Annexure AC / 5.9

~~Annexure-4.3 (a)~~

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme and Syllabus For

Bachelor of Technology Computer Science and Engineering (CSE)

(Effective from the Session: 2026-27)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Lecture (L) per week	1 Credit
2	1 Tutorial (T) per week	1 Credit
3	2 Practical (P) per week	1 Credit
4	2 Seminar/Industrial Training per week	1 Credit

2. RANGE OF CREDIT

A range of credits from 160 to 180 is required for the award of an Undergraduate Degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 18-20 credits. These could be acquired through MOOCs.

3. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM (B.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	73*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	12*
3	Engineering Science Courses	26*
4	Basic Science Courses	21*
5	Humanities and Social Sciences including Management courses	12*
6	Multidisciplinary Open Electives Courses	9*
7	Project work, seminar and internship in industry or appropriate work place/academic and research institutions in India/abroad	16*
8	Value Added Courses	01*
9	Mandatory Courses	Non Credit
	Total Credits	170*

*****_Minor variation is allowed as per need of the respective disciplines_

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses	PEC
3	Engineering Science Courses	ESC
4	Basic Science Courses	BSC
5	Humanities and Social Sciences including Management courses	HSMC
6	Multidisciplinary Open Electives Courses	MOEC
7	Value Added Courses	VAC
8	Project	PR
9	Mandatory Courses	MC
10	Lab Courses	LC
11	Practical Training	PT
12	Internship	INT

General Notes:

1. Students will be required to obtain passing marks in Mandatory Non-Credit Courses.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Computer Science and Engineering) – 5th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	CSE-301A	Computer Networks	3	0	0	3	3	40	60		100	3
2	Professional Core Courses	CSE-303A	Formal Languages and Automata	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	CSE-305A	Design and Analysis of Algorithms	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	CSE-307A	Programing in Java	3	1	0	4	4	40	60		100	3
5	Engineering Science Courses	ECE-001A	Microprocessor and Microcontroller	3	0	0	3	3	40	60		100	3
6	Professional Elective Courses	Refer Table-II	Professional Elective-II	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	CSE-L301A	Computer Networks Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	CSE-L305A	Design and Analysis of Algorithms Lab using C++	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	CSE-L307A	Programing in Java Lab	0	0	2	2	1	25		25	50	3
10	Engineering Science Courses	ECE-L001A	Microprocessor and Microcontroller Lab	0	0	2	2	1	25		25	50	3
11	Practical Training	PT-301A	Practical Training-I	0	0	2	0	0	-		-	-	-
Total Credits								**23**				**800**	

Note:

I. Students must choose one course from the Professional Elective–II category (Table II). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

II. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.. Students required getting passing marks otherwise, He / She will be required to repeat practical training-I.

Table II: Professional Elective - II

Sr. No.	Course Code	Course Title
1	CSE-309A	Distributed Systems
2	CSE-311A	Advanced Computer Architecture
3	CSE-313A	Computer Graphics
4	CSE-315A	Data Warehouse and Mining
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

B.Tech (Computer Science and Engineering) – 6th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	AI-301A	Machine Learning	3	1	0	4	4	40	60		100	3
2	Professional Core Courses	CSE-001A	Compiler Design	3	0	0	3	3	40	60		100	3
3	Professional Core Courses	CSE-302A	Web Technologies	3	0	0	3	3	40	60		100	3
4	Professional Core Courses	CSE-304A	Software Engineering	3	0	0	3	3	40	60		100	3
5	Professional Elective Courses	Refer Professional Elective Table-III	Professional Elective-III	3	0	0	3	3	40	60		100	3
6	Multidisciplinary Open Elective Courses	Refer Multidisciplinary Open Elective-I Table-IV	Multidisciplinary Open Elective-I	3	0	0	3	3	40	60		100	3
7	Professional Core Courses	AI-L301A	Machine Learning Lab	0	0	2	2	1	25		25	50	3
8	Professional Core Courses	CSE-L001A	Compiler Design Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Courses	CSE-L302A	Web Technologies Lab	0	0	2	2	1	25		25	50	3
10	Mandatory Courses (Non-Credit)	MC-301A	Constitution of India	2	0	0	2	-	40	60			3
Total Credits								**22**				**750**	

Note:

I. MC-301A is a mandatory non –credit course in which the students will be required passing marks in theory. However these marks will not be added in the total marks.

II. Students must choose one course from the Professional Elective–III category (Table III) and one course from the Open Elective–I category (Table IV). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

III. At the end of 6th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

IV. **For Working Professionals:** Students shall submit a Training/Project Report based on their work in their respective company/organization for the period of the summer/industrial training. The evaluation shall be carried out in the 7th Semester.

Table III: Professional Elective - III

Sr. No.	Course Code	Course Title
1	DS-303A	Predictive Analytics
2	CSE-306A	Software project Management
3	CSE-308A	Digital Image Processing
4	CSE-310A	Mobile Application Development
5	----------	Any one of the MOOCs (offered through SWAYAM, SWAYAM Plus, or NPTEL platforms) not studied earlier and of equal credits (3)*

Table IV: Multidisciplinary Open Elective-I

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	----------	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Course code	**CSE-301A**				
Category	Professional Core Courses				
Course title	**Computer Networks**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide fundamental knowledge of computer networking concepts, architectures, communication models, and transmission techniques. • To develop understanding of networking protocols, addressing methods, routing mechanisms, and network services across different layers. • To enable students to apply networking principles and protocols for data communication and problem solving in computer networks. • To develop analytical understanding of network performance, congestion control, QoS, Networking technologies, and security mechanisms.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the fundamental concepts, models, protocols, devices, services, techniques, and security mechanisms of computer networks.	Level 1: Remember
CO2	Explain the principles, operations, functionalities, and interactions of computer networking components, protocols, architectures, and services.	Level 2: Understand
CO3	Apply networking concepts, protocols, algorithms, addressing methods, and security techniques to solve computer networking problems.	Level 3 : Apply
CO4	Analyze network performance, routing, QoS, congestion control, and security mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Data communication, Components, Computer networks and its historical development, distributed processing, network performance metrics (bandwidth, throughput, delay, jitter and packet loss), Internet Network **Models:** OSI model and TCP/IP Model.
Physical Layer: physical layer functions, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Packet and circuit switching, Transmission media, Topologies, connectionless and connection-oriented services.
Data Link Layer: Data link layer functions and services, MAC Addressing, Framing, flow control, error detection and correction (parity check, checksum, CRC and Hamming code), Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Unit-II

Medium Access Control: MAC layer functions, Random access, Controlled Access and channelization protocols, CSMA/CD and CSMA/CA.

Network Layer: Network layer functions and services, Logical addressing, IPv4 classful and classless addressing, subnetting, NAT, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.
Network Devices: Repeater, hub, switch, router and gateway.

Unit-III

Routing Algorithms: Introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing.
Transport Layer: Transport layer functions and services, Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management.
Application Layer: Application layer functions and services, Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP.

Unit-IV

Congestion Control, Quality of Service, QoS parameters and QoS Improving techniques.
LAN and Wireless Networks: Ethernet, Wireless LAN (IEEE 802.11), Wi-Fi architecture, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH
Network Security: Firewalls, security goals, types of attack, Introduction to cryptography, Types of ciphers: symmetric and asymmetric key ciphers.

Suggested Readings:

1. Data Communication and Networking by Behrouz A. Forouzan, 4th Edition, McGraw-Hill.
2. Data and Computer Communication by William Stallings, 8th Edition, Pearson Prentice Hall India.
3. Computer Networks by Andrew S. Tanenbaum, 8th Edition, Pearson New International Edition.
4. Internetworking with TCP/IP by Douglas Comer, Volume 1, 6th Edition, Prentice Hall of India.
5. TCP/IP Illustrated by W. Richard Stevens, Volume 1, Addison-Wesley, United States of America.

Useful Video Links

Unit No.	Topics	Links
Unit-I	Introduction to Computer Networks	https://www.youtube.com/watch?v=lnU-Zw3NEEQ
	OSI Model and TCP/IP Model	https://youtu.be/zzXs0EnCin0
	Packet Switching and Circuit Switching	https://youtu.be/29Qdz0FmvmQ?si=Yedvul4uJzmfkDsh
Unit-II	Medium Access Control Protocols	https://youtu.be/sx0UPzztC5o?si=VDg2wx1B68gvenjU
	Network Layer Introduction	https://youtu.be/aP346youQOk?si=6DRTU5dc1t21Dk_D
Unit-III	Routing Algorithms	https://youtu.be/AmlOSGYkKXc?si=87eNMi6RPeTd0FkL
	Transport Layer – TCP and UDP	https://youtu.be/EqzDTO9tdqs?si=16VZZu9Oz3IzOeOA
Unit-IV	Congestion Control and QoS	https://nptel.ac.in/courses/106105081
	SDH/SONET Layering, Frame Structure	https://youtu.be/f5EmFoXlYyQ?si=8ilxCANj5flH7TP4

Course code	**CSE-303A**				
Category	Professional Core Courses				
Course title	**Formal Languages and Automata**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of automata, formal languages, grammars, and computational models. • To develop understanding of language recognition, parsing, and computational mechanisms. • To enable application of automata and grammar concepts for problem solving. • To develop analytical abilities related to computability, decidability, and complexity.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the concepts, models, grammars, languages, and computational theories related to formal languages and automata.	Level 1: Remember
CO2	Explain the principles, operations, and relationships among automata, grammars, languages, and computational models.	Level 2: Understand
CO3	Apply automata, grammars, and computational models to solve language recognition and processing problems.	Level 3: Apply
CO4	Analyze computational models, language classes, and decidability issues to evaluate computational problems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Nondeterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA , minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.
Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

Unit-II

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of regular expression, Regular expression conversion to Finite Automata and vice versa.

Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

Unit-III

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal, Reduced Forms: Removal of useless symbols, null and unit productions.

