceptions, Built in exceptions , Casting- Static casts, Const Casts, Dynamic Casts, and Reinterpret Casts. Creating Libraries and header files. Namespaces Generic Programming, Templates, Class Templates, Function Templates, Template arguments.

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Kamthane, A. (2012). *Programming in C++, 2/e*. Pearson Education India.
- Salaria, R. S. (2016). *Mastering Object-Oriented Programming with C++*. KHANNA PUBLISHING HOUSE.
- Balagurusamy, E. (2001). *Object-Oriented Programming with C++, 7e*. McGraw-Hill Education.

Course Title: Relational Database Management systems	L	T	P	Credits
Course Code: MIT1401	3	0	0	3

Total Hours: 45

Learning Outcomes: After the Completion of this course the learner will able to

- CO1. Develops an Entity-Relationship model based on user requirements.
- CO2. Implements the role of the database administrator and his responsibilities.
- CO3. Apply Normalization techniques to normalize a database.
- CO4. Declares and enforces integrity constraints on a database

Course Content

UNIT I

10 Hours

Traditional file processing system: Characteristics, limitations, Database: Definition, composition. Database Management System: Definition, Characteristics, advantages over traditional file processing system, User of database, DBA and its responsibilities, Database schema, instance.

UNIT II

12 Hours

DBMS architecture, data independence, mapping between different levels. Database languages: DDL, DML, DCL. Database utilities, Data Models, Keys: Super, candidate, primary, foreign.

UNIT III

13 Hours

Entity relationship model: concepts, mapping cardinalities, entity relationship diagram, weak entity sets, strong entity set, aggregation, generalization, Overview of Network and Hierarchical model. Relational Data Model: concepts, constraints. Relational algebra: Basic operations, additional operations.

UNIT IV

10 Hours

Database Design: Functional dependency, decomposition, problems arising out of bad database design, Normalization- Normal forms based on primary keys (1 NF, 2 NF, 3 NF, & BCNF), multi-valued dependency, Database design process, database protection, database integrity.

Database concurrency: Definition and problems arising out of concurrency.

Security and Authorization: Database Security Models, SQL Injection, Encryption Techniques. Transaction Management and Concurrency Control, Backup, Recovery, and Cloud Databases

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Ramakrishnan, R., Gehrke, J., &Gehrke, J. (2003). *Database management systems* (Vol. 3). New York: McGraw-Hill.KorthF. Henry. *Database System Concepts*, McGraw Hill.
- Dittrich, K. R., Gatzju, S., &Geppert, A. (1995, September). *The active database management system manifesto: A rulebase of ADBMS features*. In *International Workshop on Rules in Database Systems* (pp. 1-17). Springer, Berlin, Heidelberg.

Course Title: Computer System Architecture	L	T	P	Credits
Course Code: MIT1402	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

- CO1. Determine the designing process of combinational and sequential circuits.
- CO2. Understanding of instruction pipelining and RISC architecture.
- CO3. Simplify Boolean expressions.
- CO4. Design basic Gates, Sequential & Combinational circuits.

Course Content

UNIT I

15 Hours

Boolean Algebra: Boolean operations, Truth Tables, Boolean Laws, K-maps 2,3 and 4 variable maps, don't care about conditions). Basic Gates, Combinational logic design: half-adder, full adder, parallel adder.

UNIT II

15 Hours

Sequential circuits: concept, flip-flops (D, RS, JK, T), counters (Ripple, Asynchronous, Synchronous). Instruction codes, Instruction formats, Instruction cycle, addressing modes.

UNIT III

15 Hours

Register Transfer Language, Arithmetic, Logic and Shift micro-operations, Arithmetic Logic Shift Unit Control Memory: Design of control unit, Micro programmed and hardwired control unit (overview only), Features of RISC and CISC.

UNIT IV

15 Hours

Memory hierarchy-cache and shared memory concepts-Cache memory organization-cache addressing models, Aliasing problem in cache, cache memory mapping techniques-Shared memory organization-Interleaved memory organization, Lower order interleaving, Higher order interleaving. Backplane bus systems-Bus addressing, arbitration and transaction.

Transaction Modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *M.M. Mano.Computer System Architecture. Third Edition, Prentice-Hall of India, 2002.*
- *A.S.Tanenbaum. (1999).Structured Computer Organisation. Prentice-Hall of India,*
 - *William Stallings.(2002)Computer Organisation and Architecture. 6thEdition, Pearson Education.*

Course Title: Software Engineering	L	T	P	Credits
Course Code: MIT1403	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

- CO1. Analyze and model customer's requirements and model its software design.
- CO2. Estimate cost and efforts required in building software.
- CO3. Analyze and compute impact of various risks involved in software development.
- CO4. Design and build test cases, and to perform software testing.

Course Content

UNIT I

15 Hours

Introduction: Software Engineering – A Layered Approach; Software Process – Process Framework, Umbrella Activities; Process Models – Waterfall Model, Incremental Model, and Evolutionary process Model (Prototyping, Spiral Model); Introduction to Agile – Agility Principles, Agile Model – Scrum.

Software Requirements Analysis and Specifications: Use Case Approach, Software Requirement Specification Document, Flow oriented Modeling, Data Flow Modeling, Sequence Diagrams.

UNIT II

15 Hours

Design Modeling: Translating the Requirements model into the Design Model, The Design Process, Design Concepts – Abstraction, Modularity and Functional Independence; Architectural Mapping using Data Flow.

Software Metrics and Project Estimations: Function based Metrics, Software Measurement, Metrics for Software Quality; Software Project Estimation (FP based estimations, COCOMO II Model); Project Scheduling (Timeline charts, tracking the schedule).

UNIT III

15 Hours

Quality Control and Risk Management: Quality Control and Quality Assurance, Software Process Assessment and Improvement Capability Maturity Model Integration (CMMI); Software Risks, Risk Identification, Risk Projection and Risk Refinement, Risk Mitigation, Monitoring and Management.

UNIT IV

15 Hours

Testing and maintenance: Software Testing Techniques, Software testing fundamentals: objectives principles, testability; test case design, Unit testing: white box testing, basis path testing; Control structure testing: Black box testing, testing for specialized environments, Software Reliability and Quality Assurance: Quality concepts, Software quality assurance: SQA activities; Software reviews; cost impact of software defects, defect amplification and removal; formal technical reviews: The

review meeting, review reporting record keeping, review guidelines; Formal approaches to SQA;

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Pressman Roger S, Software Engineering - A Practitioner's Approach, MGH, New Delhi, New Delhi. Publications, New Delhi.*
- *Ian Sommerville, Software Engineering, Pearson Education, 5th Edition, New Delhi*
- *Jalote Pankaj, An Integrated Approach to Software Engineering, Narosa Publications, New Delhi.*
- *Mall Rajib, Fundamentals of Software Engineering, PHI, New Delhi.*
- *Ali Bethforooz, Frederick J. Software Engineering Fundamentals, Hudson Oxford University.*

Course Title: Introduction to Programming Languages Lab	L	T	P	Credits
Course Code: MIT1404	0	0	2	1

Total Hours: 30

Learning Outcomes: After the Completion of the course the learner will be able to

CO1. Design an algorithmic solution for a given problem.

CO2. Debug a given Program.

CO3. Identify solutions to a problem and apply control structures and use defined functions for solving the problem.

CO4. Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.

Course Content

1. Program to display Names, Roll No., and grades of 3 learner who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
2. Program to swap two Characters of different data types using function +++++overloading.
3. Program to demonstrate the use of inline, friend functions and this keyword.
4. Program to implement static data members and member functions.
5. Program to implement Constructor and Destructor.
6. Program to demonstrate Constructor Overloading.
7. Program to calculate factorial using Copy Constructor.
8. Program to allocate & deallocate memory using new [] and delete [].
9. Program to demonstrate the use of function overloading.
10. Program to overload comparison operator operator== and operator !=.
11. Program to create an array of pointers.
12. Create a base class containing the data member roll number and name. Also create a member function to read and display the data using the concept of single level inheritance. Create a derived class that contains marks of two subjects and total marks as the data members.
13. Program to create multilevel inheritance. (Hint: Classes A1, A2, A3)
14. Program to demonstrate the concept of function overriding.
15. Program to demonstrate the use of virtual functions and polymorphism.
16. Program to demonstrate the use of pure virtual functions.
17. Program to demonstrate the concepts of abstract class.
18. Program to perform exception handling.
19. Program to copy the contents of one file to another file.
20. Program to create Generic Functions using Template.

Course Title: Relational Database Management Systems Lab	L	T	P	Credits
Course Code: MIT1405	0	0	2	1

Total Hours: 30

Learning Outcomes: After the Completion of the course the learner will be able to:

- CO1. Populate and query a database using SQL DML/DDI commands.
- CO2. Designs SQL queries to create database tables and make structural modifications.
- CO3. Design the concept of inbuilt functions.
- CO4. Implement the concept of join, views and indexes.

Course Content

1. Data Definition, Table Creation, Constraints,
2. Insert, Select Commands, Update and Delete Commands.
3. Nested Queries and Join Queries
4. Views
5. High level programming language extensions (Control structures, Procedures and Functions).
6. Front end Tools
7. Forms
8. Triggers
9. Menu Design
10. Reports
11. Database Design and implementation (Mini Project).

Course Title: Introduction to Indian Knowledge System	L	T	P	Credits
Course Code: IKS0021	4	0	0	4

Total hours:60

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Students understand the various pramanas used in Indian Knowledge System.
- CO2. They have been introduced to some fields of IKS like Astronomy, Arts, Ayurveda and Architecture.
- CO3. They can explore the different fields of study in IKS further with the references and the resources provided during the course.
- CO4. Gain a foundational understanding of the diverse disciplines within the Indian Knowledge Systems, including their philosophical underpinnings, historical development, and relevance to contemporary knowledge and practice.

