

D. Y. Patil Education Society
Deemed to Be University
School of Engineering and Management
KASABA BAWADA, KOLHAPUR

Accredited by NAAC with
‘A+’ Grade

Structure and Syllabus (as per NEP)
of
S. Y. B. Tech in Computer Science
Engineering

Department of Computer Science
Engineering

Revised w. e. f. 2024-25

CSE Structure as per NEP

Computer Science and Engineering Structure

Semester -I

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme			
				L	T	P			Type	Max. Marks	Minimum Marks For Passing	
Students Induction Program As Per AICTE Guidelines												
1	230FYL101	BSC	Linear Algebra and Calculus	03	01	--	04	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	230FYL102	BSC	Applied Physics	03	--	--	03	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	230FYL103	ESC	Computer Programming and Problem Solving	03	--	--	03	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	230FYL104	ESC	Elements of Civil Engineering and Mechanics	03	--	--	03	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	230FYL105	ESC	Design Thinking Through Innovation	02	--	--	02	50	ISE	20	20	20
									MSE	30		
6	230FYP106	BSC	Applied Physics Laboratory	--	--	02	01	25	ISE	25	10	10
7	230FYP107	ESC	Computer Programming and Problem Solving Laboratory	--	--	02	01	50	ISE	50	20	20
8	230FYP108	ESC	Elements of Civil Engineering and Mechanics Laboratory	--	--	02	01	25	ISE	25	10	10
9	230FYP109	ESC	Design Thinking Through Innovation Laboratory	--	--	02	01	50	ISE	50	20	20
Total				14	01	08	19	600	--	--	--	--
Mandatory Courses												
1	230FYM119	MC	Rural/Social Internship	--	--	--	--	50	ISE	Grade	--	--
2	230FYM120	MC	Fundamentals of Aptitude and Technical-I	03	--	--	--	50	ISE	Grade	--	--

Semester -II

Sr. No	Course Cod0e	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme			
				L	T	P			Type	Max. Marks	Minimum Marks For Passing	
1	230FYL110	BSC	Differential Equations and Numerical Techniques	03	01	--	04	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	230FYL111	BSC	Applied Chemistry	03	--	--	03	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	230FYL112	ESC	Elements of Electrical and Electronics Engineering	03	--	--	03	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	230FYL113	ESC	Computer Aided Engineering Graphics	03	--	--	03	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	230FYL114	HSMC	Technical Communication	02	--	--	02	50	ISE	20	20	20
									MSE	30		
6	230FYP115	BSC	Applied Chemistry Laboratory	--	--	02	01	25	ISE	25	10	10
7	230FYP116	ESC	Elements of Electrical and Electronics Engineering Laboratory	--	--	02	01	25	ISE	25	10	10
8	230FYP117	ESC	Computer Aided Engineering Graphics Laboratory	--	--	02	01	50	ISE	50	20	20
9	230FYP118	HSMC	Technical Communication Laboratory	--	--	02	01	50	ISE	50	20	20
Total				14	01	08	19	600	--	--	--	--
Mandatory Courses												
1	230FYM121	MC	Capstone Project	--	--	--	--	50	ISE	Grade	--	--
2	230FYM122	MC	Fundamentals of Aptitude and Technical-II	03	--	--	--	50	ISE	Grade	--	--

SEMESTER- IV

Course Code	Course Category	Course Type	Course Name	Teaching Scheme			Theory			Practical		Total Marks	
				Credits	L	P	T	ISE	MSE	ESE	INT		OE/ PoE
23CSEU4P01	Program Core Courses	PCC	Theory of Computation	3	3	-	-	20	30	50	-	-	100
23CSEU4P02			Operating Systems	3	3	-	-	20	30	50	-	-	100
23CSEU4P03			Operating Systems Lab	1	-	2	-	-	-	-	25	25	50
23CSEU4P04			Object Oriented Programming	3	2	2	-	-	-	-	50	50	100
23CSEU4M05	Multidisciplinary Minor	MDM-2	Software Testing	2	2	-	-	20	-	30	-	-	50
23CSEU4V06	Value Education Course	VEC	Environment Study	2	2	-	-	-	-	50	-	-	50
23CSEU4H07	Humanities Social Science and Management	Entrepreneurship/ Economics/ Management course	Leveraging Technology in Project Management and Startup Ventures	2	1	2	-	-	-	-	50	-	50
23CSEU4A08	Ability Enhancement course	AEC	Trending Technology Laboratory	2	-	4	-	-	-	-	50	-	50
23CSEU4O09	Open Elective Course	OEC-II	E-Commerce and Digital Marketing	2	2	-	-	-	-	50	-	-	50
23CSEU4N10	Vocational Skills Enhancement Course	VSEC	Web Technology-I	2	1	2	-	-	-	-	25	25	50
23CSEU4D11	Mandatory Course	MC	Finishing School Training IV	-	2*	-	-	-	-	50	-	-	Grade
23CSEU4C12	Co-Curricular Activities	CCA	Liberal Learning	Audit	2	-	-	-	-	-	50	-	Grade
			Total	22	16	12	-	-	-	-	-	-	650
	Honors Courses/Double (Minor)	HC (Optional)	Honors Paper- I	04	3	1	-	20	30	50		25	125

SEMESTER-V

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MS E	ESE	INT	OE/PoE	
23CSEU5P01	Program Core Courses	PCC	Database Engineering	3	3	-	-	20	30	50	-	-	100
23CSEU5P02			Database Engineering Lab	1	-	2	-	-	-	-	25	25	50
23CSEU5P03			Information Systems Security	3	3	-	-	20	30	50	-	-	100
23CSEU5P04			Smart Phone Application Development	3	2	2	-	-	-	-	25	25	50
23CSEU5P05			Software Engineering	2	2	-	-	20	30	50			100
23CSEU5M06	Multidisciplinary Minor	MDM-3	Test Driven Development	4	3	2	-	20	30	50	25	-	125
23CSEU5O07	Open Elective Course	OCE-III	Cloud Computing	2	2	-	-	-	-	50	-	-	50
23CSEU5E08	Professional Elective	PEC 1	Internet of Things	4	3	2	-	20	30	50	25	-	125
23CSEU5E09			Computer Graphics and Multimedia Techniques	4	3	2	-	20	30	50	25	-	125
23CSEU5E10			Introduction to AIML	4	3	2	-	20	30	50	25	-	125
23CSEU5D11	Mandatory Course	MC	Finishing School Training-V	-	3*	-	-	-	-	-	-	-	Grade
23CSEU5C12	Co-Curricular Activities	CCA	Liberal Learning	Audit	2	-	-	-	-	-	50	-	Grade
			Total	22	17	10	-	-	-	-	-	-	650
	Honors Courses/Double (Minor)	HC (Optional)	Honors Paper- II (ODL)	04	3	1	-	20	30	50	25		125

SEMESTER- VI

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/ PoE	
23CSEU6P01	Program Core Courses	PCC	System Programming & Compiler Construction	3	3	-	-	20	30	50	-	-	100
23CSEU6P02			Cloud Computing	3	3	-	-	20	30	50	-	-	100
23CSEU6P03			Cloud Computing Lab	1	-	2	-	-	-	-	25	25	50
23CSEU6P04			Web Technology-II	3	2	2	-	-	-	-	50	50	100
23CSEU6M05	Multidisciplinary Minor	MDM-4	Web Testing	2	1	2	-	-	-	-	50	-	50
23CSEU6E06	Professional Elective	PEC-2	Programming Paradigms	4	3	2	-	20	30	50	25	-	125
23CSEU6E07			Ethical Hacking	4	3	2	-	20	30	50	25	-	125
23CSEU6E08			Image Processing	4	3	2	-	20	30	50	25	-	125
23CSEU6E09		PEC-3	FOSS Tools	4	3	2	-	20	30	50	25	-	125
23CSEU6E10			Blockchain Technology	4	3	2	-	20	30	50	25	-	125
23CSEU6E11			Augmented Reality/ Virtual Reality	4	3	2	-	20	30	50	25	-	125
23CSEU6N12	Vocational Skills Enhancement Course	VSEC	Project management Tools	2	1	2	-	-	-	-	25	25	50
23CSEU6D13	Mandatory Course	MC	Finishing School Training -VI	-	3*	-	-	50	-	-	-	-	Grade
23CSEU6C14	Co-Curricular Activities	CCA	Liberal Learning	Audit	2	-	-	-	-	-	50	-	Grade
			Total	22	16	12	-	-	-	-	-	-	700
	Honors Courses/Double (Minor)	HC (Optional)	Honors Paper- III	04	3	1	-	20	30	50	25	-	125