Normal Form: Chomsky Normal form(CNF) and Greibach Normal Form(GNF), Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

Unit-IV

Turing machines: The basic model for Turing machines (TM), Deterministic and NonDeterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by designed turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Suggested Readings:

1. Theory of Computer Science: Automata, Languages and Computation by K. L. P. Mishra and N. Chandrashekaran, 2nd Edition, Prentice Hall of India, India, 2003.
2. Fundamentals of the Theory of Computation: Principles and Practice by Raymond Greenlaw and H. James Hoover, Morgan Kaufmann, 1998.
3. Introduction to Languages and Automata Theory by John C. Martin, 3rd Edition, Tata McGraw-Hill, 2007.
4. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, 3rd Edition, Pearson Education.

Useful Video Link

Unit No	Topics	Links
Unit-I	Introduction to Automata, Languages and Computation	https://www.youtube.com/watch?v=_2w9UX17m_k&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=1
	Deterministic Finite Automata (DFA)	https://www.youtube.com/watch?v=CwihAY_fgRE&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=2
Unit-II	Regular expression	https://www.youtube.com/watch?v=OA8EY3HKZoc&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=17
	Pumping Lemma	https://www.youtube.com/watch?v=wQbdjmINxNU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=28
Unit-III	Chomsky Normal Form (CNF)	https://www.youtube.com/watch?v=AnHE1jVpgHA&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=47
Unit-IV	Turning Machine	https://www.youtube.com/watch?v=WYncdAzKMHU&list=PLbRMhDVUMngcwWkzVTm_kFH6JW4JCtAUM&index=60

<table>
<tr><td>Course Code</td><td colspan="5">CSE-305A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Design and Analysis of Algorithms</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
• To provide knowledge of algorithm design techniques and complexity analysis.
• To develop understanding of algorithmic paradigms and optimization methods.
• To enable application of algorithms for solving computational problems.
• To develop analytical skills for evaluating algorithm efficiency and complexity.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define algorithm design concepts, complexity measures, design paradigms, and computational problem classes.	Level 1: Remember
CO2	Explain algorithmic strategies, optimization techniques, and complexity concepts used in problem solving.	Level 2: Understand
CO3	Apply appropriate algorithm design techniques to solve computational and optimization problems.	Level 3: Apply
CO4	Analyze algorithms and computational problems based on correctness, efficiency, and complexity.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Algorithms: Algorithm, Performance Analysis (Time and Space complexity), Asymptotic Notation (Big OH, Omega and Theta)-best, average and worst-case behaviour.
Divide and Conquer: General method, Binary Search, Merge Sort, Quick Sort, and other sorting algorithms with divide and conquer strategy, Strassen's Matrix Multiplication algorithms.

Unit-II

Greedy Method: General method, Fractional Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Single source shortest paths.
Dynamic Programming: General method, Optimal Binary Search Trees, 0/1 knapsack, The Travelling Salesperson problem.

Unit-III

Back Tracking: General method, The 8-Queen's problem, Sum of subsets, Graph Colouring, Hamiltonian Cycles. Branch and Bound: The method, 0/1 knapsack problem, Travelling Salesperson problem, Efficiency considerations.

Unit-IV

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph problems, NP hard scheduling problems, NP hard code generation problems, and Some simplified NP hard problems.

Suggested Readings:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publication.
2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald Lrivest: 1990, TMH.
3. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E ., 1974, Addison Wesley.
4. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetnieni, 1997, MGH.

Useful Video links:

Unit No.	Topic	Link
Unit-I	Asymptotic Notation	https://youtu.be/EL9T1ngiCqA?si=oaMBKNhfiIOODUlM
	Divide and Conquer Paradigm	https://youtu.be/xdD0nIWe0wA?si=P3DQs80dHBg3-aiM
Unit-II	Minimum Cost Spanning Tree	https://youtu.be/k9jemw3SZe0?si=93sq4N5-AjF-oVhy
	Knapsack Problem	https://youtu.be/-Cg-aL1D8CM?si=MSMQTKSaPqcNuZME
Unit-III	Sum of subsets	https://youtu.be/yDjadhjQ3eE?si=-6NQH4xIHYqemNp6
	Traveling Salesman Problem	https://youtu.be/-cLsEHP0qt0?si=-asPYE1zbCTMokLK
Unit-IV	Cook's theorem	https://youtu.be/qpCvPS-WwGA?si=CswYDncPrmCi3b_W
	NP Complete Problems	https://youtu.be/id7k6gUkZ8Y?si=fCSY5t-XMgUKzPi1

Course code	**CSE-307A**				
Category	Professional Core Courses				
Course title	**Programming in Java**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	1	0	**4**	
Course Objectives	The objectives of this course are • To provide knowledge of Java programming concepts, syntax, and execution environment. • To develop understanding of object-oriented programming and Java application development. • To enable application of Java programming techniques for software development. • To develop analytical skills for designing and evaluating Java-based solutions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define Java programming concepts, object-oriented principles, language constructs, and application development components.	Level 1: Remember
CO2	Explain Java programming features, object-oriented concepts, multithreading, GUI development, and advanced programming techniques.	Level 2: Understand
CO3	Apply Java programming concepts, libraries, and tools to develop software applications.	Level 3: Apply
CO4	Analyze Java-based solutions using object-oriented design principles, advanced programming features, and database connectivity techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Java: Evolution and features of Java, OOP concepts and Java program structure, JVM, JRE and JDK, Java compilation and execution process, Platform independence, portability and security, JAR files and naming conventions, Data types, type casting and operators, Control statements and loops, Arrays and command line arguments, JVM security architecture and sandbox model.

Unit-II

OOPS Implementation: Classes, objects, methods, constructors, encapsulation, reference variables, method overloading and method overriding, static members and blocks, Memory structure (Stack, Heap, Method Area), Class loading and execution flow, Argument passing and wrapper classes, this and super keywords, constructor chaining, Inheritance, polymorphism, abstraction, abstract classes, final keyword, interfaces, aggregation and composition, inner and anonymous classes, String class, String Buffer and String Builder classes, tokenizer and applets.

Unit-III

Threads, Swing & AWT, Packages and Exception Handling: Thread creation and lifecycle, thread synchronization and communication using wait(), notify() and notifyAll(). Multithreading concepts, Swing and AWT components, containers, layout managers and event handling, Mouse and keyboard events. Packages, class path and access modifiers. Exception handling, try-catch-finally, throw and throws keywords, checked and unchecked exceptions, user-defined exceptions, File handling basics.

Unit-IV

Collection Framework, JDBC and Advanced Java: List, Set, Map, Queue, Iterators and Generics, Comparable and Comparator interfaces, Collections utility class and Properties handling, JDBC architecture and drivers, CRUD operations, Prepared Statement and Callable Statement, transactions and batch processing, Result Set and metadata, Input/Output streams, buffered streams, serialization and deserialization, file handling, Reflection API, new Instance(), javap tool, lambda expressions and introduction to Java 8/9 features.

Suggested Readings:

1. Java2 the complete Reference by Patrick Naughton and Herbert Schildt, TMH.
2. Head First Java by Sierra & bates, O'Reilly.
3. Programming with Java by E. Balaguruswamy, TMH.
4. Computing Concepts with Java 2 Essentials by Horstmann, John Wiley.
5. Programming. Java by Decker & Hirshfield, Brooks/Cole.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to java	https://www.youtube.com/watch?v=OjdT
	OOP Concepts and Java Program Structure	https://www.youtube.com/watch?v=Qg3HDbmbW6I
Unit-II	Abstract classes,	https://www.youtube.com/watch?v=qgBv1_Plldo
	Inheritance	https://www.youtube.com/watch?v=rxsl1TzcEgg
Unit-III	Swing—I	https://www.youtube.com/watch?v=mQj34vU
	Multithreading-I	https://www.youtube.com/watch?v=6rYOyIGfy3w
Unit-IV	JDBC—I	https://www.youtube.com/watch?v=ajhWv31oN1k&lis
	JDBC—II	https://www.youtube.com/watch?v=v5vLuC

Course Code	**ECE-001A**				
Category	Engineering Science Courses				
Course Title	**Microprocessor and Microcontroller**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	3	0	0	3	
Course Objectives	The objectives of this course are ● To understand the architecture and instruction set of microprocessors (8086, x86) and microcontrollers (8051, ARM). ● To develop low-level programming skills using assembly language. ● To learn peripheral interfacing concepts such as timers, I/O ports, ADC/DAC, and communication protocols. ● To explore advanced processors and embedded system using ARM Architecture.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Describe the features and architecture of Intel processors and microcontrollers for signal descriptions and system design.
CO2	Use addressing modes and instructions of microprocessors and microcontrollers to write simple and efficient assembly programs.
CO3	Classify the interrupts and modes of operation in microprocessors and microcontrollers and analyze their impact on system performance and functionality.
CO4	Apply appropriate data transfer schemes and hardware for transfer data between the of peripheral devices for interfacing I/O devices.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Microprocessors and Programming: Introduction to Microprocessors: Evolution, 8-bit/16-bit (8085/8086), Architecture, Pin configuration, Addressing modes and register organization of 8085.
8086 Architecture: Pin configuration, Register organization, Addressing Modes, Memory Segmentation, Instruction Set of 8086, Minimum/Maximum Mode, Assembly language programming of 8086.

Unit-II

Microprocessor Interfacing Overview of Intel Pentium family processor, Overview of Multi-core Processors and Mobile Processor, Memory Interfacing, Peripheral Interfacing (8255 PPI, 8254 Timer, 8237 DMA, 8259 PIC), Concepts of Interrupts and DMA.
Memory Concepts: Cache Memory, Virtual Memory – Mapping and Access Mechanisms.

Unit-III

8051 Microcontroller and Interfacing: 8051 Architecture: RAM/ROM layout, machine cycle, I/O structure, Instruction Set: Addressing Modes, Data Transfer, Arithmetic, Logical, Branching, Assembly Language Programming. Peripherals and Interfacing: Timers/Counters, Serial Communication, Interrupts, ADC, DAC, LCD, LED, Keypad.

Unit-IV

ARM Processor Architecture and Instruction set: RISC vs. CISC, ARM Design Philosophy, ARM Architecture: States (ARM, Thumb, Jazelle), Register, Sets, Modes, Pipelining ARM Instruction Set: Data Processing, Load/Store, Branch, Conditional Execution, SWI, Vector Tables, Exception Handling.