Course Content

UNIT I

8 Hours

Astronomy and Mathematics: Introduction to various fields in traditional Indian Knowledge system. Methods and sources. Ancient Indian Observational astronomy. Foundation concepts - nakṣatra, graha, time units, phenomena like meteors, eclipses. Mathematical thinking - numerical and spatial thinking, śulbasūtra, zero, sundials, water clock, time measurement.

UNIT II

7 Hours

Language, Literature and Art: Formation of words in saṃskṛta and some ideas from Pāṇini and Patañjali. Technical words and examples of their usage. Music Vedic chants, sāma, some concepts in ancient treatises like nāradyāśikṣā nāṭyaśāstra. Basics of related concepts like dance, meter and rasa in poetry.

UNIT III

8 Hours

Earth and Atmosphere: Anomalous phenomena, Earthquakes, clouds, rainfall, soil, agriculture and food science.

Material science : Knowledge and use of various materials in āyurveda, rasaśāstra and vāstuvidyā.

UNIT IV

7 Hours

Architecture and Civil Engineering: Sindhu-Sarasvatī cities, description in purāṇa, arthaśāstra. A glance at select texts like nāradaśilpa, mayamata, mānasāra.

Transaction Mode

Seminars, Group discussion, Team teaching, Focused group discussion, Assignments, Project-based learning, Simulations, reflection and Self-assessment

Suggested Readings

- Dikshit, S. B. (1969, 1981). *Bharatiya Jyotish Sastra (in Marathi) Poona (1896).* (Transl. RV Vaidya, Vol.1). New Delhi: Government of India Press.
- Iyengar, R. N. (2016) *Astronomy in Vedic texts, History of Indian Astronomy, A Handbook - Volume brought out on the occasion of IX International Conference on Oriental Astronomy November 14–18.*
- Iyengar, R. N. (2013). *Parāśara Tantra (Ed. Text, Trans. & Notes), Bangalore: Jain University Press.*
- Iyengar, R. N.; Sudarshan, H.S. and Anand V (2019). *Vrddhagārgīya Jyotiṣa (Part1). Tattvadīpaḥ, Journal of Academy of Sanskrit Research, Melkote, 25 (1). 60–81.*
- Sastry T.S. K (Ed.). (1984). *Vedānga Jyotiṣa of Lagadha, Indian Journal of History of Science, 4) Supplement, 1–74.*
- Sen, S. N., and Shukla, K. S. (Ed.) (2000). *History of Astronomy in India, 2nd Revised Edition. New Delhi: Indian National Science Academy.*
- Thompson R.L. (2007) *The Cosmology of the Bhāgavata Purāṇa (First Indian Edition) MLBD Publn. Delhi.*
- Iyengar, R.N; Kannan K.S; Wakankar S. Y. (2018) *Nārada Śilpaśāstra - Sanskrit Text on Architectural Civil Engineering, Jain University Press.*
- Altekar A.S. (1944) *Education in Ancient India.*

Course Title: Data warehousing and Data Mining	L	T	P	Credits
Course Code: MIT1406	4	0	0	4

Total Hours: 60**Learning Outcomes:** After the Completion of the course the learner will be able to

- CO1. Understand the functionality of various Data mining techniques.
- CO2. Familiarize yourself with the process of data analysis, identifying the problems, and choosing the relevant models and algorithms to apply.
- CO3. Identify the Classifications & Prediction Data Mining Techniques
- CO4. Compare the classification Techniques.

Course Content**UNIT I****15 Hours**

Data Warehousing: Definition, Characteristics of a Data Warehouse, Data warehouse Usage, DBMS vs. Data warehouse.

Developing Data Warehouse: Data warehousing components, Steps and Crucial decisions for the design and construction of Data Warehouses, Three-tier Data warehouse architecture, Data Warehouse Implementation, Design, performance and technological considerations, Metadata.

UNIT II**15 Hours**

Developing Data Mart based Data warehouse: Types of data marts, Metadata for a data mart, Data model for a data mart, Maintenance of a data mart, Software components for a data mart, Performance issues, Security in data mart.

OLAP Systems: Types of OLAP, Relational vs. Multidimensional OLAP, Data modeling: Star schema, Snowflake schema, OLAP tools.

UNIT III**15 Hours**

Data Mining: Introduction to data mining, Data mining process, Major issues and Application of Data mining, Data preprocessing: Data cleaning, Data integration and transformation and Data reduction; Tools for data mining.

Data Mining Techniques: Association rules: Introduction, Market basket analysis, Frequent Pattern Mining algorithms: Apriori algorithm, Partition algorithm.

UNIT IV**15 Hours**

Classification and Prediction: Definition, Issues regarding Classification and Prediction, Classification by Decision Tree Induction, Support Vector Machines, k-Nearest-Neighbour Prediction: Linear and Non-Linear Regression.

Clustering: Definition, Types of data in cluster analysis, Clustering paradigms: K-Means and K-Medoids, Mining Sequence patterns: Generalized Sequential Patterns(GSP) mining algorithm, Hidden Markov Model, Social Network Analysis.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Inmon, W. H., 2002: Building the Data Warehouse, John Wiley.*
- *Prabhu, C.S.R., 2010 : Data Warehousing, PHI.*
- *Jiawei Han, MichelineKamber, 2000: Data Mining: Concepts and Techniques, Morgan KoffmanElsvier.*
- *Pujari, Arun K, 2013 : Data Mining Techniques, Universities Press*

Course Title: IOT & Its Applications	L	T	P	Credits
Course Code: MIT1407	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

- CO1. Identify the different types of sensors and devices used in IoT.
- CO2. Understand the security and privacy challenges associated with IoT.
- CO3. Compare and contrast different IoT platforms and architectures
- CO4. Develop IoT prototypes using hardware and software components.

Course Content

UNIT I

15 Hours

FUNDAMENTALS OF IoT- Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II

15 Hours

IoT PROTOCOLS- IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, 6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT

UNIT III

15 Hours

DESIGN AND DEVELOPMENT- Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details

UNIT IV

15 Hours

Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M

Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.

CASE STUDIES/INDUSTRIAL APPLICATIONS: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment, Industry 4.0 concepts.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco (2017), IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Press.*
- *ArshdeepBahga, Vijay Madisetti (2015), Internet of Things – A hands-on approach, Universities Press.*
- *Rajkamal, Internet of Things: Architecture, Design Principles and Applications, McGraw Hill Higher Education.*

Course Title: Software Project Management	L	T	P	Credits
Course Code: MIT1408	4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the learner will be able to

- CO1. Identify the different project contexts and suggest an appropriate project management strategy.
- CO2. Practice the role of project planning, risks associated in successful software development.
- CO3. Understand the role of resource allocation and effort estimation in the project management process.
- CO4. Learn to apply the concept of project management and planning to organize team and people's behavior.

Course Content

UNIT I

15 Hours

Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered by Software Project Management, Overview Of Project Planning, plan methods, methodology.

Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation, selection of project approach: discussion on models, choice of process models.

UNIT II

15 Hours

Activity Planning : Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks,

Risk Management: Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.

UNIT III

15 Hours

Monitoring and Control: Creating Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value analysis, Prioritizing Monitoring, Getting Project Back to Target, and Change Control.

Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.

Resource allocation: introduction and nature of resources, identification of resource requirements, scheduling, creating critical path, cost schedule, counting cost.

UNIT IV

15 Hours

Effort estimation: basics of software estimation, techniques, COCOMO-II, cost, staffing pattern.

Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behavior: Background, Selecting The Right Person For The Job, Instruction In The Best Methods, Motivation , The Oldman, Hackman Job Characteristics Model, Working In Groups, Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Bob Hughes, Mike Cotterell, Software Project Management, Tata McGraw Hill Publishing*
- *Ramesh, GopalaSwamy, Managing Global Projects, Tata McGraw Hill Publishing*
- *Royce, Software Project Management, Pearson Education Publishing*
- *Jalote, Software Project Management in Practice, Pearson Education Publishing*

SEMESTER II

Course Title: Data Structures	L	T	P	Credits
Course Code: MIT2450	3	0	0	3

Total Hours: 45

Learning Outcomes: On the completion of this course, the learner will be able to

- CO1. Algorithms and algorithm complexity.
- CO2. Attain knowledge of tree and graph concepts.
- CO3. Implement link list and its applications in data structures.
- CO4. Apply the different linear data structures like stack and queue to various computing problems.

Course Content**UNIT I****10Hours**

Basic concept and notations: data structures and data structures operations, mathematical notation and functions, algorithmic complexity, Big'O'notations and time space tradeoff.

Arrays: Linear array, representation of linear array in memory, Traversing linear array, insertion and deletion in an array, multi-dimensional array: row-major, column major order, sparse array.

UNIT II**12 Hours**

Stacks: Push and Pop in stack. Representation of stack in memory (linked and sequential) application so f Stack: conversion from infix notation to postfix notations, evolution of postfix notation, matching of Parentheses, recursion, Tower of Hanoi.

UNIT III**10 Hours**

Queue: Queues and Dequeue, Priority Queues, Operations on queues. Linked list: Representation of linked list using static and dynamic data structures, Comparison of Linear and non-linear data structures, Insertion and deletion of a node from a linear linked list, Introduction to doubly and circular linked lists, Application of linked lists.

