Maharashtra Institute of Technology

Chhatrapati Sambhajinagar

An Autonomous Institute Affiliated to

Dr. Babasaheb Ambedkar Marathwada University,

Chhatrapati Sambhajinagar, Maharashtra (India)

Third Year B. Tech Syllabus

(Computer Science and Engineering)

(For students admitted in S. Y. B. Tech in AY 2024-25)

WEF AY 2025-26

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Abbreviations used in this document

AEC	Ability Enhancement Course
CIE	Continuous Internal Examination
CSE	**Computer Science and Engineering**
ESE	End-Semester Examination
ISE	In-Semester Examination
L	Theory Lecture
MDM	Multidisciplinary Minor
MIT	**Maharashtra Institute of Technology**
MOOC	Massive Open Online Course
NEP	National Education Policy 2020
MPTEL	National Programme on Technology Enhanced Learning
OEC	Open Elective Course
P	Practical
PCC	Program Core Course
PEC	Program Elective Course
S5	Semester –V
S6	Semester –VI
SLH	Self-Learning Hours
SWAYAM	Study Webs of Active-learning for Young Aspiring Minds
T	Tutorial
TA	Teacher Assessment
WEF	With Effect From

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Third Year B. Tech (Computer Science and Engineering) Curriculum Structure

WEF 2025-26 (NEP 2020 Based Curriculum) –For students admitted in S. Y. B. Tech in AY 2024-25

Semester-V

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	S SLH	Credits	ISE -I	ISE -II	CIE	TA	ESE/ Oral	Total
Orientation Program (2 Days)															
1	PCC	CSE301	Database Management System	3	-	-	3	3	3	15	15	10	10	50	100
2	PCC	CSE302	Computer Networks	3	-	-	3	3	3	15	15	10	10	50	100
3	PCC	CSE303	Design and Analysis of Algorithms	3	-	-	3	3	3	15	15	10	10	50	100
4	MDM#	***311	Multidisciplinary Minor Course-1#	3	-	-	3	3	3	15	15	10	10	50	100
5	PEC	CSE316A	Digital Image Processing	3	1	-	4	4	4	15	15	10	10	50	100
		CSE316B	Data Wrangling and Visualization												
		CSE316C	Wireless networks												
6	OEC	OEC341A TO OEC341H	Open Elective Course -3@	2	-	-	2	2	2	15	15	10	10	50	100
7	PCC	CSE321	Database Management System Laboratory	-	-	2	2	-	1	-	-	-	25	--	25
8	PCC	CSE322	Computer Networks Laboratory	-	-	2	2	-	1	-	-	-	25	25	50
9	PCC	CSE323	Design and Analysis of Algorithms Laboratory	-	-	2	2	-	1	-	-	-	25	25	50
10	MDM	*** 336	Multidisciplinary Minor Course -1 Laboratory	-	-	2	2	-	1	-	-	-	25	--	25
S5				17	01	08	26	18	22	90	90	60	160	350	750

S SLH: Self-Learning Hours per week – assessment included in CIE/TA ***** MDM Course Code as per option**

 # Student has to choose any one MDM Vertical as per eligibility criteria mentioned in Table 1 at semester V. Offered Multidisciplinary Minor Verticals are given in Table 2. Student cannot change the MDM Vertical in the subsequent semesters and it is compulsory to successfully complete all MDM courses in the same Vertical.

@ Open Elective-3 Course Basket:

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Course Code	Course Title	Course mentoring / Offering Department	Mode of offering
OEC341A	Artificial Intelligence in Industrial and Management Engineering	Mechanical Engineering	MOOC Course (NPTEL link: https://onlinecourses.nptel.ac.in/noc25_ge44/preview
OEC341B	Artificial Intelligence for Economics	Electrical Engineering	MOOC Course (NPTEL link: https://onlinecourses.nptel.ac.in/noc25_cs152/preview
OEC341C	Artificial Intelligence, Law and Justice	Emerging Science and Technology	MOOC Course (NPTEL link: https://onlinecourses.nptel.ac.in/noc25_lw12/preview
OEC341D	Advanced Algorithmic Trading and Portfolio Management	Computer Science and Engineering	MOOC Course (NPTEL link: https://onlinecourses.nptel.ac.in/noc25_mg118/preview
OEC341E	Foundations of French	Agricultural Engineering	MOOC Course (SWAYAM link: https://onlinecourses.swayam2.ac.in/imb25_mg175/preview
OEC341F	German-I	Electronics and Computer Engineering	MOOC Course (NPTEL link: https://onlinecourses.nptel.ac.in/noc25_hs121/preview
OEC341G	River Restoration Techniques	Civil Engineering	Physical Mode
OEC341H	Circular Economy and Plastic Waste Management	Plastic and Polymer Engineering	Physical Mode

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Third Year B. Tech (Computer Science and Engineering) Curriculum Structure

WEF 2025-26 (NEP 2020 Based Curriculum) –For students admitted in S. Y. B. Tech in AY 2024-25

Semester-VI

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	$ SLH	Credits	ISE -I	ISE -II	CIE	TA	ESE/ Oral	Total
1	PCC	CSE351	Software Process and Project Management	3	-	-	3	3	3	15	15	10	10	50	100
2	PCC	CSE352	Data mining and Analytics	3	-	-	3	3	3	15	15	10	10	50	100
3	PCC	CSE353	Machine Learning	3	-	-	3	3	3	15	15	10	10	50	100
4	MDM#	***361	Multidisciplinary Minor Course-2	3	-	-	3	3	3	15	15	10	10	50	100
5	PEC	CSE366A	Computer Vision	3	-	-	3	3	3	15	15	10	10	50	100
		CSE366B	Soft Computing												
		CSE366C	Internet of Things												
6	RM	REM367	Research Methodology#	3	-	-	3	3	3	15	15	10	10	50	100
7	PCC	CSE371	Data Mining and Analytics Laboratory	-	-	2	2	-	1	-	-	-	25	25	50
8	PCC	CSE372	Machine Learning Laboratory	-	-	2	2	-	1	-	-	-	25	25	50
9	PRO	PRO373	Major Project-I	-	-	2	2	-	1	-	-	-	25	--	25
10	MDM	*** 386	Multidisciplinary Minor Course -2 Laboratory	-	-	2	2	-	1	-	-	-	25	--	25
S6				**18**	**-**	**08**	**26**	**18**	**22**	**90**	**90**	**60**	**160**	**350**	**750**

$ SLH: Self-Learning Hours per week – assessment included in CIE/TA ***** MDM Course Code as per option**
#Research Methodology Course may be completed by students through NPTEL/SWAYAM/SWAYAM PLUS or any other MOOC courses offering portal as per approval of the BOS Chairman.

Those students who were enrolled for **Honor Degree** courses (offered by own Department- **Major Discipline**), and for Minor Degree courses (referred as **Double Minor** & offered by **another** department) in Second Year and as per eligibility criteria, if eligible to continue these programs should enroll for **MOOC/Online/Offline course** as per department instructions.

Students may opt for Exit after successful completion of Third Year provided s/he earns 8 additional credits from the list of courses (given below) during the summer vacation after 3rd year. S/he will be awarded a3-Year UG Degree i.e. B. Voc in Computer Science and Engineering.

Sr. No.	Course Code	Course Name	Credits
1	EX-CSE-301	Web Development	03
2	EX-CSE-302	Web Development Laboratory	01
3	EX-CSE-303	Internship/Mini Project	04

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Multidisciplinary Minor (MDM) Details

(In continuation of Pattern 2023-24)- wef AY 2025-26 (From Third Year Onwards)

Table 1: Mandatory Multi-disciplinary Minor (MDM) Option selection Matrix

Sr. No.	B. Tech Program → / MDM Verticals ↓	Agri	AIDS	Civil	CSD	CSE	EED	ECE	ETC	MECH	MTX	PPE
1	Computer Engineering	✓	X	✓	X	X	✓	X	✓	✓	✓	✓
2	Mechanical Engineering	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓
3	Civil Engineering	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓
4	Electronics Engineering	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓
5	Electrical Engineering	✓	✓	✓	✓	✓	X	✓	✓	✓	X	✓
6	Agricultural Engineering	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	Plastic and Polymer Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X

X indicates that students from the discipline (mentioned in the column) are not allowed to opt the option of MDM vertical (Mentioned in the row)

✓ indicates that students from the discipline (mentioned in the column) are allowed to opt the option of MDM vertical (Mentioned in the row)

Note:

1. Student has to choose any one MDM Vertical as per eligibility criteria mentioned in Table 1 at semester V.
2. Multidisciplinary Minor Verticals offered by department are given in Table 2.
3. Student cannot change the MDM Vertical in the subsequent semesters and it is compulsory to successfully complete all MDM courses in the same vertical.
4. Student has to follow the instructions as per the Head of Department/Course Teacher of Offering Department.
5. Student has to take care while filling the examination form and appearing the examination in the opted MDM.

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Table 2: Multidisciplinary Minor Verticals

Multidisciplinary Minor Vertical	Sr. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits
Computer Engineering (Offered by Computer Science and Engineering Department)	1	V	CSE311	Linux Operating System	3	-	-	3	3
	2	V	CSE336	Linux Operating System Laboratory	-	-	2	2	1
	3	VI	CSE361	Computer Network and Security	3	-	-	3	3
	4	VI	CSE386	Computer Network and Security Laboratory	-	-	2	2	1
	5	VII	CSE411	Fundamentals of Machine Learning Techniques	3	1	-	4	4
	6	VII	CSE436	Minor Project	-	-	4	4	2
								Total Credits	14

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Table 2: Multidisciplinary Minor Verticals ...

Multidisciplinary Minor Verticals	Sr. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits
Mechanical Engineering (Offered by Mechanical Engineering Department)	1	V	MED311	Energy Management	3	-	-	3	3
	2	V	MED336	Energy Management Lab	-	-	2	2	1
	3	VI	MED361	Metrology & Quality Control	3	-	-	3	3
	4	VI	MED386	Metrology & Quality Control Lab	-	-	2	2	1
	5	VII	MED411	Industrial Engineering	3	1	-	4	4
	6	VII	MED436	Minor Project	-	-	4	4	2
								Total Credits	14

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Multidisciplinary Minor Vertical	Sr. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits
Civil Engineering (Offered by Civil Engineering Department)	1	V	CED311	Smart Cities and Technologies	3	-	-	3	3
	2	V	CED336	Smart Cities and Technologies Lab	-	-	2	2	1
	3	VI	CED361	Software Application in Civil Engineering	3	-	-	3	3
	4	VI	CED386	Software Application in Civil Engineering Lab	-	-	2	2	1
	5	VII	CED411	Construction Management	3	1	-	4	4
	6	VII	CED436	Minor Project	-	-	4	4	2
								Total Credits	14

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Table 2: Multidisciplinary Minor Verticals …

Multidisciplinary Minor Vertical	Sr. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits
Electronics Engineering (Offered by Electronics and Computer Engineering Department)	1	V	ECE311	Embedded System Application	3	-	-	3	3
	2	V	ECE336	Embedded System Application Lab	-	-	2	2	1
	3	VI	ECE361	Communication Systems	3	-	-	3	3
	4	VI	ECE386	Communication Systems Lab	-	-	2	2	1
	5	VII	ECE411	Internet of Things	3	1	-	4	4
	6	VII	ECE436	Minor Project	-	-	4	4	2
								Total Credits	14

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Multidisciplinary Minor Vertical	Sr. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits
Electrical Engineering (Offered by Electrical Engineering Department)	1	V	EED311	Transmission and Distribution of Electrical Power	3	-	-	3	3
	2	V	EED336	Transmission and Distribution of Electrical Power Lab	-	-	2	2	1
	3	VI	EED361	Testing and Maintenance of Electrical Equipment	3	-	-	3	3
	4	VI	EED386	Testing and Maintenance of Electrical Equipment Lab	-	-	2	2	1
	5	VII	EED411	Fundamentals of Rooftop Solar System Design	3	1	-	4	4
	6	VII	EED436	Minor Project	-	-	4	4	2
								Total Credits	14

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Table 2: Multidisciplinary Minor Verticals ...

Multidisciplinary Minor Vertical	Sr. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits
Agricultural Engineering (Offered by Agricultural Engineering Department)	1	V	AED311	Introduction to Agrotech and Sustainability	3	-	-	3	3
	2	V	AED336	Agri-Data Analysis Lab	-	-	2	2	1
	3	VI	AED361	IoT and Automation in Agriculture	3	-	-	3	3
	4	VI	AED386	Sensor & Drone Application Lab	-	-	2	2	1
	5	VII	AED411	Remote Sensing and GIS	3	1	-	4	4
	6	VII	AED436	Minor Project	-	-	4	4	2
								Total Credits	14

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Multidisciplinary Minor Vertical	Sr. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits
Plastic and Polymer Engineering (Offered by Plastic and Polymer Engineering Department)	1	V	PPE311	Polymeric Materials and Testing	3	-	-	3	3
	2	V	PPE336	Polymeric Materials and Testing Lab	-	-	2	2	1
	3	VI	PPE361	Polymer Processing Techniques	3	-	-	3	3
	4	VI	PPE386	Polymer Processing Techniques Lab	-	-	2	2	1
	5	VII	PPE411	3D Printing with Polymers	3	1	-	4	4
	6	VII	PPE436	Minor Project	-	-	4	4	2
								Total Credits	14

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Syllabi of MDM courses of Semester V and VI is available in seperate booklet.

