Shivaji University, Kolhapur

Department of Technology

Second Year B. Tech (Computer Science and Technology), Semester- III

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE: ESE	IE:EE
1.	Basic Science Course	BSC 211	Applied Mathematics- I	04	-	00	04	04	40:60	50:00
2.	Professional Core Courses	PCC211	Discrete Mathematical Structure	04	-	00	04	04	40:60	00:00
3.	Professional Core Courses	PCC212	Digital System and Microprocessor	03	-	02	05	04	40:60	50:00
4.	Professional Core Courses	PCC213	Data Structures	03	-	04	07	05	40:60	50:50
5.	Professional Core Courses	PCC214	Data Communication and Networking	03	-	02	05	04	40:60	00:50
6.	Ability Enhancement Courses	AEC211	Soft Skills Development	01	-	-	01	01	-	50:00
				-	-	-	-	**22**	**500**	**300**
7.	Project Based Learning	PBL211	Mini Project I	-	01	-	01	IE at Course in charge end		
8.	Humanities, Social Sciences, Management, Environment	HSMEC 211	Environmental Studies	02	-	-	02	University Exam at the Even Semester End		
			Total Hours	**20**	**01**	**08**	**29**	-	-	-

Shivaji University, Kolhapur

Department of Technology

Second Year B. Tech (Computer Science and Technology), Semester- IV

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE: ESE	IE:EE
1.	Basic Science Courses	BSC 221	Applied Mathematics- II	03	-	-	03	03	40:60	00:00
2.	Professional Core Courses	PCC221	Theory of Computation	03	-	-	03	03	40:60	00:00
3.	Professional Core Course	PCC 222	Advanced Microprocessor	03	-	02	05	04	40:60	50:50
4.	Professional Core Course	PCC 223	Computer Organization	03	-	-	03	03	40:60	00:00
5.	Professional Core Course	PCC 224	Software Engineering	03	-	-	03	03	40:60	00:00
6.	Professional Core Course	PCC 225	Linux and Shell Programming Lab	-	-	02	02	01	00:00	50:50
7.	Professional Core Course	PCC 226	Object Oriented Programming Lab	-	-	04	04	02	00:00	50:50
8.	MDM Course	MDM 221	Multidisciplinary Minor Course I*	03	-	-	03	03	40:60	00:00
				-	-	-	-	22	600	300
9.	Indian Knowledge Systems	IKS221	Introduction to Performing Arts	01	-	-	01	IE at Course in charge end		
10.	Mandatory Audit Course	MAC 221	Aptitude Enhancement Course I	-	01	-	01	IE at Course in charge end		
11.	Project Based Learning	PBL221	Mini Project II	-	01	-	01	IE at Course in charge end		
12.	Humanities, Social Sciences, Management Environment	HSMEC 221	Environmental Studies	02	-	-	02	University Exam at the Even Semester End		
			Total Hours	**21**	**02**	**08**	**31**	-	-	-

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	BSC211					
Course Category	Basic Sciences Courses					
Course title	**Applied Mathematics – I (Advanced Calculus)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	04	**-**	**-**	**04**		**04**
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	40	**60**	**50**	**00**	**150**	
Pre-requisites(if any)	Basic knowledge of Mathematics					
Course Objectives	The Course is aimed at- 1. Introducing linear differential equations and partial differential equations 2. Explaining Laplace Transform, Inverse Laplace Transform and applications to electric circuit problems 3. Demonstrating Fourier transform and their applications. 4. Explaining mathematical programming and assignment problems. 5. Demonstrating applications to computer engineering.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Solve linear differential equations and apply them on simple electric circuit 2. Solve the problems on partial differential equations. 3. Gain the basic knowledge of Laplace transform and their applicability in solving initial value problems. 4. Understands the new notion of Fourier transform and their usability **5.** Solve engineering problems using Mathematical Programming 6. Analyze and solve engineering problems using Assignment problems.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3													
CO 2	3	3													
CO 3	3	1													
CO 4	3	2													
CO 5	3	3		2											
CO6	3	3	3												

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Linear Differential Equations** Linear Differential Equations with constant coefficients, Homogeneous Linear differential equations, Applications of LDE with constant coefficients to Electrical systems.	7

II	**Partial Differential Equations** First order partial differential equations, solutions of first order linear and non-linear PDEs-Four	6
III	**Laplace Transform** Definitions, Laplace transform of standard functions, Properties & theorems of Laplace transform Inverse Laplace transform and application to solutions of linear differential equations (electric circuit problems).	7
IV	**Fourier Transform** Definition, Properties & theorem, Fourier sine & cosine transform, Inverse Fourier transform, Discrete Fourier transform & its properties, Applications of Fourier transform	7
V	**Mathematical Programming** Linear Optimization problems, Standard and Canonical forms, Basic solutions and feasible solutions, Optimal solutions by simplex method, Big M-method, Relation between Primal and Dual L.P.P., Dual simplex method, Solution of Primal L. P. P. using Dual L. P. P	6
VI	**Assignment Problems** Definition, Balanced and Unbalanced assignment problems, Hungarian method of solving assignment problems. Travelling salesmen problem.	6

Suggested list of Assignments:

1. To find solution of LDE with constant coefficients
2. Examples of Homogeneous LDE
3. Problems on Partial differential equations
4. Examples on Properties of Laplace transform
5. Examples on Inverse Laplace transform
6. Examples on Fourier transform
7. Examples on Simplex and Dual Simplex method
8. Examples on Big M-method
9. Assignment Problems

General Instructions:

1. Students must be encouraged to solve engineering mathematics problems using different software's
2. Each Student has to write at least 6 assignments on entire syllabus.

Text Books

i)	Erwin Kreyszig, "Advanced Engineering Mathematics", Fifth Edition, John Wiley & Sons
ii)	B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi
iii)	S. D. Sharma, "Operations Research", 11th Edition.

Reference Books

i)	C. R. Wylie, "Advanced Engineering Mathematics", 6th Edition , McGraw Hill Publication, New Delhi
ii)	H. A. Taha, "Operations Research", 8 th Edition, Pearson
iii)	S. S. Sastry, "Engineering Mathematics (Volume-I)", 4 th Edition, Prentice Hall Publication, New Delhi
iv)	H. K. Dass, "Advanced Engineering Mathematics", 2014, S. Chand Publishing.
v)	N. P. Bali, Iyengar "A text book of Engineering Mathematics by", Laxmi Publications (P)Ltd., New Delhi
vi)	M. D. Greenberg, "Advanced Engineering Mathematics", 2nd Edition, Pearson Education