Suggested Readings:

1. Microprocessors and interfacing by D. V. Hall,, TMH, 2nd Edition.
2. Microprocessor 8086: Architecture, Programming and Interfacing by Sunil Mathur, PHI Publisher.
3. Microprocessors and Microcontrollers by Sunil Mathur, Jeebananda Panda, PHI Publisher.
4. Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing by Ray A. K. and Burchandi, TMH.
5. The Intel Microprocessors 8086- Pentium Processor by Brey, 8th Edition, Pearson Education.
6. The X86 PC: Assembly Language, Design and interfacing by M. A. Mazidi, J. P. Maizidi and Danny Causey, 5th Edition, Pearson Education.
7. Microcontrollers: Architectures, Programming, Interfacing and System Design by Raj Kamal, Pearson Education.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microprocessors and Interfacing – NPTEL Focuses on the interfacing aspects of microprocessors, covering essential concepts and practical applications	https://www.youtube.com/playlist?list=PLdlPA9pGVVtaUwRP-2Eaux10vo_USuDy1
	Microprocessors & Microcontrollers by Prof. Sunil Mathur	https://www.youtube.com/@profsunilmathur8809
Unit-II	Advanced Microprocessors and Memory Systems	https://www.youtube.com/playlist?list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3
Unit-III	8051 Microcontroller and Interfacing ,The 8051 Microcontroller and Embedded Systems by Prof. Santanu Chattopadhyay (IIT Kharagpur)	https://www.youtube.com/playlist?list=PLEPI1RnS5drMCNu1VPDwdrRO_U0awwTxJ
Unit-IV	ARM Processor Architecture and Embedded Design, Embedded System Design with ARM by Prof. Dhananjay V. Gadre (IIT Delhi). Focuses on ARM architecture and its application in embedded system design, offering practical insights and examples.	https://www.youtube.com/playlist?list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU

Course Code	**CSE-L301A**				
Category	Professional Core Courses				
Course Title	**Computer Networks Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To provide practical knowledge of network cabling, network devices, IP addressing, and LAN connectivity. • To develop skills in configuring and troubleshooting network devices and network communication using networking commands and tools. • To enable students to design and configure network topologies, routing protocols, and NAT using Packet Tracer and Cisco IOS commands. • To develop the ability to analyze network connectivity, routing behavior, and network performance using diagnostic and simulation tools.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain the operation of network cables, network devices, IP addressing, and basic networking commands used in computer networks.	Level 2: Understand
CO2	Configure LAN connectivity, network devices, and basic network parameters using networking tools and commands.	Level 3: Apply
CO3	Apply Packet Tracer and Cisco IOS commands to implement network topologies, NAT, and routing protocols.	Level 3: Apply
CO4	Analyze network connectivity, routing behavior, and troubleshooting results using ping, traceroute, and network configuration tools.	Level 4: Analyze

List of Experiments:

Sr. No.	**Content**	**COs**
1	Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.	CO1
2	Study of Network Devices in Detail.	CO2
3	Study of network IP.	CO2
4	Connect the computers in Local Area Network.	CO2
5	Study of basic network command and Network configuration commands.	CO2
6	Configure a Network topology using packet tracer software.	CO3

7	Performing an Initial Switch Configuration.	CO4
8	Using the Cisco IOS Show Commands.	CO3
9	Interpreting Ping and Traceroute Output.	CO3
10	Examining Network Address Translation (NAT).	CO3
11	Configure a Network using Distance Vector Routing protocol.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Study of Network Cables	https://www.netacad.com/learning-collections/cisco-packet-tracer
Configure a Network topology using packet tracer software.	https://cn-iitr.vlabs.ac.in/exp/network-topologies/
Dynamic Routing Protocols	https://cn-iitr.vlabs.ac.in/exp/dynamic-routing/simulation.html

Course Code	**CSE-L305A**				
Category	Professional Core Courses				
Course Title	**Design and Analysis of Algorithms Lab Using C++**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are • To develop understanding of algorithm design techniques and complexity analysis. • To provide practical exposure to sorting and graph algorithms. • To develop skills in greedy, dynamic programming, and backtracking techniques. • To develop analytical skills for evaluating algorithm performance.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain algorithm design techniques and complexity concepts.	Level 2: Understand
CO2	Apply divide-and-conquer and graph algorithms to computational problems.	Level 3: Apply
CO3	Apply greedy, dynamic programming, and backtracking techniques to optimization problems.	Level 3: Apply
CO4	Compare the performance of selected algorithms for computational problems.	Level 4: Analyze

List of Experiments

Sr. No.	**Content**	**COs**
1	Study the basic concepts of algorithm design and analysis of algorithms.	CO1
2	Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	CO2
3	Write a C++ program to perform Merge Sort using Divide and Conquer technique and compare its performance with Quick Sort for different input sizes.	CO2 CO4
4	Write a C++ program to find all-pairs shortest paths using the Floyd–Warshall algorithm and compare its performance with Dijkstra's algorithm for suitable graphs.	CO2 CO4
5	Write a C++ Program to solve the Knapsack Problem using Greedy Approach.	CO3
6	Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	CO2
7	Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	CO2
8	Write a C++ Program for Sum of Subsets Problem using Back Tracking.	CO3

9	Write a C++ Program to solve Travelling Sales Problem using the Dynamic Programming Approach.	CO3
10	Write a C++ program to solve the N-Queen Problem using Backtracking and analyze the effect of increasing board size on execution time.	CO3 CO4
11	Write a Program to Check whether a given graph is connected or not using DFS method.	CO2

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Write a C++ Program to perform Quick Sort using Divide & Conquer Technique.	https://ds1-iiith.vlabs.ac.in/exp/quick-sort/quick-sort/index.html
Write a C++ Program for Shortest Path using Dijkstra's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/dijkstra-algorithm/index.html
Write a C++ Program to find Minimum Spanning Tree using Prim's Algorithm.	https://ds2-iiith.vlabs.ac.in/exp/min-spanning-trees/index.html

Course Code	**CSE-L307A**				
Category	Professional Core Courses				
Course Title	**Programming in Java Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: ● To understand Java programming fundamentals and object-oriented concepts. ● To develop Java applications using core language features and programming constructs. ● To implement GUI, multithreading, exception handling, and file processing techniques. ● To apply Java collections and JDBC for software and database application development.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain Java programming concepts, object-oriented principles, and application development techniques.	Level 1: Remember
CO2	Apply Java language features and programming constructs to develop applications.	Level 2: Understand
CO3	Develop Java applications using GUI programming, multithreading, collections, and JDBC.	Level 3: Apply
CO4	Analyze Java-based solutions using object-oriented design and advanced programming techniques.	Level 4: Analyze

List of Experiments:

S. No.	**Content**	**COs**
1	Study the Basic concepts and features of Java programming language.	CO1
2	Write a program to demonstrate Java Fundamentals, OOP Concepts, Classes, Objects and Basic Program Execution	CO2
3	Write the program in java to print “Hello World”!	CO2
4	Write a program to demonstrate Java Fundamentals, JVM, JRE, JDK, data types, operators, control statements and basic program execution.	CO2
5	Write a program in Java to perform arithmetic operations, type casting and command line argument handling.	CO2

6	Write a program in Java to perform arithmetic operations, type casting and command line argument handling.	CO2
7	Write a program in Java to perform Abstract Classes, Interfaces and String handling using String, StringBuffer and StringBuilder.	CO2
8	Write a program in Java to create multithreading applications using Thread class, Runnable interface and synchronization.	CO3
9	Write a program in Java to design GUI applications using AWT/Applet components and event handling.	CO3
10	Write a program in Java to develop a scientific calculator using Swing components and layout managers.	CO3
11	Write a program in Java to demonstrate Exception Handling, User Defined Exceptions and File Handling operations.	CO4
12	Write a program in Java to implement Collection Framework, JDBC connectivity and CRUD operations using database applications.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiments under topic beyond syllabus.

Virtual Lab Links:

Experiment Name	**Virtual Lab Link**
Write a program to demonstrate Java Fundamentals, OOP Concepts, Classes, Objects and Basic Program Execution	https://java-iitd.vlabs.ac.in/exp/classes-objects/simulation.html
Write the program in java to Additions, Subtraction, Multiplication & Division of Two values.	https://www.youtube.com/watch?v=4OFg5sQQics

Course Code	**ECE-L001A**				
Category	Engineering Science Courses				
Course Title	**Microprocessor and Microcontroller Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester- V**
	0	0	2	1	
Course Objectives	The objectives of this course are • To understand architecture and working of Microprocessor and Microcontroller. • To learn assembly programming for arithmetic and data operations. • To provide hands-on experience in interfacing various peripherals with processor based systems.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Explain the architecture and functioning of microprocessors and microcontroller using model kits and instruction sets.
CO2	Develop and debug assembly language programs for arithmetic, logical and data manipulation tasks using instruction sets.
CO3	Apply interfacing techniques to connect peripherals with computing devices for practical applications.
CO4	Analyze embedded control algorithms for hardware interfacing and timing operations using microcontroller kit.

List of Experiments:

S. No.	**Content**
1	To study the architecture and functional blocks of the 8085 and 8086 microprocessors using trainer kit.
2	Write and execute program to perform arithmetic operations such as addition, subtraction, multiplication and division using 8085 instruction set.
3	Write a program to add the content of the memory location to the content of other memory location and store the result in 3rd memory location using 8086 instruction set.
4	Write a program to add 16 bit number using 8086 instruction set.
5	Write a program for multiplication of two 16 bit numbers using 8086 instruction set.
6	Write a program for division of two 16 bit numbers using 8086 instruction set.
7	Write a program to calculate the factorial of a given number using the 8086 instruction set.
8	Write a program to find the average of two given numbers using the 8086 instruction set.