SEMESTER-VII

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MS E	ESE	INT	OE/PoE	
23CSEU7P01	Program Core Courses	PCC	Advanced Database Systems	3	2	2	-	20	30	50	25	-	125
23CSEU7P02			Software Testing and Quality Assurance	3	2	2	-	-	-	-	25	50	75
23CSEU7M03	Multidisciplinary Minor	MDM-5	API Testing	2	2	-	-	-	-	-	50	-	50
23CSEU7R04	Research Methodology	RM	Research Methodology (ODL Only*)	4	2\$	-	-	20	30	50	-	-	100
23CSEU7E05	Professional Elective	PEC-4	Cyber Security and Forensic	3	3	-	-	20	30	50	-	-	100
23CSEU7E06			Artificial Neural Network	3	3	-	-	20	30	50	-	-	100
23CSEU7E07		PEC-5	Mobile Technology	3	3	-	-	20	30	50	-	-	100
23CSEU7E08			Business Intelligence and Analysis	3	3	-	-	20	30	50	-	-	100
23CSEU7E09			Software Defined Network	3	3	-	-	20	30	50	-	-	100
23CSEU7E10			Computer Vision	3	3	-	-	20	30	50	-	-	100
23CSEU7J11	Project	PR	Project	4	-	8	-	-	-	-	75	75	150
23CSEU7C12	Co-Curricular Activities	CCA	Liberal Learning	Audit	2	-	-	-	-	-	50	-	Grade
			Total	22	14	6	-	125	150	225	175	125	700
	Honors Courses/Double (Minor)	HC (Optional)	Honors Paper- IV	04	3	1	-	20	30	50	25	-	125

SEMESTER- VIII

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/ PoE	
23CSEU8P01	Program Core Courses	PCC	Natural Language Processing (ODL only*)	4	2\$	-	-	20	30	50	25	-	125
23CSEU8E02	Professional Elective	PEC-6	Real Time Operating Systems (ODL only*)	2	1\$	-	-	-	-	50	-	-	50
23CSEU8E03			Deep Learning (ODL only*)	2	1\$	-	-	-	-	50	-	-	50
23CSEU8E04			Digital Forensic and Incident response (ODL only*)	2	1\$	-	-	-	-	50	-	-	50
23CSEU8I05	Internship	INT	Internship	12	-	2#	-	-	-	-	100	300	400
23CSEU8M06	Multidisciplinary Minor	MDM-6	Capstone Project	2	2	-	-	-	-	-	25	25	50
			Total	20	4	2	-	20	30	150	100	325	625
	Honors Courses/Double (Minor)	HC (Optional)	ODL- Honors Paper- V	02	2	2	2	-	20	30	-	-	50

Co-Curricular Activities (CCA)- Liberal learning

Central Level	
Sr. No.	Name of Activity
1	Higher Education Club, Adventure Club
2	Music (Vocal), Music (Instrumental)
3	NCC
4	Astronomy Club
5	NSS
6	Yoga, Health and Fitness Club
7	Foreign Language Club (German/French)
8	Photography Club
9	Movie Club
10	Innovation Cell
11	Art, Craft and Culture Club
Department Level	
Sr. No.	Name of Activity
1	Coding Club /Community
	Professional Certificate Club
	Techno Club
	Cloud Practionerclub
	Cyber Security Club
	Web Development Club
	Animation Club
	Technical ContentRecording Club
	Startup club
	Treading with Technology Club
	Entrepreneurship club
	ARVR Club
	Learn abroad club
	Internship club

Open Electives Courses:

Department –Computer Science and Engineering												
Category	Course Code	Course Name	Teaching Scheme				Theory			Practical		Total Marks
			Credits	L	P	T	ISE	MS E	ESE	INT	OE/PoE	
OEC1 (ODL Only)	232CSELOEC101	Python Programming (ODL Only)	4	2\$	-	-	20	30	50	25	-	125
OEC2	232CSELOEC106	E-Commerce and Digital Marketing	2	2	-	-	-	-	50	-	-	50
OEC3	233CSELOEC108	Cloud Computing	2	2	-	-	-	-	50	-	-	50

5.4 Indicative list for Honors Courses:

1. Cyber Security
2. AI/ML

Department –CSE Cyber Security											
Category	Course Name	Teaching Scheme				Theory			Practical		Total Marks
		Credits	L	P	T	ISE	MS E	ESE	INT	OE/ PoE	
HC1	Fundamentals of Cyber security	04	3	1	-	20	30	50	25	-	125
HC2	Data Security Systems	04	3	1	-	20	30	50	25	-	125
HC3	Ethical Hacking	04	3	1	-	20	30	50	25	-	125
HC4	Cyber-crime and Laws	04	3	1	-	20	30	50	25	-	125
HC5	Digital Forensic and Incident response	02	2	-	-	-	20	30	-	-	50

Department –CSE AI/ML											
Category	Course Name	Teaching Scheme				Theory			Practical		Total Marks
		Credits	L	P	T	ISE	MSE	ESE	INT	OE/ PoE	
HC1	Mathematical Foundations for AI/ML	04	3	1	-	20	30	50	25	-	125
HC2	Introduction to AI/ML	04	3	1	-	20	30	50	25	-	125
HC3	Artificial Neural Networks	04	3	1	-	20	30	50	25	-	125
HC4	Deep Learning	04	3	1	-	20	30	50	25	-	125
HC5	Natural Language Processing	02	2	-	-	-	20	30	-	-	50

Semester III

Course Code:	23CSEU3P01		L	T	P	Credit
Course Name:	Discrete Mathematical Structures		3			3

Course Prerequisites:

1. Mathematics - Probability theory, Set theory, functions

Course Description:

This Course consists of concepts of Discrete mathematical structures such as mathematical logic, Sets, relations, functions, lattices and Boolean algebra, combinatorics and graph theory.

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

CO1	Explain the basic concepts of discrete mathematical structures
CO2	Demonstrate the applications of discrete structures in different fields of computer science.
CO3	Solve problems using the concepts of Discrete structures.
CO4	Apply the mathematical proofs and techniques to prove the theorems in computer science.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				1									
CO2	2			1	2	1						1	1	
CO3	2	2	2	1	1									
CO4	2	1	1	1	1	1								
CO5														

Assessment Scheme:

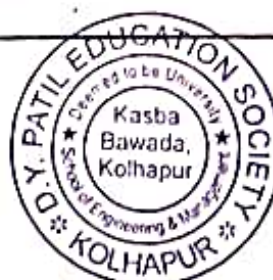
SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Handwritten signature

Course Contents:

Unit 1	Mathematical logic	8 Hours
1.1 Statements and Notations 1.2 Connectives , Statement formulas and truth tables, well formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connectives 1.3 Normal and principal normal forms, completely parenthesized infix and polish notations 1.4 Theory of Inference for statement calculus – validity using truth table, rules of inference, consistency of Premises and indirect method of proof, Predicate calculus		
Unit 2	Set theory	8 Hours
2.1 Basic concepts of set theory, Operations on sets, Ordered pairs, Cartesian Products 2.2 Representation of discrete structures 2.3 Relation and ordering - properties of binary relations in a set, Relation matrix and the graph of a relation, Partition and Covering of set, Equivalence relations, Recurrence relations, Composition of Binary relations, Partial ordering , POSET and Hasse diagram. 2.4 Functions – types, composition of functions, Inverse functions.		
Unit 3	Algebraic systems	5 Hours
3.1 Algebraic systems, properties and examples 3.2 Semigroups and Monoids, properties and examples, Homomorphism of Semigroups and Monoids 3.3 Groups: Definition and examples, Subgroups and homomorphism		
Unit 4		5 Hours
4.1 Lattice as POSETs , definition , examples and properties 4.2 Lattice as algebraic systems, Special lattices 4.3 Boolean algebra definition and examples 4.4 Boolean functions		
Unit 5	Permutations, Combinations and Probability theory	7 Hours
5.1 The Basics of Counting 5.2 The Pigeonhole Principle 5.3 Permutations and Combinations 5.4 Generalized Permutations and Combinations 5.5 Discrete Probability 5.6 Conditional probability 5.7 Bayes' Theorem		
Unit 6	Graphs	7 Hours