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	PCC211					
Course Category	Professional Core Courses					
Course title	**Discrete Mathematical Structure**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	04	-	-	04		04
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	40		**60**	**00**	**00**	**100**
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed at- 1. Introducing most of the basic terminologies used in computer science courses and application of ideas to solve practical problems 2. Explaining basic mathematical logic and Set theory 3. Demonstrating relations and functions 4. Extending student's Logical and Mathematical ability to deal with abstraction 5. Exposing to concepts and properties of algebraic structures such as semi groups, monoids and groups 6. Demonstrating core ideas in graph theory					
Course Outcomes	Upon completion of this course, student should be able to – 1. Apply mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving 2. Demonstrate the fundamental concepts related to set theory, relations and functions which are frequently required in advanced courses such as analysis of algorithms. 3. Compare algebraic structures like monoid, semi groups and groups. 4. Learn and summarize the group theory and group codes with applications in communication model. 5. Develop the ability to solve the problems related to algebra, POSETs, lattices, Boolean algebra and their application in computer science. 6. Solve the practical problems using graphs and related discrete structures					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3														
CO 2	2	3													
CO 3				2											
CO 4			2												
CO 5	2	2													
CO6		2				2									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Mathematical Logic :** Introduction, statements and Notation, Connectives, statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connectives, Normal & Principle normal forms.	8
II	**Set Theory:** Basic concepts of set theory, types of operations on sets, ordered pairs, Cartesian product, representation of discrete structures, relation, properties of binary relations, matrix and graph representation, partition and covering of set, equivalence relation, composition, POSET and Hasse diagram, Function – types, composition of functions, Inverse function.	9
III	**Algebraic Systems:** Semigroups and Monoids, properties and examples.	3
IV	**Groups:** Definition and examples, subgroups and homomorphism, Group codes, communication model, Generation of codes using checksum, error recovery in group codes.	4
V	**Lattices and Boolean Algebra:** Lattice as POSETs, definition, examples and properties, Lattice as algebraic systems, Special lattices, Boolean algebra definition and examples, Boolean functions, representation and minimization of Boolean functions.	7
VI	**Graph Theory:** Basic concepts of graph theory, Storage representation and manipulation of graphs, Fault detection in combinational switching circuits – Faults in combinational circuits, Notions of Fault detection, Algorithm for fault matrix, PERT and related techniques.	8

	Text Books
i)	Discrete mathematical structures with applications to computer science", J. P. Tremblay& R. Manohar, Tata McGraw-Hill Edition, 35th Reprint
ii)	"Elements of Discrete Mathematics", C. L. LIU, Tata McGraw-Hill, 2nd Edition, 2002, ISBN 0- 07-043476-X.
	Reference Books
i)	Discrete Mathematics and Its Applications", Kenneth H. Rosen, Tata McGraw-Hill, 5th Edition, 2003, ISBN 0-07-053047-5.
ii)	"Theory and problems in Abstract algebra",Schaums outline series, MGH.
iii)	Discrete Mathematics",Lipschutz, Lipson, Tata McGraw-Hill, 2nd Edition, 1999, ISBN 0-07- 463710--X.
iv)	Graph Theory", V. K. Balakrishnan, TMH (Recommended for Graph) ISBN 0-07-058718-3
v)	"Discrete Mathematical Structures", B. Kolman, R. Busby and S. Ross, Pearson Education, 4th Edition, 2002, ISBN 81-7808-556-9

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC212</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Digital system and Microprocessor</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>40</td><td>60</td><td>50</td><td>---</td><td>150</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Basic knowledge of digital logic and computer hardware basics.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The Course is aimed at-
1. Introducing the analysis and design of digital systems and microprocessors.
2. Understanding combinatorial analysis and design.
3. Explaining Computer aided design and programming of digital electronic circuits through the application of several modern software packages.
4. Explaining features and architectures of 8085.
5. Introducing 8085 Instruction set.
6. Studying types of Main memory.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to –
1. Understand the logical behavior of digital circuits
2. Design combinatorial logic using K maps
3. Design sequential logic using ASM charts
4. Analyze combinatorial and sequential digital circuits
5. Explain the architecture, pin configuration of various microprocessors
6. Perform various microprocessor-based programs and apply the concepts of 8085 programming, interrupts, stacks & subroutines</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1		2								2				
CO 2			2	2	2										
CO 3			1		2										
CO 4		3					2								
CO 5		1									1				
CO6					1						3				

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Fundamentals Concepts:** Logic Families, TTL, TTL sub families, Characteristics of TTL gates, Axioms and laws of Boolean algebra, Practical examples with logic gates IC's.	3
II	**Combinatorial Logic Design:** Boolean algebra, min and max terms, K-maps and quine –McCuskey methods, Solution using Kmaps, SOP & POS representation of digital logic and their reduction using K-map, BCD to 7- segment converter, Multiplexer and DE multiplexer, encoder, decoder, Half and Full adder design	8
III	**Sequential Logic Design:** Various flip flops (R-S, D, J-K, T) using gates, counter using J-K flip-flops, shift Register using flip-flops, study of different ICs (7490, 7495, 74LS138, 7447) Timer IC (555), IEEE / ANSI symbols Analog Electronics: OP-AMP (741), Basics of OP-AMP, Characteristics, Adder, Subs tractor, Integrator, Differentiator, Comparator using OP-amp	8
IV	**8085 Microprocessor:** Introduction: Introduction to Microprocessor, Features of 8085, 8085-CPU architecture, DE multiplexing of address and data bus, Instruction fetching and execution operation of microprocessor.	4
V	**8085 Instruction Set:** Instruction formats, addressing modes, Op-code formats, Classification of Instruction set, Programming technique, Instruction timings, WAIT state, Single step and single cycle execution.	8
VI	**Interrupt and DMA Transfer:** Types of Memory, Memory organizations Mapping of I/O 8085 Interrupts RST5.5, RST6.5, RST7.5, TRAP & INTR. Designing hardware for INTR, Interrupt priorities, SIM and RIM instruction, DMA transfer, HOLD and HLDA pins for DMA transfer. I/O Operation and Interfacing: Devices, IN & OUT Instruction with timing diagrams study of 8255 PPI, Interfacing Keyboards, Interfacing Thumbwheel switches, 8253.	8
Text Books		
i)	"Modern Digital Electronics" 4thEdition,By R.P.Jain	
ii)	Microprocessor Architecture Programming & Application", Ramesh Gaonkar, Willey Estern.5th Edition	
iii)	Digital Systems-Principals and Application", Tocci, Widmer, Moss, (Pearson Education) 11th Edition	
iv)	Design with operational amplifier", Sergio Franko and book by Ramakant Gaiekwad 4th Edition	
Reference Books		
i)	"Fundamentals of digital circuits", B.Anandkumar 4th Edition	
ii)	Digital Systems & Microprocessor", Douglas Hall MGH 3rd Edition	
iii)	Digital Logic and Computer Design", Book by M. Morris Mano 5th Edition	