UNIT IV**13 Hours**

Trees: Basic terminology, binary trees, binary search trees (BST), Tree traversal: In-order, pre-order, post-order, AVL trees and balanced binary trees (basic concepts)

Graphs: Terminology and representations (adjacency matrix/list), Traversal: BFS and DFS, Applications of trees and graphs (e.g., shortest path, minimum spanning tree overview)

Searching and Sorting: Linear and binary search, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Radix Sort and Quick sort comparison of various searching and sorting algorithms.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Samet, H. (1990). The design and analysis of spatial data structures (Vol.85,p.87). Reading, MA: Addison-Wesley.*
- *Wirth, N.(1985). Algorithms & data structures. Prentice-Hall, Inc.*
- *Samet, H.(1990). Applications of spatial data structures: computer graphics, image processing, and GIS. Addison-Wesley Longman Publishing Co. Inc.*

Course Title: Programming using Python	L	T	P	Credits
Course Code: MIT2451	3	0	0	3

Total hours:45

Learning Outcomes: After the Completion of this course, the learner will be able to:

- CO1. Understand basic of Python Programming
- CO2. Apply conditional and looping constructs.
- CO3. Learn basic algorithmic problem-solving techniques (decision structures, loops, functions).
- CO4. Know the basics of Strings and Dictionaries of programming.

Course Content

UNIT I

10Hours

Introduction to Python Getting Started: Introduction to Python-an interpreted high-level language, interactive mode and script mode.

Variables, Expressions and Statements: Values, Variables and keywords; Operators and Operands in Python: (Arithmetic, relational and logical operators), operator precedence, Expressions and Statements (Assignment statement); Taking input (using raw input () and input ()) and displaying output (print statement); Putting Comments

Conditional constructs and looping: if else statement While, for (range function), break, continue, else, pass, Nested loops, use of compound expression in conditional constructs and looping

UNIT II

12Hours

Functions: Importing Modules (entire module or selected objects), invoking built in functions, functions from math module, using random () and randint() functions of random module to generate random numbers, composition.

Defining functions, invoking functions, passing parameters, scope of variables, void functions and functions returning values, flow of execution

UNIT III

13Hours

Strings: Creating, initializing and accessing the elements; String operators: +, *, in, not in, range slice [n:m]; Comparing strings using relational operators; String functions & methods: len, capitalize, find, isalnum, isalpha, isdigit, lower, islower, isupper, upper, lstrip, rstrip, isspace, istitle, partition, replace, join, split, count, decode, encode, swap case, Pattern Matching.

Lists: Concept of mutable lists, creating, initializing and accessing the elements, traversing, appending, updating and deleting elements; List Operations (joining, list slices); List functions & methods: len, insert, append, extend, sort, remove, reverse, pop

UNIT IV**10 Hours**

Dictionaries: Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, traversing, appending, updating and deleting elements. Dictionary functions & Methods: `cmp`, `len`, `clear()`, `get()`, `has_key()`, `items()`, `keys()`, `update()`, `values()`

Tuples: Immutable concept, creating, initializing and accessing the elements in a tuple; Tuple functions: `cmp()`, `len()`, `max()`, `min()`, `tuple()` Input and Output: Output Formatting, Reading and Writing Files

Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Predefined Clean-up Actions

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Dawson Michael. *Programming with python, A users Book* Cengage Learning
- Beazley Davi. *Python Essential Reference, Third Edition*

Course Title: Digital Electronics	L	T	P	Credits
Course Code: MIT2452	4	0	0	4

Total Hours: 60

Learning Outcomes: On the completion of his course, the learner will be able to:

- CO1. Solve the conversions of various number systems.
- CO2. Learn the basics of Logic Gates.
- CO3. Analyze and Design various combinational and sequential circuits.
- CO4. Analyze and prevent various hazards and timing problems in a digital design.

Course Content

UNIT I

15Hours

Information Representation: Number systems, Integer and floating point representation, character codes (ASCII, EBCDIC).
Digital IC's: Logic gates, flip-flops, clocks and timers, shift registers, counters.

UNIT II

15Hours

Boolean Algebra & Circuit Design: Basic laws of Boolean algebra, circuit design using standard (NAND) Gates, Adder, coder/De-multiplexer, encoder/multiplexer design.

UNIT III

15Hours

MOS & LSI Digital Systems: Semiconductor memory, static and dynamic devices, read only & random-access memory chips, PROMS and EPROMS. Address selection logic. Read and write control timing diagrams for memory ICs.

UNIT IV

15 Hours

Logical Families: TTL, STTL, CMOS logic families.
ADC (Analog to Digital Converter) and DAC (Digital to Analog Converter)
Digital Peripherals: Keyboard, multiplexed seven segment display, CRT display schemes, Printers, Control interfaces (parallel and serial) for the peripheral units.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Maini, A. K. (2007). *Digital electronics: principles, devices and applications*

.John Wiley & Sons.

- *Cook, N.P. (2001). Digital electronics with PLD integration.*
- *Rosen berg, P.(2005).Audel Basic Electronics(Vol.29).John Wiley & Sons*

Course Title: Computer Network	L	T	P	Credits
Course Code: MIT2453	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

- CO1. Understand the fundamental concepts of data networks
- CO2. Explain the different network security threats and vulnerabilities
- CO3. Evaluate network security measures and technologies
- CO4. Implement network security controls

Course Content

UNIT I

15 Hours

Introduction to Computer networks and applications: Network Structure and Architecture, Network Hardware and Software (protocol hierarchies, design issues for layers, interfaces and services: connection oriented and connection less), Network structure and architecture-point to point, multicast, broadcast, Classification of networks on the basis of Geographical Span (PAN, LAN, MAN and WAN) , LAN topologies (Bus, Ring, Star, Mesh, Tree and Hybrid). Network Connecting Devices: Repeaters, Hubs, Bridges, Routers, Gateways and Switches, Network Reference models: OSI model, TCP / IP model. Comparison between OSI and TCP/IP.

UNIT II

15 Hours

Introduction: Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, hash algorithms.

Secret Key Cryptography: Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.

UNIT III

15 Hours

Hash Functions and Message Digests: Length of hash, uses, algorithms (MD2, MD4, MD5, SHA) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHA: Overview, padding, stages.

Public key Cryptography: Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.

UNIT IV

15 Hours

Authentication: Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Inter

domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics. Security Policies and Security Handshake Pitfalls: What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Tanenbaum, A. S. (2002). Computer networks. Pearson Education India.*
- *Peterson, L. L., & Davie, B. S. (2007). Computer networks: a systems approach. Elsevier.*
- *Kiesler, S. (1986). The hidden messages in computer networks (pp. 46-47). Harvard Business Review Case Services.*
- *AtulKahate .Cryptography and Network Security ,TMH.*
- *Behourz A Forouzan,Data Communications and Networking*

Course Title: Data Structures Lab	L	T	P	Credits
Course Code: MIT2454	0	0	2	1

Total Hours: 30

Course Outcomes: On completion of this course the students will be able to:

- CO1. Create the applications of data structures.
- CO2. Solve the algorithmic problems like insertion and deletion of data.
- CO3. Interpret the programming code to implement the Link List Structure.
- CO4. Analyze Singly, Doubly, Circular Singly linked lists and its operations.
- CO5. Implement the insertion and deletion on BST and heap sort.

Course Content

1. Program to input 1-D Array
2. Program to perform insertion in Arrays
3. Program to perform deletion in Arrays
4. Program to input 2-D arrays (Matrices)
5. Program to find transpose of a matrix. Multiply 2 matrices.
6. Program to implement sparse matrices.
7. Program to perform linear search
8. Program to perform Binary search
9. Program to reverse array without using another variables.
10. Program to perform sorting using Insertion Sort.
11. Program to input and traverse N-nodes in a one way linked list.
12. Program to reverse a one way linked list.
13. Program to perform insertion/deletion in linked lists.
14. Program to input and traverse doubly linked list.
15. Program to implement stack operations.
16. Program to implement Queues.
17. Program to find factorial using recursion.
18. Program to print Fibonacci series using recursion.
19. Program to input a BST.
20. Program to perform insertion in a BST.
21. Program to perform deletion in a BST.

22. Program to implement min-heaps.
23. Program to implement max-heaps.
24. Program to implement AVL trees.
25. Program to perform rotations in AVL trees.
26. Program to perform rotations in AVL trees.
27. Program to input a graph.
28. Program to print adjacency list of a graph.
29. Program to perform traversal in graphs using DFS.
30. Program to perform traversal in graphs using BFS.
31. Program to implement shortest path methods.
32. Programs to perform Dynamic memory allocation.
33. Programs to perform sorting on data stored in a file.
34. Programs to delete duplicates in arrays and linked lists.

Course Title: Programming Using Python Lab	L	T	P	Credits
Course Code: MIT2455	0	0	2	1

Total Hours:30

Learning Outcomes: After the Completion of this course, the learner will be able to:

CO1. Demonstrate proficiency in writing Python programs.

CO2. Solve the algorithmic problems like insertion and deletion of data.

CO3. Summarize and describe the flow control structures (conditionals, loops) In Python.