9	Write a program to find the largest number in a data array using 8086 Instruction set.
10	Write and execute an 8086 assembly language program to interface and control a stepper motor using the 8255 (PPI).
11	To study the architecture and functioning of the 8051 microcontroller using trainer kit.
12	Write and execute a program to generate a square wave using the 8051 microcontroller.
13	Write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Sr. No.	Topics	Links
1	Introduction of Microprocessor 8085 Trainer Kit. Introduction of Microprocessor 8086 Trainer Kit	https://www.youtube.com/watch?v=GsPxk6GYf2Y&list=PLbEc0iDORYCp1yLvEfNxbZOZ4lTPUv_4f https://www.youtube.com/watch?v=GZibA34SU0c
2	Write a program to find the average of two given numbers using the 8086 instruction set.	https://www.youtube.com/watch?v=nOt9Wa-ClRo&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=10
3	Write a program to find the largest number in a data array using 8086 Instruction set.	https://www.youtube.com/watch?v=vNRGKG8ujVc&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=12
4	Write a program to calculate the factorial of a given number using the 8086 instruction set..	https://www.youtube.com/watch?v=riliLJP0Q_0&list=PLNdrDld4dxeVrRU4OmzVCR6UUgyRYMquI&index=13
5	To write and execute an 8086 assembly language program to interface a stepper motor using 8255 PPI and control its rotation.	https://www.youtube.com/watch?v=lj5L1nGZAwg
6	To write and execute a program to interface an LED with the 8051 microcontroller and generate a blinking effect using software delay.	https://www.youtube.com/watch?v=aGVn4xGrAfY

<table>
<tr><td>Course Code</td><td colspan="5">PT-301A</td></tr>
<tr><td>Category</td><td colspan="5">Practical Training</td></tr>
<tr><td>Course Title</td><td colspan="5">Practical Training-I*</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are to
Develop practical skills using industry-standard software tools and technologies.
Apply software engineering practices and technical documentation in real-world projects.
Enhance professional communication, teamwork, time management, and ethical practices.
Analyze and solve real-world computing problems using appropriate tools and methodologies.</td></tr>
<tr><td>Assessment</td><td colspan="5">50 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Explain industry practices, coding standards, and software development processes.	Level 2: Understand
CO2	Apply computing knowledge and programming skills to solve practical problems.	Level 3: Apply
CO3	Demonstrate effective communication, teamwork, professional ethics, and time management.	Level 3: Apply
CO4	Analyze real-world computing problems and formulate appropriate solutions using collaborative and systematic approaches.	Level 4: Analyze
CO5	Evaluate the application of theoretical concepts, modern technologies, and innovative methodologies to solve practical computing challenges.	Level 5: Evaluate
CO6	Utilize industry-standard tools, frameworks, platforms, and development methodologies for the design, implementation, testing, and deployment of software solutions.	Level 6: Create

Note:

1. Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the V semester.
2. Assessment of Practical Training will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc.

Course Code	**CSE-309A**				
Category	Professional Elective Courses				
Course Title	**Distributed Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To provide knowledge of distributed system architectures, communication models, and design issues. ● To develop understanding of synchronization, resource management, and distributed services. ● To enable application of distributed computing techniques for system implementation. ● To develop analytical abilities related to performance, reliability, and security of distributed systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define the concepts, architectures, communication mechanisms, services, and security aspects of distributed systems.	Level 1: Remember
CO2	Explain the principles, models, synchronization techniques, resource management methods, and services used in distributed systems.	Level 2: Understand
CO3	Apply distributed system concepts, communication mechanisms, and resource management techniques to solve computing problems.	Level 3: Apply
CO4	Analyze distributed systems based on performance, reliability, scalability, fault tolerance, and security requirements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Distributed Operating Systems Definition and goals, Hardware and Software concepts, Design issues.
Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

Unit-II

Synchronization in Distributed System: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems.
Processes and processors in Distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, real time distributed systems, Process migration and related issues.

Unit-III

Distributed File systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study.
Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing.

Unit-IV

Security Issues: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management.
Distributed Web-based Systems: Architecture, Processes, Communication, Naming, and Synchronization.
Case Studies: JAVA RMI, Sun Network File System, Google Case Study.

Suggested Readings:

1. Distributed Operating Systems by Andrew S Tanenbaum, Pearson.
2. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI.
3. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore, Tim Kindberg, Pearson.
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD.
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI.
6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, Hagit Attiya and Jennifer Welch, Wiley India.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Distributed Systems	https://onlinecourses.nptel.ac.in/noc25_cs130/preview
	Remote Procedure Call/Message Passing Concepts	https://freevideolectures.com/course/4596/nptel-distributed-systems/5
Unit-II	Clock Synchronization	https://www.youtube.com/watch?v=6rtGYTuJn9k
	Distributed Mutual Exclusion	https://onlinecourses-archive.nptel.ac.in/noc17_cs42/preview
Unit-III	Distributed Shared Memory (DSM)	https://onlinecourses-archive.nptel.ac.in/noc17_cs42
	Google File System / Distributed File Systems	https://onlinecourses.nptel.ac.in/noc25_cs130/preview
Unit-IV	Security in Distributed Systems	https://onlinecourses.nptel.ac.in/noc25_cs130/preview
	Cloud Computing & Distributed Web Systems	https://onlinecourses.nptel.ac.in/noc22_cs18/preview

Course code	**CSE-311A**				
Category	Professional Elective Courses				
Course title	**Advanced Computer Architecture**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To introduce advanced computer architecture concepts. • To familiarize students with advanced memory hierarchy techniques. • To provide knowledge of parallel and multiprocessor architectures. • To develop understanding of modern performance-enhancement techniques in computing				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define concepts and terminology of advanced computer architecture.	Level 1: Remember
CO2	Explain the principles of processor performance, instruction-level parallelism, memory organization, and multiprocessor architectures.	Level 2: Understand
CO3	Apply advanced computer architecture concepts to computing systems.	Level 3 : Apply
CO4	Analyze architectural techniques and performance trade-offs in modern computing systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Processor Performance and Instruction-Level Parallelism: Review of Processor Performance Metrics, CPU Performance Equation, Amdahl's Law, Performance Benchmarking, Instruction-Level Parallelism (ILP), Data, Structural and Control Hazards, Pipeline Optimization Techniques, Branch Prediction, Speculative Execution.
Superscalar Architecture: Multiple-Issue Processors, Dynamic Scheduling, Register Renaming, Out-of-Order Execution, Reorder Buffer and Precise Exceptions.

Unit-II

Advanced Memory Hierarchy: Memory Hierarchy Design, Cache Performance Metrics, Multi-Level Cache Organization, Inclusive and Exclusive Caches, Cache Optimization Techniques, Prefetching Methods, Victim Cache.
Virtual Memory Systems, Translation Lookaside Buffer (TLB), Virtual-to-Physical Address Translation, Memory Protection Mechanisms, Memory Consistency Models.

Unit-III

Multicore and Parallel Architectures: Introduction to Parallel Computing, Flynn's Classification, Shared Memory and Distributed Memory Architectures, Multicore Processors, Simultaneous Multithreading (SMT), Chip Multiprocessors (CMP).
Vector Processors and SIMD Architectures, Introduction to General-Purpose GPU Computing (GPGPU), Comparison of CPU and GPU Architectures, Applications of Parallel Architectures.

Unit-IV

Multiprocessor Systems and Emerging Architectures: Shared Memory Multiprocessors, Interconnection Networks, Synchronization Mechanisms, Cache Coherence Problem, Snooping and Directory-Based Coherence Protocols, MESI Protocol.
NUMA Architectures, Manycore Systems, Heterogeneous Computing Architectures, Architecture Trends for Artificial Intelligence, Cloud Computing and High-Performance Computing Systems.

Suggested Readings:

1. Computer Architecture: A Quantitative Approach by John L. Hennessy and David A. Patterson, 6th Edition, Morgan Kaufmann Publishers, USA, 2017.
2. Computer Organization and Architecture: Designing for Performance by William Stallings, 11th Edition, Pearson Education, United Kingdom, 2019.
3. Advanced Computer Architecture: Parallelism, Scalability, Programmability by Kai Hwang, Naresh Jotwani and Hsiao H. Wang, 3rd Edition, McGraw-Hill Education, India, 2015.
4. Structured Computer Organization by Andrew S. Tanenbaum and Todd Austin, 6th Edition, Pearson Education, USA, 2013.
5. Computer System Architecture by M. Morris Mano, 3rd Edition, Pearson Education, India, 2007.
6. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

Useful Video Links:

Unit	Topic	NPTEL Video Lecture Link
Unit-I	Processor Performance and Benchmarking	https://youtu.be/H4oSQZIBkNY?si=ir7y01X1rsADDU8I
	Pipeline Hazards and Branch Prediction	https://youtu.be/Gp2cwH740O0?si=NXNjjg-7Ig-o7h0n
	Superscalar Processors	https://youtu.be/0Ce22P_jeLQ?si=HB0YSigienbFtK6P
Unit-II	Memory Hierarchy	https://youtu.be/__Cs4PWT3fs?si=ezFLd9HzYL5J4RnM
	Multi-Level Cache Organization	https://youtu.be/dkquNQNaXxg?si=aX_P2Ybg-92VoVqA
	Virtual Memory	https://youtu.be/Ev4BET3i5R0?si=-5EGwNEZimxafagm
Unit-III	Multicore Processors	https://youtu.be/nF3kr5KvUno?si=jFPHp_GWR5rmOwXZ
	GPU Architecture Fundamentals	https://youtu.be/GOam2jFb700?si=kn50mvslNcg4jEvK
Unit-IV	Cache Coherence Protocols	https://youtu.be/zxHxgB07Yn8?si=RlycvUZ-u55AOR3u
	Snooping and Directory-Based Protocols	https://youtu.be/wOEV6Oy3A64?si=QL4Ib2JksX9mIH9e

Course Code	**CSE-313A**				
Category	Professional Elective Courses				
Course Title	**Computer Graphics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are ● To provide knowledge of computer graphics principles, transformations, and viewing techniques. ● To develop understanding of graphical representations, rendering, and visualization methods. ● To enable application of graphics techniques for modeling and image generation. ● To develop analytical skills related to graphical algorithms and visualization techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define computer graphics concepts, graphical primitives, transformations, viewing techniques, and rendering methods.	Level 1: Remember
CO2	Explain graphical representations, transformation processes, viewing mechanisms, and rendering techniques.	Level 2: Understand
CO3	Apply computer graphics algorithms and techniques for modeling, transformation, visualization, and image generation.	Level 3: Apply
CO4	Analyze graphical models, rendering methods, visualization techniques, and image processing approaches.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Refresh CRT, Color CRT Monitors, LCD, Two-dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm, DDA Algorithm, Bresenham Algorithm.