Experiment No.	Experiment Title/Objective	Hours
1.	Study of Basic gates.	02
2.	Study of Universal gates	02
3.	Study of Boolean algebra & De Morgan's theorem using gates.	02
4.	Study of MUX/DEMUX.	02
5.	Study of 74138	02
6.	Study of R-S and J-K flip-flops	02
7.	Study of counters	02
8.	Interfacing of counters to seven segment display.	02
9.	Realization of 4/5 variable K-maps	02
10.	Study of 8085.	02
11.	Assembly language programming for 8085 (Arithmetic, Logical and data transfer- Minimum 8 programs).	02
12.	Writing subroutine to perform delay operation of 10 ms	02
13.	Designing & implementing hardware for INTR	02
14.	Study of 8255. Interfacing using 8255	02
15.	Study of 8253 interfacing.	02

General Instructions: Students have to perform 8-10 practical's from the list

Reference Books

1	"Digital Logic and Computer Design "Book by M. Morris Mano 5th Edition
2	Fundamentals of logic design "Book by Charles H Roth 7th edition
3	Microprocessor Architecture, Programming and Applications with the 8085 written by Ramesh .
4	Fundamentals of digital circuits", B.Anandkumar 4th edition

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC213</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Data Structures</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>04</td><td colspan="2">07</td><td>05</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">40</td><td>60</td><td>50</td><td>50</td><td>200</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basic understanding of C programming language and basic mathematics.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Provide the knowledge of basic data structures and their implementations.
2. Demonstrating data structures such as arrays, stacks, queues, hash tables and linked list etc.
3. Understanding searching and sorting techniques.
4. Introducing the concepts of trees and graphs.
5. Understanding the hashing technique.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Implement abstract data types using arrays and linked list.
2. Apply the different linear data structures like stack and queue to various computing problems.
3. Implement different types of trees and apply them to problem solutions.
4. Discuss graph structure and understand various operations on graphs and their applicability
5. Analyze the various sorting and searching algorithms.
6. Understand the hashing technique and hash functions.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3														
CO 2				3	1										
CO 3	2	2		2	1								2		
CO 4	3	2		3	1								2		
CO 5	2	2	1	2	1										
CO6	1	2													

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Stacks and Queue** Fundamentals stack and queue as ADT, Representation and Implementation of stack and queue using sequential and linked organization, circular queue: representation and implementation, Application of stack for expression evaluation and for expression conversion, Recursion, Priority queue, Doubly Ended Queue	7
II	**Searching and sorting Search:** Importance of searching, Sequential, Binary, Fibonacci search algorithms Sorting: Quick sort, two-way merge sort, heap sort, shell sort, Radix sort.	7
III	**Linked list** Concept of linked organization, Singly linked list, doubly linked list and dynamic storage management, circular linked list, Operations such as Insertion, deletion, inversion, Concatenation, Computation of length, traversal on linked list, Representation & manipulations of polynomials using linked lists.	7
IV	**Hashing** Definition, Hash functions, Overflow, Collision, Open Hashing, closed hashing, Rehashing Techniques.	5
V	**Tree** Basic Technology, Binary Tree, Traversal methods, Binary search tree, B tree, B+ tree, Heaps-operations and their applications.	6
VI	**Graph** Basic concepts of graph theory, storage representation and manipulation of graphs, Introduction to Sparse matrix, representation of sparse matrix using linked list.	7
Text Books		
i)	Data Structure using C -- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI). 2nd Edition	
ii)	Data Structures using C – ISRD Group, TMH publication 2nd Edition	
Reference Books		
i)	Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (AddisionWesely Series)	
ii)	Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines. 4th Edition	
iii)	Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education). 2nd Edition	
iv)	Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2nd Edition	

Experiment No.	Experiment Title/Objective	Hours
1.	Write a program for matrix Manipulation using array.	02
2.	Implement Tower of Hanoi problem using recursion.	02
3.	Implement different operations on string without using library function.	02
4.	Implementation of palindrome string.	02
5.	Implement different operation on file.	02
6.	Implement stack as an ADT. Perform push() and pop() operations on it.	02
7.	Implementation of queue using array.	02
8.	Implement circular queue and double ended queue using arrays.	02
9.	Write a program for sequential search and linear search.	02
10.	Apply following searching techniques on list or array: Binary ii) Fibonacci	02
11.	Implement following sorting techniques on list or array: i) Quick sort ii) Merge sort.	02
12.	Write a program to create linked list and perform operation such as insert, delete, update, reverse	02
13.	To implement of binary tree traversal.	02
14.	To study hashing techniques.	02
15.	To study graph traversal method.	02
General Instructions: Practical Journal Assessment, Internal practical Examination and External Practical Examination		

Reference Books	
i)	Data Structure using C -- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI).
ii)	Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2ndEdition
iii)	Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines.
iv)	Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (Addision- Wesely Series)

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	PCC214					
Course Category	Professional Core Course					
Course title	**Data Communication and Networking**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	02	05		04
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	40	**60**	**--**	**50**	**150**	
Pre-requisites(if any)	Basics of Communication and Computers					
Course Objectives	The Course is aimed at - 1. Providing knowledge about basics of Data Communication and computer network 2. Providing knowledge about the Functions of Physical Layer. 3. Providing details of different data link layer functions including error detection and error corrections. 4. Providing knowledge about different framing techniques and network layer protocols for data communication 5. Providing detail knowledge of Transport Layer and protocols. 6. Providing knowledge about protocols from application layer.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Explain Data Communications System, its components and Articulate the networking Basics. 2. Explain and examine wired and wireless communication with medium access control layer. Differentiate and analyze various multiplexing techniques. 3. Apply error control techniques and study different protocols used at Data Link Layer. 4. Examine IPv4 and IPv6 structure. Solve sub-netting problems and analyze various routing mechanism, Identify and compare congestion control mechanisms 5. Examine the services provided by transport layer and have a hands-on experience of socket programming 6. Inspect the networking applications used in everyday tasks such as reading email or surfing the web and analyze its architecture					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3														
CO 2	2	1	1												
CO 3	2	1	1		1								1		
CO 4	2	2	2	1	2								1		
CO 5	2	2	2	1	2								1		
CO6	1	2	2	1	2								1		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Communication Fundamentals, Protocols and Models :** Introduction to data communications, data and signals, transmission impairment, Network Representations and Topologies, Common Types of Networks, Internet Connections, Layered network model: OSI, TCP/IP	06
II	**Physical Layer Characterization:** Purpose of the Physical Layer, transmission media: - Guided and Unguided media, Network Hardware components, Introduction to packet switching: Circuit switching vs. packet switching, Types of services: - Connection oriented services, Connectionless services, Multiplexing	05
III	**Data Link Layer:** Purpose of the Data Link Layer, Error detection & correction: cyclic codes, hamming code, Data Link Control: - Farming, Flow & error control, Protocol basics- stop & wait protocol, sliding window protocol, MAC protocols, ALHOA, CSMA, CSMA/CD, CSMA/CA	09
IV	**Network Layer:** Network Layer Services, Network Layer Performance: Delay, throughput, congestion control, IPv4 Addresses: Address space, Classful addressing, classless addressing, IP datagram format, IPv6 Address Representation, IPv6 Address Types, Introduction to Network Routing Algorithm- Link State routing, Distance Vector Routing etc	09
V	**Transport Layer:** Transportation of Data, TCP Overview, UDP Overview, Port Numbers, TCP Communication Process, Reliability and Flow Control, UDP Communication	05
VI	**Application Layer:** Application, Presentation, and Session, Peer-to-Peer, NAME SPACE, DOMAIN NAME SPACE, Web and Email Protocols, File Sharing Services, Security Threats and Vulnerabilities, Network Attacks	05
	Text Books	
i)	B. A. Forouzan, "Data Communications and Networking", 4th Edition, Tata McGraw-Hill, 2013, ISBN-10: 1-25-906475-1	
ii)	Computer Networks – Andrew S. Tanenbaum (Pearson Education) 4th Edition	
	Reference Books	
i)	William Stallings, "Data and computer Communication", 7th Edition, Pearson Education, 2003, ISBN-13: 978-0131006812, ISBN-10: 0131006819.	
ii)	Larry L. Peterson and Bruce S. Davie, "Computer Networks a systems approach", 5th Edition, Morgan Kaufmann an imprint of Elsevier, 2014, ISBN: 978-93-80501-93-2	