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Semester-V
Detail Course Curriculum

Third Year B. Tech Syllabus
(Computer Science and Engineering)

(For students admitted in S.Y. Btech in A.Y.2024-25)
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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: PCC Course Code: CSE301 **Course: Database Management System** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours-3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic understanding of programming concepts, computer system fundamentals, data representation and data structures.
Objectives	• Understand database concepts, applications, data models, schemas and instances. • Use of SQL in querying the database • Learn the new emerging Technologies and Applications in database.
Unit-I	**Introduction** Database Management Systems, Comparison with File Systems, Actors on the Scenes, Workers behind the Scenes, A Brief History of Database Applications, When Not to use a DBMS Database System **Concepts and Architecture** - Data Models, Schemas, and Instances, , Database Languages and Interfaces, The Database System Environment, Centralized and Client /Server Architectures for DBMSs. **(07 Hrs)**
Unit-II	**Data Modelling** The importance of data models, Basic building blocks, Using High-Level Conceptual Data Models for Database Design, an example Database Application, Entity Types, Entity Sets, attributes and keys, Relation Types, Relationship Sets, roles and structural constraints, Weak Entity Types, Refining the ER Design for the Company Database, ER Diagrams, naming conventions and design issues, Relationship Types. **(06 Hrs)**
Unit-III	**Structured Query Language** Introduction, SQL Data Types and Literals, DDL, DML, DCL, TCL. SQL Operators, Tables: Creating, Modifying, Deleting. Views: Creating, Dropping, Updating using Views, Indexes. SQL DML Queries: SELECT Query and clauses, Set Operations, Joins, Aggregate Functions, Nested Queries. **(07 Hrs)**
Unit-IV	**Relational Database Design** Normalization, Need of Normalization, Functional Dependencies, Normal forms 1NF, 2NF, 3NF, BCNF, multi valued functional dependency and 4NF, properties of relational decomposition. **(06 Hrs)**
Unit-V	**Fundamentals of Data Base Transaction Processing** Transaction Concept, A simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, ACID Properties, Serializability Concurrency Control Techniques: Lock based Protocols, Deadlock handling, Multiple Granularity, Time Stamp-Based Protocols, Recovery System. **(07 Hrs)**

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Unit-VI	**NoSQL** Introduction to Distributed Database System, Advantages, disadvantages, CAP Theorem. Types of Data: Structured, Unstructured Data and Semi-Structured Data. NoSQL Database: Introduction, Need, Features. Types of NoSQL Databases: Key-value store, document store, graph, wide column stores, BASE Properties, Data Consistency model, ACID Vs BASE, Comparative study of RDBMS and NoSQL. MongoDB (with syntax and usage): CRUD Operations. **(06 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Fundamentals of Database Systems	Ramez Elmasri, Shamkan B. Navathe,	Pearson Education, ISBN-9788131792476	6th
2.	Database System Concepts	Silberschatz A., Korth H., Sudarshan S.	McGraw Hill Publishers, ISBN 0- 07-120413-X	6th
3.	Database Systems	Connally T, Begg C.	Pearson Education, ISBN 81-7808-861-4	4th
4.	SQL Complete Reference	Paul N. Weinberg and Andy Oppel	McGraw Hill Publishers, ISBN: 9781259003882	3rd
5.	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence	Pramod J. Sadalage, Martin Fowler	Addison-Wesley	1st
6.	Learning MongoDB	Doug Bierer	Packt Publishing	Latest Edition

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE301 **Course: Database Management System** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours-3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes

CO1: Describe core concepts of database systems including data models, schemas, instances, architectures.

CO2: Write SQL commands to define, manipulate, and query relational databases.

CO3: Apply normalization techniques to design efficient database schemas and implement transaction processing using ACID properties and concurrency control.

CO4: Describe the concepts of distributed database systems, various data types, NoSQL databases with their classifications and properties, and basic CRUD operations in MongoDB.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1			–	–	–	–	–	–
CO2	2	2	3	1	1	–	–	–	–	–	–
CO3	2	2	3	1		–	–	–	–	–	–
CO4	2	2	1		2	–	–	–	–	–	–
Average	2.25	2	2.0	1.0	1.5	–	–	–	–	–	–
Mapping Strength	2	**2**	**1**	**1**	2	–	–	–	–	–	–

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	–	2	–
CO2	–	2	–
CO3	–	2	–
CO4	–	2	–
Average	–	2	–

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Faculty of Science & Technology Syllabus of Third Year B. Tech (Computer Science and Engineering) (Semester V)	
Course Category: **PCC** Course Code: CSE302 **Course: Computer Networks** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours-3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.
Prerequisite	Basic of networking
Objectives	• To learn about computer network organization and implementation. • To provide theoretical understanding of data communication and computer networks. • To introduce computer communication network design and its operations. • To understand the basic principles of network design and operations and development of programs to handle client server-based computations.
Unit-I	**Introduction:** Applications of computer networks, Personal Area Networks, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Protocol Hierarchy, Design Issues, connection oriented vs. connectionless, Service Primitives, Reference models: OSI and TCP/IP **(06 Hrs)**
Unit-II	**Physical Layer:** Fourier Analysis, Bandwidth-Limited Signals, The Maximum Data Rate of a Channel, Guided Transmission Media: Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Wireless Transmission: The Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission, Light Transmission **(06 Hrs)**
Unit-III	**Data Link Layer:** Service provided to network layer Framing, Error Control, Flow Control, Error Detection and Correction: error correcting codes, error detecting codes, Noiseless and Noisy channels, Stop-and-Wait ARQ, Sliding Window Protocol (Go-Back-N and Selective Repeat), HDLC, Point-to Point protocol. **(06 Hrs)**
Unit-IV	**Medium Access Control Sub Layer:** Static Channel Allocation, Assumptions for Dynamic Channel Allocation, Multiple Access Protocols ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Data Link Layer Switching Use of Repeaters, Hubs, Bridges, Switches, Routers, and Gateways Virtual LANs. **(07 Hrs)**
Unit-V	**Network Layer and Congestion Control:**

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	Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Comparison of Virtual-Circuit and Datagram Networks, Routing Algorithms: The Optimality Principle, Different Routing algorithms, Congestion Control Algorithms, Approaches to Congestion Control **(07 Hrs)**
Unit-VI	**Application Layer:** Protocols: DNS, SMTP, POP, FTP, HTTP, HTTPs, Application layer services, Client server architecture, firewalls. **(07 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Computer Networks	Andrew S. Tanenbaum	Pearson	5th
2.	Data Communications and Networking	Behrouz A. Forouzan	McGraw-Hill Forouzan Networking series	4th
3.	Computer Networks and Internet	Douglas E. Comer	Pearson Education Publishers	6th

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE302 **Course: Computer Networks** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours-3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes	**CO1:** Explain the functions of protocol layers, types of networks, and communication services using OSI and TCP/IP reference models. **CO2:** Apply bandwidth and signal processing concepts to determine the maximum data rate over various transmission media. **CO3:** Analyze flow and error control techniques and protocols for reliable data communication at the Data Link Layer. **CO4:** Analyze routing and congestion control algorithms used in packet-switched networks

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	-	-	-	1	-	1
CO2	3	3	2	2	3	-	-	-	1	-	2
CO3	3	2	3	2	2	-	-	-	1	-	2
CO4	3	2	3	3	3	1	-	-	1	-	2
Average	3.00	2.25	2.50	2.00	2.50	1.00			1.00		1.75
Mapping Strength	3	2	3	2	3	1			1		2

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	2
Average	3	2	1

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)	
Course Category: PCC Course Code: CSE303 **Course: Design And Analysis of Algorithm** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Data Structure, Discrete Mathematics
Objectives	• To analyze and compare the performance of algorithms based on time and space complexity, and to demonstrate algorithmic strategies such as graph and tree traversals, greedy methods, and dynamic programming in solving classical computational problems. • To apply advanced algorithmic techniques including backtracking, branch and bound, and to understand the theoretical foundations of algorithm complexity classes such as deterministic and non-deterministic algorithms.
Unit-I	**Foundations of Algorithm Analysis** Introduction to Algorithm, definition and properties, expressing algorithms, design techniques, order of growth, performance analysis: space complexity, time complexity, Asymptotic Notation: Big (O) notation, Omega notation, Theta notation, Recursion & Recurrence relation: Solving recurrences using Recursion Tree, Substitution Method, Master's Theorem. **(06 Hrs)**
Unit-II	**Divide and Conquer & Search Techniques:** Divide and Conquer: General method, Applications - Analysis of Binary Search, Finding Maximum and Minimum, Quick sort, Merge sort, Strassen's Matrix Multiplication. **(06 Hrs)**
Unit-III	**Greedy Algorithms** Greedy Method: General method, Job Sequencing with Deadlines, Fractional Knapsack Problem, Optimal Merge Pattern, Huffman Coding, Activity Selection Problem, Dijkstra's Single Source Shortest Path Algorithm. **(06 Hrs)**
Unit-IV	**Dynamic Programming:** Dynamic Programming General method, Multistage Graph Problem, 0/1 Knapsack Problem, Floyd -Warshall's All Pair Shortest Path Algorithm, Travelling Salesperson Problem, Longest Common Subsequence Algorithm, String Matching: Knuth-Morris-Pratt (KMP) Algorithm, Optimal Binary Search Trees. **(07Hrs)**

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Unit-V	**Backtracking and Branch & Bound** Backtracking: General method, Applications - N-Queen Problem, Sum of Subsets Problem, Graph Colouring, Branch and Bound: General method, applications - Travelling Salesperson **(07Hrs)**
Unit-VI	**NP-Completeness and Advanced Concepts** Basic Concepts: NP-Hard and NP-Complete Problems: Basic concepts, non-deterministic algorithms, NP-Hard and NP - Complete Classes: Cook's Theorem, Example Problems: Vertex Cover, 3 SAT. **(07Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Introduction to Design and Analysis of Algorithms A strategic approach	R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai	McGraw Hill	1st edition
2.	Data structures and Algorithm Analysis in C++	Allen Weiss	Pearson education	2nd edition
3.	Design and Analysis of algorithms	Aho, Ullman, Hopcroft	Pearson education	2nd edition
4.	Introduction to Algorithms	Thomas H. Cormen	PHI Publication	2nd edition

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE303 **Course: Design And Analysis of Algorithm** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes	**CO1:** Describe the fundamentals of algorithm design techniques and analysis with time and space complexity. **CO2:** Apply important algorithmic design techniques for solving problems. **CO3:** Analyze the asymptotic performance of algorithms. **CO4:** Distinguish between P and NP classes of problems.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3		–	–	–	–	–	1
CO2	1	3	3	2	3	–	–	–	–	–	1
CO3	2	2	–	–	–	–	–	–	–	–	1
CO4	3	3	–	–	–	–	–	–	–	–	1
Average	2	3	3	2	3	–	–	–	–	–	1
Mapping Strength	2	3	3	2	3	–	–	–	–	–	1

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	2	–	–
CO2	2	–	–
CO3	2	–	–
CO4	2	–	–
Average	2	–	–

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PEC** Course Code: CSE316A **Course: Digital Image Processing** Teaching Scheme: Theory- 3 Hrs./week Tutorial-1Hrs/week Self-Learning Hours- 4 Hrs./Week	Credits: 3-0-1 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Fourier Transform
Objectives	• To study Digital Image Processing concepts. • To study the different Image processing algorithms to achieve desired result. • To study applications in image processing.
Unit-I	**Introduction to Image Processing** Digital image, Fundamental steps in digital image processing, Components of an image processing system, Image sensing and acquisition, Image sampling and quantization, Basic relationship between pixels: Neighbours of a pixel, Adjacency, Connectivity, Regions and Boundaries, Distance Measures. **(6 Hrs)**
Unit-II	**Intensity Transformation and Filtering** Basics of intensity transformation and filtering, Basic intensity transformation functions, Histogram processing, Histogram equalization, Discrete Fourier transform (DFT), Discrete cosine transform, Fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Basics of filtering in the frequency domain, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters **(6 Hrs)**
Unit-III	**Image Compression Fundamentals:** Coding Redundancy, Spatial and temporal Redundancy, Irrelevant Information, measuring image Information, Fidelity Criteria, Image compression Model, Some Basic Compression Methods: Lossless Compression methods-Huffman coding, LZW coding, Run- Length Coding, Lossy Compression methods: Block Transform Coding, Image File formats: BMP, GIF, TIFF, JPEG, PNG. **(7 Hrs)**
Unit-IV	**Image Segmentation Fundamentals:** Point, Line and Edge Detection, Detection of Isolated Points, Line Detection, Edge Models, Basic Edge detection, Thresholding, Region-Based Segmentation Methods: Region Growing, Region Splitting and Merging. **(6 Hrs)**
Unit-V	**Morphological Image Processing and Color Image Processing Morphological Image** Processing: Preliminaries, Erosion and Dilation, Opening and Closing the Hit-or-Miss Transformation, Basic Morphological Algorithms: Boundary Extraction, Hole Filling. Color Image Processing: Color Fundamentals and Color Models: RGB color model, CMY and

	CMYK color models, HSI color model, Basics of Full-Color Image Processing, Color Transformations: Formulation, color complements, color slicing, Tone and color corrections. **(7 Hrs)**
Unit-VI	**Representation and Description** Representation, Boundary Descriptors: Simple descriptors, Shape Numbers, Fourier descriptors, Statistical Moments, Regional Descriptors: Simple descriptors, Topological descriptors. **(7 Hrs)**

References

Sr.No.	Title	Author	Publication	Edition
1	Digital Image Processing	Rafael Gonzalez Richard Woods	Pearson Education.	3rd
2	Digital Image Processing using MATLAB	Rafael C Gonzalez, Richard E Woods	Pearson Education	1st
3	Digital Image Processing	Anil K Jain	PHI	3rd
4	Digital Image Processing	William K. P.	Mc Graw Hill	3rd
5	Digital Image Processing Analysis	B. Chanda,D. Dutta Majumder	PHI	2nd

Suggestive list of Tutorials:

1. Write a program to read and display an image.
2. Write a program to save and convert image formats.
3. Write a program for arithmetic operations on images.
4. Write a program for logical operations on images.
5. Write a program for image transformations using log transformation, negative transformation, and power law transformation.
6. Write a program to perform thresholding on the image
7. Write a program to perform smoothing (mean, median) filters on an image to reduce noise.
8. Write a program to perform sharpening (Laplacian or high-pass) filters to enhance edges in an image.
9. Write a program for a 1D discrete cosine transform.
10. Write a program for a 2D discrete cosine transform.
11. Write a program for a histogram and histogram equalization.
12. Write a program for bit plane slicing.
13. Write a program for edge detection.
14. Write a program for color image processing.
15. Write a program for morphological operations on an image.

Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: PEC Course Code: CSE316A **Course: Digital Image Processing** Teaching Scheme: Theory- 3 Hrs./week Tutorial-1Hrs/week Self-Learning Hours- 4 Hrs./Week	Credits: 3-1-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes

CO1: Describe the fundamental concepts, models, and components of digital image processing systems.
CO2: Explain image enhancement techniques in spatial and frequency domains for improving image quality.
CO3: Compare various image compression and segmentation techniques used in image processing.
CO4: Analyse morphological, colour, and shape-based methods for image interpretation and object recognition.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	–	–	–	–	–
CO2	3	2	2	–	2	–	–	–	–	–	–
CO3	3	2	2	1	2	–	–	–	–	–	–
CO4	3	2	2	1	2	–	–	–	–	–	–
Average	3	2	2	1	2	–	–	–	–	–	–
Mapping Strength	3	2	2	1	2	–	–	–	–	–	–

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	2	–	–
CO2	2	–	–
CO3	2	–	–
CO4	2	–	–
Average	2	–	–

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PEC** Course Code: CSE316B **Course: Data Wrangling and Visualization** Teaching Scheme: Theory- 3 Hrs./week Tutorial-1Hrs/week Self-Learning Hours- 4 Hrs./Week	Credits: 3-1-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Knowledge of python programming
Objectives	1. Understand the need for data wrangling in data science. 2. Perform data pre-processing with exploratory analysis. 3. Apply data wrangling techniques and perform data visualization. 4. Study impact of feature engineering on data science applications.
Course Outcomes	**CO1:** Apply data wrangling techniques to prepare structured data from various formats like CSV, JSON, and XML. **CO2:** Perform data cleaning using techniques such as formatting, de-duplication, and fuzzy matching. **CO3:** Use exploratory data analysis to identify patterns, trends, and outliers using statistical methods. **CO4**: Create and customize visualizations and dashboards using Python libraries and tools like Tableau or Power Bi
Unit-I	**Introduction to Data Wrangling** Definition of Data Wrangling, Importance of Data Wrangling, how is Data Wrangling performed? - Tasks of Data Wrangling-Data Wrangling Tools-Introduction to Python-Python Basics-Data Meant to Be Read by Machines-CSV Data-JSON Data-XML Data. **(06 Hrs)**
Unit-II	**Data Clean-up:** Data Clean up Basics-Identifying Values for Data Clean-up-Formatting Data-Finding Outliers and Bad Data-Finding Duplicates Normalizing and Standardizing the Data-Saving the Data Determining suitable Data Clean-up Scripting the Clean-up Testing with New Data **(06 Hrs)**
Unit-III	**Data Exploration and Analysis:** Exploring Data-Importing Data-Exploring Table Functions-Joining Numerous Datasets-Identifying Correlations-Identifying Outliers, Creating Groupings-Analysing Data-Separating and Focusing the Data Presenting Data-Visualizing the Data-Charts-Time-Related Data-Maps- Interactives -Words Images, Video, and Illustrations-Presentation Tools-Publishing the Data-Open-Source Platforms. **(06 Hrs)**

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Unit-IV	**Exploratory Data Analysis (EDA):** Importance of EDA in data science workflow – Understanding data distributions and patterns – Summary statistics: mean, median, mode, standard deviation, variance – Handling categorical and numerical variables – Grouping and aggregation techniques – Creating pivot tables and cross-tabulations – Identifying correlations and relationships among features – Visual exploration using plots: histograms, box plots, scatter plots – Detecting anomalies and outliers – Handling time-series data – Feature extraction and selection for modeling. **(07 Hrs)**
Unit-V	**Web Scraping:** What to Scrape and How-Analyzing a Web Page-Network/Timeline, Interacting with JavaScript-In-Depth Analysis of a Page- Getting Pages-Reading a Web Page-Reading a Web Page with LXML-XPath-Advanced Web Scraping -Browser-Based Parsing-Screen Reading with Selenium-Screen Reading with Ghost, .Py Spidering the Web-Building a Spider with Scrapy-Crawling Whole Websites with Scrapy **(07 Hrs)**
Unit-VI	**Introduction to Data Visualization Tools** Overview of Tableau, Power BI, and Stream lit, Importance and applications of visual analytics in data science, Comparison of tools based on features and use cases – Best practices for dashboard design and storytelling with data. Publishing and Sharing Data stories. **(07 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Principles of Data Wrangling: Practical Techniques for Data Preparation	Joseph M. Hellerstein, Tye Rattenbury, Jeffrey Heer, Sean Kandel, Connor Carreras	O'Reilly Media, Inc. ISBN: 9781491938928	3rd
2.	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython	William McKinney	O'Reilly Media, Inc.	2nd
3.	Web Scraping with Python: Collecting Data from the Modern Web	Ryan Mitchell	O'Reilly Media ISBN: 9781491985571	2nd
4.	Data Wrangling with Python: Creating actionable data from raw sources	Dr. Tirthajyoti Sarkar (Author), Shubhadeep Roychowdhury	Packt Publishing	1st

Suggestive list of Tutorials:

1. Handling missing values: Suppose you have a dataset with missing values in a column. How would you handle these missing values?
2. Data merging: You have two datasets, one with customer information and another with order information. How would you merge these datasets based on a common column?
3. Data transformation: You have a column with date values in string format. How would you convert this column to a date time format?
4. Creating a bar chart: You have a dataset with categorical data and want to create a bar chart to visualize the frequency of each category. How would you do this?
5. Choosing a visualization type: Suppose you want to visualize the distribution of a continuous variable. What type of visualization would you use?
6. Customizing visualizations: How would you customize the appearance of a visualization, such as changing colors, fonts, and labels?
7. Data cleaning: You have a dataset with duplicate rows. How would you remove these duplicates?
8. Visualizing relationships: You want to visualize the relationship between two continuous variables. What type of visualization would you use?
9. Customizing visualizations: How would you customize the appearance of a visualization, such as changing colors, fonts, and labels?
10. Pandas and NumPy: How would you use Pandas and NumPy to manipulate and analyze data in Python?
11. Matplotlib and Seaborn: How would you use Matplotlib and Seaborn to create visualizations in Python?
12. Data visualization best practices: What are some best practices for creating effective data visualizations?
13. Business intelligence: How can data wrangling and visualization be used in business intelligence to inform decision-making?
14. Scientific research: How can data wrangling and visualization be used in scientific research to communicate findings and insights?
15. Data storytelling: How can data wrangling and visualization be used to tell a story with data and communicate insights to a non-technical audience?

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PEC** Course Code: CSE316B **Course: Data Wrangling and Visualization** Teaching Scheme: Theory- 3 Hrs./week Tutorial-1Hrs/week Self-Learning Hours-4 Hrs./Week	Credits: 3-1-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes	**CO1**: Apply data wrangling techniques to prepare structured data from various formats like CSV, JSON, and XML. **CO2:** Perform data cleaning using techniques such as formatting, de-duplication, and fuzzy matching. **CO3:** Use exploratory data analysis to identify patterns, trends, and outliers using statistical methods **CO4**: Create and customize visualizations and dashboards using Python libraries and tools like Tableau or Power BI.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	2	–	–	–	–	–	–
CO2	2	2	2	2		–	–	–	–	–	–
CO3	2	3	1	2		–	–	–	–	–	–
CO4	2	2		3	3	–	–	–	–	–	–
Average	2	2.25	1.7	2.3	2.5	–	–	–	–	–	–
Mapping Strength	2	2	2	2	3	–	–	–	–	–	–

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	–	2	–
CO2	–	2	–
CO3	–	2	–
CO4	–	2	–
Average	–	2	–

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)	
Course Category: **PEC** Course Code: CSE316C **Course: Wireless Networks** Teaching Scheme: Theory- 3 Hrs./week Tutorial-1 Hrs./Week Self-Learning Hours-4 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Computer networks
Objectives	• To understand the concept about Wireless networks, protocol stack and standards • To understand and analyse the network layer solutions for Wireless networks • To study about fundamentals of 3G Services, its protocols and applications • To have in depth knowledge on internetworking of WLAN and WWAN • To learn about evolution of 4G Networks, its architecture and applications
Unit-I	**Wireless Lan** Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hipper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, Wireless HART **(6 Hrs)**
Unit-II	**Mobile Network Layer** Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer on the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP **(7 Hrs)**
Unit-III	**3G Overview** Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA. **(7Hrs)**
Unit-IV	**Internetworking Architecture** WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System **(6 Hrs)**
Unit-V	**Internetworking Between WLAN And WWAN**

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	Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility. **(6Hrs)**
Unit-VI	**4G & Beyond** Introduction – 4G and 5G vision – features and challenges – Applications of 4G AND 5G – 4G and 5G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO. **(7Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Mobile Communications	Jochen Schiller	Pearson Education	2nd
2.	Wireless Communications and networking	Vijay Garg	Elsevier	1st
3.	Evolution HSPA and LTE for Mobile Broadband 3G	Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming	Academic Press	2nd
4.	Wireless Networking	Anurag Kumar, D.Manjunath, Joy kuri	Elsevier	1st
5.	Modern Wireless Communications	Simon Haykin , Michael Moher, David Koilpillai	Pearson Education	1st

Suggestive list of Tutorials:

1. Explain IEEE 802.11 architecture with diagram.
2. Compare Bluetooth and Zigbee protocols.
3. How does WPAN differ from WLAN?
4. How does Mobile IP handle mobility?
5. Analyse IPv6 routing in wireless networks.
6. Case study: Routing in ad-hoc networks.
7. Simulate integration of UMTS with WLAN.
8. Compare CDMA2000 and TD-CDMA.
9. Design a hybrid 3G-WLAN network.
10. What are the challenges in 5G deployment?
11. Analyse LTE architecture.
12. Present IMS integration in 4G.
13. Case study example on 4G.
14. Case study example on real time wireless network
15. Case study example on 5G

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: PEC Course Code: CSE316C **Course: Wireless Networks** Teaching Scheme: Theory- 3 Hrs./week Tutorial-1Hrs/week Self-Learning Hours- 4 Hrs./Week	Credits: 3-1-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes

1. CO1: Explain the architecture and protocols of Wireless LANs including IEEE 802.11, Bluetooth, Zigbee, and WPAN standards using appropriate diagrams and examples.
2. CO2: Apply Mobile IP, IPv6, and routing mechanisms to analyze network layer protocols in wireless environments through case studies and problem-solving exercises.
3. CO3: Compare 3G network technologies such as UMTS, CDMA2000, and TD-CDMA, and demonstrate their integration with WLAN and GPRS systems using simulation tools.
4. CO4: Evaluate the features, challenges, and applications of 4G and 5G technologies including LTE and IMS architecture through analytical reports and presentations.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			1							
CO2	3	3		2								
CO3	2		3		3							
CO4	2					2				1		
Average	2.5	2.5	3	2	2	2				1		
Mapping Strength	3	3	3	2	2	2				1		

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	3	2	
CO2	3		2
CO3		2	3
CO4	2		1
Average	3	2	2

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (All Branches) (Semester V)
Open Elective-3 offered by the Mechanical Engineering Department

Course Category: OEC Course Code: **OEC341A** Course: **Artificial Intelligence in Industrial and Management Engineering**	**Credits: 2-0-0** Mode of delivery- MOOC

NPTEL Link: https://onlinecourses.nptel.ac.in/noc25_ge44/preview

Course Instructor (MOOC): By Prof. Deepu Philip, Prof. Prabal Pratap Singh | IIT Kanpur

Course layout

Week 1: 1. Introduction to AI 2. Evolution of AI 3. Latest advancements in AI 4. Roles of AI in business	**Week 5:** 1. Introduction to NLP 2. Processing stages in NLP 3. Speech processing 4. Applied NLP
Week 2: 1. Introduction to knowledge representation 2. Introduction to logic 3. Reasoning systems 4. Advantages & Disadvantages of knowledge representation methods	**Week 6:** 1. Machine learning basics 2. Inductive learning 3. Decision tress 4. Neural Network
Week 3: 1. Basic architecture of expert systems 2. Simple backward chaining expert systems 3. Medical expert system case study – I 4. Medical expert system case study - II	**Week 7:** 1. Introduction to production scheduling 2. Metaheuristics for scheduling 3. Applied scheduling case study using metaheuristics – I 4. Applied scheduling case study using metaheuristics - II
Week 4: 1. Search algorithms 2. Local search 3. Solving puzzles 4. Limitation of search techniques	**Week 8:** 1. Introduction to facility layout problems 2. Metaheuristics for facility layouts 3. Applied case study on facility layout – I 4. Applied case study on facility layout - II

Books and references

- Russell, S. J., Norvig, P., Chang, M.-W., Devlin, J., Dragan, A., Forsyth, D., Goodfellow, I., Malik, J., Mansinghka, V., Pearl, J., & Wooldridge, M. J. (2022). Artificial intelligence : a modern approach (Fourth edition. Global edition). Pearson.
- Rich, E., Knight, K., & Nair, S. B. (2009). Artificial intelligence (3rd ed). Tata McGraw-Hill.