Unit-II

Two-dimensional transformations: Geometric, Coordinate and, composite transformation. Two-Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping, Homogeneous Coordinates and matrix representation of 2d transformation.

Unit-III

Three-dimensional transformations: Three-dimensional graphics concept, Geometric and Coordinate transformations, Viewing in 3D: Projection, Taxonomy of projection, Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

Unit-IV

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, BSpline curves. Parametric representation of surfaces; Interpolation method. Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

Suggested Readings:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2nd Edition, TMH Education.

Useful Video Links:

Unit	Topic Name	Link
Unit-I	Introduction to Computer Graphics	https://youtu.be/NmMky9Pg8Yc?si=iSIGpSitxssO39FN
	Region Filling	https://youtu.be/TNbkX5bYrtE?si=Cvkg1exdIzl9GL0n
Unit-II	Two-dimensional transformations	https://youtu.be/lNYhWBPEeaY?si=lFi1URIAlDrp41aB
	Two-Dimensional Viewing	https://youtu.be/JPADSZzY-ko?si=X7OrdpEhtF9yS9po
Unit-III	Three-dimensional transformations	https://youtu.be/I8o4kK9QRL4?si=5fBczLrRdqQZIxYJ
	The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.	https://youtu.be/b1Qpvqm0UAo?si=2wDTVIN23b7gccal
Unit-IV	Representing Curves and Surfaces	https://youtu.be/OkncKzflw8I?si=inLgPagikbEkzB81
	Image manipulation	https://youtu.be/JD9O6e8Q0Xw?si=cff2gyNh7OSL7f_5

Course Code	**CSE-315A**				
Category	Professional Elective Courses				
Course Title	**Data Warehouse and Mining**				
Scheme and Credits	L	T	P	**Credits**	**Semester-V (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	3	0	0	**3**	
Course Objectives	The objectives of this course are ● To introduce the fundamentals of data warehousing and data mining. ● To provide knowledge of data mining techniques for pattern discovery and classification. ● To familiarize students with clustering methods and web data mining concepts. ● To develop understanding of techniques and tools for knowledge discovery from large datasets.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define concepts and terminology related to data warehousing and data mining.	Level 1: Remember
CO2	Explain data mining techniques, algorithms, and knowledge discovery processes.	Level 2: Understand
CO3	Apply data warehousing and data mining methods to extract useful patterns from data.	Level 3: Apply
CO4	Analyze data mining models, clustering techniques, and web mining approaches for knowledge discovery.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Data warehousing: Introduction, Operational data stores, ETL, Data warehouses – design guidelines for data warehouse implementation, Data warehouse metadata; OLAP – introduction, Characteristics, Multidimensional view and data cube, Data cube operations.

Unit-II

Data mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation(FP, growth), performance evaluation of algorithms.

Unit-III

Classification: Introduction, decision tree, tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method; classification software, software for association rule mining; case study; KDD Insurance Risk Assessment.

Unit-IV

Cluster analysis: Introduction, partitional methods, hierarchical methods, and density based methods, dealing with large databases, cluster software.
Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

Suggested Readings:

1. Data mining concepts and techniques by Han J., Kamber M. and Pei J., Morgan Kaufmann Publishers (2011) 3rd ed.
2. Data Mining by Pudi V., Krishana P.R., Oxford University press, (2009) 1st ed.
3. Data mining by Adriaans P., Zantinge D., Pearson education press (1996), 1st ed.
4. Data Warehousing Fundamentals by Pooniah, Willey interscience Publication, (2001), 1st ed.

Useful Video links

Unit No	Topics	Links
Unit-I	Introduction, Knowledge Discovery Process	https://www.youtubeeducation.com/watch?v=ykZ-_UGcYWg
	OLAP	https://youtu.be/m-aKj5ovDfg?si=1IqwlHoN5T4VWfPK
Unit-II	Classification	https://www.youtubeeducation.com/watch?v=VsYKqOokgaE
	Apriori algorithm	https://youtu.be/hEQkqpmtx-Y?si=hMDJ-3cvDvx_PIur
Unit-III	Bayes Classifier	https://www.youtubeeducation.com/watch?v=DXnnvprUl2Y
	Decision Tree	https://www.youtubeeducation.com/watch?v=4l4_BREP6ZI
Unit-IV	Cluster analysis	https://www.youtubeeducation.com/watch?v=VcPWL9Nlozs
	Density based methods	https://youtu.be/E_SdiZQ23xI?si=hupzFk1EjSNbge4q

Course Code	**AI-301A**				
Category	Professional Core Courses				
Course Title	**Machine Learning**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	3	**1**	**0**	**4**	
Course Objectives	The objectives of this course are • To provide knowledge of machine learning concepts, techniques, and applications. • To develop understanding of data preprocessing, feature engineering, and dimensionality reduction methods. • To enable application of machine learning algorithms for prediction and pattern discovery. • To develop analytical skills for evaluating and improving machine learning models.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define machine learning concepts, learning paradigms, techniques, and applications.	Level 1: Remember
CO2	Explain data preprocessing, feature representation, dimensionality reduction, and learning methodologies.	Level 2: Understand
CO3	Apply machine learning algorithms to solve classification, prediction, and clustering problems.	Level 3: Apply
CO4	Analyze machine learning models using appropriate performance measures and evaluation techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Machine Learning: Definition, History, Need, Features, Block diagrammatic representation of learning machines, Classification of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement Learning, Machine Learning life cycle, Applications of Machine Learning.

Unit-II

Dimensionality reduction: Definition, Row vector and Column vector, how to represent a dataset, how to represent a dataset as a Matrix, Data preprocessing in Machine Learning: Feature Normalization, Mean of a data matrix, Column Standardization, Co-variance of a Data Matrix, Principal Component Analysis for Dimensionality reduction.

Unit-III

Supervised Learning: Definition, how it works, Types of Supervised learning algorithms k - Nearest Neighbours, Naïve Bayes, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines, Generalized Linear Models, Non-linearity and Kernel Methods**.**

Unit-IV

Unsupervised Learning: Clustering: K-means. Ensemble Methods: Boosting, Bagging, Random Forests.
Evaluation: Performance measurement of models in terms of accuracy, confusion matrix, precision & recall, F1-score, receiver Operating Characteristic Curve (ROC) curve and AUC, Median absolute deviation (MAD), Distribution of errors.

Suggested Readings:

1. Introduction to machine learning by E. Alpaydin.
2. The Elements of Statistical Learning Data Mining, Inference, and Prediction by T Hastie, R Tibshirani and J Friedman, 2nd Edition, Springer, 2009.
3. Pattern Recognition and Machine Learning by C. M. Bishop, Springer, 2010.
4. Pattern Classification by R. O. Duda, P. E. Hart, and D.G. Stork, John Wiley and Sons, 2012.
5. Networks and Learning Machines by Simon O. Haykin, Neural, Pearson Education, 2016.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Machine Learning	https://www.youtube.com/watch?v=r4sgKrRL2Ys&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77
	Supervised Learning	https://www.youtube.com/watch?v=OTAR0kT1swg&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=3
	Unsupervised Learning	https://www.youtube.com/watch?v=HTSCbxSxs-g&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=4
	Reinforcement Learning	https://www.youtube.com/watch?v=9vMpHk44XXo&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=5
Unit-II	Dimensionality Reduction: Principal Component Analysis (PCA) & kernel PCA	https://www.youtube.com/watch?v=YepECGlOl4Y
	Introduction to Data Preprocessing	https://www.youtube.com/watch?v=cO6lrQuepcs
Unit-III	Types of supervised learning	https://www.youtube.com/watch?v=5NSKURYzU70
	Linear Regression	https://www.youtube.com/watch?v=_M7Km1XZERU&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=9
	Logistic Regression	https://www.youtube.com/watch?v=g__LURKuIj4&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77&index=17
Unit-IV	Unsupervised Learning & K-means Machine Learning for Engineering & Science Applications	https://www.youtube.com/watch?v=FeVrAK77mV8
	The ROC Curve	https://www.youtube.com/watch?v=6RjcFVm_k4c

Course Code	**CSE-001A**				
Category	Professional Core Courses				
Course Title	**Compiler Design**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI (Common for B. Tech. CSE/ CSE-AIML/CSE-DS)**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are ● To provide knowledge of compiler organization, language processing, and translation techniques. ● To develop understanding of lexical, syntax, and semantic analysis methods. ● To enable application of compiler construction techniques for program translation. ● To develop analytical abilities related to code generation, optimization, and error handling.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define compiler components, language processing concepts, translation techniques and code generation mechanisms.	Level 1: Remember
CO2	Explain lexical analysis, syntax analysis, semantic processing and intermediate code generation techniques.	Level 2: Understand
CO3	Apply compiler design techniques for lexical processing, parsing, translation and code generation.	Level 3: Apply
CO4	Analyze compiler structures, optimization techniques, error handling methods and code generation strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Compilers: Language Processors, The Structure of compiler: its different phases, Compiler Construction Tools, Applications of Compiler Technology. Lexical Analysis: Role of lexical analyzer, Input Buffering, Specification and recognition of tokens, design of lexical analyzer, regular expressions, A language specifying lexical analyzer, Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing number of states of DFA, Implementation of lexical analyzer.

Unit-II

Syntax Analysis: Role of parsers, context free grammars, Parsing Technique: Bottom-up Parsing, Shift-reduce parsing, Operator precedence parsing, Top down parsing, Predictive parsing, Recursive Descent Parsing.