Experiment No.	Experiment Title/Objective	Hours
1.	Study and demo of LAN, WAN and various connecting devices and components.	02
2.	Study of Different Networking Command	02
3.	Implementation of Framing Method By Character Count	02
4.	Implementation of Error Detecting Code (CRC)	02
5.	Implementation of Error Correcting Code (Hamming Code).	02
6.	Implementation of Simplex Stop and Wait Protocol.	02
7.	File transfer using Go back n / Selective Repeat Protocol	02
8.	Implementation of Shortest Path algorithm	02
9.	Implementation of connection oriented (TCP) client-server socket program.	02
10.	Implementation of connectionless (UDP) client-server socket program.	02
11.	Study of network protocol analyzer (Wire-Shark) / (Packet sniffer) and understanding packet formats for UDP, TCP, ARP, ICMP protocols	02
12.	DNS client utilities with Nslookup and Dig	02
13.	Implement simple web page design	02
14.	Case study of campus-wide network	02

General Instructions: Students have to perform 8-10 practicals from the list

Reference Books

i)	Richard Steven, "Unix network programming", for Socket Programming, Prentice Hall 3rd edition, 2015
ii)	James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education,5th /6th edition, 2012/2013
iii)	Jeffery S. Beasley, "Networking", New Riders Press, 2nd edition, 2008.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="5">AEC211</td></tr>
<tr><td>Course Category</td><td colspan="5">Ability Enhancement Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Soft skills Development</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td>50</td><td>-</td><td>50</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">H. S. C. Level English language competency</td></tr>
<tr><td>Course Rationale:</td><td colspan="5">In today's competitive professional landscape, technical skills alone are insufficient. Soft skills such as communication, teamwork, problem-solving, and adaptability are essential for engineering graduates to thrive in their careers. This course aims to Equip students with the necessary soft skills to complement their technical expertise and enhance their employability and success in the workplace.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The Course aimed at -
1. Enhancing communication, teamwork, problem-solving skills.
2. Fostering adaptability and resilience in engineering contexts.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to –
1. Proficient in oral and written communication.
2. Effective as regards teamwork and collaboration skills.
3. Apply critical thinking to industrial problems.
4. Demonstrate adaptability and resilience in profession.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1									3	3	-				
CO2									3	-	-				
CO3		3													
CO4												2			

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Written communication** • Email Writing • Technical Report	03
II	**Oral Communication** • Presentation Skills	02
III	**Soft Skills** • Importance of Soft Skills • Overview of Various Soft Skills	02
IV	**Team Spirit & Leadership Ability** • Understanding team dynamics and roles • Building trust and rapport within team	02
V	**Assessment** • Discussion on incorporating soft skills development into daily practice • Case Studies or Role-Play	05
	Text Books	
i)	1. Soft Skills, 2015, Career Development Centre, Green Pearl Publications.	
	Reference Books	
i)	Sharma R. & Krishna Mohan (2017), *Business Correspondence and Report Writing*, McGraw Hill Education	
ii)	P. D. Chaturvedi & Mukesh Chaturvedi (2013), *Business Communication: Skills, Concepts & Applications*, Pearson Publications, New Delhi, 3rd Edition, Seventh Impression	
iii)	K. K. Sinha (2006), *Business Communication*, 2nd Edition (Reprint), Galgotia Publishing, New Delhi	
iv)	Khera, S. (1998). "You Can Win: A Step by Step Tool for Top Achievers." New Delhi: Macmillan Publishers India.	
v)	Covey, S. R. (2004). "The 7 Habits of Highly Effective People." New York: Free Press.	
vi)	Carnegie, D. (2009). "How to Win Friends and Influence People." New York: Pocket Books.	
vii)	Bradberry, T., & Greaves, J. (2009). "Emotional Intelligence 2.0." San Diego, CA: Talent Smart.	
viii)	Dweck,C.S.(2006). "Mindset: The New Psychology of Success." New York: Ballantine Books.	
	Assessment	

	For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested: **1. Quizzes/Tests (10 marks)** Periodic quizzes or tests to evaluate students' understanding of key concepts and their ability to apply them. **2. Activity 1 (10 marks)** Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance 3. **Activity 2 (20 marks)** Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance **4. Classroom Participation and Engagement (10 marks)** Demonstrating engagement with course material and Active participation in class discussions, group activities and question-answer sessions. .

Year, Program, Semester	**S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III**			
Course Code	**PBL211**			
Course Category	**Project Based Learning**			
Course title	**Mini Project I**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	-	**01**	**-**	**01**
Evaluation Scheme	IE at Course in charge end			
Pre-requisites(if any)	Basics of Computers			
Course Objectives	The Course is aimed to- 1. Create awareness among the students to express technical ideas, strategies and methodologies in written form. 2. Enable students to work as a responsible member and possibly a leader of a team in developing software solutions. 3. Motivate students to self-learn new tools, algorithms, and/or techniques that contribute to the software solution of the project 4. Create awareness among the students of the characteristics of several domain areas where IT can be effectively used. 5. Improve the team building, communication and management skills of the students 6. Enable students to develop a design solution for a set of requirements			
Course Outcomes	Upon completion of this course, student should be able to – 1. Acquire practical knowledge within the chosen area of technology for project development 2. Identify, analyze and handle programming projects with a comprehensive and systematic approach 3. Contribute as an individual or in a team in development of technical projects 4. Develop effective communication skills for presentation of project related activities 5. Formulate and propose a plan for creating a solution for the problem identified 6. Report and present the findings of the study conducted in the preferred domain			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		2	2												
CO2		2	2	2											
CO3									2	2					
CO4							2								
CO5						2									
CO6											2	2			

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Mini Project I is a dynamic course designed to bridge the gap between classroom learning and real-world application. Throughout the semester, all students will engage themselves in a series of mini projects that challenge them to apply theoretical concepts learned in previous courses to solve practical problems. These projects, conducted in small groups, will cover a range of topics relevant to their field of study, allowing students to explore different facets of their discipline and develop versatile skill sets.