[Handwritten signature]

- 6.1 Introduction to Graphs
- 6.2 Graph Terminology
- 6.3 Representing Graphs and Graph Isomorphism
- 6.4 Connectivity
- 6.5 Euler and Hamilton Paths
- 6.6 Planar Graphs
- 6.7 Introduction to Trees

Text Books:

1. Discrete Mathematical Structures with Application to Computer Science - J. P. Tremblay & R. Manohar (MGH International)
2. Discrete Mathematics and its Applications - Kenneth H. Rosen (AT&T Bell Labs) (mhhe.com/rosen)

Reference Books:

1. Discrete Mathematics - Seymour Lipschutz, Marc Lipson (MGH), Schaum's outlines.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", SiE Edition, TataMcGrawHill, 2008, ISBN 10:0-07-066913-9
3. Schaums Solved Problem Series – Lipschutz.
4. Discrete Mathematical Structures – Bernard Kolman, Robert Busby, S.C. Ross and Nadeemur Rehman (Pearson Education)



Course Code:	23CSEU3P02
Course Name:	Computer Network

L	T	P	Credit
3			3

Course Prerequisites:

1. Must have basic knowledge of Communication Technology

Course Description:

This course provides a solid understanding of OSI reference model and TCP/IP protocol suite. Also

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

CO1	Define different concepts of OSI/TCP/IP network models and physical layer.
CO2	Make use of framing, error control, flow control and medium access control techniques.
CO3	Explain IP addresses, IP protocols, types of routing algorithm and congestion control techniques.
CO4	Illustrate process to process communication, multiplexing and transport layer protocols.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2								1		2	1	
CO2	2	2			2				1	2				
CO3	1	1	2	1	3							1		2
CO4	2	2		1	1								1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Handwritten signature

Course Contents:

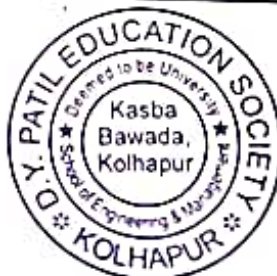
Unit 1	Introduction to Network	5 Hours
Data Communication, , Networks, Internet, Protocols and Standards, Layered Task, OSI Model and Layers, TCP/IP Protocol Suite, Addressing, Physical Layer and Media		
Unit 2	Data Link Control Layer	9 Hours
Error Detection and Correction, Block Coding, Linear Block Codes, Cyclic Codes, Checksum, Data Link Control: Framing, Flow and Error Control, Protocols: Noiseless channels, Noisy Channels		
Unit 3	Medium Access Control Sub layer	7 Hours
Channel allocation Problem, Multiple Access Protocols: ALHOA, CSMA, Collision free protocols, Limited contention protocols IEEE Standard 802 for LANS and MANS, Bridges, Introduction to VLANS		
Unit 4	Network Layer	8 Hours
Network Layer Design Issues Routing Algorithms : Shortest Path, Flooding, Distance Vector, Link State, Broadcast IP, ARP, RARP, ICMP. Congestion control algorithms: Principles, Congestion prevention policies, Traffic Shaping, congestion control in datagram subnet, Choke Packet, Load Shedding, Jitter Control, IPv4 Addresses : Introduction, Classfull and Classless addressing, Special Addresses and NAT.		
Unit 5	Transport Layer	4 Hours
Transport Layer functions, UDP- datagram, services, applications, TCP - services, segment, connection, state transition diagram, Flow control, congestion control, error control, timers.		
Unit 6	Application Layer	9 Hours
DHCP: Introduction, DHCP operation, Packet Format, DHCP Configuration, DNS: Need, Name Space, Domain Name Space, Distribution of name space, and DNS in internet, Resolution, DNS messages, Types of records, Compression examples, encapsulation. Telnet and SSH, FTP and TFTP, HTTP and SMTP, SNMP: Concept and Management Component, SMI, MIB, SNMP, UDP Port and Security		

Text Books:

1. Data Communications and Networking – Behrouz A Forouzan (The McGraw Hill) (Unit 1,2,3)
2. Computer Networks – Andrew S. Tanenbaum- (Prentice Hall) 5th Edition (Unit 3, 4)
3. TCP/IP Protocol Suite- Behrouz Forouzan-(The McGraw Hill) (4,5,6)

Reference Books:

1. Computer Networking with Internet Protocols and Technology, William Stallings (Prentice Hall)



[Handwritten signature]

Course Code:	23CSEU3P03
Course Name:	Computer Network Lab

L	T	P	Credits
		2	1

Course Prerequisites:

1. Must have basic knowledge of computers and LINUX/UNIX-based operating system

Course Description:

This course provides a solid understanding of implementation of different framing, error control, flow control and routing algorithms.
 Help students to design network as per the requirement. Students can develop client server application using socket API and make them understand different application layer protocol with help of simulation and demonstration.

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

CO1	Build sample network and VLAN as per the organization requirements.
CO2	Develop software programs for framing, error control, flow control and routing algorithms.
CO3	Make use of socket API to develop client-server programs.
CO4	Inspect working of different types of application layer protocols from TCP/IP protocol suite.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2								1		2	1	
CO2	2	2			2				1	2				
CO3	1	1	2	1	3							1		2
CO4	2	2		1	1								1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	100%	Experiment, Practical Performance and Oral Exam etc.
2	Practical Oral Exam (ESE)	100%	Practical Performance and Oral Exam



[Handwritten signature]

Course Contents:

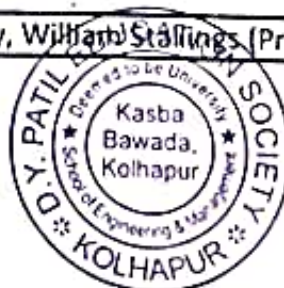
Experiment 1: Demonstration of networking commands	2 Hours
Experiment 2: Design and simulation of sample network	2 Hours
Experiment 3: Implementation of framing techniques A) Character count B) Bit stuffing	2 Hours
Experiment 4: Implementation of Error control mechanisms A) CRC B) Hamming Code	2 Hours
Experiment 5: Implementation of Flow control mechanisms A) Stop and wait ARQ B) Go Back N C) Selective repeat	2 Hours
Experiment 6: Design and simulate working of Virtual LAN	2 Hours
Experiment 7: Implementation of Routing algorithm A) Shortest path routing B) Distance vector routing	2 Hours
Experiment 8: Implementation of Client-Server model A) Simple client-server model B) Iterative client-server model C) Concurrent client-server model	2 Hours
Experiment 9: Simulation of application layer protocol	2 Hours
Experiment 10: Installation and Configuration of FOSS server	2 Hours

Text Books:

1. Data Communications and Networking – Behrouz A Forouzan (The McGraw Hill) (Unit 1,2,3)
2. Computer Networks – Andrew S. Tanenbaum- (Prentice Hall) 5th Edition (Unit 3, 4)
3. TCP/IP Protocol Suite- Behrouz Forouzan-(The McGraw Hill) (4,5,6)

Reference Books:

1. Computer Networking with Internet Protocols and Technology, William Stallings (Prentice Hall)



Course Code:	
Course Name:	Data Structures and Algorithms

L	T	P	Credit
2		2	3

Course Prerequisites:

1. Basic Knowledge of C2. Basic mathematical Approach

Course Description:

The course is designed to develop skills to design and analyze simple linear and non linear data structures. It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures

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

CO1	Illustrate the concepts of Data Structures
CO2	Identify the appropriate data structure for specific application
CO3	Choose appropriate sorting and searching algorithms.
CO4	Outline the solution to the given software problem with appropriate data structure

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	2	3	2	2	2				1					1
CO3	1	1	2	2	2				1					1
CO4	1	3	1	2	1				1					3
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ES)	50%	Practical Oral Exam



[Handwritten signature]

Course Contents:

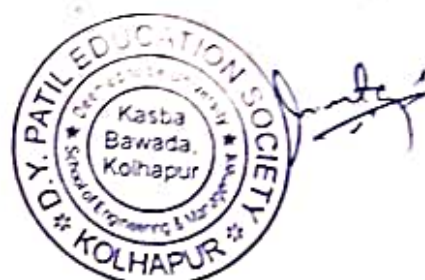
Unit 1	Introduction to Data Structures	4 Hours
Structures in C, Pointers in C, Data structure- Definition, Types of data structures, Data Structure Operations, Algorithms: Complexity, Time and Space complexity.		
Unit 2	Stacks and Queues	4 Hours
Stack: Definition, operations, Array representation of stack, applications Queue: Definition, operations, Array representation of queue, applications, Circular queue, Priority queue, Deque.		
Unit 3	Linked Lists	5 Hours
Definition, representation, operations, implementation and applications of singly, doubly and circular linked lists. Linked representation of stack and Queue.		
Unit 4	Trees	5 Hours
Terminology, representation, binary tree, traversal methods, binary search tree, AVL tree (Introduction), Heaps- Operations and their applications		
Unit 5	Graphs	4 Hours
Basic concept of graph theory, storage representation, graph traversal techniques- BFS and DFS		
Unit 6	Searching and Sorting Techniques	4 Hours
Searching: Linear search, Binary search Sorting: Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Heap Sort Complexity and analysis of Searching and Sorting Algorithms		

Text Books:

1. Schaum's Outlines Data Structures – Seymour Lipschutz (MGH)
2. Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2nd Edition

Reference Books:

1. Data Structure using C- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI)
2. Fundamentals of Data Structures - Horowitz, Sahani (CBS India)



List of Experiments:

1. Basic C Programs based on data types, decision control, and arrays
2. C Program based on structure
3. C program based on pointers
4. Write a C program to implement operations on Stack using array
5. Write a C program to implement operations on Linear Queue using array
6. Write a C program to implement operations on Circular Queue using array
7. Write a C program to implement operations on Singly Linked list
8. Write a C program to implement operations on Doubly Linked list
9. Write a C program to implement operations on Circular Linked list
10. Write a C program to implement Searching Techniques
11. Write a C program to implement sorting Techniques
12. Write a C program to implement BST and its traversal



A handwritten signature in black ink, appearing to be "J. S. Patil".

Course Code:	23CSEU3F05
Course Name:	Community Engagement Project

L	T	P	Credit
		4	2

Course Prerequisites:

1. Basic Knowledge of Computer programming

Course Description:

This course aims to engage students in understanding the issues faced by rural areas in India and equipping them with the knowledge of computer science and e-services provided by the Government of India to address these issues. Through group projects, presentations, and practical demonstrations, students will develop a deeper understanding of community service and the use of technology in addressing societal challenges.

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

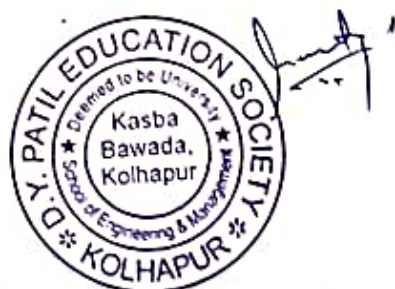
CO1	Identify the real life problem in rural areas of India
CO2	Work effectively in groups while collecting data, preparing presentations and videos on the identified project
CO3	Apply classroom knowledge to identify and solve the problems of people in nearby community.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1								3					
CO2	1	2	2		2	1			3	3			2	1
CO3	1	1	2		2			2	3		2		2	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (INT)	50%	Demo, Seminar, Presentation, etc.
2	End Semester Examination (ESE)	50%	Practical Oral Exam



Course Contents:**Unit 1 | Introduction to Community engagement projects and common people issues.**

Introduction to Community engagement projects and common people issues.
Identify common problems in rural areas
Case studies and discussions on successful community service initiatives.

Unit 2 | Introduction to HTML

What is HTML?, Features of HTML, HTML Elements and Tags, HTML Page Structure, Web Browsers, Why learn HTML?, Advantages and Disadvantages of HTML, HTML Editors (Notepad, Brackets, Sublime Text Editor, Atom, Visual Studio Code), HTML Basics, HTML Elements, Attributes, Heading, Paragraph, Text Formatting, colors, Hyperlink, Image, Tables, List, div, class, id, HTML Favicon, Iframes, Layout, HTML events, HTML 5, HTML form, HTML API (Geolocation API)

Unit 3 | Introduction to CSS

CSS Fundamentals: CSS Syntax, Ruleset, Selectors, Combinators, Box model, Layout, lists, table, image gallery, CSS Styling: Fonts, colors, Background, borders, Grid, images, list, counters, columns, conditional rules, logical properties, CSS Responsive Design

Unit 4 | Introduction to Bootstrap 5

Introduction, Layout, Content, Forms, Forms Layout, Components, Helpers, Utilities
Introduction to Joomla & Wordpress CMS,
Web Hosting Basics

Unit 5 | Guidelines

The Project should be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The group will select a project with the approval from the domain expert panel and submit the name of the project with a synopsis. The Project should consist of defining the problem and analyzing it, designing the solution and implementing it using a suitable programming language. A presentation and demonstration based on the above work is to be given by the group for ISE. The work will be jointly assessed twice in a semester by an internal domain expert panel. A hard copy of project report of the work done is to be submitted along with the softcopy of the project during ESE.

Assessment:

Participation in group activities: 20%

Group project development and presentations: 40%

Project demonstration: 10%

Final reflection of the work: 30%

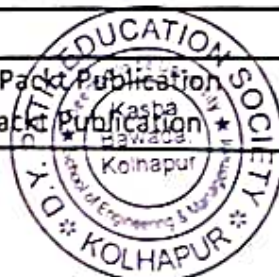
Note: Two practical sessions of 2 hours per week will be dedicated to project development, research, and hands-on training

Text Books:

1. HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell
2. Pro HTML5 and CSS3 Design Patterns by Michael Bowers, Dionysios Synodinos and Victor Sumner, Apress edition

Reference Books:

1. Responsive Web Design with HTML5 and CSS3 by Ben Frain, Packt Publication
2. Twitter Bootstrap Development How to by David Cochran, Packt Publication



Course Code:	23CSEU3M06	L	T	P	Credit
Course Name:	Software Engineering	2			2

Course Prerequisites:

Problem Solving Using C

Course Description:

This course gives you fundamentals of software development in the current IT industry. The fundamentals are divided into different parts. The first part deals with different software models followed for development of software. The subsequent parts deals with requirement specification, software design with UML, coding and testing respectively. You will get complete insight of software development process which will help you a lot in your career in IT industry

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

CO1	Summarize the basic processes of software development and various SDLC models.
CO2	Analyze software requirements analysis and formulate design solution for a software.
CO3	Apply new software design techniques and technologies to bring out innovative solutions for the social problems evolving into their continuous professional development.
CO4	Use knowledge of software testing approaches for verification and validation.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1										2			
CO2		1	2		1				3	3	1		1	2
CO3		1	1		2			1	3	3	2	3	3	2
CO4	1	1	1		2			1	3	2		3	3	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	40%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	60%	100% course contents



[Handwritten Signature]

Course Contents:

Unit 1	Software and Software Process	5 Hours
The Problem Domain, SE Challenges, SE Approaches, Software Process, Desired Characteristics of a Software Process, Software Development Process Models- Waterfall Model, Prototype Methodology, Agile Software Development Methodology, Rapid Application Development (RAD), Dynamic Systems Development Model Methodology, Spiral Model, Extreme Programming Methodology, Feature Driven Development.		
Unit 2	Software Requirement Analysis and Specifications	4 Hours
Software Requirements, Problem Analysis, Requirements Specification, Functional Specifications with use cases, Validation, Metrics		
Unit 3	Software Design Approaches	6 Hours
Design Principles, Module-Level Concepts, Design Notation and Specification, Structured Design Methodology, OO Analysis and OO Design, OO Concepts, Design Concepts		
Unit 4	UML Structural Modeling	4 Hours
Classes, Relationship, Common Mechanics, Diagrams and Class Diagrams, Advanced Classes, Advanced Relationships, Interfaces, Types, and Roles, Packages, Instances and Object Diagram		
Unit 5	UML Behavioral and Architectural Modeling	5 Hours
Behavioral: Interactions, Use Cases, Use Case Diagrams, Interaction Diagrams, Activity Diagrams Architectural: Components, Deployment, Collaborations, Patterns and Frameworks, Component Diagrams, Deployment Diagrams		
Unit 6	Coding and Testing	4 Hours
Programming Principles and Guidelines, Coding Process, Refactoring, Verification, Metrics, Testing Fundamentals, Black-Box Testing, White-Box Testing.		

Text Books:

1. An Integrated approach to Software Engineering' –Pankaj Jalote, 3rd Edition, Narosa Publication. (1,2,3,6)
2. UML User Guide- Grady Booch, James Rumbaugh, Publisher: Addison Wesley (4,5)

Reference Books:

1. Software Engineering- A Practitioner's Approach – Roger S. Pressman (TMH) , ISBN-13: 978-0071267823 ISBN-10:0071267824
2. Software Engineering- Ian Sommerville – Pearson, 10th Edition, ISBN-13: 9780137503148
3. Software Engineering, Kogent Learning Solutions Inc., Dreamtech Press India Pvt. Ltd, ISBN: 9789350042663, 9789350042663



Course Code:	23CSEU3V08
Course Name:	Programing Ethics Through Python

L	T	P	Credit
1		2	2

Course Prerequisites:	Basic Knowledge of computers
-----------------------	------------------------------

Course Description:	This subject covers basic principles of programming and programming ethics through the python programming language.
---------------------	---

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Study Programming Ethics.
CO2	Demonstrate use of decision and repetition structure in order to solve specific problem
CO3	Model a given big problem statement in to smaller parts to provide modular approach.
CO4	Choose proper data structure like list, tuples, dictionaries etc. for solving given problem

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

Assessment Scheme:			
SN	Assessment	Weightage	Remark
1	INT	100%	



[Handwritten signature]

Course Contents:

Unit 1	An Overview of Programing Ethics	3 Hours
Introduction to Ethics in Programming, What is an Ethics, Importance of ethics in programming, Ethical Issues in Technology: privacy, security, bias, and social implications of technology. Ethics in Software Development		
Unit 2	Introduction to Python and Decision Structures	4 Hours
Input, Processing, and Output: Introduction to programming and Python, Basic syntax, Displaying Output with the print Function, Comments, Variables, Operators, Reading Input from the Keyboard, Performing Calculations		
Decision Structures: The if Statement, The if-else Statement, Comparing Strings, Nested Decision Structures, and the if-elif-else Statement		
Unit 3	Repetition Structures and Functions	4 Hours
Repetition Structures: Introduction to Repetition Structures, The while Loop: A ConditionControlled Loop, The for Loop: A Count-Controlled Loop, Calculating a Running Total, Sentinels, Input Validation Loops, Nested Loops		
Functions: Introduction to Functions, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Introduction to Value Returning Functions		
Unit 4	Python Datastructures and String	5 Hours
Lists and Tuples: Sequences, Introduction to Lists, List Slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, TwoDimensional Lists, Tuples,		
Dictionaries and Sets: Operations and use.		
Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.		

Text Books:

1. Ethics for the Information Age 6th edition Michael J. Quinn
2. Starting Out with Python 5th Tony Gaddis Pearson March 17th 2021
3. Core Python Programming 3rd R. Nageswara Rao Dreamtech Press 1 Jan 2018

Reference Books:

1. Python: The Complete Reference Indian Edition Martin C. Brown MGH March 2018

Experiment List

1. Writing hello world program in compiled and interpreted language & understanding the difference between compilation and interpretation.
2. Program to perform demonstration of input and output operation.
3. Program based on different types of operators.
4. Program based on the decision structures(if, If else, nested if else, if elif else)
5. Program to demonstrate use of different types of looping statements.
6. Program to write and use different types of user defined function
7. Programs to demonstrate use of various built in functions in python,
8. Program demonstrating operations and use of List and Touple
9. Program demonstrating operations and use of Dictionary and set.
10. Program to perform CURD operations in file using file handling .



A handwritten signature in black ink, appearing to be "J. Patil".

Course Code:	23CSEU3009
Course Name:	OEC-1: Python Programming (ODL)

L	T	P	Credit
2	0	2	3

Course Prerequisites:	Nil
-----------------------	-----

Course Description:	This is ODL course, students are supposed to select 12 week course from NPTEL Swayam. The
---------------------	---

Course Outcomes:	After the completion of the course the student will be able to -
CO1	explain basic programming concepts like data types, variables, control structures, loops, functions.
CO2	write correct Python code using variables, data types, and basic operations.
CO3	effectively utilize Python's core data structures (lists, tuples, dictionaries, and sets) to store, retrieve, and manipulate data.
CO4	create reusable code modules, demonstrating an understanding of code organization and modularity principles.

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

Assessment Scheme:			
SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



[Handwritten signature]

Course Contents:

Unit 1	Introduction to Python Programming	5 Hours
Overview of Python, Features and benefits of Python, Setting Up the Environment, Understanding the Python interpreter Data Types and Variables: Basic Data Types - Integers, floats, strings, and Booleans, Variables and Constants, Naming conventions and rules, Dynamic typing, Basic Operations, Arithmetic operations, String manipulation and methods, Type Conversion, Converting between data types.		
Unit 2	Control Structures	5 Hours
Conditional Statements- If, elif, and else statements, Nested conditions Loops - While loops, For loops, Break and continue statements, Iterating Over Collections		
Unit 3	Python Data Structures	6 Hours
Lists - Creating, accessing, and modifying lists, List methods and functions Tuples - Understanding immutability, Tuple operations Dictionaries - Key-value pairs, accessing and modifying, Dictionary methods and use cases Sets - Basic set operations and use cases		
Unit 4	Functions and Modules	4 Hours
Defining Functions, Function syntax and parameters, Return statements, Scope and Lifetime of Variables, Local vs. global variables, Commonly used built-in functions Modules and Libraries - Importing and using modules, Overview of standard libraries (math, random, datetime)		
Unit 5	File Handling and Exception Management	4 Hours
File Operations - Reading from and writing to files, Working with different file formats (text, CSV) Exception Handling - Understanding exceptions and errors, Try, except, finally blocks, Best Practices for Error Handling, Raising exceptions		

Text Books:

1. "Python Crash Course" by Eric Matthes
2. "Head First Python" by Paul Barry

Reference Books:

1. "Python for Everybody: Exploring Data in Python 3" by Charles Severance



Course Code:	23CSEU3H10
Course Name:	Intellectual Property Rights

L	T	P	Credit
2			2

Course Prerequisites:

Basic understanding of Intellectual Properties, Patents, Trademarks, Copyrights and designs.

Course Description:

Intellectual property rights (IPR) refers to the legal rights given to the inventor or creator to protect his invention or creation for a certain period of time. These legal rights confer an exclusive right to the inventor/creator or his assignee to fully utilize his invention/creation for a given period of time.