Unit-III

LR parsers: SLR, LALR and Canonical LR parser. Syntax Directed Translations: Syntax directed definitions, construction of syntax trees, syntax directed translation scheme, implementation of syntax directed translation, Intermediate-Code Generation: Directed Acyclic graphs, three address code, Postfix notation, quadruples, triples and indirect triples.

Unit-IV

Symbol Table & Error Detection and Recovery: Symbol tables: its contents and data structure for symbol tables; trees, arrays, linked lists, hash tables. Errors, lexical phase error, syntactic phase error, Semantic error, Code Optimization & Code Generation: Basics Blocks & flow graphs, common subexpression elimination, dead code elimination, constant propagation, loop and Peephole optimization, forms of objects code, machine dependent code, register allocation for temporary and user defined variables.

Suggested Readings:

1. Compilers Principles, Techniques & Tools by Alfread V. AHO, Ravi Sethi & J.D. Ullman, Addison Wesley.
2. Theory and Practice of Compiler Writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.
3. System Software by Dhamdere, 1986, MGH.
4. Principles of Sompiler Design, Narosa Publication.
5. Elements Compiler Design, Dr. M. Joseph, University Science Press.

Useful Video Links:

Unit No	Topics	Links
Unit-I	The Structure of compiler	https://youtu.be/L7B7b9phxV8?si=aFcs3kO9JbYGJozI
	Input Buffering, Specification of tokens, Regular Expression	https://youtu.be/5Vv3HHSeJUA?si=ogMow48rYdMRPBMy
	Finite Automata, Regular Expression to Finite Automata	https://youtu.be/zpuouhg1NWM?si=wy-BRoIMcRcl7B_K
Unit-II	Context Free Grammar	https://youtu.be/yS52K_CrFCc?si=a4UAhbIjIoW_h0rg
	Top-Down Parser: Recursive Descent Parsing	https://youtu.be/yE8JXOwWo5I?si=5JMmaPHftAGAr4F4
	Predictive Parsing	https://youtu.be/P9uw8XyVtF8?si=MZE8JG7J-UfplZmL
	Intermediate Code Generation	https://youtu.be/Gc6PpW_SxKY?si=pIXzxJQn48a5XLjP
Unit-III	LR Parser: LR(0), SLR(1)	https://youtu.be/tvNy8-oqoq0?si=EMQPmVanXAW02oML
	LALR(1)	https://youtu.be/QFVorwdIZRg?si=SJFJwv-FXq8ORnds
Unit-IV	Symbol Table	https://youtu.be/FQb0hQ6Bgp8?si=c2KFMQpOGzAvjXhN
	Register Allocation	https://youtu.be/mzKUVBoTIJ8?si=6TY3SD3Q50gTOO5W

Course Code	**CSE-302A**				
Category	Professional Core Courses				
Course Title	**Web Technologies**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of web technologies, Internet concepts, and web architecture. • To develop understanding of client-side and server-side web development techniques. • To enable application of web technologies for developing dynamic web applications. • To develop analytical skills related to web application design and integration.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define Internet technologies, web development concepts, markup languages, scripting techniques, and database integration methods.	Level 1: Remember
CO2	Explain web technologies, document structures, styling techniques, scripting mechanisms, and data exchange methods.	Level 2: Understand
CO3	Apply web development technologies and tools to design and implement dynamic web applications.	Level 3: Apply
CO4	Analyze web applications, data exchange mechanisms, database interactions, and client-server communication processes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser.

HTML: History of HTML, Structure of HTML Document: Text Basics, Mark up Tags, Heading-Paragraphs, Line Breaks, Understand the structure of HTML tables. Lists, Working with Hyperlinks, Understanding Frames and their needs, HTML forms for User inputs, Document: Images and Multimedia, Links and webs, Document Layout.

Cascading Style Sheet: Need for CSS, introduction to CSS, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects and structure using CSS, inline, internal and external CSS.

Unit-II

XML: Introduction of XML- Some current applications of XML, Features of XML, Anatomy of XML document, structuring data, XML namespace, Document Type Definitions and Schemas, Document object model, DOM methods, XSL, SAX, SOAP, XML vs JSON in Modern Development, Future Trends of XML.

Unit-III

PHP: Introduction to PHP,Working with Variables and Constants, Controlling Program flow, Working with Functions, Arrays, Files, and Directories, operator precedence.Working with Forms and Database, Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs, Exploring Cookies, Sessions, and PHP Security.

Unit-IV

AJAX: AJAX with PHP, PHP Code and the Complete AJAX Example, AJAX Database, Working of AJAX live search with PHP, Ajax PHP Database Form, AJAX PHP MySQL Database, connect, create DB, create table, insert data, select query.

Suggested Readings:

1. HTML Black Book by Steven Holzner, Dreamtech Press.
2. Web Technologies: Black Book, Dreamtech Press.
3. Web Applications: Concepts and Real-World Design by Knuckles, Craig D, Wiley-India.
4. Internet and World Wide Web How to program by P.J. Deitel & H.M. Deitel, Pearson.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Internet	https://youtu.be/YOXwcbwSEUo?si=gzzW4Ax-7-QEazbH
	Introduction to HTML and CSS	https://youtu.be/h_RftxdJTzs?si=d1Pdy020kgY6w_BG
Unit-II	Extensible Markup Language(XML)	https://youtu.be/-oLlHA0Uy-s?si=kxkQSMbC3NVsQONz
	Document Object Model	https://youtu.be/Uwu-A1sULMc?si=ORcmRS_2BsCFW8yu
Unit-III	Introduction to PHP	https://youtu.be/wwsWLXxKVtM?si=1XdM_dl0gmp6L9Tc
	Cookies in PHP	https://youtu.be/Tbn0H0r7d4Y?si=p143YSwlfDXKoiRV
Unit-IV	AJAX with PHP	https://youtu.be/DIufdUeDpoc?si=7ZTApYU5WUhdn_0L
	Ajax PHP Database Form	https://youtu.be/XV9x17zVZFU?si=XqIyOGgdus0bIhq8

Course Code	**CSE-304A**				
Category	Professional Core Courses				
Course Title	**Software Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	**0**	**0**	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of software engineering principles, processes, life cycle models, and project management practices. • To develop understanding of requirements engineering, system modeling, software design, and architectural concepts. • To enable application of software development, testing, maintenance, and project management techniques. • To develop analytical abilities for evaluating software quality, reliability, performance, and process effectiveness.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	Skill Demonstrated	RBT Level
CO1	Define software engineering concepts, processes, life cycle models, project management practices, and quality standards.	Level 1: Remember
CO2	Explain software requirements, modeling techniques, design principles, architectural concepts, testing methods, and quality assurance activities.	Level 2: Understand
CO3	Apply software engineering methodologies, project management techniques, design approaches, and testing strategies to software development problems.	Level 3: Apply
CO4	Analyze software systems, project parameters, quality attributes, reliability measures, and process outcomes for effective software engineering solutions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis.
Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking.

Unit-II

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping, Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis Modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, Behavioral Modeling; The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the control and process specification; The data dictionary; Other classical analysis methods.

System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit-III

Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into a software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design.

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing: Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering.

Unit-IV

Software Reliability and Quality Assurance: Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability, The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management. Computer Aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

Suggested Readings:

1. Fundamentals of software Engineering by Rajib Mall, PHI.
2. Software Engineering by Nasib Singh Gill, Khanna Book Publishing Co (p) Ltd.
3. Software Engineering by Ian Somerville, Pearson Edu, 5 edition, 1999, AW
4. Software Engineering by David Gustafson, 2002, T.M.H.
5. Effective Methods for Software Testing by William Perry, John Wiley & Sons, New York, 1995.
6. Software Testing by Louise Tamres, Pearson Education Asia, 2002.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Software Crisis	https://youtu.be/Ln_LP7c23WM?si=VbTajcclrOt9sN9Y
	Software Project Management	https://youtu.be/w9BSk8MGOGM?si=SqU7aKGfy7NsrEcj
Unit-II	Introduction to requirement specification	https://youtu.be/l9XFipXoJb0?si=UHgpfj3VCno5tHjG
	Modular Design	https://youtu.be/FTyncRpLd5g?si=pmt_sPKssS4wVMnI
Unit-III	Architectural Design	https://youtu.be/IPlP2R7l-Nc?si=2xKG1D8-1PxJuEGE
	Software Testing	https://youtu.be/Q50ZyydS7pI?si=olsiSLBbKXOEn_pC
Unit-IV	The ISO 9000 Quality standards	https://youtu.be/KTePzwgNfPw?si=dN7aMBS8uJnRqSbT

Course Code	**AI-L301A**				
Category	Professional Core Courses				
Course Title	**Machine Learning Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)**
	0	0	2	**1**	
Course Objectives	The objectives of this course are: • To understand and implement basic machine learning algorithms for classification and prediction tasks. • To apply clustering and recommendation techniques for pattern discovery and personalized suggestions. • To perform dimensionality reduction and optimization using PCA and Gradient Descent techniques. • To develop and evaluate advanced machine learning models using Artificial Neural Networks (ANN).				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Understand the fundamental concepts of machine learning, including types of learning, basic algorithms, and model building techniques.	Level 2: Understand
CO2	Apply machine learning algorithms to implement solutions for classification, regression, and clustering problems using appropriate techniques.	Level 3: Apply
CO3	Apply data preprocessing, feature selection, and dimensionality reduction techniques for effective data analysis and model improvement.	Level 3: Apply
CO4	Analyze the performance of machine learning models using evaluation metrics and optimize models for better accuracy and efficiency.	Level 4: Analyze

List of Experiments:

Sr. No.	**Contents**	**COs**
1	Study the basic concept of Machine Learning	CO1
2	Write a program to implement Linear Regression for predicting continuous target values based on given input features.	CO2
3	Write a program to implement Logistic Regression for binary classification of a dataset.	CO2
4	Write a program to implement K-Nearest Neighbors (KNN) algorithm for classification problems.	CO2
5	Write a program to implement Decision Tree classifier for predicting outcomes based on input data.	CO3
6	Write a program to implement Random Forest algorithm for classification and regression tasks.	CO4
7	Write a program to implement Support Vector Machine (SVM) for classification of data points.	CO3