The course structure is carefully crafted to align with NEP 2020 and Outcome Based Education principles, emphasizing experiential learning, competency development, and holistic skill enhancement. Through active participation in mini project, students will not only deepen their understanding of academic concepts but also cultivate essential soft skills such as teamwork, problem-solving, and effective communication.

Each week, students will dedicate one hour to course activities, including project discussions, progress updates etc. Faculty guidance and mentorship will be provided to support students throughout their project work, ensuring they maximize their learning outcomes and derive meaningful insights from their engagements. By the end of the semester, students will emerge with a comprehensive understanding of how theoretical knowledge translates into practical applications, equipping them with the competencies and confidence to thrive in their future careers.

The mini-project should be undertaken preferably by a group of 3 students who will jointly work and implement the mini-project. The group will select a project with the approval of the guide. A batch of practical / Tutorial will be divided into mini project groups. Mini project topics and the work for these groups in the batch will be guided by a teacher for the batch, preferably on one of the topics like Compiler Construction, Database Engineering, Operating System, Computer Graphics and Multimedia, Advanced Programming and latest developments and trends in Computer Science and Technology. The teacher will periodically assess the performance of individual student in the mini project, jointly with a teacher of another batch. Project group will submit hardcopy project report along with project demonstration software in CD and/or project hardware gadget at the term end. The IOE of mini project will be jointly conducted by appointed examiners. Note: Use of Open source tools should be preferred.

Course Assessment Process

The course evaluation will be at the course teacher end. The teachers will follow the instructions as below:

- Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:
    - Rubric-based assessment for mini project.
    - Peer evaluation for team-based projects.
    - Written exams or quizzes to assess theoretical knowledge.
    - Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
    - Overall course grading based on a weighted average of individual assessments and participation.

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III				
Course Code	HSMEC211				
Course Category	Humanities, Social Science, Management, Environment				
Course title	**Environmental Studies**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	02	**-**	**-**	**02**	**00**
Evaluation Scheme	**SEE: 60 Marks + IOE: 40 Marks, evaluation only at Even Semester End.**				
Pre-requisites (if any)	BSC111, BSC121				
Course Rationale	The Course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging Environmental issues affecting nature.				
Course Objectives	The Course Teacher will 1. Introduce students to the fundamental concepts and principles of environmental science. 2. Describe the components of various ecosystems and their interrelationships. 3. Classify different types of natural resources and assess their availability and distribution. 4. Define biodiversity and its significance to ecosystem functioning and human Well-being.				
Course Outcomes	Upon completion of this course, student should be able to 1. Define key terms and concepts related to environmental science. 2. Analyze ecosystem services and their importance to human well-being. 3. Identify various types of natural resources and their significance. 4. Describe the levels and patterns of biodiversity and their importance.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO 1	3	2	-	-	-	-	3	3	-	-	-	-	-	-	-
CO 2	-	3	3	-	-	-	3	3	3	2	-	-	-	-	-
CO 3	-	2	3	-	-	-	3	3	3	3	-	-	-	-	-
CO 4	-	2	-	-	-	-	3	3	3	3	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	**Nature of Environmental Science:** Definition, scope and importance. Multidisciplinary nature of environmental studies. Need for public awareness. Introduction to sustainable development: Sustainable Development Goals (SDGs) - targets and indicators, challenges and strategies for SDGs.	**04**
II.	**Ecosystem:** Concept of an ecosystem, Structure and function of an ecosystem, Producers,	**06**

	Consumers and decomposers, Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids, Introduction, types, characteristics features, structure and function of the Following ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Degradation of ecosystems and its impacts.	
III	**Natural Resources and Associated Problems:** Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water scarcity and stress; Conflicts over water. c) Soil and Mineral resources: Soil as resource and its degradation, Usage and exploitation, Environmental effects of extracting and using mineral resources, Wasteland reclamation, d) Energy resources: Growing energy needs, renewable and non- renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy, e) Role of Indian traditions and culture in conservation of the environment.	**08**
IV	**Biodiversity and its conservation:** Introduction- Definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega- diversity nation. Western Ghats as a biodiversity region. Hot-spots of biodiversity, Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife, Conflicts, Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone.	**07**
	Nature Visits / Field Work /Field Tour/ Industrial visits / Activities related to Campus environmental management	**05**

Text Books

i)	Agarwal, K. C., (2001), Environmental Biology, Nidi Publ. Ltd., Bikaner.
ii)	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India.
iii)	Brunner R. C., (1989), Hazardous Waste Incineration, McGraw Hill Inc, 480p.

Reference Books

1.	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M.T., (2001), Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
2.	Gleick, H., (1993), Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p.
3.	Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
4.	Heywood, V. H. & Watson, R. T., (1995), Global Biodiversity Assessment, Cambridge Univ. Press.
5.	Jadhav, H. & Bhosale, V. M., (1995), Environmental Protection and Laws, Himalaya Pub. House, Delhi, 284p.
6.	Mckinney, M. L. & Schocl. R. M., (1996), Environmental Science Systems & Solutions, Web enhanced edition.
7.	Odum, E. P., (1971), Fundamentals of Ecology, W. B. Saunders Co. USA, 574p.
8.	Rao M. N. & Datta, A. K., (1987), Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.

9.	Sharma B. K., (2001), Environmental Chemistry, Goel Publ. House, Meerut.
10.	Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
11.	Trivedi R. K. and P. K. Goel, Introduction to air pollution Techno-Science Publications (TB).
12.	Wagner K. D., (1998), Environmental Management, W. B. Saunders Co. Philadelphia, USA.

Important web links	
1.	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
2.	http://nitttrc.edu.in/nptel/courses/video/109105203/L41.html