Course Content

Program 1: Print hello world

Program 2: add numbers and concatenate strings

Program 3: input from user

Program 4: using loops (for,while)

Program 5: Loop control statements (break, continue, pass)

Program 6: if-else - conditional checking

Program 7: functions

Program 8: math library

Program 9: strings

Program 10: exceptional handling

Program 11: random numbers/string

Program 12: demo of data structure - list

Program 13: demo of data structure – dictionary

Program 14: demo of data structure – tuple

Program 15: command line argument

Program 16: Filter Even Numbers

Program 17: Convert Decimal to Binary

Program 18: Read a File

Program 19: Find the Largest Number in a List

Program 20: Sort a List

Course Title: Web Technologies-I	L	T	P	Credits
Course Code: MIT2456	0	0	4	2

Total Hours:60**Course Content****1. HTML & CSS Fundamentals**

- Design a basic web page using HTML elements such as headings, paragraphs, lists, and tables.
- Implement internal, inline, and external CSS to style the web page.
- Create a responsive layout using CSS media queries

2. Forms and Input Validation

- Develop a registration form incorporating various input types like text fields, radio buttons, checkboxes, and dropdowns.
- Use JavaScript to validate form inputs, ensuring data integrity before submission

3. JavaScript Programming

- Write scripts to perform operations such as sorting an array of numbers in descending order.
- Create a script that converts numerical input into its corresponding word representation, handling edge cases like non-numeric input or out-of-range values.

4. Document Object Model (DOM) Manipulation

- Use JavaScript to dynamically modify HTML content and styles based on user interactions.
- Implement event listeners to respond to user actions like clicks and form submissions.

2. PHP Basics

- Develop simple PHP scripts to display text and variables.
- Implement loops and arrays in PHP to process and display data.
- Create functions in PHP to perform tasks such as calculating the factorial of a number or comparing two values.

3. Form Handling with PHP

- Design forms that send data to the server using GET and POST methods.

- Process and validate form data on the server side using PHP.

4. **Session Management**

- Implement cookies and sessions in PHP to maintain user state across multiple pages.
- Create login systems that utilize sessions to authenticate users.

5. **Mini Project**

- Develop a small-scale web application that integrates HTML, CSS, JavaScript, and PHP.
- Examples include a personal blog, a simple e-commerce site, or a task management tool.

Course Title: Machine Learning	L	T	P	Credits
Course Code: MIT2457	4	0	0	4

Total Hours: 60**Learning Outcomes:**

After the Completion of the course the learner will be able to

CO1. Recognize the basic concepts of Bayesian Decision Theory.

CO2. Apply structured thinking to unstructured problems.

CO3. Class conditional probability distributions.

CO4. Apply Multi-Layer Perceptions and Back Propagation learning.

Course Content**UNIT I****15 Hours**

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.

UNIT II**15 Hours**

Linear machines: General and linear discriminates, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptions: two-layers universal approximates, back propagation learning, on-line, off-line error surface, important parameters.

UNIT III**15 Hours**

Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data

Instance-based Learning: Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability

UNIT IV**15 Hour**

Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Trade off.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Zhang, C., & Ma, Y. (Eds.). (2012). *Ensemble machine learning: methods and applications*. Springer Science & Business Media.
- Marsland, S. (2011). *Machine learning: an algorithmic perspective*. Chapman and Hall/CRC..
- C. M. Bishop. *Pattern Recognition and Machine Learning*, Springer, (2006).

Course Title: Data visualization	L	T	P	Credits
Course Code: MIT2458	4	0	0	4

Total Hours:60**Learning Outcomes:** After the Completion of this course learner will be able to

- CO1. Build and maintain reliable, scalable, distributed systems with Apache Hadoop
- CO2. Understand Spark framework and explore various ML tools for data processing
- CO3. Apply HIVEQL, PIG techniques to solve big data queries
- CO4. Understand conventional SQL query language and No SQL
- CO5. Design, build and query Mongo DB
- CO6. Visualize big data to perform decision making in real world problems

Course content**UNIT I****15 Hours**

Introduction to Big Data: Distributed file system– Big data and its importance, 3Vs of Data Volume, Velocity and Variety, Data sets, Data analysis, Data analytics, Business intelligence, KPI, Big data characteristics, Different types of data, Drivers for big data adoption. Big Data Analysis Techniques: Quantitative analysis, Qualitative analysis, Data mining, Statistical analysis, Machine learning, Semantic analysis, Visual analysis, Case studies.

UNIT II**15 Hours**

Hadoop Architecture: Overview of Distributed database Systems, Hadoop eco-system, Hadoop core components, Hadoop distributions, Developing enterprise applications with Hadoop. Storing Data in Hadoop: Moving data in and out of Hadoop, HDFS architecture, HDFS files, Hadoop specific file types, HDFS federation and high availability, working with HDFS Commands, Fundamentals of HBASE, Zookeeper concepts and methods to build applications with Zookeeper.

UNIT III**15 Hours**

Introduction to SPARK: Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib. HIVE, HIVEQL and PIG: HIVE: Architecture and installation, Comparison with traditional database, HIVEQL querying data, Sorting and aggregating, Joins & sub queries, HIVE Views, PIG: Architecture and installation, Execution Mechanisms, load/store operator, Pig scripts.

UNIT IV**15 Hours**

No SQL and Mongo DB: Introduction, Types of NoSQL databases, Advantages of No SQL, Use of No SQL in industry, SQL VS No SQL, Mongo DB: Mongo DB Support for dynamic queries, Replications, Sharding, Create Database and Drop Database, Collections and Documents, MongoDB Query Language.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Borislublsinsky, Kevint.Smith, Alexey Yakubovich, “*Professional Hadoop Solutions*”, Wiley, ISBN: 9788126551071, 2015
- Thomas Erl,” *Big Data Fundamentals-Concepts, Drivers and Techniques*”, Pearson publication, 2016
- KyleBanker, PiterBakkum, ShaunVerch, “*MongoDB in Action*”, Second Edition, Dreamtech Press
- TomWhite, “*HADOOP: The Definitive Guide*”, O Reilly 2012
- AlainF. Zuur, ElenaN. Ieno, ErikH.W.G.Meesters, “*Beginner's GuidetoR*”, Springer 2009

Course Title: Natural Language Processing	L	T	P	Credits
Course Code: MIT2459	4	0	0	4

Total Hours: 60

Learning Outcomes: After the completion of this course, the learner are expected to

- CO1. Develop interactive augmented reality applications for both PC based mobile devices using a variety of novel input devices
- CO2. In depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information
- CO3. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches

UNIT I

15 Hours

Introduction: Knowledge in speech and language processing, Ambiguity, Models and Algorithms, Brief History. Regular Expressions and Automata, Morphology and Transducers: Inflectional and derivational morphology, finite state morphological parsing, Combining FST Lexicon and rules. Lexicon free FST: Porter Stemmer N-grams: Counting Words in Corpora, Simple Unsmoothed n-grams, Smoothing, Entropy HMM and Speech Recognition: Speech Recognition Architecture, Overview of HMM, A* decoding.

UNIT II

15 Hours

World Classes and Part-of-Speech Tagging: English word classes, Targets for English, Part of Speech tagging, Rule based part of speech Tagging, Transformation based tagging. Context Free Grammars for English: Constituency, Context Free rules and Trees, Sentence level construction, The Noun Phrase, Coordination, Agreement, The verb phrase and sub categorization. Spoken Language Syntax, Grammar Equivalence and Normal form, Finite state context free grammars, Grammar and human processing.

UNIT III

15 Hours

Parsing with context free grammars: Parsing as Search, basic Top Down Parser, Problems with basic top-down-parsers, the early Algorithm, Finite state parsing method. Features and Unifications: Feature Structures, Unification of Features Structures, Features Structures in the grammar, Implementing Unification. Lexicalized and probabilistic parsing: Probabilistic context free grammars, problems with probabilistic context free grammars

UNIT IV

15 Hours

Semantics: (Representing Meaning): Computational Desiderata for representation, meaning structure of language, First order predicate calculus, linguistically relevant concept, Related Representational approaches, Alternative approaches to meaning.

Semantic Analysis: Syntax driven semantic analysis, Attachment of Fragment of English, Robust Semantic Analysis Lexical Semantics: Relation among lexemes and their senses, Internal Structure of words

Transactional Mode

Project based learning, Team Teaching, flipped teaching, Open talk, Collaborative Teaching, Case Analysis, Panel Discussions, Group Discussions

Suggested Readings

- Speech and Language processing an introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin
- Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward Loper
- Handbook of Natural Language Processing, Second Edition—Nitin Indurkha, Fred J. Damerau, Fred J. Damerau

Semester III

Course Title: Artificial Intelligence	L	T	P	Credits
Course Code: MIT3500	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Differentiate the various searching techniques, constraint satisfaction problem.
- CO2. Classify the role of agents and the way of evaluating it.
- CO3. Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.
- CO4. Compare different machine learning techniques to design AI machines and enveloping applications for real world problems.

Course Content

UNIT I

10 Hours

Introduction to Artificial Intelligence (AI) and Problem Space: Introduction AI technique, Turing test, History and developments in AI, applications of AI, State space representation, production systems, systematic control strategies: Breadth first search and Depth first search, problem characteristics, product system characteristics, issues in the design of search programs.

Heuristic Search Technologies: Introduction to heuristic search, Generate and test, Hill Climbing, Best First search, A*, Problem reduction, AO*.

UNIT II

10 Hours

Knowledge representation methods - Propositional logic and first order predicate logic, Resolution principle, Semantic networks, partitioned semantic nets, Frames, Scripts and conceptual dependencies.

Game playing: Minimax search procedure, reducing alternatives using Alpha-Beta pruning method examples.

UNIT III

12 Hours

Approaches to AI: Turing Test and Rational Agent Approaches; State Space Representation of Problems, Heuristic Search Techniques, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.

Natural Language Processing: Grammar and Language; Parsing Techniques, Semantic Analysis and Pragmatics.