8	Write a program to implement Naive Bayes classifier for text or categorical data classification.	CO3
9	Write a program to implement K-Means clustering algorithm for grouping similar data points.	CO3
10	Write a program to implement Principal Component Analysis (PCA) for dimensionality reduction.	CO3
11	Write a program to implement Gradient Descent algorithm for optimizing a machine learning model.	CO4
12	Write a program to implement Artificial Neural Network (ANN) for classification or prediction tasks.	CO4
13	Write a program to implement a Recommender System using collaborative filtering technique.	CO4

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Useful Video Links:

Experiment Name	**Virtual Lab Link**
Implement Random Forest for Multi-Class Classification	https://www.youtube.com/watch?v=5ONlGP0Nx3Q
Gradient Descent	https://www.youtube.com/watch?v=JA5rIxOve20
Principal Component Analysis (PCA)	https://www.youtube.com/watch?v=hkCT-6KJAK0
K-Means Clustering	https://www.youtube.com/watch?v=oFr4JX75MCc

Course Code	**CSE-L001A**				
Category	Professional Core Course				
Course Title	**Compiler Design Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are • To provide knowledge of lexical analysis, syntax analysis, and compiler construction concepts. • To develop understanding of LEX and YACC tools. • To enable application of parsing techniques and grammar transformations. • To develop analytical abilities for grammar and parsing evaluation.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Explain lexical analysis, parsing, grammar representation and compiler construction tools.	Level 2: Understand
CO2	Implement lexical and syntax analysis programs using LEX, YACC and string processing techniques.	Level 3: Apply
CO3	Apply parsing techniques, grammar transformations and stack operations in compiler design.	Level 3: Apply
CO4	Analyze grammars, parse trees, recursion, factoring methods and compiler processing results.	Level 4: Analyze

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study of LEX & YACC TOOLS LEX - A Lexical Analyzer Generator.	CO1
2	Write a program to count the total number of Blank Spaces in the String.	CO2
3	Write a program to find whether a given String is an Identifier or not.	CO2
4	Write a program to check whether a string is keyword or not.	CO2
5	Write a program to find whether a string is constant or not.	CO2
6	Write a program to check and generate parse tree.	CO3
7	Write a program to find the First of non-terminals in the String.	CO3
8	Write a program to find the LEFT RECURSION.	CO4

9	Write a Program to find Left Factoring in the String.	CO4
10	Write a program for stack operations.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Useful Video Links:

Experiment Name	**Virtual Lab Link**
Write a program to find whether a given String is an Identifier or not.	https://gr16vlabiem.netlify.app/identifier
Write a Program to generate Left Most Derivation and Right Most Derivation.	https://gr16vlabiem.netlify.app/leftrightderivation
Write a Program to check and generate parse tree.	https://gr16vlabiem.netlify.app/parsetree

Course code	**CSE-L302A**				
Category	Professional Core Courses				
Course title	**Web Technologies Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	0	0	2	1	
Course Objectives	The objectives of this course are ● To understand the fundamentals of web technologies including HTML, CSS, XML and PHP. ● To design and develop static web pages using HTML elements and styling techniques. ● To apply CSS and XML for structuring and presenting web content effectively. ● To develop dynamic web applications using PHP and basic programming concepts.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

CO	**Skill Demonstrated**
CO1	Explain the structure and usage of HTML tags, lists, hyperlinks, frames, forms, and XML concepts for designing web pages.
CO2	Apply HTML, CSS, and XML techniques to develop structured web pages including navigation, multimedia integration, and styled layouts.
CO3	Implement PHP programs using variables, control structures, functions, arrays, and loops to solve basic programming problems.
CO4	Analyze and develop dynamic web applications by integrating PHP with XML, CSS, and related technologies for data processing and presentation.

List of Experiments

Sr. No.	**Contents**	**COs**
1	Study of various tags used in HTML.	CO1
2	Write a program to create a simple html page using heading and text element.	CO1
3	Write a program to create ordered and an ordered list.	CO1
4	Write a program to create definition list using HTML.	CO1
5	Write a program to connect more than two pages using hyperlink in HTML.	CO1
6	Write a program to import images and videos in HTML.	CO2
7	Write a program to implement navigation frame in HTML.	CO2
8	Write a program to implement an inline floating frame.	CO2
9	Write a program to create a registration form using HTML and CSS.	CO2
10	Write a program to implement inline CSS.	CO2
11	Write a program to implement internal CSS.	CO2

12	Write a program to implement external CSS.	CO2
13	Write a program to create a student marksheet using table in HTML.	CO2
14	Write an XML program to accept student details (Name, I'd, Branch, CGPA).	CO1
15	Write a program to display Catalog created using CSS and XSL.	CO4
16	Write a PHP program to perform the addition of two numbers.	CO3
17	Write a PHP program to display numbers from 1 to 10 using loops (for, while).	CO3
18	Write a PHP program to demonstrate functions (with and without parameters).	CO3
19	Write a PHP program to sort an array.	CO3
20	Write a PHP program to calculate factorial of a number.	CO3

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment if they feel useful to add.

Virtual Lab Links

Experiment Name	**Virtual Lab Link**
Write a program to create ordered and an ordered list.	https://youtu.be/3cTpjhD0YlQ?si=25aBaaZJqs5iEHO1
Write a program to create a registration form using HTML and CSS.	https://youtu.be/ttNqr6tU4p8?si=x_ucIj01UQnpTnG4
Write a PHP program to display numbers from 1 to 10 using loops (for, while).	https://youtu.be/UtYGSL06vo4?si=TAXJnYEZYzBZ1Q98
Write a PHP program to calculate factorial of a number.	https://youtu.be/OtmKgh8DlGM?si=Z40cm9sRd9AHgbeQ

Course Code	**DS-303A**				
Category	Professional Elective Courses				
Course Title	**Predictive Analytics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI (Common for B. Tech. CSE/CSE-DS)**
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide knowledge of predictive analytics concepts, statistical models, and analytical frameworks. • To develop understanding of regression, classification, decision trees, and machine learning techniques. • To enable application of predictive modeling and data preprocessing methods for real-world analytics problems. • To develop analytical abilities for model evaluation, variable selection, dimensionality reduction, and performance optimization.				
Assessment	40 Marks				
End Semester Practical Examination	60 Marks				
Total	100				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define predictive analytics concepts, analytical frameworks, regression models, classification techniques, and machine learning fundamentals.	Level 1: Remember
CO2	Explain predictive modeling methods, data preprocessing techniques, feature selection approaches, and analytical processes.	Level 2: Understand
CO3	Apply predictive analytics techniques, statistical models, and machine learning methods to solve real-world problems.	Level 3: Apply
CO4	Analyze predictive models using evaluation measures, dimensionality reduction methods, regularization techniques, and validation strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Introduction: The Analytics Life Cycle, Introduction to Predictive Analytics, Matrix Notation, Basic Foundations, Model, Method and Feature Selection, CRISP-DM framework, and data partitioning (training/validation sets).
Regression: Covariance, Correlation and ANOVA review; Simple Linear Regression, OLS Model Diagnostics, Dummy Variables, Multivariate Regression, OLS Assumptions, Weighted Least Squares (WLS), Generalized Linear Models (GLM).

Unit II

Classification Models: Introduction, Binomial Logistic Regression, Multinomial Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis.
Decision Trees: Introduction Regression Trees, Regression Tree Issues, Classification Trees, Pruning Trees, Bootstrap Aggregation (Bagging), Random Forest Models, Support Vector Machines (SVM), and Neural Networks.

Unit-III

Data Pre-Processing: Overview, Variable Types, Introduction to Data Transformations,
Data Transformations: Categorical to Dummy Variables, Polynomials, Box-Cox Transformation, Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization, Rank Transformations, Lagging Data (Causal Models), Data Reduction.

Unit-IV

Variable Selection: Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step Methods.
Dimensionality: Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO, Dimension Reduction Models, Principal Components Regression (PCR), Partial Least Squares (PLS).
Machine Learning: Machine Learning Overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation.

Suggested Readings:

1. An Introduction to Statistical Learning: with Applications in R by James, Witten, Hastie and Tibshirani, Springer, 1st Edition, 2013.
2. The Elements of Statistical Learning-Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman, Second Edition , Springer Verlag, 2009.
3. Predictive & Advanced Analytics, IBM ICE Publication.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Introduction to Predictive Analytics	https://youtu.be/suIMSpBJiyM?si=wghj_qWKuUc01sS0
	Method and Feature Selection	https://youtu.be/0xFT0yvqRo4?si=BC3RJuyDRl8b8kdQ
	CRISP-DM framework data partitioning (training/validation sets)	https://youtu.be/q_okDS2RtzY?si=L0-fXwDtLUchigXM
Unit-II	Multinomial Logistic Regression	https://youtu.be/cM4lmkq8XsU?si=Z0F0fT0CgHIBJWK7
	Linear Discriminant Analysis	https://youtu.be/LNL4G87DpI0?si=jthNR0t1c4syCrkM
	Introduction Regression Trees	https://youtu.be/1GZDVRskXGE?si=Mlc1rNSDs_5c2zFB
	Support Vector Machines (SVM)	https://youtu.be/3ki3RKdbcPo?si=Og-G9XnbOPUw1WBf
Unit- III	Data pre-processing	https://youtu.be/L_DeunKU-FA?si=EYEVxpjcKJlqeJSj
	Categorical to Dummy Variables	https://youtu.be/aMPeChbJg9A?si=7A0vzl-UDnTH3V92
	Standardization, Rank Transformations,	https://youtu.be/J_rDIm7dI3Y?si=y778gzeyW5gfaiRV
	Lagging Data (Causal Models)	https://youtu.be/LpRC9ds6GIc?si=MXYyawUQo_WGsJiT
Unit- IV	Variable Selection Methods, Step Methods.	https://youtu.be/9h1YikP2Sno?si=hr5O_7TK9lbpLAzy
	Regularization (Penalized or Shrinkage Models, Ridge Regression, LASSO	https://youtu.be/whA8Geg4Knk?si=6Ps80ti6EE4RYbPj
	Principal Components Regression (PCR) Partial Least Squares (PLS)	https://youtu.be/SWfucxnOF8c?si=4zx8fArev1W5EZZc https://youtu.be/cSeMy8xJvNA?si=vukpap1nDEGKnb_O

Course Code	**CSE-306A**				
Category	Professional Elective Courses				
Course Title	**Software Project Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide knowledge of software project management concepts, planning methods, and project life cycle activities. • To develop understanding of estimation, scheduling, risk management, and project evaluation techniques. • To enable application of resource allocation, monitoring, contract management, and team management practices. • To develop analytical skills for software quality management and project control.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define software project management concepts, planning techniques, estimation methods, scheduling approaches, and quality standards.	Level 1: Remember
CO2	Explain project evaluation, risk management, resource allocation, monitoring mechanisms, and quality management practices.	Level 2: Understand
CO3	Apply project planning, estimation, scheduling, resource management, and monitoring techniques in software projects.	Level 3: Apply
CO4	Analyze software project performance, quality measures, risk factors, organizational structures, and project control mechanisms.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Software Project Management (SPM): Definition of a Software Project (SP), SP Vs. other types of projects activities covered by SPM, categorizing SPs, project as a system, management control, requirement specification, information and control in organization.
Stepwise Project planning: Introduction, selecting a project, identifying project scope and objectives, identifying project infrastructure, analyzing project characteristics, identifying project products and activities, estimate efforts each activity, identifying activity risk, allocate resources, review/ publicize plan.