Guidelines for students:

1. **Students have to complete the MOOC course under the mentorship of the Department allotted faculty.**
2. **Students have to successfully complete the course as per instructions on the portal and get the certificate of completion of the course with credits by appearing the MOOC portal conducted examinations and continuous assessment/assignments.**
3. **Take the help of faculty mentor and the central level coordinator for any support required.**

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (All Branches) (Semester V) Open Elective-3 offered by the Electrical Engineering Department	
Course Category: OEC Course Code: **OEC341B** Course: **Artificial Intelligence for Economics**	**Credits: 2-0-0** Mode of delivery- MOOC

NPTEL Link: https://onlinecourses.nptel.ac.in/noc25_cs152/preview

Course Instructor (MOOC): By Prof. Adway Mitra, Prof. Dripto Bakshi, Prof. Palash Dey | IIT Kharagpur

Course layout

Week 1: Motivating Applications of AI/ML in Economics & Politics. Basic ideas of AI/ML, formulating / deciphering real life problems using these techniques. - DB	**Week 5:** Introduction to Game Theory (Cooperative and noncooperative Game Theory, dilemma problems), Bayesian Games, Mechanism Design with Economics applications - DB
Week 2: Optimization and Search techniques (unconstrained and constrained optimization, concept of pareto-optimality, heuristic search, game tree) - AM	**Week 6:** Auction Theory (Vickrey, Myerson Auctions), Case studies of auctions, advertising strategies on the internet - PD
Week 3: Basic Predictive Algorithms (Linear Regression, Decision Trees, Random Forests, Bayesian classifier), Neural Networks, Time Series Prediction - AM	**Week 7:** Case Studies: i) Learning Theory for Economics ii) Customer Behavior Analysis for Recommender Systems - PD(i) DB(ii)
Week 4: Causality and Attribution (Shapley value analysis of predictive models, Granger Causality, Causal Graphical Models and do-Calculus, Randomized Control Trials) - AM Put-call, Hedging - DB	**Week 8:** Case studies: i) Reinforcement Learning in Finance, ii) Multi-agent simulation of economic systems, Econo-physics - AM

Books and references

Mullainathan, Sendhil, and Jann Spiess. 2017. "Machine Learning: An Applied Econometric Approach." *Journal of Economic Perspectives*, 31 (2): 87-106.

Athey, Susan, and Guido W. Imbens. "Machine learning methods that economists should know about." *Annual Review of Economics* 11 (2019): 685-725.

Goulet Coulombe, Philippe, et al. "How is machine learning useful for macroeconomic forecasting?." *Journal of Applied Econometrics* 37.5 (2022): 920-964.

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2. **Students have to successfully complete the course as per instructions on the portal and get the certificate of completion of the course with credits by appearing the MOOC portal conducted examinations and continuous assessment/assignments.**
3. **Take the help of faculty mentor and the central level coordinator for any support required.**

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (All Branches) (Semester V) Open Elective-3 offered by the Emerging Science and Technology Department	
Course Category: OEC Course Code: **OEC341C** Course: Artificial Intelligence, Law and Justice	**Credits: 2-0-0** Mode of delivery- MOOC

NPTEL Link: https://onlinecourses.nptel.ac.in/noc25_lw12/preview

Course Instructor (MOOC): By Prof. Krishna Ravi Srinivas | NALSAR University of Law

Course layout:

Week 1: Introduction to AI, Rule of Law, Data and AI, AI and Judicial System in India

Week 2: Use of AI in Law in India, Algorithmic Decision Making, AI and Rule of Law

Week 3: AI and Rule of Law, Algorithmic Justice, AI and Copyright

Week 4: AI and Copyright, AI and Patents/Patening, AI Ethics

Week 5: AI Ethics and Law and Justice, Responsible AI in Law and Justice, Explainable AI

Week 6: Explainable AI and Law and Justice, AI and Employment Law, AI and Health Law, AI and Competition Law, AI and Law and Justice in Select Jurisdictions

Week 7: AI and Law and Justice in USA, AI and Judges, AI and Human Rights, AI and Constitution

Week 8: AI and Constitution, AI, Law, Justice and Innovation, AI, Law and Justice : Beyond Technosolutionism, Law, AI, Technology and Future, Final Session and Summing Up

Books and references

1. Global Toolkit on AI and the Rule of Law for the Judiciary UNESCO 2024
2. Responsible AI for Indian Justice System- Vidhi Center
3. Niti Aayog Reports on AI
4. Multidisciplinary Perspectives on Artificial Intelligence and the Law Springer 2024
5. Law and Artificial Intelligence: Regulating AI and Applying AI in Legal Practice by Bart Custer Springer 2024
6. The Oxford Handbook of AI Governance (Oxford Handbooks) by Justin B. Bullock Oxford University Press 2024
7. Governmental Automated Decision-Making and Human Rights: Reconciling Law and Intelligent Systems by Stefan Schäferling Springer 2024
8. AI and Law: How Automation Is Changing the Law by Tamò-Larrieux, Aurelia, Guitton, Clement, Mayer, Simon CRC Press 2025
9. The Cambridge Handbook of Artificial Intelligence: Global Perspectives on Law and Ethics 2022(This is an indicative list)

Guidelines for students:

1. **Students have to complete the MOOC course under the mentorship of the Department allotted faculty.**
2. **Students have to successfully complete the course as per instructions on the portal and get the certificate of completion of the course with credits by appearing the MOOC portal conducted examinations and continuous assessment/assignments.**
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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (All Branches) (Semester V)
Open Elective-3 offered by the Computer Science and Engineering Department

Course Category: OEC Course Code: **OEC341D** Course: **Advanced Algorithmic Trading and Portfolio Management**	**Credits: 2-0-0** Mode of delivery- MOOC

NPTEL Link: https://onlinecourses.nptel.ac.in/noc25_mg118/preview

Course Instructor (MOOC): By Prof. Abhinava Tripathi | IIT Kanpur

Course layout:

Week 1: Introduction to R Programming, R Fundamentals, Basic mathematical and logical operations with R, working with different data-types in R, wrangling with dataframes, Exploratory data analysis and data visualization with R.

Week 2: Introduction to Portfolio Construction : Risk-return framework in financial markets, risk diversification with portfolios, portfolio optimization in mean-variance framework, concept of market risk and beta, Portfolio Possibility curve, Efficient frontier, Minimum Variance portfolios, Introduction to risk-free lending and borrowing

Week 3: Asset Pricing Models: Capital Asset Pricing Model (CAPM), Capital Market Line, Security Market Line, Fallings of CAPM, Single-Index and Multi-Index models, Expected Risk and Return with Index models, 3-Factor Fama-French Model

Week 4: Portfolio Management and Performance Evaluation: Portfolio Management strategies, Active vs Passive Portfolio Management, Value vs Growth investing, One-parameter performance measures Timing & Selection performance measures, application of asset pricing models in performance management

Week 5: Introduction to Algorithmic Trading: Technical analysis and trend determination, Dow Theory, Moving averages, Momentum indicators, Classical price patterns.

Week 6: Advanced time-series regression algorithms: ARMA/ARIMA models, Mean reverting trading strategies with vector error correction models and cointegration, model risk management, back testing, model validation, and stress testing with R

Week 7: Advanced time-series algorithms for financial risk-management: Value-at-risk, Expected Shortfall, ARCH/GARCH models, implementation with R

Week 8: Advanced topics: Alternative versions of CAPM, Delineating Efficient Frontier, Performance Evaluation with Multi-index models, Portfolio construction, optimization, back-testing, and visualization with R

Books and references

1. Machine Learning in Finance by M. Dixon, I Halperin, and P. Bilokon, Springer, 1st Edition
2. Advances in Financial Machine Learning, Marcos Lopez, Wiley, 1st Edition
3. Machine Learning for Asset Managers, Marcos Lopez, Cambridge University Press, 1st Edition
4. Machine Learning for Algorithmic Trading, Stefan Jansen, 2nd Edition, Packt
5. Elton & Gruber, "Modern Portfolio Theory", Wiley, 9th Edition
6. Reilly, Frank,K., "Investment Analysis and Portfolio Management," 5th Edition, Dryden.

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (All Branches) (Semester V) Open Elective-3 offered by the Agricultural Engineering Department	
Course Category: OEC Course Code: **OEC341E** Course: **Foundations of French**	**Credits: 2-0-0** Mode of delivery- MOOC

SWAYAM Link: https://onlinecourses.swayam2.ac.in/imb25_mg175/preview

Course Instructor (MOOC): By Ramya Jagannathan | Indian Institute of Management, Bangalore

Course layout:

Week 1: Introduction, Greetings and Alphabet Articulation

Week 2: Indefinite Articles and Numbers

Week 3: Family Vocabulary, Colours and Numbers

Week 4: Words of Politeness, Pronouns and Conversation

Week 5: 6 Points to Self-Introduction, Simple Propositions and Verbs

Week 6: Grammar and Conclusion

Books and references

- Saisons 1 Méthode de français
- https://www.frenchcircles.ca/
- https://blog.rosettastone.com/french-accent-marks/

Guidelines for students:

1. **This course mentioned is of 3 Credits in the MOOC Portal, However, for credit transfer purpose it will be considered as 2 credits.**
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Faculty of Science & Technology Syllabus of Third Year B.Tech. (All Branches) (Semester V) Open Elective-3 offered by the Electronics and Computer Engineering Department	
Course Category: OEC Course Code: **OEC341F** Course: German - I	**Credits: 2-0-0** Mode of delivery- MOOC

NPTEL Link: https://onlinecourses.nptel.ac.in/noc25_hs121/preview

Course Instructor (MOOC): By Prof. Milind Brahme | IIT Madras

Course layout:

Week 1: Themes: Introducing oneself and others; Grammar: W questions, personal pronouns, simple sentence, verb conjugation

Week 2: Themes: hobbies, the week, numbers, the alphabet, months, seasons /Grammar : articles , plural, the verbs to have and to be

Week 3: Theme: In the city / naming places and buildings, means of transport, basic directions / Grammar : definite and indefinite articles; negation - kein and nicht; imperative

Week 4: Themes: food, drink, family / groceries and meals / Grammar : the accusative

Week 5: Theme: Everyday life, telling time, making appointments / Grammar :prepositions am, um, von..bis; modal verbs, possessive articles

Week 6: Leisure activity, celebrations / Grammar: separable verbs, the accusative, past tense of to have and to be

Week 7: Contacts, writing letters / Grammar: dative

Week 8: My apartment, rooms, furniture, colours / Grammar: changing prepositions

Week 9: Professions / Grammar : perfect tense

Week 10: Clothes / Grammar: perfect tense and dative

Week 11: Health and the body / Grammar: the imperative and modal verbs

Week 12: Holiday and weather

Books and references

Prescribed Textbook: NETZWERK Deutsch als Fremdsprache A1(Goyal, New Delhi, 2015)

Other recommended books:

Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar)

Web Resources:

FACTS ABOUT GERMANY https://www.tatsachen-ueber-deutschland.de/en

ONLINE GERMAN-ENGLISH DICTIONARY www.leo.org

PRACTICE MATERIAL

https://www.goethe.de/en/spr/kup/prf/prf/sd1/ueb.html

https://www.deutschkurse-passau.de/JM/images/stories/SKRIPTEN/a1_skrjpt_gr.pdf

https://www.schubert-verlag.de/aufgaben/arbeitsblaetter_a1_z/a1_arbeitsblaetter_index_z.htm

Guidelines for students:

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (All Branches) (Semester V)
Open Elective-3 offered by the Civil Engineering Department

Course Category: OEC Course Code: **OEC341G** Course: **River Restoration Techniques** Teaching Scheme: Theory: 02 Hrs./week Self-Learning Hours – 2 Hrs./week	**Credits: 2-0-0** In-Semester Examination -I: 15 Marks In-Semester Examination -II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration):02 Hrs.