UNIT IV**13 Hours**

Tools and Technologies for AI: Introduction to AI language, Natural Language Processing (NLP), Ethical and Social Implications of AI, AI Trends and Future Directions, LISP: Symbolic expression, creating, appending and modifying lists, defining functions, Predicates, Conditionals, Recursion, Iteration, Printing and reading, Lambda expressions and higher order function, List storage.

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Khemani , D. (2013). A first course in artificial intelligence. McGraw-Hill Education.*
- *Fu, L. M. (2003). Neural networks in computer intelligence. Tata McGraw- Hill Education.*
- *Kamruzzaman, A. M. Artificial Intelligence & Applications.*
- *Russell, S. J. (2010). Artificial intelligence is a modern approach. Pearson Education, Inc.*

Course Title: Cloud Computing	L	T	P	Credits
Course Code: MIT3501	3	0	0	3

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Recognize the fundamentals and essentials of Cloud Computing.
- CO2. Describe the Concept of Cloud Infrastructure Model.
- CO3. Analyze the key technical and organizational challenges.
- CO4. Interpret the importance of virtualization in distributed computing.

Course Contents

UNIT I

10 Hours

Introduction to Cloud Computing: Introduction to Cloud Computing, History and Evolution of Cloud Computing, Types of Cloud Computing, Cloud Computing Architecture, Basics of Cloud Infrastructure.

UNIT II

10 Hours

Cloud Computing Delivery Models: Introduction, Cloud Computing Delivery Models, Attributes of Cloud Computing, Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Comparison of Different Services, Combining Different Services, Obstacles for Cloud Technology, Cloud Vulnerabilities, Cloud Challenges, Practical Applications of Cloud Computing.

Migrating to the Cloud: Introduction, Broad Approaches to Migrating to the Cloud, The Seven-step Model of Migration to the Cloud, Service Level Agreements (SLA). Evaluating the Business Need, Cloud vs. Hosted Applications, Cloud vs. Licensed Software Vendors.

UNIT III

12 Hours

Selection of Cloud Provider: Introduction, A Brief about Leading Cloud Service Providers, Considerations for Selecting a Cloud Solution, Business Considerations, Data Safety and Security, Interoperability, Portability and Integration, Geographical Considerations, Contingency and Recovery Management, Ethical and Legal Considerations, Scalability and Flexibility

UNIT IV

13 Hours

Abstraction and Virtualization: Introduction to Virtualization Technologies, Understanding Hypervisors, Scheduling and Load

Balancing.

Securing the Cloud: Securing the Cloud, Securing Data, Establishing Identity and Presence.

Case-Studies: Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services. Emerging Trends and Best Practices: Edge and Fog Computing, Serverless Computing and Function as a Service (FaaS), Cloud Automation and Orchestration, Best Practices in Cloud Deployment and Management, Future Directions in Cloud Computing

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings:

- *Buyya, R., Broberg, J., & Goscinski, A. M. (Eds.). (2010). Cloud computing: Principles and paradigms. John Wiley & Sons.*
- *Sosinsky, B. (2010). Cloud computing bible. John Wiley & Sons.*
- *Miller, M. (2008). Cloud computing: Web-based applications that change the way you work and collaborate online. Que publishing.*
- *Kiswani, J. H., Dascalu, S. M., & Harris Jr, F. C. (2021). Cloud computing and its applications: A comprehensive survey. International Journal of Computer Applications IJCA, 28.*

Course Title:	Artificial Intelligence LAB	L	T	P	Credits
Course Code:	MIT3502	0	0	2	1

Total Hours: 30**Course Content:**

- Program 1: Implementation of toy problems
- Program 2: Developing agent programs for real world problems
- Program 3: Implementation of constraint satisfaction problems
- Program 4: Implementation and Analysis of DFS and BFS for an application
- Program 5: Developing Best first search and A* Algorithm for real world problems
- Program 6: Implementation of minimax algorithm for an application
- Program 7: Implementation of unification and resolution for real world problems.
- Program 8: Implementation of knowledge representation schemes - use cases
- Program 9: Implementation of uncertain methods for an application
- Program 10: Implementation of block world problem
- Program 11: Implementation of learning algorithms for an application
- Program 12: Development of ensemble model for an application
- Program 13: Expert System case study
- Program 14: Implementation of NLP programs
- Program 15: Applying deep learning methods to solve an application.

Course Title: Cloud Computing Lab	L	T	P	Credits
Course Code: : MIT3503	0	0	2	1

Total Hours: 30**Course Content****1. Virtualization and Environment Setup**

- Install and configure virtualization tools like VirtualBox or VMware Workstation.
- Set up various operating systems (e.g., Linux, Windows) within virtual machines.
- Transfer files between virtual machines and host systems.

2. Cloud Platform Deployment

- Install and configure private cloud platforms such as OpenStack.
- Launch and manage instances using platforms like TryStack.
- Explore public cloud services (e.g., AWS, Google Cloud) for deploying application.

3. Hadoop and Big Data Processing

- Set up a single-node Hadoop cluster.
- Execute MapReduce programs for tasks like word count and data analysis.

4. Cloud Application Development

- Develop and deploy applications using Platform as a Service (PaaS) offerings like Google App Engine.
- Implement web applications that leverage cloud storage and databases.

2. Version Control and Collaboration

- Use Git for version control: clone repositories, commit changes, push to remote repositories, and manage branches.
- Collaborate on code using platforms like GitHub or GitLab.

3. Security and Compliance

- Implement authentication and authorization mechanisms in cloud applications.
- Understand and apply best practices for data security and compliance in cloud environments.

4. Monitoring and Performance Tuning

- Monitor cloud resources and application performance using tools like CloudWatch or Nagios.
- Optimize resource utilization and cost in cloud deployments.

5. **Mini Project**

- Undertake a project that integrates multiple cloud computing concepts, such as developing a scalable web application with backend services and database integration.

Course Title: Web Technologies II	L	T	P	Credits
Course Code: MIT3504	0	0	4	2

Course Content

1. Advanced Client-Side Scripting

- Implement dynamic functionalities using JavaScript frameworks such as React, Angular, or Vue.js.
- Utilize AJAX for asynchronous data retrieval and DOM manipulation.

2. Server-Side Programming

- Develop web applications using server-side languages like PHP, Node.js, or Python with frameworks such as Express or Django.
- Handle form submissions, session management, and authentication mechanisms.

3. Database Integration

- Connect web applications to databases like MySQL or MongoDB.
- Perform CRUD (Create, Read, Update, Delete) operations and implement data validation.

4. Web Services and APIs

- Consume and create RESTful APIs.
- Implement JSON/XML data handling and integrate third-party APIs.

6. Content Management Systems (CMS)

- Install and customize CMS platforms like WordPress or Joomla.
- Develop themes and plugins to extend CMS functionalities.

10. Security Practices

- Implement input validation and sanitization to prevent common vulnerabilities.
- Use HTTPS, manage user sessions securely, and understand basic encryption techniques.

11. Version Control and Deployment

- Utilize Git for version control and collaboration.
- Deploy applications to web servers or cloud platforms like Heroku or AWS.

Mini Project

- Develop a comprehensive web application incorporating the above technologies.
- Examples include e-commerce sites, blogging platforms, or task management tools.

Course Title: Information Security	L	T	P	Credits
Course Code: MIT3505	4	0	0	4

Total Hours: 60**Learning Outcomes**

After completion of this course, the learner will be able to:

- CO1. Understand Core Concepts of Information Security
- CO2. Demonstrate knowledge of classical and modern encryption algorithms (e.g., DES, AES, RSA).
- CO3. Identify and mitigate common web vulnerabilities such as SQL injection and cross-site scripting (XSS).

Course Content**UNIT I****15 Hour**

Definition and objectives of information security (CIA triad), Types of attacks: Active and passive attacks, Security threats and vulnerabilities, Security services and mechanisms, Security policies and procedures, Risk analysis and management, Introduction to cryptography: Symmetric and asymmetric encryption

UNIT II**15 Hours**

Classical encryption techniques (Caesar cipher, monoalphabetic, polyalphabetic), Modern symmetric encryption: DES, AES, Asymmetric encryption: RSA, ECC, Hash functions: MD5, SHA-1, SHA-256, Digital signatures and certificates, Key management and distribution, Public Key Infrastructure (PKI)

UNIT III**15 Hours**

Operating system security: User authentication, file permissions, Firewalls: Types and configurations, Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS), Virtual Private Networks (VPNs), Secure Socket Layer (SSL)/Transport Layer Security (TLS), Wireless network security (WEP, WPA, WPA2), Email security (PGP, S/MIME)

UNIT IV**15 Hours**

Web application security: SQL injection, XSS, CSRF, Security in software development: Secure SDLC, OWASP Top 10, Social engineering and phishing attacks, Security audits and compliance (ISO 27001, HIPAA, PCI DSS), Incident response and disaster recovery, Ethical hacking and penetration testing (basic concepts). Emerging trends: Cloud security, IoT security, Zero Trust model

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- **William Stallings** – Cryptography and Network Security: Principles and Practice
- *A comprehensive book covering cryptography, network threats, and security protocols.*
- **Behrouz A. Forouzan** – Cryptography and Network Security
- *Offers detailed examples and practice problems in encryption and security systems.*
- **Charles P. Pfleeger & Shari Lawrence Pfleeger** – Security in Computing
- *Covers system-level and organizational aspects of security.*
- **Michael E. Whitman & Herbert J. Mattord** – Principles of Information Security
- *Discusses management, policies, and practices for organizational security.*
- **Mark Stamp** – Information Security: Principles and Practice
- *A balanced mix of theoretical and practical security concepts.*

Course Title: Ethical Hacking	L	T	P	Credits
Course Code: MIT3506	4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

CO1. Evaluate new Hacking Methodology.