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B. Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="6">BSC221</td></tr>
<tr><td>Course Category</td><td colspan="6">Basic Science Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Applied Mathematics – II (Numerical Methods and Statistics)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">40</td><td>60</td><td>--</td><td>--</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basic knowledge of Mathematics-I</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at –
1. Elaborating numerical methods and statistics.
2. Analyzing engineering problems based on probability
3. Familiarizing with correlation and regression
4. Providing knowledge of the Test of Hypotheses and Significance.
5. Discussing and solve Transportation Problem.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution
2. Apply numerical methods for solving problems in different areas of engineering
3. Gain the basic knowledge of correlation and regression.
4. Formulate and solve different problems in the field computer engineering using probability and test of Significance
5. Analyze and solve engineering problems using transportation problem.
6. Formulate a mathematical model for engineering problem, solve and interpret the solution in real world.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	1			1									
CO2	3	2	1			1									
CO3	3	2			2										
CO4	3	2			2										
CO5	3	2													
CO6	3	2	2			1									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Numerical solution of algebraic and transcendental equations** Zeroes of polynomial and transcendental equation using Bisection method, Iterative method, Secant method, Regula-falsi method and Newton-Raphson method, Newton-Raphson method for system of equations, Mullers method, Rate of convergence of above methods.	7
II	**Interpolation, Numerical Differentiation and Numerical Integration** Lagrange's interpolation formula, Newton's forward and backward difference interpolation formula, Newton's divided difference interpolation formula, Numerical differentiation based on interpolation, Numerical Integration: Trapezoidal Rule, Simpson's 1/3 rd rule, Simpson's 3/8 th rule.	6
III	**Curve Fitting** Fitting of Curves by method of Least-squares for linear, parabolic, and exponential, Coefficient of correlation, Spearman's rank correlation, coefficient and lines of regression of bivariate data.	7
IV	**Probability** Random variable, Mean, median, mode and standard deviation. Binomial, Poisson, and Normal distributions.	6
V	**Test of Significance** Sampling distribution of mean and standard error, Large sample tests: Test for an assumed mean and equality of two population means. Small sample tests: t-test for an assumed mean and equality of means of two populations, Paired t-test. Test by using Chi – square Distribution. Goodness of fit test. Test for independence of attributes Yates's Correction.	7
VI	**Transportation Problem** Introduction, Mathematical formulation, Method for obtaining initial basic feasible solution, North –West corner method, Low cost entry method, Vogel′s approximation method, Method to obtain optimal solution (MODI Method).	6

Text Books

i)	M. K. Jain, S. R. K. Iyengar, R. K. Jain, "Numerical methods for scientific and Engineering Computation" , 2012, New Age International Limited Publishers.
ii)	S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 2020.
iii)	B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition , Khanna Publishers, Delhi.
iv)	S. D. Sharma, "Operations Research ", 11th Edition

Reference Books

i)	S.C. Chapra, R.P. Canale, "Numerical method for Engineers", 2015, Tata McGraw Hill Publications
ii)	James L. Johnon, "Probability and Statistics for Computer science", 2011.
iii)	H. K. Dass, "Advanced Engineering Mathematics", 2014, S. Chand Publishing.
iv)	Erwin Kreyszig, "Advanced Engineering Mathematics", Fifth Edition , John Wiley & Sons.
v)	M. D. Greenberg, "Advanced Engineering Mathematics", 2nd Edition , Pearson Education.
vi)	C. R. Wylie, "Advanced Engineering Mathematics", 6th Edition , McGraw Hill Publication, New Delhi.

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC221</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Theory of Computation</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>40</td><td colspan="2">60</td><td>--</td><td>--</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Discrete Mathematical Structure</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at –
1. Helping students to develop ability to understand and conduct mathematical proofs for computation and algorithms
2. Introducing students to the mathematical foundations of computation including automata theory.
3. Demonstrating students to design DFA and NFA for solution to engineering problems.
4. Explaining the theory of formal languages and grammars.
5. Demonstrating the PDA and normal forms of grammar.
6. Explaining different types of Turing Machines</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Analyze problem solving situations in related areas of theory in computer science.
2. Enhance ability to understand and conduct mathematical proofs for computation and algorithms.
3. Design deterministic and nondeterministic automata to recognize specified regular languages
4. Analyze and design finite automata, pushdown automata, formal languages, and grammars.
5. Convert among equivalently powerful notations for a language, including among DFAs, NFAs, and regular expressions, and between PDAs and CFGs.
6. Design and analyze Turing Machine</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	2	3	3	2											
CO2	3	2	2												
CO3	3	2	3												
CO4	1		3												
CO5	2		2												
CO6	1		3	2											

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Proofs and Regular Languages: Types of Proofs, Mathematical Induction and Recursive definitions with examples. Regular expressions & corresponding regular languages, examples and applications, unions, intersection & complements of regular languages.	6
II	Finite State Machines: Deterministic finite automata definition and representation, Non-deterministic F.A., NFA with ^ transitions, Equivalence of DFAs, NFAs and NFA-^s. Kleene's theorem - part I & II statements & proofs, minimum state FA for a regular language, minimizing number of states in an FA.	10
III	Grammars & Languages: Definition and types of grammars and languages, derivation trees and ambiguity, CFL's & Non CFL's., Union, Concatenation and Kleene's operations, Intersection and complements of CFLs, Pumping Lemma & examples.	6
IV	Chomsky Normal Form: BNF and CNF notations, Eliminating ^ production and unit productions from a CFG, Eliminating useless variables from a Context Free Grammar.	3
V	Push Down Automata: Definition, deterministic PDA, types of acceptance and conversions to each other, CFGs & PDAs., Top-Down, & Bottom-up parsing.	6
VI	Turing Machines: Models of computation, definition of TM as Language Acceptors, Combining Turing machines, computing a function with a TM. Variations in TM, TMs with doubly-infinite tapes, more than one tape, Non-deterministic TM and Universal TM.	8

	Text Books
i)	Introduction to Languages & Theory of Computation", John C. Martin, TMH, 3rd Edition.
ii)	"Discrete Mathematical Structures with Applications to Computer Science", J. P. Tremblay & R. Manohar, Tata McGraw-Hill Edition, 35th Reprint.
	Reference Books
i)	"Introduction to Automata Theory, Languages and Computations", John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman (Pearson Edition).
ii)	"Introduction to Theory of Computations", Michael Sipser, Thomson Brooks/Cole.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC222</td></tr>
<tr><td>Course Category</td><td colspan="5">Program Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Advanced Microprocessor</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td>04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>40</td><td>60</td><td>50</td><td>50</td><td>200</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Basic knowledge of microprocessor</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The Course is aimed at –
1. Analyzing the architecture, instruction set and operations of microprocessors 8086 and contemporary peripherals.
2. Elaborating the single and multiprocessor mode of 8086 processor.
3. Discussing to develop assembly level programs for microprocessor and microcontroller.
4. Describing and analyze 80386 microprocessor and PIC microcontroller.
5. Illustrating and analyze I/O Interfacing and Interrupt handling concept and to implement these concepts with Intel 8086 Assembly Language.
6. Elaborating the operation of microprocessors and microcontrollers, machine language programming and interfacing techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Upon completion of this course, student should be able to –
1. Get complete knowledge of architecture, instruction sets and operations of microprocessors 8086.
2. Understand 8086 microprocessor, multiprocessor addressing modes.
3. Develop various assembly language programs and understands the various addressing modes required for assembly language programming.
4. Develop enough confidence to take up the challenges in building useful microprocessor based applications.
5. Analyze instruction sets, applying programming and gain hands-on experience of 8086 & 80386 microprocessor and microcontroller.
6. Outline the architecture of ARM processor and PIC microcontroller.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	1	2		2											
CO2		2													
CO3	1	2													
CO4					1										
CO5		2			1										
CO6	1	2													