Prerequisite	Basics in Environmental Engineering, Engineering Chemistry and problem-solving thinking
Objectives	To learn river engineering and its restoration techniques.
Course Outcomes	At the end of the course, student will be able to- **CO1:** Understand the importance of rivers and the necessity of controlling them. **CO2:** Analyze the environmental significance of rivers, including cultural, natural, and historical aspects. **CO3:** Solve steady and unsteady flow problems in rivers using appropriate equations of motion. **CO4:** Apply knowledge of water quality parameters and relevant standards (e.g., BIS, WHO) to assess and control river pollution. **CO5:** Apply the principles of river training along braided rivers and other river systems. **CO6:** Evaluate the effectiveness of soil stabilization, dredging, and sediment management techniques for river restoration.
Unit-I	**Introduction to River Engineering:** Importance of rivers and necessity of controlling them. Rivers of India and their origins, Importance of Catchment area, Types of rivers and their characteristics, Classification of rivers on the basis of topography, Classification of Drainage basin or Channel, River morphology and regimes. River behaviour and Characteristics, Watershed forms, Classification of watershed. **(05 Hrs)**
Unit-II	**Understanding the River, Environmental Context and Challenges:** Importance of river ecosystems: Natural, cultural, and Historical Significance of river, Climate change and its impact on water resources, Geographical and Hydrological Data of river - Length, catchment area, flow patterns, and seasonal variations. Status of river: Pollution levels, encroachments, biodiversity degradation, and waste inflow sources. **(04 Hrs)**
Unit-III	**River flow kinematics:** Physical properties and equations: Dimensions and units, Properties of water and sediment, River flow kinematics, Conservation of mass, Equations of motion, **Steady flow in rivers:** Steady River flow, Steady-non-uniform River flow, Sediment transport in rivers. Unsteady flow in rivers: River continuity equation, River momentum equations **(04 Hrs.)**
Unit-IV	**River Water Quality and Pollution Standards:** Sources and types of river pollutants, Chemical properties of pollutants (organic and inorganic) in rivers, Water quality parameters: pH, turbidity, dissolved oxygen, conductivity, and temperature,National & Global Standards, BIS standards (Bureau of Indian Standards) WHO guidelines, control and

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	measures of river pollution, Application of biodegradable materials in reducing long-term pollution, Decentralized water treatment units for small urban streams. **(05 Hrs.)**
Unit-V	**River Training Work:** River stabilization and river training work, Riverbank stability, Riverbank riprap revetment, Riverbank protection, River flow-control structures, Objective, classification and methods of river training, River training along braided rivers. **(04 Hrs.)**
Unit-VI	**Restoration Techniques:** Engineering Approaches: River channel reconfiguration, River flood control, River closure, Soil stabilization methods, Riverbank erosion control, Dredging and sediment management. **(04 Hrs.)**

	Sr. No.	Title	Author	Publication	Edition
Textbooks and Reference Books	1.	Hydrology and Water Resources Engineering	S.K. Garg	Khana Publisher	1st Edition, 2015
	2.	Environmental Engineering (Vol. II) Sewage Waste Disposal and Air Pollution Engineering	S.K. Garg	Khana Publisher	37th Edition, 1985
	3.	GIS and Environmental Modeling	Keith C. Clarke	Prentice Hall	1st Edition, 2001
	4	Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats	Philip Roni and Tim Beechie	Wiley-Blackwell	1st Edition (2012)
	5	River Mechanics	Pierre Y. Julien	Cambridge University Press	1st Edition, 2010
E-Resource	1	Manual of River Restoration Techniques	River Restoration Centre (RRC), UK	The River Restoration Centre	www.therrc.co.uk

Guidelines: Course Teacher will internally conduct the following: In-Semester Examination(I&II) (30 Marks), CIE - Field visit and report (10 Marks), TA - Case Study Presentation (10 Marks)

CO and PO Mapping: (3-Strong, 2-Medium and 1- Low)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1		2	1							
CO2	1	2									
CO3	2		1								
CO4	1	1		1							
CO5	2		1								
CO6	1	2		1							

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (All Branches) (Semester V)
Open Elective-3 offered by the Plastic and Polymer Engineering Department

Course Category: OEC	**Credits: 2-0-0**
Course Code: **OEC341H**	In-Semester Examination -I: 15 Marks
Course: **Circular Economy and Plastic Waste Management**	In-Semester Examination -II: 15Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 02 Hrs./week	Continuous Internal Evaluation: 10 Marks
Self-Learning Hours – 2 Hrs./week	End Semester Examination: 50 Marks
	End Semester Examination (Duration):02 Hrs.

Prerequisite	Basics of Polymer Engineering
Objectives	1. To analyze sources and impacts of plastic waste generation. 2. To explore methods and technologies for effective plastic waste management. 3. To promote awareness of circular economy principles in the context of plastics. 4. To review policies, regulations, and global initiatives supporting sustainable plastic management.
Unit-I	**Understanding Plastics and impact of Plastic Waste:** Types of plastics: Thermoplastics and Thermosets, common plastic products and their lifecycle, environmental and health impacts of plastic waste, challenges and implications. Impact and management of plastic production and consumption trends, Sources of plastic waste in manufacturing, packaging, automotive, biomedical sectors. **(04 Hrs)**
Unit-II	**Sources, Types and Characterization of Plastic Waste:** Sources: household, industrial, packaging, biomedical. Classification: pre-consumer, post-consumer, micro plastics. Techniques for plastic waste identification: FTIR, DSC, TGA. Life cycle assessment (LCA) in plastic materials. Waste audit methodology for polymer industries. **(04 Hrs)**
Unit-III	**Collection, Segregation, and Transportation Systems:** Mechanisms of plastic waste collection: formal and informal sectors, segregation practices at source and centralized facilities. Role of municipalities, waste pickers, and private players. Challenges in logistics, infrastructure, and rural-urban differences. **(03 Hrs)**
Unit-IV	**Plastic Recycling and Recovery Technologies:** Mechanical recycling: sorting, washing, shredding, and reprocessing. Chemical recycling: pyrolysis, depolymerization, solvolysis. Biodegradable and compostable plastics: behaviour and challenges. Role of additives, fillers, and compatibilizers in recycled plastic processing. Energy recovery from plastic waste. **(06 Hrs)**
Unit-V	**Circular Economy and Sustainability:** Concept of Circular Economy (CE) vs. Linear Economy, circular strategies: Reduce, Reuse, Recycle, and Redesign. Extended Producer Responsibility (EPR) and design for recyclability. CE models in plastic packaging, construction, automotive sectors. Sustainability principles in polymer production and waste management, sustainable materials and green design in plastic applications. Global initiatives through case study (EU Green Deal, Ellen MacArthur Foundation). **(05 Hrs)**
Unit-VI	**Policy Framework, Regulations, and Future Trends:** Plastic waste management rules (India), global regulations. Role of government, NGOs, and industries. SDGs related to plastic waste and CE. Innovation, R&D, and future trends in sustainable plastic use Public awareness and education. **(04 Hrs)**

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	Sr. No.	Title	Author	Publication	Edition
Textbooks and Reference Books	1.	Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions	Trevor M. Letcher	Academic Press (Elsevier)	1st
	2.	Sustainable Plastics: Environmental Assessments of Biobased, Biodegradable, and Recycled Plastics	Joseph P. Greene	Wiley	1st
	3.	Circular Economy: Global Perspective	Sadhan Kumar Ghosh	Springer	1st
	4.	Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists	Ernst Worrell, Markus A. Reuter	Elsevier	1st
	5.	The Circular Economy A User's guide	Walter R Stahel	Routledge	1st
	6.	An introduction to Circular Economy	Lerwen Liu, Seeram Ramkrishna	Springer	1st
	7.	Municipal Solid Waste Management in Developing Countries	Sunil Kumar, Rakesh Kumar, A.K. Sengupta	TERI Press	1st
NPTEL/ Swayam/ web links	1.	https://www.gefislands.org/course/e-learning-course-waste-management-and-circular-economy			
	2.	https://www.ellenmacarthurfoundation.org			
	3.	https://www.coursera.org/learn/circular-economy			
	4.	https://online-learning.harvard.edu/course/introduction-circular-economy?delta=0			

Course Outcomes
After the completion of the course students will be able to-

CO1	Identify types of plastics and their environmental impacts.
CO2	Classify plastic waste based on the characterization of materials.
CO3	Describe systems for plastic waste collection, segregation, and recycling methods.
CO4	Apply sustainability and circular economy concepts and policy frameworks.

CO and PO Mapping: (3- Strong, 2- Medium and 1- Low)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	2	2	2	-	2	-	2
CO2	2	2	2	2	2	2	2	1	2	-	2
CO3	2	2	2	2	2	2	2	1	2	-	2
CO4	2	2	2	2	2	2	2	1	2	-	2
Average	2	2	2	2	2	2	2	1	2	-	2

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)	
Course Category: PCC Course Code: CSE321 Course: Database Management System Lab Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks
Prerequisite	Basic understanding of programming concepts, data structures, and computer system fundamentals.
Objectives	1. To design ER diagrams for real-world applications. 2. To create and modify databases using SQL. 3. To perform data manipulation and retrieval using queries. 4. To use NoSQL databases like MongoDB for basic operations.
List of Practical	**1. Design and Implementation of an E-R Model** Design an E-R diagram for a chosen domain, identify entities and relationships, and convert into SQL tables. **2. Creating Databases and Tables with and without Constraints** Create a database with tables, applying constraints like PRIMARY KEY, FOREIGN KEY, UNIQUE, and NOT NULL. **3.Basic Data Manipulation Operations** Use SQL to insert, update, delete, and view data in tables. **4. Modifying and Managing Table Structures** Alter, rename, drop, and truncate tables. **5.Use of Aggregate Functions and SQL Built-in Functions** Write SQL queries using aggregate, string, date, and math functions. **6. Working with Join Operations** Use INNER, LEFT, and RIGHT JOINs to combine data from related tables. **7. Querying with Subqueries and Conditional Operators** Apply subqueries, IN, EXISTS, and conditional operators for data filtering. **8. Implementing Views** Create and query views to simplify complex data retrieval. **9. Implementing Transactions and Recovery Mechanisms** Implement COMMIT, ROLLBACK, and SAVEPOINT to manage transactions. **10. Advanced Querying with Nested Subqueries** Use nested and correlated subqueries for complex data analysis.

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	11. Perform following operations by using NoSQL (MongoDB) Create a database and collection. Insert single and multiple documents. Update and delete documents.
Software	• Any ERD Design Tool (like dbdiagram.io., draw.io.,Lucidchart.) • Any SQL interface (like Oracle, MySQL, Postgres., etc).

References

Sr. No.	Title	Author	Publication	Edition
1	SQL, PL/SQL the Programming Language o Oracle	Ivan Bayross	BPB Publications	4th
2	Learning SQL: Master SQ Fundamentals	Alan Beaulieu	O'reilly	2nd
3	SQL: The Complete Reference	James R. Groff, Paul N. Weinberg	McGraw-Hill Education	3rd

Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE321 Course: **Database Management System Lab** Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks

Course Outcomes

CO 1: To design and implement relational database schemas using E-R modelling techniques and execute SQL DDL and DML queries (CREATE, INSERT, UPDATE, DELETE, SELECT).

CO 2: To apply advanced SQL and NoSQL operations, including nested queries, joins, transactions (COMMIT, ROLLBACK), and basic CRUD operations in MongoDB, on structured and semi-structured datasets.

CO 3: Demonstrate professional ethics, teamwork, punctuality, and documentation skills in lab activities.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	2	2	-	-
CO4	3	3			3			2	2		
Average	3	3			3			2	2		
Mapping Strength	3	3	-	-	3	-	-	2	2	-	-

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	3	-	-
CO2	3	2	-
Average	3	2	2

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Faculty of Science & Technology
Syllabus of Third Year B. Tech (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE322 Course: **Computer Networks Laboratory** Teaching Scheme: Practical: 02 Hrs/Week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks

Objectives	• To build an understanding of the fundamental concepts of computer networking. • To familiarize the student with the basic taxonomy and terminology of network • To introduce the student to advanced networking concepts. • To identify the different types of network topologies and protocols
Course Outcomes	**CO1:** Implement routing techniques and address resolution protocols used in the network layer. **CO2:** Develop application-layer communication and security mechanisms.
List of Pract	1. Apply TCP/IP command-line utilities (ping, traceroute, ipconfig/ifconfig, netstat, arp, whois) to diagnose and troubleshoot network issues using a Linux/Windows environment 2. Develop a TCP socket-based echo server-client application to understand connection-oriented communication using Python or C. 3. Develop a real-time TCP-based chat application using socket programming in any language (e.g., Python). 4. Implement a TCP client-server file transfer application using Python or netcat to demonstrate file sharing in a network. 5. Execute remote command execution from client to server using Python sockets or SSH tools in a Linux-based setup. 6. Develop a simple connectionless communication system using UDP sockets in Python or C for client-server data exchange. 7. Simulate and analyze the Address Resolution Protocol (ARP) using Packet Tracer and verify packet exchanges using Wireshark. 8. Configure static routing between multiple networks using Cisco Packet Tracer and test connectivity using ping/traceroute. 9. Apply basic firewall rules using iptables or ufw in a Linux system to allow/deny services (SSH, HTTP, etc.). 10. Implement a cross-language socket communication system: client in C and server in Java (or vice versa), using TCP sockets to exchange messages.

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE322 Course**: Computer Networks Laboratory** Teaching Scheme: Practical: 02 Hrs/Week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks

Course Outcomes	**CO1:** Apply basic network diagnostic tools and socket programming techniques to implement reliable and efficient network communication. **CO2:** Apply fundamental network administration concepts such as routing, ARP, and firewall configuration using standard tools and simulators.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	2	3	-	-	-	2	-	2
CO2	3	3	2	-	3	2	-	1	2	2	2
Average	3	2.5	2	2	3	2	-	1	2	2	2
Mapping Strength	3	3	2	2	3	2		1	2	2	2

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	3	2	1
CO2	3	3	2
Average	3	2	2

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Faculty of Science & Technology Syllabus of Third Year B. Tech (Computer Science and Engineering) (Semester V)	
Course Category: **PCC** Course Code: CSE323 Course: **Design and Analysis of Algorithms Lab** Teaching Scheme: Practical:02 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks
Objectives	• To understand the concepts of Algorithm Design techniques. • To Implement computer algorithms in programming language. • Familiarizing students with specific algorithms for a number of important • computational problems like sorting, searching, and graphs, etc.
Course Outcomes	**CO1:** Apply various algorithmic paradigms like Recursion, Divide and Conquer, Greedy, Backtracking, and Dynamic Programming to solve classical problems. **CO2:** Implement and analyze graph-based algorithms for shortest path and optimization problems in real-world scenarios.
List of Practical	1. Write a program for iterative and recursive binary search. Write a program for merge sort. 2. Implementation of quick sort using divide and conquer. 3. Implementation of single source shortest path (Dijkstra's algorithm). 4. Implementation of the knapsack problem using a greedy approach. 5. Implementation of multistage graphs / all pair shortest path using dynamic programming. 6. Implementation of Floyd's Warshall algorithm. 7. Implementation of N Queen Problem using Backtracking. 8. Implementation of sum of subset problems using Backtracking. 9. Implementation of Min Max algorithm. 10. Implementation of Knuth Morris Pratt string matching algorithm. 11. Implementation of TSP with dynamic programming.