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

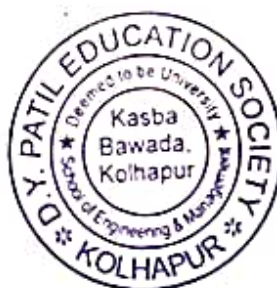
CO1	To Understand importance of Intellectual Property right
CO2	To Demonstrate filing procedure of patents & copy write
CO3	To Demonstrate Registration procedure of Trademark & Design.
CO4	To Understand IT Act for Intellectual property Right

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2														
CO3														
CO4														
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents



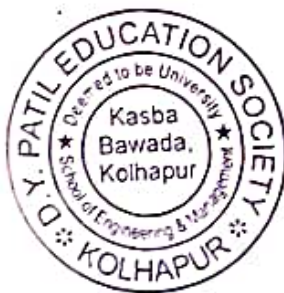
Handwritten signature

Course Contents:

Unit 1	INTRODUCTION TO IPR	3 Hours
Meaning of property, Meaning of Intellectual Property Rights, Kinds of Intellectual property rights— Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication.		
Unit 2	PATENT RIGHTS AND COPY RIGHTS	4 Hours
Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence. COPY RIGHT—Origin, Definition &Types of Copy Right, Registration procedure, Assignment & licence, Terms of Copy Right, Piracy.		
Unit 3	TRADE MARKS	4 Hours
Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties.		
Unit 4	DESIGN, Patent Acts in India	5 Hours
Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. patent Act 1950 &1970 – amendments of 1999, 2000, 2002 and 2005. Patentability criteria, non patentable inventions		

Text Books:

1. Intellectual Property Rights and the Law, Gogia Law Agency, by Dr. G.B. Reddy
2. Intellectual Property A Primer for Academia, Prof. Rupinder Tewari, Bureau Panjab University Chandigarh.
3. IPR by P. Narayanan
4. Law of Intellectual Property, Asian Law House, Dr.S.R. Myneni.



Semester IV

Course Code:	23CSEU4P01
Course Name:	Theory of Computation

L	T	P	Credit
3			3

Course Prerequisites:

1. Discrete Mathematics, Sets, Cartesian Product and Functions

Course Description:

This course deals with the theoretical background of computer science.

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

CO1	Explain types of formal languages and their acceptors.
CO2	Classify formal languages on the basis of their features.
CO3	Relate the computational models with the modern day computer technologies.
CO4	Design computational machines of various types for specified problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			1									
CO2	2	2		1	3									
CO3	2	2	2	2	2									2
CO4	2	1	2	1	1	1								3
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Handwritten signature



Course Contents:

Unit 1	Mathematical Induction, Regular Languages & Finite Automata	8 Hours
The Principle of Mathematical Induction Recursive Definitions, Definition & types of grammars & languages, Regular expressions and corresponding regular languages, examples and applications, unions, intersection & complements of regular languages, Finite automata-definition and representation, on-deterministic F.A.,NFA with null transitions, Equivalence of FA's , NFA's and NFA's with null transitions.		
Unit 2	Kleene's Theorem	4 Hours
Part I & II statements and proofs, minimum state of FA for a regular language, minimizing number of states in Finite Automata.		
Unit 3	Grammars and Languages	10 Hours
Derivation and ambiguity, BNF & CNF notations, Union, Concatenation and *'s of CFLs, Eliminating production & unit productions from CFG, Eliminating useless variables from a context Free Grammar. Parsing: Top-Down, Recursive Descent and Bottom-Up Parsing		
Unit 4	Push Down Automata	4 Hours
Definition, Deterministic PDA & types of acceptance, Equivalence of CFG's & PDA's.		
Unit 5	CFL's and non CFL's	4 Hours
Pumping Lemma and examples, intersections and complements		
Unit 6	Turing Machines	10 Hours
Models of computation, definition of Turing Machine as Language acceptors, combining Turing Machines, Computing a function with a TM, Non-deterministic TM and Universal TM, Recursively enumerable languages,Unsolvable problems.		

Text Books:

- 1.Introduction to languages & Theory of computations – John C. Martin (MGH) –Chapters 1,2,3,4,5,6,7,8
- 2.Discrete Mathematical Structures with applications to Computer Science—J .P.Trembley &R.Manohar"

Reference Books:

- 1.Introduction to Automata Theory , Languages and computation – John E. Hopcraft , Rajeev Motwani, Jeffrey D. Ullman (Pearson Edition).
- 2.Introduction to Theory of Computations – Michael Sipser (Thomson Brooks / Cole)
- 3.Theory Of Computation- Vivek Kulkarni, 1st edition OXFORD university Press
- 4.Theory Of Computation A problem Solving Approach Kavi Mahesh Wiley India



Course Code:	23CSEU4P02
Course Name:	Operating Systems

L	T	P	Credit
3			3

Course Prerequisites:	Fundamentals of Electronics and Computer
-----------------------	--

Course Description:	This is one of the core course of Computer Science & Engineering Programme. In this course you will
---------------------	---

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Describe the basic concepts of operating systems.
CO2	Evaluate the performance of various scheduling & page replacement algorithms.
CO3	Distinguish techniques of inter process communication and synchronization.
CO4	Identify potential deadlock situations and propose appropriate strategies to handle or avoid d

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

Assessment Scheme:			
SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



[Handwritten signature]

Course Contents:		
Unit 1	Introduction	5 Hours
Introduction to OS, OS Structure, Types of OS, OS Kernel, OS Services, Users Perspective of OS, System Boot Process, Architecture of UNIX OS		
Unit 2	Process, Threads & Scheduling	7 Hours
Process: Concept, States and Transitions, Context, Creation (fork), Termination (exit), Signals (signal, kill), Awaiting Process Termination(wait, waitpid), Invoking other programs (exec), Threads (pthreads) Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.		
Unit 3	Interprocess Communication	6 Hours
Inter-Process Communication - Pipe, Shared Memory, Message Passing		
Unit 4	Process Synchronization	7 Hours
Inter-Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization		
Unit 5	Deadlocks	6 Hours
Deadlock: System Model; Deadlock Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from Deadlock		
Unit 6	Memory Management	8 Hours
Memory background, Hierarchy, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.		

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
2. Operating Systems –Concepts and design –Milan Milenkovic (TMGH)

Reference Books:

1. The Design of Unix Operating System - Maurice J. Bach (PHI)
2. Operating Systems: Internals and Design Principles (8th Edition)- by William Stallings (Pearson Education)
3. Modern Operating Systems by Andrew S. Tanenbaum (Pearson Education International)
4. Unix concepts and administration – 3rd Edition – Sumitabha Das (TMGH).



[Handwritten signature]

Course Code:	23CSEU4P03
Course Name:	Operating Systems Lab

L	T	P	Credit
		2	1

Course Prerequisites:

1. Knowledge of any programming language like (C, C++, Python, Java)

Course Description:

This is one of the core course of Computer Science & Engineering Programme. In this course you will become familiar with the core concepts of OS - how OS work, how a processes & threads are created, inter-process communication & synchronisation, the various scheduling algorithms, memory management & memory allocation strategies, etc. This course will be also helpful for exams like GATE.

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

CO1	write multithreaded applications.
CO2	implement various IPC mechanisms such as pipes, message queues, shared memory.
CO3	solve the sychronization problems for process/thread coordination.

CO-PO Mapping:

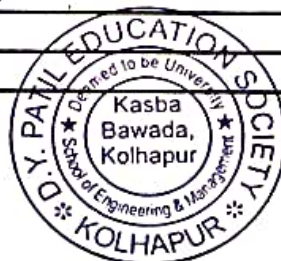
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		1		3				1			1	3	2
CO2	3	1	2		3				1			1	3	1
CO3	3	1	2		3				1	1		1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE)	50%	Practical Oral Exam

List of Experiments:

1	Study of basic Linux Commands
2	Multiprocessing with fork()
3	Multithreading with pthread
4	Scheduling Algorithm - 1
5	Scheduling Algorithm - 2
6	Interprocess Communication with PIPE
7	Interprocess Communication with MESSAGES QUEUE
8	Interprocess Synchronization with SEMAPHORES
9	Bankers Algorithm
10	Page Replacement Algorithm



[Handwritten signature]

Course Code:	23CSEU4P04
Course Name:	Object Oriented Programming

L	T	P	Credit
2	0	2	3

Course Prerequisites:

1. Procedural Programming Language

Course Description:

This course introduces students to the principles of object-oriented programming using Java. Students will develop practical skills through hands-on coding exercises and projects, learning to design and implement efficient, reusable, and maintainable code using OOP concepts.