CO2. Install hacking software on a closed network environment.

CO3. Identify tools and techniques to carry out penetration testing.

CO4. Exemplify security techniques used to protect system and user data.

Course Content

UNIT I

15 Hours

Introduction to Ethical Hacking: Hacking Methodology, Process of Malicious Hacking, Footprinting and Scanning: Foot printing, Scanning. Enumeration: Enumeration. System Hacking and Trojans: System Hacking, Trojans and Black Box Vs White Box Techniques.

UNIT II

15 Hours

Hacking Methodology: Denial of Service, Sniffers, Session Hijacking and Hacking Web Servers: Session Hijacking, Hacking Web Servers. Web Application Vulnerabilities and Web Techniques Based Password Cracking: Web Application Vulnerabilities, Web Based Password Cracking Techniques

UNIT III

15 Hours

Web and Network Hacking: SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking. Evading IDS and Firewalls: Evading IDS and Firewalls

UNIT IV

15 Hours

Report writing & Mitigation: Introduction to Report Writing & Mitigation, requirements for low level reporting & high-level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues identified including tracking

Transactional Modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Karake-Shalhoub, Z., & Al Qasimi, L. (2010). *Cyber law and cyber security in developing and emerging economies*. Edward Elgar Publishing.
- Palmer, C. C. (2001). *Ethical hacking*. *IBM Systems Journal*, 40(3), 769-780.
- Farsole, A. A., Kashikar, A. G., & Zunzunwala, A. (2010). *Ethical hacking*. *International Journal of Computer Applications*, 1(10), 14-20.

Course Title: Theory of Computation	L	T	P	Credits
Course Code: MIT3507	4	0	0	4

Total Hours: 60**Learning Outcomes:**

On the completion of this course the students will be able to:

- CO1. Recognize and comprehend formal reasoning languages.
- CO2. Use the basic concepts of formal languages of finite automata techniques.
- CO3. Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.
- CO4. Design different types of Push down Automata as Simple Parser.
- CO5. Analyze Context Free languages, Expression and Grammars.

Course Content**UNIT I** **13 Hours**

1. Introduction: Basic Terminology: Alphabet, Formal Language and operations on formal languages, Examples of formal languages.
2. Finite automata: Concept of Basic Machines, Properties and Limitations of Finite State Machines, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Equivalence of DFA and NDFA, Non-Deterministic Finite automata with Λ -Transitions.

UNIT II **14 Hours**

1. Regular expression: Regular Languages and Regular Expressions, Kleen's Theorem. Arden's Method.
2. Properties of Regular sets: The Pumping Lemma for Regular sets, Application of the Pumping Lemma, Closure Properties of Regular Sets, Myhill- Nerode Theorem and Minimization of Finite Automata, Minimization Algorithm.
3. Finite Automata with output: Moore and Mealy Machines. Equivalence of Moore and Mealy Machines.

UNIT III **17 Hours**

1. Context Free Grammars: Examples and Definitions, Derivation trees and ambiguity, An Unambiguous CFG for Algebraic Expressions. Regular Grammar, Simplified forms and Normal forms: Removal of useless symbols and UNIT production, Removal of Λ -moves, Chomsky Normal Form (CNF), Greenback Normal Form (GNF).
2. Pushdown Automata: Introduction and Definition of Push-Down Automaton, Applications of Pushdown Automata.

UNIT IV**16 Hours**

1. Turing Machines: Definitions and Examples, Deterministic and Non-Deterministic Turing Machines, Unsolvable Problems: A Non-recursive Language and an Unsolvable Problem, PCP Problem and MPCP Problem.
2. More General Languages and Grammars: Recursively Enumerable and Recursive Languages, Unrestricted grammars, Context sensitive Language and grammar. Relation between languages of classes, Chomsky hierarchies of grammars.
3. Recursive And Recursively Enumerable Languages
4. Undecidability: Halting Problem, PCP (Post Correspondence Problem)

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Sipser, M. (1996). Introduction to the Theory of Computation. *ACM Sigact News*, 27(1), 27-29.
- Dai, H. Y. (2015). McCarthy's LISP and Basis for Theory of Computation. In *Third International Conference on the History and Philosophy of Computing* (p. 39).
- Kozen, D. C. (2006). *Theory of computation* (Vol. 121). Heidelberg: Springer.
- Core, A. (1998). Theory of Computation.

Course Title: Big Data	L	T	P	Credits
Course Code: MIT3508	4	0	0	4

Total Hours: 60

Learning Outcomes After completion of this course, the learner will be able to:

- CO1. Discuss the building blocks of Big Data.
- CO2. Articulate the programming aspects of cloud computing (map Reduce etc.).
- CO3. Knowledge about the recent research trends related to Hadoop File System, Map Reduce and Google File System etc.
- CO4. Study different types Case studies on the current research and applications of the Hadoop and big data in industry

Course Content

UNIT I

15 hours

Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error

UNIT II

15 hours

Mining Data Streams: Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real Time Analytics Platform(RTAP)Applications – Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT III

15 hours

Hadoop Environment: History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Hadoop file systems- Java interfaces to HDFS- Basics- Developing a Map Reduce Application-How Map Reduce Works- Anatomy of a Map Reduce Job run-Failures-Job Scheduling- Shuffle and Sort

– Task execution - Map Reduce Types and Formats- Map Reduce Features - Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop

UNIT IV

15 hours

Data Analysis Systems and Visualization: Link Analysis – Pagerank - Efficient Computation of Pagerank- Topic-Sensitive Page Rank – Link Spam- Recommendation Systems- A Model for Recommendation Systems- Content-Based Recommendations - Collaborative Filtering- Dimensionality Reduction- Visualizations - Visual data analysis techniques-interaction techniques- Systems and applications.

Transactional Mode

Project based learning, Team Teaching, Flipped teaching, Open talk, Collaborative Teaching, Case Analysis, Panel Discussions, Group Discussions.

Suggested Readings

- *Chris Eaton, (2012). Dirk deRoos et al., Understanding Big data, McGraw Hill.*
- *Tom White, (2012). HADOOP: The Definitive Guide, O'Reilly.*
- *Hurwitz, J., Nugent, A., Halper, F., & Kaufman, M. (2013). Big data for dummies (Vol. 336). Hoboken, NJ: John Wiley & Sons.*

Course Title: Data Science	L	T	P	Credits
Course Code: MIT3509	4	0	0	4

Total Hours: 60

Learning Outcomes After completion of this course, the learner will be able to:

- CO1. Understand the basic concepts of data science, including data collection, preprocessing, and types of data.
- CO2. Apply statistical and machine learning techniques to analyze and interpret data.
- CO3. Visualize data and communicate insights using appropriate tools and methods.
- CO4. Develop and evaluate data science models to solve real-world problems.

Course Content

UNIT I

15 Hours

Introduction to Data Science: Definition and scope of data science, Data science vs. traditional data analysis, Applications of data science in business, healthcare, finance, and social media, Data science lifecycle: Problem definition, data collection, data processing, modeling, evaluation, and deployment, Role of data scientist: Skills and responsibilities, Tools and technologies: Python, R, Jupyter, Git, SQL, etc.

UNIT II

15 Hours

Data Collection and Preprocessing: Data types: Structured, semi-structured, unstructured, Sources of data: APIs, Web scraping, Databases, Open datasets, Data preprocessing: Handling missing data, outliers, duplicates, Data transformation: Normalization, standardization, encoding categorical variables, Data wrangling and cleaning using Python (Pandas and NumPy)

UNIT III

15 Hours

Exploratory Data Analysis (EDA) and Visualization: Descriptive statistics: Mean, median, mode, variance, standard deviation, Data distributions: Histograms, boxplots, skewness, and kurtosis, Correlation and covariance, Visualization tools: Matplotlib, Seaborn, Plotly, Feature selection and dimensionality reduction (PCA, t-SNE)

UNIT IV

15 Hours

Introduction to Machine Learning: Supervised learning: Regression (Linear, Logistic), Classification (KNN, Decision Trees, SVM), Unsupervised learning: Clustering (K-Means, Hierarchical), Dimensionality reduction, Model evaluation techniques: Confusion matrix, Precision, Recall, F1-score, ROC-AUC, Overfitting and underfitting, Bias-variance tradeoff, Cross-validation and hyperparameter tuning

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Joel Grus – Data Science from Scratch*
- *Jake VanderPlas – Python Data Science Handbook*
- *Wes McKinney – Python for Data Analysis*
- *Anil Maheshwari – Data Science (For conceptual clarity)*
- *Ian Goodfellow, Yoshua Bengio, and Aaron Courville – Deep Learning (for advanced study)*

Course Title: Blockchain Technology	L	T	P	Credits
Course Code: MIT3510	4	0	0	4

Total Hours: 60**Learning Outcomes**

After completion of this course, the learner will be able to:

- CO1. Understand the fundamental architecture and functioning of blockchain systems
- CO2. Apply cryptographic concepts used in blockchain for secure transaction processing
- CO3. Develop and deploy smart contracts using Ethereum and Solidity
- CO4. Analyze real-world blockchain applications and identify implementation challenges

Course Content**UNIT I****15 Hours**

Introduction to Blockchain: Introduction to blockchain: History and evolution, Key concepts: Distributed ledger, decentralization, consensus mechanisms, Types of blockchain: Public, private, consortium, Components of blockchain: Blocks, chain, nodes, miners, wallets, Blockchain vs traditional databases, Use cases: Cryptocurrency, supply chain, digital identity, voting systems

UNIT II**15 Hours**

Cryptography and Consensus Mechanisms: Cryptographic primitives in blockchain: Hash functions (SHA-256), Digital signatures, Public key cryptography. Merkle trees and hash pointers. Consensus algorithms: Proof of Work (PoW), Proof of Stake (PoS), Delegated PoS, Practical Byzantine Fault Tolerance (PBFT). Block mining and validation

UNIT III**15 Hours**

Smart Contracts and Ethereum: Concept of smart contracts: Definition and features, Ethereum overview: Ether, gas, and EVM, Introduction to Solidity programming, Writing, deploying, and interacting with smart contracts, Tokens and standards: ERC-20, ERC-721, Issues with smart contracts: Bugs, security risks, real-world legal challenges.