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: PCC Course Code: CSE323 Course: **Design and Analysis of Algorithms Lab** Teaching Scheme: Practical: 02 Hrs/week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks

Course Outcomes	**CO1**: Implement algorithm design techniques for sorting, searching, and optimization problems efficiently using modern tools. **CO2:** Apply advanced algorithms to develop optimized solutions for pathfinding, string matching, and matrix-related tasks. **CO3:** Demonstrate professional ethics, teamwork, punctuality, and documentation skills in lab activities

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	3	-	2	–	–	–	–	–	1
CO2	3	3	3	-	2	–	–	–	–	–	1
Average	-	-	-	-	–	–	2	2	2	–	–
Mapping Strength	3	2	2	2	–	–	–	–	–	–	–

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	2	–	–
CO2	2	–	–
Average	2	–	–

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Semester-VI
Detail Course Curriculum

Third Year B. Tech Syllabus
(Computer Science and Engineering)

(For students admitted in S.Y. Btech in A.Y.2024-25)
WEF AY 2025-26

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester VI)

Course Category: PCC Course Code: CSE351 **Course: Software Process and Project Management** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Object-Oriented Programming concepts, and fundamental principles of Software Engineering.
Objectives	• To acquire knowledge on software process management. • To obtain managerial skills for software project development. • To understand the basic steps of project planning, project management, quality assurance.
Unit-I	**Introduction to Software Engineering:** SDLC, Software Development Process: The Process, Phases of SDLC, Improving the process discipline, Software Production Process. Basic Software Process Models: Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Assembly Model, Agile method. **(07 Hrs)**
Unit-II	**Software Requirement Analysis, Specification:** Requirement Analysis, Types of Requirements, Feasibility Study, Data Dictionary, and Requirement Elicitation Techniques, Characteristics of SRS, Use Case Approach. Product Specifications, Defining the Final Product, Data Flow Diagram, Data Dictionary. **(07 Hrs)**
Unit-III	**Software Project Management & Organization:** Three Vital Aspects of Software Project Management: The Team - Meaning of Leadership, Communicating in Harmony, Personality traits. Project Organizations. Project Planning, Top-Down and Bottom-Up Planning, Activities, Types of Activity, Project Scheduling and Staffing, Project Duration: Schedule Monitoring Tools. **(07 Hrs)**
Unit-IV	**Project Review:** Tracking Meetings, Recovery plans: Schedule Work & Escalation Meetings. Project Engineering: Product Requirements, Understanding the Customer Problem to solve - Initial Investigation, Strategies for determining information requirements, Information gathering Tools, Product Objectives **(06 Hrs)**

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Unit-V	**Software Quality Management:** Software Quality, Quality Measures, FURPS, and Software Reviews: Format Technical Review (FTR), Software Reliability: The Software Quality Assurance Plan, Formal approaches to SQA. Introduction to Software Testing: Testing Life Cycle, Types of Testing, Test Plan. **(06 Hrs)**
Unit-VI	**Modern Practices in software management:** CCPD-R, Case Study and Future Software Project Management Practices, Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions. **(06 Hrs)**

References	1.	Software Engineering	Rogger S Pressman	McGraw Hill	8th
	2.	Fundamentals Of Software Engineering	Carlo Ghezzi	Prentice Hall India, ISBN-10: 0133056996	1st
	3.	Handbook of Software	Tom Halt	Clanye	1st
	4.	Fundamentals of Software Engineering	Rajib Mall	Prentice Hall India, ISBN-13: 978-8120348981	1st

Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE351 **Course: Software Process and Project Management** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes	**CO1:** Understand software development processes, basic models, and software pro organization. **CO2:** Analyze software requirements, project reviews, and evaluate product and process qua **CO3:** Apply software testing techniques and investigate software product and process. **CO4:** Examine current trends and models in software application development.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3		3						2	2	
CO2	3	3	2	3							
CO3	3	2	2	3							
CO4	2	3	2		2						2
Average	3		3						2	2	
Mapping Strength	3	3	2	3					2	2	2

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	2	1	
CO2	2		
CO3	2		
CO4	3	2	
Average	2	2	

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester VI)

Course Category: PCC Course Code: CSE352 Course: **Data Mining & Analytics** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Knowledge of python programming
Objectives	• Understand the fundamental concepts, functionalities, and architecture of data mining and knowledge discovery in databases. • Gain proficiency in data pre-processing, exploratory data analysis, and data warehousing techniques. • Learn and apply key data mining techniques including association rule mining, classification, and clustering. • Analyze and evaluate the performance of various data mining models using suitable metrics. • Explore advanced topics such as stream data mining, social network analysis, and web/multimedia data mining.
Course Outcomes	**CO1:** Apply data mining techniques such as classification, clustering, and association to extract meaningful patterns from datasets. **CO2:** Differentiate various classification algorithms including Decision Trees, Naïve Bayes, and Support Vector Machines for solving real-world classification problems. **CO3:** Analyse the performance of clustering and classification models using appropriate metric for predictive analytics. **CO4:** Describe predictive models using algorithms such as logistic regression, neural networks, and ensemble methods to solve business problems. **CO5:** Interpret social network metrics and apply social network analysis methods for extracting insights from web and social media data.
Unit-I	**Introduction to Data Mining:** Definition of data mining, Data Mining Functionalities, Architecture of typical Data Mining System, Knowledge Discovery in Databases, Classification of Data Mining Systems, Data Mining Task Primitives, Kinds of Data that can be Mined, Kinds of Patterns that can be Mined, Other Kinds of Data, Data Mining Techniques from many domains, Real-world applications of Data Mining, Major Issues in Data Mining. **(06 Hrs)**
Unit-II	**Introduction to Data Warehouse:** Basic Concepts, Data Warehouse- A Multi-layered Architecture, Difference between Operational Database Systems and Data Warehouse, Data Warehouse Models, Extract-Transform-Load, Data warehouse Modelling: Data Cube & OLAP, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Data Model, OLAP Operations. **(06 Hrs)**

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Unit-III	**Association Rule Mining:** Market Basket Analysis, Association Rules, Apriori Algorithm, Generating Association Rules from Frequent Item Sets, Improving the Efficiency of Apriori Algorithm, Mining Frequent Item Sets without Candidate Generation: FP Growth Algorithm, Mining Various Kinds of Association Rules, Pattern Mining, and Pattern Mining in Multilevel, Multidimensional Space. **(06 Hrs)**
Unit-IV	**Introduction to Classification & Clustering:** General Approach to Classification, Decision Tree Induction, Attribute Selection Measures: Information Gain, Gain Ratio, Gini Index, Other Attribute Selection Measures, Techniques to Improve Classification Accuracy, Ensemble Methods: Bagging, Boosting & AdaBoost, Random Forest, Support Vector Machine, Introduction to Cluster Analysis, Categorization of Major Clustering Methods, Clustering by k-means, k-medoids, hierarchical methods partitioning. **(07 Hrs)**
Unit-V	**Mining of Stream Data:** Mining Streams, Mining Times Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multirelational Data Mining. **(07 Hrs)**
Unit-VI	**Data Analytics with R:** Exploring Basic features of R, Exploring RGUI, Exploring RStudio, Handling Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and using Objects, Interacting with users, Handling data in R workspace, Executing Scripts, Creating Plots, accessing help and documentation in R Reading datasets and Exporting data from R, Manipulating and Processing Data in R, Using functions instead of script, built-in functions in R6.3 Data Visualization: Types, Applications **(07 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Data Mining Concepts and Techniques by	Han, Kamber, Morgan Kaufmann	MK publication	3rd
2.	Data Mining: Concepts and Techniques	Margaret Dunham,	Morgan Kaufmann Pub.	4th
3.	Data Warehousing, Data Mining and	OLAPby AlexBerson, S.J. Smith	Tata McGraw Hill	--

	4.	Social Network Analytics Computational Research Methods and Techniques	Nilanjan Dey, Samarjeet Borah, Rosalina Babo, Amira S. Ashour	Academic Press	1st
	5.	Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking	Foster Provost and Tom Fawcett	O'Reilly Media, **ISBN**: 978-1449361327	2nd
	6	Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization	Dreamtech Publication	DT Editorial Services	

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE352 Course: **Data Mining & Analytics** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes

CO1: Apply data mining techniques such as classification, clustering, and association r mining to extract meaningful patterns from datasets.
CO2: Differentiate various classification algorithms including Decision Trees, Naïve Bayes, and Support Vector Machines for solving real-world classification problems. (
CO3: Analyse the performance of clustering and classification models using appropria metrics for predictive analytics.
CO4: Describe predictive models using algorithms such as logistic regression, neural networks, ensemble methods to solve business problems.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	3	-	-	-	-	-	1
CO2	3	3	1	2	3	-	-	-	-	-	1
CO3	3	3	1	3	2	-	-	-	-	-	1
CO4	3	2	1	3	3	-	-	-	-	-	1
Average	3	2.5	1	2.5	2.75						1
Mapping Strength	3	3	1	3	3						1

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	-	2	2
CO2	-	2	2
CO3	-	2	2
CO4	-	2	2
Average	-	2	2

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester VI)	
Course Category: PCC Course Code: CSE353 Course: **Machine Learning** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	**Credits: 3-0-0** In Semester Examination-I: 15 Marks In Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs.

Prerequisite	Basic knowledge of Probability & Statistics
Objectives	• To understand basics of Machine Learning • To explore supervised and unsupervised Machine Learning algorithms • To introduce Ensemble Learning techniques and Deep Neural Networks
Course Outcomes	**CO1:** Explain fundamental concepts and types of machine learning, including evaluation metrics, and performance measures. **CO2**: Apply data preprocessing and Exploratory Data Analysis techniques to prepare datasets for Machine Learning tasks. **CO3**: Apply/Implement various supervised and unsupervised Machine Learning algorithms for real-world data-driven problems. **CO4:** Describe ensemble learning techniques such as bagging, boosting, stacking, and deep learning architectures including CNN, Autoencoder, and RNN.
Unit-I	**Introduction to Machine Learning:** Basic definitions, Types of Machine Learning, Understanding Data: Properties of Data, Structured, Unstructured and Semi Structured Data, Hypothesis Space. Evaluation, Training Data, Validation Data, and Testing Data, Cross Validation, Overfitting, Underfitting. Introduction to Recommender Systems. Performance Analysis Measures: Confusion Matrix, Classification Accuracy, Precision, Recall or Sensitivity, Support, F1 Score, AUC (Area Under ROC curve), Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R Squared (R2). **(6 Hrs)**
Unit-II	**Data Preprocessing & EDA** Types of Data: Numerical and Categorical, Introduction to Preprocessing and Exploratory Data Analytics: Removing duplicates, handling missing values, data type conversion & formatting, normalization and standardization, binning, numerical conversion of categorical, outlier detection and handling, dimensionality reduction. Introduction to EDA: Descriptive statistics, Correlations and Heat Maps, Chi-Square test, EDA & visualization plots. **(6 Hrs)**
Unit-III	**Supervised Learning:**

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	Linear Regression, Polynomial Regression, Non-Linear Regression, Logistic Regression, Regularization. Classification: Probability & Bayes Learning, Decision Trees, K-Nearest Neighbour (KNN), Support Vector Machine (SVM) **(7 Hrs)**
Unit-IV	**Unsupervised Learning:** Introduction to clustering, Clustering approaches, Partition Based Clustering: K-Means, Hierarchical Based Clustering – Agglomerative clustering, Density Based Clustering: DBSCAN & HDBSCAN, Gaussian Mixture Model, Grid Based Clustering. **(6 Hrs)**
Unit-V	**Ensemble Techniques:** Combining multiple learners, Model combination schemes, Ensemble learning – Voting, Bagging, Boosting, Stacking, Averaging, PAC Learning Model, Sample Complexity, VC Dimension. **(7 Hrs)**
Unit-VI	**Neural Networks:** Basic architecture of Neural Network, activation functions, network training, Feed- forward and feed-backward neural network, Introduction to Gradient Descent. Introduction to Deep Neural Network: Architectures of CNN, Autoencoders and RNN. **(7 Hrs)**

Textbooks and Reference Books

Sr. No.	Title	Author	Publication	Edition
1	Introduction to Machine Learning	Ethem Alpaydin,	MIT Press	Third Edition
2	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer, 2006	First Edition
3	Foundations of Machine Learning	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar,	MIT Press, 2012	Second Edition
4	Machine Learning	Tom M Mitchell	McGraw Hill Education, 2013.	First Edition

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Course Category: **PCC** Course Code: CSE353 **Course: Machine Learning** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes

CO1: Explain fundamental concepts and types of machine learning, including evaluation metrics, and performance measures.
CO2: Apply data preprocessing and Exploratory Data Analysis techniques to prepare datasets for Machine Learning tasks.
CO3: Apply/Implement various supervised and unsupervised Machine Learning algorithms for real-world data-driven problems.
CO4: Describe ensemble learning techniques such as bagging, boosting, stacking, and deep learning architectures including CNN, Autoencoder, and RNN.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	-	-	-	-	-	1
CO2	2	1	1	3	1	-	-	-	-	-	2
CO3	3	2	2	2	3	-	-	-	-	-	2
CO4	2	1	-	-	2	-	-	-	-	-	1
Average	2	1	2	3	2	-	-	-	-	-	2
Mapping Strength	2	1	2	3	2	-	-	-	-	-	1

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	-	2	-
CO2	2	3	-
CO3	2	3	-
CO4	-	2	-
Average	2	3	-

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Syllabus of Third Year B. Tech (Computer Science and Engineering) (Semester VI)