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

CO1	explain object oriented concepts, principles and techniques.
CO2	create well-structured classes with appropriate data members and member functions, demonstrating proper encapsulation principles.
CO3	apply various object-oriented features to solve real-life problems using Java language.
CO4	demonstrate an understanding of exception handling in Java

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									1	1		3		
CO2	1	1	2		3			2	1	2			3	3
CO3	1	2	2		3			2	1	1		3	3	3
CO4	1				3				1				2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Assessment	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	Practical/Oral Examination



[Handwritten Signature]

Course Contents:

Unit 1 Introduction to OOP	4 Hours
Introduction to procedural & object-oriented programming, Limitations of procedural programming, Need of object-oriented programming, Fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism.	
Unit 2 Fundamentals of Java Programming	6 Hours
Understanding the Java Virtual Machine (JVM), Basic Syntax and Structure of a Java Program, Variables and Data Types, Access specifiers – public, private, protected, Operators and Expressions, Basic Input and Output, Control Flow Statements	
Unit 3 Classes and Objects	6 Hours
Defining classes and creating objects, Instance variables and methods, Constructors, use of the new keyword, this keyword, Method overloading, array of objects, passing objects to functions, returning object.	
Unit 4 Inheritance and Polymorphism	6 Hours
Inheritance basics, superclass and subclass, Using extends keyword, Method overriding, Understanding polymorphism and dynamic method, dispatch, Abstract classes and methods, Interfaces, Implementing interfaces in classes, Differences between abstract classes and interfaces	
Unit 5 Exception Handling and File I/O	4 Hours
Introduction to exception handling, Using try, catch, finally blocks, Creating custom exceptions, Understanding the basics of File I/O, Reading from and writing to files using FileReader, FileWriter, BufferedReader, and BufferedWriter	

Text Books:

1. "Core Java Volume I – Fundamentals" by Cay S. Horstmann and Gary Cornell
2. "Java: The Complete Reference" by Herbert Schildt

Reference Books:

1. "Head First Java" by Kathy Sierra and Bert Bates



A handwritten signature in black ink, appearing to be "Judy".

Course Code:	23CSEU4M05	L	T	P	Credit
Course Name:	Software Tesing	2			2

Course Prerequisites:

1. Programing for problem solving
2. Software Engineering

Course Description:

The subject of software testing encompasses the principles, methods, techniques, and practices used to evaluate and validate software applications and systems. It involves ensuring that software functions correctly, meets requirements, and performs reliably under various conditions before it is released to users.

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

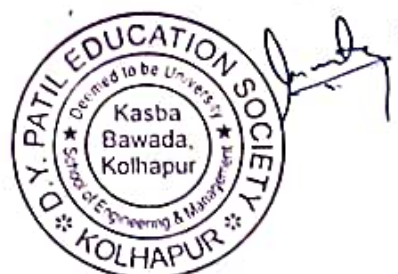
- | | |
|-----|---|
| CO1 | Describe importance of software testing. |
| CO2 | Understand the software testing process and various types of testing. |
| CO3 | Construct various technical documents for Testing. |
| CO4 | Make use of Automation Tools for testing various types of S/W applications. |

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1											1			1
CO2				1	1				3	1		1	1	
CO3			2	2	2				3	2		1	3	1
CO4			2		2					2		3	3	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation	40%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE)	60%	100% course contents



Course Contents:	
Unit 1	Introduction to Software Testing 6 Hours
Software Error Case Studies, What Is a Bug?, Cost of Bugs, Role of Software Tester, Software Development Process, Product Components, Software Project Staff, Software Development Lifecycle Models, Big-Bang, Code and fix, Waterfall Model, Spiral Model, testing Axioms, Software Testing Terms and Definitions	
Unit 2	Testing Fundamentals 4 Hours
Examining the Specification, Dynamic Black-Box Testing, Test-to-Pass and Test-to-Fail, Equivalence Partitioning, Data Testing, State Testing, Other Black-Box Test Techniques.	
Unit 3	Static and Dynamic Testing 5 Hours
Static White-Box Testing, Coding Standards and Guidelines, Generic Code Review Checklist, Dynamic White-Box Testing, Testing the Pieces, Data Coverage, Code Coverage.	
Unit 4	Usability Testing & Web Site Testing 4 Hours
Usability Testing: User Interface Testing, Standards or Guidelines for Good GUI, Accessibility Testing, Web Site Testing: Web Page Fundamentals, Black-Box Testing, Gray-Box Testing, White-Box Testing, Introducing Automation.	
Unit 5	Testing the Documentation 4 Hours
Types of Software Documentation, The Importance of Documentation, What to Look for in reviews, The Realities of Documentation	
Unit 6	Automated Testing and Test Tools 5 Hours
The Benefits of Automation and Tools, Test Tools, Software Test Automation, Open Source Tools: Selenium, Appachi Jmeter.	
Text Books:	
1. Software Testing, Ron Patton, by Sams Publishing 2. Software Testing: Principles and Practices, Srinivasan Desika Gopalswamy ramesh, Pearson Publisher: Pearson India 2005, ISBN:9788177581218. 3. http://www.selenium.com . 4. https://jmeter.apache.org	
Reference Books:	
1. Software Testing, Yogesh Singh, Cambridge University Press, Bangluru, ISBN 978-1-107-65278-1 2. Software Testing: Principles, Techniques and Tools, limaye M.G. Tata McGrawHill Education, New Delhi. 2007, ISBN-9780070139909	



Handwritten signature

Course Code:	23CSEU4V06
Course Name:	Environmental Studies

L	T	P	Credit
2			2

Course Prerequisites:

1. Understanding of Environmental Education course

Course Description:

The main objective of course is to create awareness among students regarding environmental issues and its impact on society. Knowledge regarding environmental components, its degradation and protection of environment is need for sustainable future ahead.

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

CO1	Understand the scope and importance of Environmental awareness and Sustainable development
CO2	Understand various Environmental issues due to development
CO3	Understand various modes of Environmental management through technology and legislation
CO4	Acquire problem solving attitude through actual field experience, reporting it in the form of Field

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2														
CO3														
CO4														
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



[Handwritten signature]

Course Contents:

Unit 1	Our Environment	5 Hours
Introduction to Environment, Scope of Environmental studies, importance of environmental awareness, Concept of sustainability, Sustainable Development- history and Goals, environmental ethics, Sustainability ethics, Population growth of world and reduced health content of the environment		
Unit 2	Development and Environmental Health	8 Hours
Natural resources: Types(renewable and non-renewable), developmental benefits, Forest- Benefits, problems (Deforestation), Biodiversity-- importance, threats, conservation, Ecosystems- importance, problem associated with major ecosystems, ecological restoration, Air- Benefits, problems (Pollution, climate change), Water- Benefits, problems (Depletion, pollution), Soil/ Land- Benefits, problems (Degradation, loss of fertility, desertification), Mineral- Benefits, problems (Mining, over exploitation, depletion, pollution), Energy resources- Benefits, problems (depletion, energy crisis) Urbanization and Environmental health: Urban problems, Solid waste- Effects of MSW, Plastic waste, Hazardous waste, E- waste		
Unit 3	Environmental Management	8 Hours
Renewable energy technologies- current, new(Bio gas, Bio fuel, hydrogen, etc), Pollution abetment –5R, ZLD, carbon credit, bio remedies, Soil/ land reclamation, Sustainable agriculture, Concept of EIA, Environmental audit, ISO certification (ISO 14001), Role of CPCB and MPCB in Environmental protection of India, Emerging technologies for environmental management- GIS, Remote sensing, Smart bin, IoT integration, Waste-to-Energy Technologies, Recycling Automation, Advanced Data Analytics, Circular Economy Practices, Sustainable Packaging Solutions, Community Engagement and Education, Decentralized Waste Treatment, Zero-Waste Initiatives, Legislative and Regulatory Changes, Environmental legislation- Environmental Protection Act, Air Act, Water Act, Solid waste Management Act, Hazardous waste Management Rule, E- Waste (Management) Rules, 2022		
Unit 4	Field Project Work	5 Hours
Case studies based on site visit (Each candidate has to go for field visit and complete a project work on Environmental issues and probable solutions)		