UNIT IV**15 Hours**

Advanced Blockchain Applications and Challenges: Blockchain in finance, healthcare, IoT, supply chain, and governance, Hyperledger Fabric overview: Architecture and components, Interoperability and scalability challenges in blockchain. Security, privacy, and regulatory issues. Blockchain and GDPR. Future trends: Web3, DeFi, NFTs, and Metaverse

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Arshdeep Bahga & Vijay Madisetti – Blockchain Applications: A Hands-On Approach*
- *Imran Bashir – Mastering Blockchain*
- *Andreas M. Antonopoulos – Mastering Bitcoin*
- *Narayanan et al. – Bitcoin and Cryptocurrency Technologies (Princeton University)*

Course Title: Software Testing & Quality Assurance	L	T	P	Credits
Course Code: MIT3511	4	0	0	4

Total Hours: 60**Learning Outcomes**

After completion of this course, the learner will be able to:

- CO1. Explain and Apply Knowledge of Key Concepts of Software Testing, Quality and Testing Tools.
- CO2. Draw the DD Graph and Identify the Various Test Cases from Paths of Flow Graph of Software Testing Problem and Determine the Complexity of Software.
- CO3. Design Test Cases and Develop Test Suite, Write Test Scripts, Set Environmental Variables for Carrying Out the Various Levels of Testing Manually and Automatically.
- CO4. Manage Software Defects, and Risks Within a Software Project.
- CO5. Work Effectively in Profile of Software Tester, Quality Assurance and Control officer, Project Manager and Leaders.

Course Content**UNIT I****15 Hours**

Software Testing Process, Objectives, Testing Techniques, Software Testing Life Cycle, Concept of Testing, Types of Errors, Stubs and Drivers Verification and Validation, Different Types of Verification & Validations Mechanisms, Concepts of Software Reviews, Code Inspection and Code Walkthrough, Testing of Component Based Software System, Energy Efficient Testing, Mobile Application Testing.

UNIT II**15 Hours**

Software Testing Methods, Testing Fundamentals, Test Case Design, White Box Testing and its Types, Black Box Testing and its Types, Software Testing Strategies, Strategic Approach to Software Testing, UNIT Testing, Integration Testing, Validation Testing, System Testing, Test Planning, Budgeting and Scheduling.

UNIT III**15 Hours**

Software Testing Metrics, Concept and Developing Testing Metrics, Different Types of Metrics, Complexity Metrics, Defect Management, Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.

UNIT IV**15 Hours**

Software Quality, Factors Affecting Software Quality, Quality Models, Software Quality Estimation, Quality Metrics, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, Quality Control Quality Management, and, SQA Plan. Quality Improvement, Pareto Diagrams, Cause- Effect Diagrams, Scatter

Diagrams, Run Charts, Total Quality Management, Statistical Quality Assurance, Software Reliability, the ISO 9001 Quality Standard, Six Sigma, Informal Reviews.

Quality Costs, Quality Cost Measurement, Utilizing Quality Costs for Decision-Making. Manual Vs Automatic Testing, Basics of Automated Testing, Drawbacks of Manual Testing, Advantages of Automation of Testing, Factors for Automation Testing, Types of Automation Testing Tools, Introduction to QTP, QTPIDE, Basic Components in QTP, QTP Framework, Write Scripts, Introduction to Win runner, and Rational Robot.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

SUGGESTED READINGS

1. Roger S. Pressman, Software Engineering - a Practitioners Approach, McGraw-Hill Education; 7 Edition, 1 April 2009.
2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International Publishers, New Delhi, 2005.
3. Kshirsagar Naik, Priyadarshi Tripathy, Software Testing and Quality Assurance Theory and Practice. Wiley-Spektrum; I Edition, August 18, 2008.
4. Donna C. S. Summers, Quality Management, Pearson; 2 Edition, April 26, 2008.
5. Yogesh Singh, Software Testing, Cambridge University Press, 2012.
6. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995
7. Louise Tamres, "Software Testing", Pearson Education Asia, 2002.
8. Cem Kaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.
9. Boris Beizer, "Black-Box Testing - Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York, 1995.

Course Title: Software Testing & Quality Assurance	L	T	P	Credits
Course Code: MIT3512	4	0	0	4

Total Hours: 60**Learning Outcomes:**

After the Completion of the course, the learner will be able to

- CO1. Design the learner-centered instructional plans and learning outcomes.
- CO2. Apply innovative teaching strategies and technologies to engage learners.
- CO3. Analyze the different assessment methods to evaluate student learning.
- CO4. Develop effective communication and classroom management skills.

Course Contents**UNIT I****15 Hours**

Background: Introduction to electronic systems for image transmission and storage, computer processing and recognition of pictorial data, overview of practical applications.

UNIT II**15 Hours**

Fundamentals: Mathematical and perceptual preliminaries, human visual system model, image signal representation, imaging system specification building image quality, role of computers,

Image data formats: Image Processing Techniques: Image enhancement, image restoration, image data compression and statistical pattern recognition.

UNIT III**15 Hours**

Techniques of Colour Image Processing: Colour image signal representation, colour system transformations, extension of processing techniques to colour domain.

UNIT IV**15 Hours**

Applications of Image Processing: Picture data archival, machine vision, medical image Processing.

TRANSACTION MODE

Discussions, Case Studies, Microteaching, Classroom Observations, Peer Teaching: Video Analysis, Role-Playing, Lecture-cum-demonstration, Classroom Simulations, Reflective Journals/Blogs, Teaching Portfolios and Technology Integration, Flipped Teaching.

SUGGESTED READINGS

- Pratt, W.K. *Digital Image Processing*, John Wiley, N.Y./ 1978.

- *Rosenfield, A and Kak, A.C., Picture processing, Academic Press N.Y., 1982.*
- *Jain, A.K., Fundamentals of Digital Image Processing, Englewood Cliffs, Prentice Hall,*
- *1989.*
- *Chris Soloman, Stuart Gibson, Fundamentals of Digital Image Processing: A Practical*
- *Approach using MatLab, John Wiley and Sons, 2007.*
- *Digital Image Processing by Gonzalez & Wood, Addison Wesley, 2000.*

Course Title: Neural Networks	L	T	P	Credits
Course Code: MIT3513	4	0	0	4

Total Hours: 60**Learning Outcomes**

After the Completion of the course the learner will be able to

- CO1. Understand the mathematics behind functioning of artificial neural networks.
- CO2. Analyze the given dataset for designing a neural network-based solution.
- CO3. Design and implementation of deep learning models for signal/image processing applications.
- CO4. Able to design and deploy simple Tensor Flow-based deep learning solutions to classification problems

Course Content**UNIT I****15 Hours**

Artificial Neural Networks- The Neuron-Expressing Linear Perceptrons as Neurons- Feed-Forward Neural Networks- Linear Neurons and Their Limitations –Sigmoid – Tanh – and ReLU Neurons -Softmax Output Layers – Training Feed-Forward Neural Networks-Gradient Descent-Delta Rule and Learning Rates- Gradient Descent with Sigmoidal Neurons- The Backpropagation Algorithm-Stochastic and Minibatch Gradient Descent – Test Sets – Validation Sets – and Overfitting- Preventing Overfitting in Deep Neural Networks – Implementing Neural Networks in TensorFlow.

UNIT II**15 Hours**

Local Minima in the Error Surfaces of Deep Networks- Model Identifiability- Spurious Local Minima in Deep Networks- Flat Regions in the Error Surface – Momentum-Based Optimization – Learning Rate Adaptation.

UNIT III**15 Hours**

Convolutional Neural Networks(CNN) – Architecture -Accelerating Training with Batch Normalization- Building a Convolutional Network using TensorFlow- Visualizing Learning in Convolutional Networks – Embedding and Representation Learning -Autoencoder Architecture-Implementing an Autoencoder in TensorFlow –DenoisingSparsity in Autoencoders Models for Sequence Analysis – Recurrent Neural Networks- Vanishing GradientsLong Short-Term Memory (LSTM) Units- TensorFlow Primitives for RNN Models-Augmenting Recurrent Networks with Attention.

UNIT IV**15 Hours**

Sequence Modeling: Recurrent Nets: Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks, LSTM networks.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer

Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm”, O’Reilly, 2017.*
- *Ian Goodfellow, YoshuaBengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.*
- *Bunduma, N. (2017). Fundamentals of Deep Learning*
- *Heaton, J.(2015). Deep Learning and Neural Networks, Heaton Research Inc.*

SEMESTER IV

Course Title: Research Methodology	L	T	P	Credits
Course Code: MIT4550	4	0	0	4

Total Hours:60**Learning Outcomes:**

After the Completion of this course the learner will be able to:

- CO1. Understand key research methodology concepts and issues
- CO2. Identify the role and importance of research in the Computer Applications
- CO3. Analyze appropriate research problem and parameters
- CO4. Implement the basic concepts of research and its methodologies

Course Content**UNIT I****15 Hours**

Research: its concept, nature, scope, need and Objectives of Research, Research types, Research methodology, Research process – Flow chart, description of various steps, Selection of research problem.