Course Category: **PEC** Course Code: CSE 366A **Course: Computer Vision** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 Mid-Semester Examination-I: 15 Marks Mid-Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Fundamental concepts of Digital Image Processing
Objectives	• Understand the fundamental principles of computer vision and its applications. • Analyze and apply image processing techniques for feature extraction and image manipulation. • Implement algorithms for object detection, recognition, and segmentation. • Explore the role of deep learning in computer vision tasks.
Unit-I	**Introduction to Computer Vision** Definition and goals of computer vision, Distinction between image processing and computer vision, Relationship between computer vision and artificial intelligence, Applications of Computer Vision, Biological vs. Computational Vision, Image Formation and Camera Models. **(6 Hrs)**
Unit-II	**Filtering and Transformation** Point operators, Linear filtering, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations, Global optimization. **(6 Hrs)**
Unit-III	**Feature detection and matching** Points and patches, Feature detectors, Feature descriptors, Feature matching, Feature tracking, Application: Performance-driven animation, Edges, Edge detection, Edge linking, Application: Edge editing and enhancement, Lines, Successive approximation, Hough transforms, Vanishing points, Application: Rectangle detection. **(6 Hrs)**
Unit-IV	**Segmentation** Active contours, Split and merge, Watershed, Region splitting, Region merging, Graph-based segmentation, Probabilistic aggregation, Mean shift and mode finding, K-means and mixtures of Gaussians, Mean shift, Normalized cuts, Graph cuts and energy-based methods. **(7 Hrs)**
Unit-V	**Image classification using Machine Learning** Introduction to Machine Learning for Computer Vision, Image classification, Datasets

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	for Image Classification, Working with Image Datasets, k-NN: A Simple Classifier, A Basic Image Preprocessor, Building an Image Loader, k-NN Hyperparameters, Implementing k-NN, k-NN Results, Pros and Cons of k-NN **(7 Hrs)**
Unit-VI	**Convolutional Neural Networks in Computer Vision** Overview, Convolutional Neural Networks (CNNs) for image processing, Convolutional Neural Networks (CNNs) for Object Classification, Object Detection with YOLO and R-CNN Architectures. **(7 Hrs)**

References

Sr. No	Title	Author	Publication	Edition
1.	Computer Vision: Algorithms and Applications	Richard Szeliski	Springer	2nd
2.	Computer Vision: Principles, Algorithms, Applications, Learning	E. R. Davies	Academic Press	5th
3.	Learning OpenCV 4 Computer Vision with Python 3	Joseph Howse and Joe Minichino	Packt	3rd
4.	Computer Vision: Algorithms and Applications	Richard Szeliski	Springer	2nd

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Course Category: **PEC** Course Code: CSE366A Course: **Computer Vision** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes

CO1: Explain the core concepts and goals of computer vision and distinguish it from image processing and artificial intelligence.
CO2: Apply image processing and feature detection techniques for object recognition and scene understanding.
CO3: Analyse and implement segmentation methods and classification algorithms in computer vision tasks.
CO4: Describe deep learning models including Convolutional Neural Networks (CNNs) for image classification and object detection.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	–	–	–	–	–
CO2	3	2	2	1	2	–	–	–	–	–	–
CO3	3	2	2	1	2	–	–	–	–	–	–
CO4	3	2	2	1	2	–	–	–	–	–	–
Average	3	2	2	1	2	–	–	–	–	–	–
Mapping Strength	3	2	2	1	2	–	–	–	–	–	–

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	2	–	–
CO2	2	–	–
CO3	2	–	–
CO4	2	–	–
Average	2	–	–

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester VI)

Course Category: **PEC** Course Code: CSE366B **Course: Soft Computing** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	Basic Mathematics, Image Processing
Objectives	• To understand the scope of soft computing and pattern recognition tasks that can be performed by some of the basic structures of artificial neural networks • Analyze feed forward networks and understand the significance of nonlinear output functions of processing unit in feedback network for pattern storage. • To describe and explain Core concepts and techniques of fuzzy logic.
Unit-I	**Soft Computing:** Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Characteristics of Neural Networks, Structure and Working of a biological neural network, Artificial Neural Network Terminology, models of neurons: MP model, Perceptron model, Adaline model, Topology, Basic Learning laws, What is learning, supervised and unsupervised learning, Functional Units of ANN for pattern recognition task: Pattern Recognition Problem, Basic functional units. **(06 Hrs)**
Unit-II	**Perceptron learning:** Single layer and multilayer perceptron, linear and non-linear separability problems, supervised learning algorithms, Error correction and Gradient Decent Rules, FFNN, Architecture of FFNN, Backpropagation learning algorithm, pattern classification, pattern association by FFNN **(06 Hrs)**
Unit-III	**Pattern association:** Auto association and hetero association, feedback NN, architecture of FBNN, energy function, associative memory, bidirectional associative memory. **Hopfield Networks:** Hopfield Network Architecture (Discrete and Continuous versions), Energy Function in Hopfield Networks, Learning Rule (Hebbian Learning), Pattern Storage and Retrieval, Limitations and Applications of Hopfield Models **(06 Hrs)**
Unit-IV	**Unsupervised learning:** Pattern clustering, Self-organization map (SOM), Generalized learning laws, Competitive Learning, examples, learning Vector Quantization, self –organizing feature map, Applications of self-organizing feature map. **(07 Hrs)**

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Unit-V	**Fuzzy Systems:** Classical sets, Fuzzy sets, Crisp relations, Fuzzy relations, Examples, Properties of membership functions, fuzzification and Defuzzification to crisp sets, Application of fuzzy control. Fuzzy logic in database and information systems, Fuzzy relational data models, Operations in fuzzy relational data models, Design theory for fuzzy relational b databases. Fuzzy If-Then Rules, Fuzzy Linear Programming. **(07 Hrs)**
Unit-VI	**Genetic algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization **GA based Backpropagation Networks:** GA based Weight Determination, K - factor determination in Columns. **(07 Hrs)**

References

Sr. No.	Title	Author	Publication	Edition
1.	Principles of Soft Computing	S. N.Sivanandam & T. S.N. Deepa	Wiley Publications.	3rd
2.	Artificial Neural Networks	B.Yegnanarayana	PHI Publications	5th
3.	Fuzzy Logic	John Yen, Reza Langari	Pearson Education	--
4.	Neural Networks, Fuzzy Logic and Genetic algorithms- Synthesis and Applications	S. Rajasekaran, Vijaylakshmi Pai	PHI Publications	2nd
5.	Neuro-Fuzzy Systems,	Chin Teng Lin, C. S. George Lee	Prentice Hall of India	

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Course Category: **PEC** Course Code: CSE366B Course: Soft Computing Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes

CO1: Understand the fundamentals of soft computing, neural networks, and their differe from hard computing.
CO2: Analyze the working of various neural network models like perceptron, Adaline, multilayer perception.
CO3: Implement and evaluate feedback networks such as Hopfield and Bidirecti Associative Memory.
CO4: Apply unsupervised learning techniques including Self-Organizing Maps and Lear Vector Quantization.
CO5: Understand and apply fuzzy logic concepts in database and control systems.
CO6: Apply genetic algorithms for optimization and integration with neural networks.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	-	-	-	-	-	2
CO2	3	3	2	2	3	-	-	-	-	-	2
CO3	3	3	2	3	3	-	-	-	-	-	2
CO4	3	3	3	3	3	-	-		-	1	3
Average	3	2	3	2	3	2	2	1	-	1	3
Mapping Strength	3	3	3	3	3	1	-	1	-	1	3

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	-	2	2
CO2	-	2	2
CO3	-	2	2
CO4	-	2	2
Average		2	2

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester VI)

Course Category: PEC Course Code: CSE366C **Course: Internet of Things** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Prerequisite	• Computer Networks, Electronics and Embedded Systems
Objectives	• To understand the fundamental concepts of IoT, including its architecture, components, and applications. • To explore the various technologies and protocols used in IoT communication and networking. • To explore real-world IoT applications across different domains such as healthcare, agriculture, smart cities, etc.
Unit-I	**IoT Introduction** Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. **(6 Hrs)**
Unit-II	**Smart Objects** The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. **(6 Hrs)**
Unit-IV	**Data and Analytics for IoT** An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IoT Security, Common Challenges in IoT Security. **(7 Hrs)**
Unit-V	**IoT Physical Devices and Endpoints** Building iot with Arduino: Arduino–Interfaces-Arduino IDE–Programming, RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Accessing Temperature from sensors, Remote access to RaspberryPi. **(7 Hrs)**

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Unit-VI	**IoT Applications** Smart home automation, Industrial IoT (IIoT), Healthcare IoT, Agriculture IoT, Smart cities and environmental monitoring. **(7 Hrs)**

References

Sr. No	Title	Author	Publication	Edition
1.	Fundamentals: Networking Technolog Protocols, and Use Cas for the Internet of Thin	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Bart Jerome Henry	Pearson Education	1st
2.	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	VPT	1st
3.	Internet of Things	Srinivasa K G	CENGAGE Leaning Ind	—
4.	Getting Started with Raspberry Pi	Matt Richardson & Sha Wallace	O'Reilly (SPD)	—

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PEC** Course Code: CSE366C **Course: Internet of Things** Teaching Scheme: Theory- 3 Hrs./week Self-Learning Hours- 3 Hrs./Week	Credits: 3-0-0 In Semester Examination-I: 15 Marks In Semester Examination-II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 2 Hrs.

Course Outcomes	**CO1:** Describe the evolution, architecture, and core components of IoT along with challenges. **CO2:** Explain the role of smart objects, sensors, actuators, and communication technologie IoT. **CO3:** Apply IP-based communication and protocols such as MQTT and CoAP to design systems. **CO4**: Analyze IoT data processing, security challenges, and application domains ac industries.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	2	–	–	–	–	–	–	3
CO2	3	2	-	2	–	–	–	–	–	–	3
CO3	3	3	2	2	–	–	–	–	2	–	3
CO4	2	3		2	–	1	–	–	–	–	2
Average	3	3	2	2	–	1	–	–	–	–	3
Mapping Strength	3	3	2	2	–	1	–	–	2	–	3

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	2	–	–
CO2	2	1	–
CO3	2	1	–
CO4	2	–	–
Average	2	1	–

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Syllabus of Third Year B.Tech. (All Branches) (Semester VI)

Course Category: **REM** Course Code: **REM367** Course: **Research Methodology** Teaching Scheme: Theory: 03 Hrs./week Self-Learning Hours – 3 Hrs./week	**Credits: 3-0-0** In-Semester Examination -I: 15 Marks In-Semester Examination -II: 15Marks Teacher Assessment: 10 Marks Continuous Internal Evaluation: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration):02 Hrs.

Prerequisite	-
Objectives	➢ To guide students from understanding foundational research concepts to critically formulating research problems, culminating in the adept creation of comprehensive research plans and literature reviews. ➢ To equip students with the skills to proficiently create and present diverse research reports, encompassing various formats, oral delivery, technical writing, and ethical awareness regarding plagiarism.
Course Outcomes	At the end of the course, student will be able to- **CO1:** Develop the ability to comprehend core research concepts, define key elements like variables and hypotheses, and critically evaluate literature to identify research gaps. **CO2:** Justify their chosen research methods and explain their advantages and limitations. **CO3:** Create well-structured research proposals that include clear research objectives, methods, and expected outcomes. **CO4:** Proficient in using data analysis techniques relevant to their chosen research methods, such as statistical analysis for quantitative research or thematic analysis for qualitative research.
Unit-I	**Introduction to RM:** Meaning of Research, Objectives of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Defining the Research Problem, Selecting the Problem, Technique Involved in Defining a Problem, Research Design, Important Concepts Relating to Research Design, Developing a Research Plan, Literature review, Impact factor, H-index, citations **(7 Hrs)**
Unit-II	**Methods of Research:** Qualitative and quantitative methods of research like Historical, case study, ethnography, documentary and content analysis, survey (Normative, descriptive, evaluative etc.) field and laboratory experimental studies. Characteristics of methods and their implications in research area. **(6 Hrs)**
Unit-III	**Methods of data collection:** Concept of sampling and other concepts related to sampling. Probability and non-probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. Redesigning, research tools-like questionnaire, opinionnaire, observation, interviews, scales and tests etc. **(6 Hrs)**
Unit-IV	**Methods of data analysis:** Analysis of qualitative data based on various tools. Analysis of quantitative data and its presentation with tables, graphs etc. Statistical tools and techniques of data analysis-measures of central tendency, dispersion. Decision making with hypothesis testing through parametric and non-parametric tests. Validity and delimitations of research

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	findings. **(7 Hrs)**
Unit-V	**Development of research proposal:** Research proposal and its elements Formulation of research problem-criteria of sources and definition Development of objectives and characteristics of objectives. Development hypotheses and applications. **(6 Hrs)**
Unit-VI	**Interpretation and Report Writing:** Meaning of Interpretation, Techniques of Interpretation, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Writing a technical paper, plagiarism and its implications. **(6 Hrs)**

Textbooks and Reference Books

Sr. No.	Title	Author	Publication	Edition
1.	An introduction to Research Methodology	Garg B. L., Karadia R., Agarwal F. and Agarwal U. K.	RBSA Publishers	2002
2.	Research Methodology: Methods and Techniques	Kothari C. R.	New Age International	1990
3.	Qualitative Research: A Guide to Design and Implementation	Merriam S. B., Tisdell E. J.	John Wiley & Sons	4th edition, 2016
4	Research Design: Qualitative, Quantitative and Mixed Methods Approaches	Creswell J. W.	SAGE Publications, Inc	4th edition, 2014
5	Introduction to Statistics and Data Analysis	Olsen C., Devore J., Peck R.	Brooks/Cole	5th edition, 2015
6	Research Methodology	Panneerselvam R.	PHI Learning	2nd edition, 2014

CO and PO Mapping: (3- Strong, 2- Medium and 1- Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	2		2	1				
CO2	2	3	2	3		2					
CO3	2	2	3	3		1	2				
CO4	2	2	1	3	3		1				

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester VI)

Course Category: **PCC** Course Code: CSE371 **Course: Data Mining & Analytics Lab** Teaching Scheme: Practical: 02 Hrs/Week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks

Objectives	• To introduce students to data mining tools and techniques using WEKA. • To enable students to implement classification, clustering, and association rule mining algorithms, interpret data mining results for real-world datasets.
Course Outcomes	**CO1:** Apply data mining techniques such as classification, clustering, and association rule mining using tools like WEKA. **CO2:** Demonstrate the ability to preprocess and prepare data sets in ARFF format for effective data mining and machine learning processes.
List of Practical	**Module 1: Introduction to WEKA Toolkit** **1.Installation and Introduction to WEKA** Install the WEKA toolkit. Explore WEKA interface: Explorer, Experimenter, KnowledgeFlow, and Simple CLI. 2.**Data Preprocessing in WEKA** Create and load datasets in .arff format Perform preprocessing operations Normalization Attribute selection Handling missing values **Module 2: Classification Techniques using WEKA** **3.Naïve Bayes Classification** Implement Naïve Bayes on sample datasets. Evaluate performance using metrics: accuracy, precision, recall, and confusion matrix **.4.Decision Tree Classification (J48)** Apply the J48 algorithm (C4.5 decision tree). Visualize and interpret the decision tree model. **5.ID3 Algorithm** Implement the ID3 algorithm. Compare results with J48 in terms of accuracy and tree depth. **Module 3: Clustering Techniques using WEKA** **6.Clustering using k-means Algorithm** Perform k-means clustering on datasets like iris.arff. Analyze intra-cluster and inter-cluster distances.