Text Books:

1. Handbook of Environmental Studies by Dr. G. R. Parihar, Publisher: Satyam Publishers and Distributors (1 January 2013), ISBN-10 : 9382664408, ISBN-13 : 978-9382664406
2. Environmental Studies by Anubha Kaushik, New Age International Private Limited (1 January 2007), ISBN-10 : 8122422403, ISBN-13 : 978-8122422405
3. Introduction to Environmental Engineering and Science 3e, by Masters, Publisher : Pearson Education India; 3rd edition (1 January 2015), ISBN-10 : 9332549761, ISBN-13 : 978- 9332549760
4. Solid Waste Management in developing countries, by Bhide A. D. and Sundersen B. B.- Indian National Scientific Documentation Centre, New Delhi

Reference Books:

[Handwritten signature]

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I & II, Environmental Media
2. Ecology And Environment Pb, by P. D. Sharma, Rastogi Publications (1 January 2011)



Handwritten signature

Course Code:	23CSEU4H07	L	T	P	Credit
Course Name:	Leveraging Technology in Project Management and Start-up ventures	1		2	2

Course Prerequisites:

Software Engineering, project Management Basic Concepts

Course Description:

This course explores the integration of technology with project management principles, emphasizing how computer engineering students can leverage advanced tools and strategies in managing projects and launching start-up ventures. The course covers project management methodologies, software tools, and real-world applications.

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

CO1	Apply technology to optimize project planning, execution, and monitoring.
CO2	Dmonstrate practical skills in using project management tools and technologies
CO3	Learn the use of technology in start-up ventures and entrepreneurial projects

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			1		1						2			
CO2			1		3		3		2	2	2	2	3	
CO3			1		3		3		2	3	2	2	3	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.



[Handwritten signature]

Course Contents:

Unit 1	Introduction	Hours
	Project Management (PM) Fundamentals, People, Process, and Product, Technology Classic mistakes, PMI Processes, Software project phases, Organizational structures, Project charter, Statement of Work (SOW)	
Unit 2	Project Management Methodologies	Hours
	Development lifecycle models, Project plans Work Breakdown Structures (WBS), Agile and Scrum: Principles and Practices, Comparing Methodologies: When to Use Which.	
Unit 3	Project Planning and Scheduling Tools	Hours
	Introduction to Project Planning Software (e.g., MS Project, Jira, Asana), Creating Project Plans and Gantt Charts, Resource Allocation and Budgeting.	
Unit 4	Vision and the Business Model & Innovation Strategies	Hours
	The Vision, The Mission Statement, The Value Proposition, The Business Model, Business Model Innovation in Challenging Markets, Core Competencies, Sustainable Competitive Advantage. First Movers Versus Followers, Imitation, Creativity and Invention, Types and Sources of Innovation, Technology and Innovation Strategy, New Technology Ventures.	

Text Books:

1. "Information Technology Project Management", Kathy Schwalbe, Cengage Learning, 7/e, 2013.
2. "Technology Ventures From Idea to Enterprise", Thomas H. Byers, Richard C. Dorf, Andrew J., Nelson

Reference Books:

1. "Software Project Management", M. Cottrell and B. Hughes, McGraw-Hill, 5/e, 2009.
2. "Project Management Software Tools: A Guide to Choosing the Right Tools" by Michael S. Dobson
3. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries



Course Code:	23CSEU4A08
Course Name:	Trending Technology Laboratory

L	T	P	Credit
		4	2

Course Prerequisites:

Mathematics, Data Structures, Software Engineering and knowledge of Programming language.

Course Description:

This course emphasis on a problem-based learning approach. It is a group activity where students have to present an idea / solution for the problem chosen. Then requirement analysis and design specification of the system is to be developed by the students. This is followed by software design, implementation, testing and finally demonstrate the results obtained. This course helps the students to learn how to analyze the demands of a customer and represent them in the form of software requirements specification (SRS) document including quality requirements. Ultimately this course enhances students programming skills and enable them to learn how to perform requirement analysis, system designing, coding, testing and report writing.

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

CO1	Define appropriate problem statement for real world problems.
CO2	Design the various modules of the project to provide a solution to the problem with the help of various design tools.
CO3	Able to present their work and prepare technical project report.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1								3					
CO2	1	2	2		2	1			3	3			2	1
CO3	1	1	2		2			2	3		2		2	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	



[Handwritten Signature]

Course Contents:**Trending Technologies : Internet of Things, GIT, GITHUB**

Introduction to IoT concepts and architecture
Hands-on with IoT platforms and devices (e.g., Arduino, Raspberry Pi)
Building a basic IoT project (e.g., sensor data collection and visualization)
Introduction to git and github

Guidelines

This course emphasis on a problem-based learning approach. It is a group activity where students have to present an idea / solution for the problem chosen. Then requirement analysis and design specification of the system is to be developed by the students. This is followed by software design, implementation, testing and finally demonstrate the results obtained. This course helps the students to learn how to analyze the demands of a customer and represent them in the form of software requirements specification (SRS) document including quality requirements. Ultimately this course enhances students programming skills and enable them to learn how to perform requirement analysis, system designing, coding, testing and report writing.

Assessment:

Participation in group activities: 20%
Group project development and presentations: 40%
Project demonstration: 10%
Final reflection of the work: 30%

Note: Two practical sessions of 2 hours per week will be dedicated to project development, research, and hands-on training



A handwritten signature in black ink, appearing to be "J. Patil", with a small arrow pointing to the right.

Course Code:	23CSEU4N10
Course Name:	Web Technology II

L	T	P	Credit
1		2	2

Course Prerequisites:

1. Knowledge of Programming language basics like C, Python

Course Description:

It is a commonly used programming language to create dynamic and interactive elements in web applications. The Students will learn all the basics to advanced topics and concepts of JavaScript.

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

CO1	Learn the Basics of JavaScript & jQuery
CO2	Write a basic JavaScript and jQuery programs
CO3	Create interactive user interface.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2		2			1				1	2	
CO2	1	1	2		2			1				1	2	
CO3	1	1	2		2			1				1	2	
CO4														
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	50%	Lab Assignment, Test, Quiz
2	End Semester Examination (ESE)	50%	Practical oral Exam



Handwritten signature

Course Contents:

Unit 1	Introduction to Javascript	4 Hours
JS Introduction, Getting Started, Syntax, Variables, Generating Output, Data Types, Operators, Events, Strings, Numbers, If...Else, Switch...Case, Arrays, Sorting Arrays, Loops, Functions, Objects		
Unit 2	Advanced Javascript	4 Hours
Date and Time, Math Operations, Type Conversions, Event Listeners, Event Propagation, Borrowing Methods, Hoisting Behavior, Closures, Strict Mode, JSON Parsing, Error Handling, Regular Expressions, Form Validation, Cookies, AJAX Requests, ES6 Features		
Unit 3	Introduction to JQuery	4 Hours
Introduction, Syntax, selectors, events, JQuery effects, JQuery HTML/CSS, JQuery traversing, JQuery form, JQuery misc		

Text Books:

1. JavaScript: The Definitive Guide by David Flanagan, O'Reilly Media
2. jQuery in Action by Bear Bibeault, Manning Publication

Reference Books:

1. JavaScript: The Complete Reference by Thomas A Powell, Fritz Schneider, Tata McGraw Hill
2. Head First jQuery by Ryan Benedetti, O'reilly Publication



A handwritten signature in black ink, appearing to be "S. S. S." or similar, written in a cursive style.