Unit-II

Project Evaluation & Estimation: Cost benefit analysis, cash flow forecasting, cost benefit evaluation techniques, risk evaluation. Selection of an appropriate project report; Choosing technologies, choice of process model, structured methods, rapid application development, waterfall, V-process model, spiral models, Prototyping, Incremental model, Evolutionary model, Agile model, delivery, Albrecht function point analysis.

Activity planning & Risk Management: Objectives of activity planning, project schedule, projects and activities, sequencing and scheduling activities, network planning model, representation of lagged activities, adding the time dimension, backward and forward pass, identifying critical path, activity throat, shortening project, precedence networks.
Risk Management: Introduction, the nature of risk, managing risk, risk identification, risk analysis, reducing the risks, Evaluating schedule risk using PERT, calculating the z values.

Unit-III

Resource allocation: Introduction, the nature of resources, identifying resource requirements, scheduling resources creating critical paths, counting the cost, being specific, publishing the resource schedule, cost schedules, the scheduling sequence.
Monitoring the control: Introduction, creating the frame work, collecting the data, visualizing progress, cost monitoring, earned value, prioritizing monitoring, getting the project back to target, change control.

Unit-IV

Managing contracts and people: Introduction, types of contracts, stages in contract, placement, typical terms of a contract, contract management, acceptance, Managing people and organizing terms: Introduction, understanding behaviour, organizational behaviour: a back ground, selecting the right person for the job, instruction in the best methods, motivation, working in groups, becoming a team, decision making, leadership, organizational structures.
Software quality: Introduction, the place of software quality in project planning, the importance of software quality, defining software quality, ISO 9126, Practical software quality measures, product versus process quality management, external standards, techniques to help enhance software quality.

Reference Books:

1. Software Project Management (2nd Edition) by Bob Hughes and Mike Cotterell, 1999, TMH.
2. Software Engineering – A Practitioner's Approach by Roger S. Pressman (5th Edition), 2001, MGH.
3. Software Project Management by Walker Royce, 1998, Addison Wesley.
4. Managing Global software Projects by Ramesh, 2001, TMH.

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Software Project Management	https://youtu.be/ilHPCbkZLV4?si=swk2REfI1YMaggY8
	Stepwise Project Planning	https://youtu.be/W2EdffbwgcM?si=x7CLBtnWydiaWh3r
Unit-II	Project Evaluation	https://youtu.be/8RuJfk1Xj2U?si=cf2vUFxsYWlC4CGg
	Life cycle models	https://youtu.be/yC0A6_nYPYQ?si=UomwV6gBpilNFL
	Project Scheduling	https://youtu.be/AvwZ7JO8LNk?si=bK1llghcmFkYNMXQ
	Risk Management	https://youtu.be/PehmL5jOmW8?si=jWbx2PPO8jzFyxWW
Unit-III	Resource allocation	https://youtu.be/Sg5eFtcugEA?si=71KLxlFDB-WtBMiY
	Project monitoring & control	https://youtu.be/3Rjj4IyO3hc?si=3b9a2jPq1fX67zvm
Unit-IV	Contract management	https://youtu.be/olrW1tqGnsM?si=udYfA2JcE2Xc7lPe
	Organizational structure	https://youtu.be/MpNjo7bhBTg?si=nOTIoHpqyGB_Zeec
	Software quality management	https://youtu.be/zQXss82WudM?si=NLhhtS397sXZYMpN
	ISO 9000	https://youtu.be/ODQNex8xtjU?si=fE8W_yNv1JzoptIz
	ISO 9126	https://youtu.be/X-3JAyHtSlo?si=-48rGC0RpE7LQfgF

<table>
<tr><td>Course code</td><td colspan="5">CSE-308A</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Digital Image Processing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI (Common for B. Tech. CSE/CSE-AIML/CSE-DS)</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objectives of this course are
To provide knowledge of digital image processing concepts, image representation, and transformation techniques.
To develop understanding of image enhancement, restoration, segmentation, and feature extraction methods.
To enable application of image processing techniques for image analysis and interpretation.
To develop analytical abilities for evaluating image processing algorithms and outcomes.</td></tr>
<tr><td>Assessment</td><td colspan="5">40 Marks</td></tr>
<tr><td>End Semester Examination</td><td colspan="5">60 Marks</td></tr>
<tr><td>Total Marks</td><td colspan="5">100</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Define digital image processing concepts, image models, transformations, enhancement techniques, and feature extraction methods.	Level 1: Remember
CO2	Explain operation of image transformation, enhancement, restoration, compression, segmentation, representation techniques and analysis procedures.	Level 2: Understand
CO3	Apply image processing techniques for image enhancement, segmentation, feature extraction, and analysis.	Level 3 : Apply
CO4	Analyze image processing algorithms, segmentation results, feature representations, and image interpretation outcomes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit-II

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms.
Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering

Unit-III

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-IV

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested Readings:

1. Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods, Pearson, Third Edition, 2010.
2. Fundamentals of Digital Image Processing by Anil K. Jain, Pearson, 2002.
3. Digital Image Processing by Kenneth R. Castleman, Pearson, 2006.
4. Multidimensional Digital Signal Processing by D, E. Dudgeon and RM. Mersereau, Prentice Hall Professional Technical Reference, 1990.
5. Digital Image Processing by William K. Pratt, John Wiley, New York, 2002.

Useful Video Links:

Unit	Topic	NPTEL Video Lecture Link
Unit-I	Introduction to Digital Image Processing	https://digimat.in/nptel/courses/video/117105135/L01.html
	Image Digitalization, Sampling & Quantization	https://digimat.in/nptel/courses/video/117105135/L03.html
	Color Fundamentals & Image Representation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
Unit-II	Histogram Processing	https://digimat.in/nptel/courses/video/117105135/L34.html
	Histogram Equalization & Specification	https://digimat.in/nptel/courses/video/117105135/L35.html
	Fourier Transform – I	https://www.youtube.com/watch?v=11b5NnpEoVE
	Image Transformations & Frequency Domain	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
Unit-III	Image Compression Fundamentals	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_7/7_intro.html
	JPEG Compression	https://onlinecourses-archive.nptel.ac.in/noc18_ee40/preview
	Coding Redundancy & Huffman Coding	https://digimat.in/nptel/courses/video/117105135/117105135.html
Unit-IV	Edge Detection & Boundary Detection	https://digimat.in/nptel/courses/video/117105135/117105135.html
	Thresholding & Segmentation	https://arxiv.org/abs/1909.05084
	Hough Transform & Region Based Segmentation	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
	Boundary Representation & Descriptors	https://archive.nptel.ac.in/content/storage2/courses/117104069/chapter_1/1_intro.html

Course Code	**CSE-310A**				
Category	Professional Elective Courses				
Course Title	**Mobile Application Development**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	0	0	**3**	
Course Objectives	The objectives of this course are • To provide knowledge of mobile operating systems, architectures, development environments, and security mechanisms. • To develop understanding of mobile application frameworks, user interfaces, communication methods, and deployment techniques. • To enable application of mobile development tools and technologies for creating mobile applications. • To develop analytical skills for evaluating mobile application performance, security, communication, and deployment strategies.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	**Skill Demonstrated**	**RBT Level**
CO1	Define mobile operating systems, architectures, development frameworks, communication mechanisms, and security concepts.	Level 1: Remember
CO2	Explain mobile application development processes, development tools, user interface frameworks, communication methods, and deployment techniques.	Level 2: Understand
CO3	Apply mobile development technologies, frameworks, tools, and services to develop mobile applications.	Level 3: Apply
CO4	Analyze mobile application architectures, security mechanisms, resource management techniques, communication protocols, and deployment strategies.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

Unit-II

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments, Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

Unit-III

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

Unit-IV

Android: Introduction to Android, Architecture, memory management, communication
iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

Suggested Readings:

1. Professional Mobile Application Development by Jeff McWherter, Scott Gowell, Wiley India.
2. Android Application Development All-in-One For Dummies by Barry Burd, Wiley Publications.
3. Learning Apache Cordova by John M. Wargo, Addison-Wesley.
4. iOS Programming: The Big Nerd Ranch Guide by Big Nerd Ranch Guides.

Useful Video links:

Unit No.	Topics	Links
Unit-I	Mobile OS, structure, multitasking, memory management, security, multimedia features	https://nptel.ac.in/courses/106106147
Unit-II	Worklight, adapters, debugging, fragments, client technologies, Apache Cordova	https://cordova.apache.org/
Unit-III	Android/iOS development, UI frameworks, authentication, notifications, globalization	https://developer.apple.com/tutorials/
Unit-IV	Android & iOS architecture, memory management, communication protocols, deployment	https://nptel.ac.in/courses/106106147