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	7.Clustering using Hierarchical Methods (Optional if supported in WEKA) Apply agglomerative or divisive hierarchical clustering. Visualize dendrograms (if available). **Module 4: Data Analysis & Visualization using R Programming** **8.Basic Functionalities in R Programming** Load a dataset from sources like Kaggle. Set the working directory and unpack data Display top/bottom 10 rows. Count lines in the dataset. Encode categorical variables. Generate basic plots and provide insights. **9.Data Analytics and Visualization in R** Perform: Text analysis (e.g., word clouds or frequency analysis using R or Python) General data analysis (mean, std. dev., correlation, etc.) Data visualization (using csv, Excel, JSON input) via **ggplot2, plotly,** etc. **Module 5: Mini Project / Case Study** **10.Mini Project / Case Study (Compulsory)** Select a real-world or publicly available dataset. Perform full data mining lifecycle: Data preprocessing Model selection and training Evaluation (accuracy, F1 score, etc.) Insights and conclusion Submit a well-structured report and demonstrate the results.

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE371 **Course: Data Mining & Analytics Lab** Teaching Scheme: Practical: 02 Hrs/Week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks

Course Outcomes	**CO1**: Apply data mining techniques such as classification, clustering, and association rule mining using tools like WEKA. **CO2**: Demonstrate the ability to preprocess and prepare data sets in ARFF format for effective data mining and machine learning processes.

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	2	3	-	-	-	-	-	-
CO2	3	2	-	2	3	-	-	-	-	-	-
Average	3	2.5		2	3						
Mapping Strength	3	3		2	3						

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	-	2	-
CO2	-	2	-
Average	-	2	-

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Faculty of Science & Technology
Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester VI)

Course Category: PCC Course Code: CSE372 **Course: Machine Learning Lab** Teaching Scheme: Practical: 02 Hrs/Week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks

Objectives	• To understand & apply classification and regression algorithms. • To understand & implement supervised machine learning to solve problems. • To understand & apply unsupervised machine learning to solve problems.
Course Outcomes	**CO1:** Apply essential Python libraries to perform data preprocessing and Exploratory Data Analysis to prepare datasets for Machine Learning model development. **CO2:** Apply and evaluate supervised and unsupervised machine learning algorithms using Python for regression, classification, and clustering.
List of Practical	1. Understand Python libraries required for ML applications such as NumPy, Pandas and Matplotlib and implement simple programs using these libraries. 2. Write Python program to perform following data preprocessing: Removing duplicates, Handling missing values, Data type conversion & formatting, Normalization/Standardization, Binning, Numerical conversion of categorical data, Outlier detection and handling, Dimensionality reduction 3. Write a Python program: using Statistics library to compute central tendency measures: Mean, Mode, Median and Measures of Dispersion: Variance and Standard deviation. Generate Correlations and Heat Maps Apply Chi Square Test for categorical features Perform EDA with visualization plots: Distributions, Correlations, Histogram, Bar plots 4. Write a Python program to implement Simple Linear Regression for Diabetes dataset. 5. Implement Multiple Linear Regression for house price prediction using sklearn. Apply preprocessing and create pipeline for implementation of algorithm. Evaluate the performance of the algorithm. 6. Write a program to implement Naïve Bayes classification. Compute accuracy of the classifier. Evaluate the performance of the algorithm. 7. Write a program to implement K-NN algorithm and evaluate the performance of the algorithm. 8. Write a program to implement Logistic Regression and predict whether a patient has diabetes or not. Evaluate the performance of the algorithm. 9. Write a program to implement Support Vector Machine (SVM). Apply GridSearch for multiple parameters and identify the optimal parameters. Evaluate the performance of the algorithm. 10. Apply K-Means clustering algorithm to cluster a set of data in .csv file.

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Syllabus of Third Year B.Tech. (Computer Science and Engineering) (Semester V)

Course Category: **PCC** Course Code: CSE372 **Course: Machine Learning Lab** Teaching Scheme: Practical: 02 Hrs/Week	Credits: 0-0-1 Teacher Assessment: 25 Marks End Semester Oral Examination: 25 Marks

Course Outcomes	**CO1:** Apply essential Python libraries to perform data preprocessing and Exploratory Data Analysis to prepare datasets for Machine Learning model development. **CO2**: Apply and evaluate supervised and unsupervised machine learning algorithms using Python for regression, classification, and clustering. **CO3:** Demonstrate professional ethics, teamwork, punctuality, and documentation skills in lab activities

CO PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	2	3	3	-	-	-	-	-	1
CO2	-	-	3	-	3	2	-	-	-	-	2
CO3	-	-	-	-	-	-	2	2	3	-	-
Average	-	-	3	3	3	2	2	2	3	-	2
Mapping Strength	-	-	3	3	3	2	2	2	3	-	2

CO PSO Mapping

COs	PSO I	PSO II	PSO III
CO1	1	2	1
CO2	1	3	2
CO3	-	-	2
Average	1	3	2

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Faculty of Science & Technology Syllabus of Third Year B.Tech. (All Branches) (Semester VI)	
Course Category: Project Course Code: PRO373 Course: Major Project-I Teaching Scheme: Practical: 02 Hrs./week	Credits: 0-0-1 Teacher Assessment: 25 Marks

Prerequisite	-
Objectives	1. To identify real-world engineering problems relevant to research or industry. 2. To define project objectives with clarity based on literature review. 3. To enable students to conceptualize and theoretically model solutions. 4. To develop project planning skills including scheduling and resource allocation. 5. To promote teamwork and communication in multidisciplinary environments. 6. To prepare students for technical documentation and mid-semester presentations.
Course Outcomes	**CO1:** Identify real-world engineering problems and articulate clear problem definitions. **CO2:** Formulate well-defined objectives aligned with identified engineering problems. **CO3:** Conduct a comprehensive literature review to analyze research gaps and support problem framing. **CO4:** Design a theoretical system, component, or process addressing defined objectives under given constraints. **CO5:** Collaborate effectively in multidisciplinary teams to plan and progress project development. **CO6:** Demonstrate effective technical communication through reports, presentations, and documentation.
Process	1. Identification and definition of project topic and problem statement. 2. Submission of project synopsis with methodology. 3. Interim report including literature review and theoretical framework& Presentation. 4. Final documentation of Part-I including time-line, and conceptual designs.
Activities to be included	**1. Topic Identification and Relevance:** Students are expected to select a project topic that is innovative, relevant to mechanical engineering, and/or solves real-world problems. **2. Literature Review:** A detailed literature review is essential to understand the existing work, research gaps, and technological advances. **3. Problem Statement and Objective Formulation:** Define project goals, scope, deliverables, and constraints based on literature review. **4. Methodology Design:** Students must design the methodology outlining tools/software, materials, simulations, or initial calculations. **5. Resource Planning:** Plan activities, milestones, and responsibilities & time-line **6. Conceptual Design or System Modeling:** Develop basic conceptual sketches, CAD models, or simulated prototypes. **7. Technical Documentation and Presentation:** Prepare project report, presentations, and incorporate feedback from reviews.

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Process Flow for Major Project – Part I

Stage	Week	Activity Description
1. Group Formation and Topic Finalization	Week 1	Form groups of 2–3 students. Identify and propose a topic with initial idea. Approval from project guide.
2. Synopsis Submission	Week 2	Submit 2-page synopsis with title, objectives, methodology, and Gantt chart.
3. Literature Review & Initial Research	Weeks 3–4	Conduct thorough literature review and identify research gaps.
4. Review Presentation – I	Week 5	Present literature review and problem definition to guide/panel.
5. Concept Design / Methodology Development	Weeks 6–8	Finalize design framework and conduct feasibility study.
6. Review Presentation – II	Week 9	Present concept designs, simulation results, and methodology.
7. Interim Report Drafting	Weeks 10–11	Draft reports based on work completed and incorporate guide's feedback.
8. Final Report Preparation	Weeks 12–13	Prepare final project report adhering to formatting guidelines.
9. Final Viva & Evaluation	Week 14-15	Submit report and present work to external/internal examiners.

Evaluation Criteria and Weightage

Sr. No.	Criteria	Weightage (%)
1	Identification of the Problem	20%
2	Documentation	30%
3	Demonstration	20%
4	Awareness/ Consideration of Environment, Social, Ethics, Safety, Legal Aspects	10%
5	Outcome	20%

The format and other guidelines for the Project Submission in spiral bound copies should be as follows:

REPORT STRUCTURE

1. Introduction
2. Literature survey
3. System development
4. Performance analysis
5. Conclusions

References Appendices

Acknowledgement

Prof. Dr. A. J. Kerle

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CONTENTS:

1. INTRODUCTION

1.1 Introduction
1.2 Necessity
1.3 Objectives
1.4 Theme
1.5 Organization

2. LITERATURE SURVEY

Literature Survey Related information available in standard Books, Journals, Transactions, Internet Websites etc. till date (More emphasis on last three to five years)

3. SYSTEM DEVELOPMENT

Model Development

- Mechanical / Fabricated
- Analytical
- Computational
- Experimental
- Mathematical
- Software (out of above methods at least one method is to be used for the model development) some mathematical treatment or related information is required to be embodied.

4. PERFORMANCE ANALYSIS

Analysis of system developed either by at least two methods depending upon depth of standard. These methods normally used are Analytical /Computational/Statistical/Experimental/ or Mathematical Results at various stages may be compared with various inputs. Output at various stages with same waveforms or signals or related information/parameters Comparison of above results by at least two methods and justification for the differences or error in with theory or earlier published results.

5. CONCLUSIONS

5.1 Conclusions
5.2 Future Scope
5.3 Applications Contributions (if any,)

The innovative work/invention/new ideas generated from the analysis of the work which can be taken from the conclusions REFERENCES Author, "Title", Name of Journal/Transactions/ Book, Edition/Volume, Publisher, Year of Publication, page to page (pp.__).

These references must be reflected in text at appropriate places in square bracket In case of web pages complete web page address with assessing date has to be enlisted List of references should be as per use in the text of the report APPENDICES Related data or specifications or referred charts, details computer code/program, etc.

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ACKNOWLEDGEMENTS

Expression of gratitude and thankfulness for helping in completion of the said task with name & signed by the candidate General Guidelines

Text should be printed on front and correct side of the watermark on quality bond paper size- A4, 75 to 85 gsm paper Left Margin-1.5" Right Margin3/4" Top Margin-1" Bottom Margin-1" Pagination.

First page of every chapter need not be printed but counted, second page onwards page number to print at bottom center place.

All Greek words must be italic Report Heading -ALL CAPITAL—16 Font Chapter heading -ALL CAPITAL—14 Font Subchapter –Title Case-12 Font Sub-Subchapter –First Alphabet Capital case-12 Font Page numbers for Index/Contents/Intent should be in roman.

All text should be in Times New Roman (TNR)

Cover page should have complete symbol of institute Suitable flap (bookmark) with name of the candidate, Department and Institute name and symbol can be used with nylon strip.

For more information and sample of hard copy please contact the respective Head of the Department.

Guideline for Report Writing:

Text: Manuscripts should be submitted in Word.

- Use a normal, plain font (e.g., 12-point Times Roman) for text.
- Use italics for emphasis.
- Use the automatic page numbering function to number the pages.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions)

Reference List: The list of references should only include works that are cited in the text and that have been published or accepted for publication.

Note:

The soft copy of final report should be submitted along with the hard copy signed by faculty / guide, project coordinator and countersigned by HoD / Dean and director. The report will be subject to plagiarism check for authencity.

Industrial Project : Relevant documents related to permission from Institute, Industry, Funding if any needs to furnish the details of the funding, mode of funding, funding agency, breakup expenditure, CA report about the funding, Completion certificate from the industry where the project work was carried out needs to be submitted to the faculty Guide, a copy of the same should be submitted to the Project coordinator through and application duly signed by the Project guide and endorsed by Head of department.

Publications: All publications related to research papers, conference papers, poster presentation, should be through Project coordinator and Head of department including relevant authorities if any.

Important Instructions to students and faculty Guides:

The students should submit the soft copy of the PPT and the report in PDF (as well as Spiral Hard copy) to faculty guide signed by Coordinator, before 1 week of final presentation.

The final presentation and evaluation should be organized by the Department before last instruction date.

Assessment:

The students will be evaluated by panel of internal faculty members nominated by the departmental project coordinator on the basis of their presentation.

Prof. Dr. A.S. Kedar

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