UNIT II**15 Hours**

Research Design: Meaning, Objectives and Strategies of research, different research designs, important experimental designs, Methods of Data Collection and Presentation: Types of data collection and classification, Observation method, Interview Method, Collection of data through Questionnaires, Schedules, data analysis and interpretation, editing, coding, content analysis and tabulation

UNIT III**15 Hours**

Sampling Methods: Different methods of Sampling: Probability Sampling methods, Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling and Multistage Sampling. Non probability Sampling methods, Sample size.

UNIT IV**15 Hours**

Report writing and Presentation: Types of reports, Report Format – Cover page, Introductory page, Text, Bibliography, Appendices, Typing instructions, Oral Presentation

Transactional Modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Panneerselvam, R, *Research Methodology*, PHI, New Delhi.
- Cooper, D.R., Schindler, P.S., *Business Research Methods*, Tata McGraw Hill
- Gupta S P, *Statistical Methods*, Sultan Chand & Sons, Delhi
- Ronald E Walpole, *Probability and Statistics for Engineers and Scientists (International Edition)*, Pearson Education.

- *Geode, Millian J. & Paul K. Hatl, Methods in Research, McGraw Hills, New Delhi*
- *Kothari C.R., Research Methodology, New Age Publisher*
- *Sekran, Uma, Business Research Method, Miley Education, Singapore*

Course Title: Network Administration	L	T	P	Credits
Course Code: MIT4551	0	0	4	2

Total Hours:60**Learning Outcomes:**

- CO1. Configure, manage, and troubleshoot network devices, including routers, switches, and firewalls.
- CO2. Implement network security measures to protect against vulnerabilities and threats.
- CO3. Monitor and optimize network performance using various tools and techniques.
- CO4. Establish and maintain user access policies and authentication mechanisms.
- CO5. Design and manage scalable networks to meet organizational requirements.

Course Content

1. Server/Client Installation over VMware Environment
2. Packet Analysis by using TCPDUMP and WIRESHARK 149
3. Network Practice with Packet Tracer
4. System Administration: User/Group management, File System Management
5. Network Configuration: Start/Stop network Service, network interface configuration
6. Firewall Configuration
7. DNS and DHCP Configuration and Troubleshooting
8. Web and Proxy Server Configuration and Troubleshooting
9. Basic Mail Server Configuration and Troubleshooting
10. SAMBA, NFS, CUPS and FTP configuration and Troubleshooting
11. SDN controller installation and client network implementation (OpenDaylight)
12. Network topology programming with Mininet and visualization
13. Backup and Disaster Recovery Planning
14. Advanced Network Administration and Troubleshooting

15. Network Performance Optimization

16. Server Administration Basics (e.g., Windows Server, Linux Server)

Course Title: Dissertation		L	T	P	Credits
Course Code: MIT4552		0	0	0	12

Course Learning Outcomes: After completion of this course, the learner will be able to:

- CO1. Apply knowledge of recent computing technologies, skills and current tools of computer science and engineering.
- CO2. Design and conduct experiments, as well as to analyze and interpret data.
- CO3. Understand the contemporary research issues in the different areas of computer science & engineering.
- CO4. Explore research gaps, analyze and carry out research in the specialized/ emerging areas.

Course Content

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations with implementation tools with suitable platform.

Transactional Mode:

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Course Title: Data Network & Security	L	T	P	Credits
Course Code: MIT4553	4	0	0	4

Total Hours: 60**Learning Outcomes:**

After the Completion of the course the learner will be able to

- CO1. Understand the fundamental concepts of data networks
- CO2. Explain the different network security threats and vulnerabilities
- CO3. Evaluate network security measures and technologies
- CO4. Implement network security controls

Course Content**UNIT I****15 Hours**

Introduction to Computer networks and applications: Network Structure and Architecture, Network Hardware and Software (protocol hierarchies, design issues for layers, interfaces and services: connection oriented and connection less), Network structure and architecture-point to point, multicast, broadcast, Classification of networks on the basis of Geographical Span (PAN, LAN, MAN and WAN) , LAN topologies (Bus, Ring, Star, Mesh, Tree and Hybrid). Network Connecting Devices: Repeaters, Hubs, Bridges, Routers, Gateways and Switches, Network Reference models: OSI model, TCP / IP model. Comparison between OSI and TCP/IP.

UNIT II**15 Hours**

Introduction: Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, has algorithms. Secret Key Cryptography: Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.

UNIT III**15 Hours**

Hash Functions and Message Digests: Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS: Overview, padding, stages. Public key Cryptography: Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.

UNIT IV**15 Hours**

Authentication: Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Inter domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.

Security Policies and Security Handshake Pitfalls: What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Tanenbaum, A. S. (2002). *Computer networks*. Pearson Education India.
- Peterson, L. L., & Davie, B. S. (2007). *Computer networks: a systems approach*. Elsevier.
- Kiesler, S. (1986). *The hidden messages in computer networks* (pp. 46-47). Harvard Business Review Case Services.
- AtulKahate .*Cryptography and Network Security* ,TMH.
- Behourz A Forouzan,*Data Communications and Networking*

Course Title: Wireless Networks	L	T	P	Credits
Course Code: MIT4554	4	0	0	4

Total Hours: 60**Learning Outcomes**

After completion of this course, the learner will be able to:

- CO1. Understand the fundamentals of wireless communication systems
- CO2. Apply transport layer protocols and routing in wireless environments
- CO3. Analyze common wireless security threats and implement security protocols like WEP, WPA, and WPA2/3.
- CO4. Explore current trends and technologies such as 3G, 4G, 5G, LTE, and IoT, and assess their impact on wireless networking.

Course Content**UNIT I****15 Hours**

Fundamentals of Wireless Communication: Introduction to wireless communication, Evolution and types of wireless networks: WLAN, WWAN, WPAN, WMAN. Wireless transmission basics, Cellular systems: Frequency reuse, handoff, and roaming. Radio propagation: Free space, path loss, fading, and multipath effects

UNIT II**15 Hours**

Wireless LANs and Mobile Networking: IEEE 802.11 Standards (a/b/g/n/ac/ax), Wi-Fi architecture and MAC protocols, CSMA/CA and wireless medium access issues, Bluetooth and IEEE 802.15, Mobile IP: Goals, components, agent discovery, registration, and tunneling, DHCP in mobile environments

UNIT III**15 Hours**

Wireless Transport and Ad Hoc Networks: Transport layer issues in wireless networks, Wireless TCP variants: Indirect TCP, Snooping TCP, Mobile TCP, Ad Hoc networks: Characteristics, challenges, and architecture, Routing protocols: DSDV, AODV, DSR. Wireless sensor networks: Features, architecture, and applications

UNIT IV**15 Hours**

Wireless Security and Emerging Technologies: Wireless network security: Challenges, threats, and solutions, Security protocols: WEP, WPA, WPA2, WPA3. Mobile IP and Ad Hoc security concerns. Emerging technologies: 3G, 4G, 5G, LTE, LTE-Advanced. Internet of Things (IoT) and wireless connectivity, WiMAX architecture

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Wireless Communications and Networks – William Stallings*
- *Mobile Communications – Jochen Schiller*
- *Wireless Networking – Anurag Kumar, D. Manjunath, Joy Kuri*
- *Ad Hoc Wireless Networks – C. Siva Ram Murthy, B. S. Manoj*

Course Title: E-Commerce	L	T	P	Credits
Course Code: MIT4555	4	0	0	4

Total Hours: 60**Learning Outcomes**

After completion of this course, the learner will be able to:

- CO1. Discuss the basic concepts and technologies used in the field of E-Commerce and Governance.
- CO2. Apply their knowledge of various Electronic Payment Systems in practical scenarios.
- CO3. Analyze and differentiate between various Governance Process Models.
- CO4. Evaluate Internet trading relationships, including Business-to-Consumer (B2C), Business-to-Business (B2B), and Intra-organizational dynamics.

Course Content**UNIT I****15 Hours**

Introduction to e-commerce: History of e-commerce, e-business models B2B, B2C, C2C, C2B, legal; environment of e-commerce, ethical issues, electronic data interchange, value chain and supply chain, advantages and disadvantages of e-commerce. Electronic Payment Systems: Credit cards, debit cards, smart cards, e-credit accounts, e-money, Marketing on the web, marketing strategies, advertising on the web, customer service and support, introduction to m-commerce, case study: e-commerce in passenger air transport.

UNIT II**15 Hours**

E-Government, theoretical background of e-governance, issues in e-governance applications, evolution of e-governance, its scope and content, benefits and reasons for the introduction of e-governance, e-governance models- broadcasting, critical flow, comparative analysis, mobilization and lobbying, interactive services

UNIT III**15 Hours**

E-readiness, e-government readiness, E- Framework, step & issues, application of data warehousing and data mining in e-government, Case studies: NICNET-role of nationwide networking in e-governance, e-seva.

UNIT IV**15 Hours**

E-Government systems security: Challenges and approach to e-government security, security concern in e-commerce, security for server computers, communication channel security, security for client computers.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- Winn, J. K., & Wright, B. (2000). The law of electronic commerce. Wolters Kluwer.
- United States. White House Office. (1997). A framework for global electronic commerce. White House.
- Andrea, G. (Ed.). (2002). Development Centre Studies Electronic Commerce for Development. OECD Publishing.