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**8086 Architecture** 8086 CPU Architecture, EU & BIU activities, Segmentation and address transition, 8086 pin description, 8284 clock generation 8286, 8282, configuration of 8086. Accessing even and add address memory with byte/ word. Software and Hardware interrupts.	8
II	**8086 Addressing modes and instruction sets** Addressing modes, data Transfer, arithmetic logical string, i/o instruction, control group of instruction, writing programs using assembler directive and in different module and linking, BIOS /DOS interrupts for Printer, VDU, serial, FDC, Add on cards interface.	8
III	**Minimum & Maximum mode of 8086** Multifunction pins of 8086, 8088-Bus controller, IOB mode of 8288, Minimum & Maximum mode Configuration diagram. Study of 8087 NDP	3
IV	**Modular Programming** Linking and relocation, Stacks, procedures, interrupt and interrupt routines, macros, program design, program design examples.	4
V	**80386, 32~bit processor** Salient features of 80386DX, Architecture and signal description, Register organization, addressing modes, data types, Real address mode, protected mode, Segmentation, Paging.	5
VI	**Embedded System and other Microcontrollers** PIC Microcontroller 8 bit Microcontroller, architecture, Addressing Modes, Timers, Counters, Interrupts, Serial Communication, Programming Concepts, design of embedded systems with microcontrollers.	11
Text Books		
i)	"8086/8088 Family design programming and interfacing", John Uffenbeck, PHI.8 th Edition.	
ii)	"Design with PIC Microcontrollers", John B. Peatman, Pearson Education.4 th Edition	
Reference Books		
i)	"The INTEL Microprocessor".	
ii)	"An introduction to 8086/8088 assembly language programming for beginners", N. M. Morris.	
iii)	"Microcomputer Systems: The 8086 / 8088Family Architecture, Programming and Design", Yn - cheng Liu and Gibson, G.A. Prentice Hall of India, 2nd Edition, 2006.	

Experiment No.	Experiment Title/Objective	Hours
1.	8086 Architecture: To understand 8086 Architecture in details.	02
2.	Implement 8086 program for addition and subtraction of two 16 bit numbers.	02
3.	Implement 8086 program for signed and unsigned multiplication.	02
4.	Implement 8086 program for signed and unsigned division	02
5.	Implement 8086 program to check number is even or odd.	02
6.	Implement 8086 program for check number is positive or negative.	02
7.	Implement a program: a) To find largest number from array. b) To find smallest number from array.	02
8.	Implement program for password matching.	02
9.	Implement a program to display a string and to do case conversion.	02
10.	Implement a program to string reverse and string copy.	02
11.	Implement a program: a) To sort numbers in ascending order. b) To sort numbers in descending order.	02
12.	Implement a program for counting 1's and 0's.	02
13.	Write NDP architecture in detail with diagram.	02
General Instructions: Practical Journal Assessment, Internal Oral Examination and External Practical Examination		
Reference Books		
i)	"8086/8088 Family design programming and interfacing", John Uffenbeck, PHI.2nd Edition	
ii)	"An introduction to 8086/8088 assembly language programming for beginners", N. M. Morris	

Year, Program, Semester	**S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV**
Course Code	**PCC223**
Course Category	**Professional Core Course**
Course title	**Computer Organization**

Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03

Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**
	40	**60**	**--**	**--**	**100**

Pre-requisites(if any)	Basic knowledge of digital logic and computer hardware basics
Course Objectives	The Course is aimed at- 1. Conceptualizing the basics of organizational and architectural issues of computer 2. Helping to analyze performance issues in processor and memory design of a computer. 3. Discussing various data transfer techniques in computer. 4. Explaining to analyze processor performance improvement using instruction level parallelism. 5. Providing the knowledge on Instruction Level Parallelism. 6. Providing the knowledge and Analyze Memory Organization.
Course Outcomes	Upon completion of this course, student should be able to – 1. Understand basic structure of computer. 2. Perform computer arithmetic operations. 3. Understand control unit operations. 4. Design memory organization that uses banks for different word size operations. 5. Understand the concept of cache mapping techniques. Ability to understand the concept of I/O organization 6. Conceptualize instruction level parallelism

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	2														
CO2	1		2												
CO3	1														
CO4			2												
CO5	1	1													
CO6		2													

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Basic Computer Organization:** Evolution of computers - Mechanical era, Electronic computers, Generations, VLSI era, CPU organization , communications, user and supervisor modes, accumulator based CPU, System bus, instruction cycle, types of instruction(zero, one, two and three address machines), IO interface, RISC & CISC, definition, comparison and examples.	3
II	**CPU design:** Specifications, (memory, speed, frequency etc.) with example, Instruction fetching, decoding, executing, Case Study (architecture, block diagram, instruction sets etc.), Pentium 4 processor, AMD processor.	8
III	**Computer Arithmetic:** Data Representation, basic formats, storage order, fixed point numbers, binary, signed, decimal, hexadecimal, Floating point numbers, basic formats, normalization, biasing, IEEE754 format, Fixed point arithmetic - Addition and subtraction, overflow, high speed adders, adder expansion, Fixed point multiplication - Two's complement multiplier, Booth's algorithm, Combinational array multiplier, Fixed point division - Restoring, Non restoring algorithm, Combinational array divider, Division by repeated multiplication, Floating point arithmetic - Basic operations, Difficulties, Floating point units, Addition, subtraction, multiplication, division.	8
IV	**Control Design:** Introduction, multi cycle operation, implementation methods, Hardwired control, design methods, state tables, GCD processor, Classical method, one hot method, Design example-twos complement multiplier control, CPU control unit design.	4
V	**Micro programmed control:** Basic concepts, control unit organization, parallelism in microinstructions, Microinstruction addressing, timing, Control unit organization, Design example- twos complement, multiplier control, Control field encoding, encoding by function, multiple microinstruction formats.	8
VI	**Memory Organization:** Types of memory, Memory systems, multilevel, address translation, memory allocation, Caches, Associative memory, direct mapping, set associative addressing.	8
Text Books		
i)	Computer Architecture and Organization - John P Hayes (MGH) 3rd Edition.	
ii)	Computer Systems Organization & Architecture – John D. Carpinelli (Pearson Education)	
Reference Books		
i)	Computer Organization - HamacherZaky (MGH).	
ii)	http://cse.stanford.edu/class/sophomore-college/projects-00/risc/risccisc/ (RISC vs CISC)	
iii)	http://www.cpu-world.com/sspec/	
iv)	http://www.intel.com/technology/itj/q12001/pdf/art_2.pdf (The Micro architecture of the Pentium 4 Processor).	
v)	http://www.amd.com/usen/assets/content_type/white_papers_and_tech_docs/30579_AMD_Processor _ Evaluation_Guide3.1.pdf (AMD Processor Performance Evaluation Guide)	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC224</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="6">Software Engineering</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>40</td><td colspan="2">60</td><td>--</td><td>--</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basics of Computers</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Providing knowledge of basic Software engineering methods and practices, and their appropriate applications.
2. Giving a general understanding of software process models such as the waterfall and evolutionary models and an understanding of software requirements and the SRS document.
3. Elaborating to know role of project management in planning, scheduling, risk management, different software architectural styles, implementation issues such as modularity and coding standards.
4. Providing knowledge of software testing approaches such as unit testing and integration testing and understanding of software evolution and related issues such as version management.
5. Illustrating quality control and how to ensure good quality software.
6. Explaining some ethical and professional issues that are important for software engineers and development of significant teamwork and project based experience.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –

1. Apply the project management and analysis principles to Software project development
2. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. Identify and solve engineering problems and to gain Knowledge about software development life cycle.
4. Communicate effectively and the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
5. Apply the design & testing principles to software project development to maintain software systems.
6. Identify and Apply methods for software quality and its control.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		2	2								3				
CO2			3			2	2	2							
CO3		2	2												
CO4			3			3	2			2					
CO5			2		2										
CO6		1			2										

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Introduction to Software Engineering:** The Problem Domain, Software Engineering Challenges, Software Engineering approaches, Software Processes, Software Development Process Models, Extreme programming and agile software development, Other Software Processes	6
II	**Software Requirement Engineering:** Requirement Engineering Processes, Requirement elicitation and analysis, Software Requirement Specification, Requirement Validations	7
III	**Software Architecture:** Role of software architecture, Architecture View, Component and Connector View, Architecture styles for Component and Connector View, Evaluating Architectures.	6
IV	**Software Design:** **Function Oriented Design :** Design Principles, Module Level Concepts, Design Notation and Specifications, Structure Design Methodology, Metrics **Object Oriented Design:** OO Analysis and OO Design, OO Concepts, Design Concepts, Design Methodology, Metrics.	8
V	**Coding and Testing:** Programming Principles and Guidelines, Coding Process, Refactoring, Testing, Black Box Testing, White Box Testing, Program Analysis Tools, Unit Testing, Integration Testing, System Testing	7
VI	**Software Quality and Management:** Software quality, Software standards, CMM, Reviews and inspections, Software measurement and metrics. **Case Study:** Complete a case study related to requirements gathering and analysis, designing, coding and testing phase of software development by forming a group of 3-4 students.	5
Text Books		
i)	An Integrated Approach to software engineering by Pankaj Jalote, Narosa Publication, 3rd Edition (Unit I,III,IV)	
ii)	Software Engineering by Ian Sommerville, Pearson Publication, 9th Edition	
iii)	Fundamentals of Software Engineering by Rajib Mall, PHI, 3rd Edition. (Unit V)	
iv)	Software Engineering by Roger Pressman, McGraw-Hill Publication, 9th Edition (Unit II,VI)	
v)	The Unified Modeling Language User Guide by Grady Booch, James Rumbaugh, Ivar Jacobson (Unit IV)	

Reference Books	
i)	.Software Engineering - Concepts & Practices by UgrasenSuman (Cenage Learning)
ii)	Software Engineering Fundamentals -- Behforooz& Hudson (Oxford : Indian Edition 1st)

Year, Program, Semester	**S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV**					
Course Code	**PCC225**					
Course Category	**Professional Core Course**					
Course title	**Linux and Shell Programming Lab**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	-	-	02	02		01
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	**-**		**50**	**50**	**100**
Pre-requisites(if any)	Basics of Operating System					
Course Objectives	The Course is aimed at - 1. Familiarizing students with the Linux environment 2. Teaching the Vi editor at an introductory level of proficiency 3. Familiarizing students the fundamentals of shell scripting/programming 4. Helping to perform simple concurrent programs 5. Explaining to write and use moderately complex regular expressions 6. Familiarizing students with basic Linux administration.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Use and execute basic Linux commands and understand features of Linux 2. Use Vi editor 3. Use and write Shell Programming using Linux 4. Write and use moderately complex regular expressions. 5. Perform basic Linux administration					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	3	-	-	-	-								2		
CO2	2	-	-	-	-								2		
CO3	2	-	-	-	1								2		
CO4	2	1	-	-	1								2		
CO5	2	-	-	-	1								2		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Introduction to Linux and Linux utilities – A brief history of Linux Architecture , Features of Linux , Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, sty, pwd, cd, mkdir, rmdir etc	3
II	The File System: Basic File Attributes, the vi Editor	4
III	The Shell, The Process, Customizing the environment	5
IV	More file attributes, Simple filters	4

V	Filters using regular expressions	5
VI	Essential Shell Programming, awk – An Advanced Filter	5

Experiment No.	Experiment Titles	Hours
1.	Introduction Linux Operating System- Linux Architecture, features of Linux, Versions of Linux	02
2.	Study basic Linux Commands	02
3.	Study File System commands and basic File Attributes	02
4.	Vi Editor: Hands-on	02
5.	Shell Script: Basic Commands	02
6.	Shell Script: Control Statements (Fibonacci Program)	02
7.	Shell Script: Function arrays- string operation and addition	02
8.	Shell Script: Head, tell, wc, sort, eval	02
9.	Shell Script: Regular expression, cut and grep command	02
10.	Shell Script: awk	02
11.	Essential system Administration concepts and commands	02
12.	Design a calculator using different commands	02
General Instructions: Students have to perform minimum 8 to 10 practical's		
Text Books		
i)	Unix Concepts and Applications, 4thedititon , Sumitabha Das , MGH	
ii)	Linux system programming, Robert Love, O` Reilly, SPD	
Reference Books		
i)	Beginning Linux Programming, 4th edition, N . Mathew, R.stone, Wrox Willey India Edition	
ii)	Linux, The Complete Reference , 6th edition, Richard Petersen, MGH	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC226</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">Object Oriented Programming Lab</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>04</td><td colspan="2">04</td><td>02</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Knowledge of Programming Methodology, ‘C’ language</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed to-
1. Introduce students to the principals and concepts of object oriented programming paradigm
2. Familiarize students with the basics of C++ language and its features
3. Impart knowledge about inheritance and polymorphism and their implementation in C++
4. Provide an understanding of file handling and streams for input/output operations.
5. Explore advanced features of C++ including templates, standard template library and exception handling
6. Enhance problem solving skills through practical implementation of concepts learned in C++ programming.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Demonstrate solid understanding of fundamental principal of object oriented programming and its significance in software development.
2. Proficient in C++ Programming language.
3. Implement OO features like inheritance and polymorphism
4. Implement function overloading, operator overloading and virtual functions.
5. Proficient in file handling operations.
6. Utilize C++ features of exception handling.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	3														
CO2			3												
CO3		2	3												
CO4			2												
CO5					2										
CO6			3												3

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Introduction to Object Oriented Programming:** Introduction object-oriented programming, Need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, features of OOP.	2
II	**Basics of C++ programming:** Variable declarations, global scope, const variables, reference variables, functions with default arguments, call by value, call by reference, returning by reference, call by pointer, Classes and Objects defining Class, data members, member functions, Access specifies – public, private, protected, constructor, destructor.	2
III	**Inheritance:** Need of Inheritance, Concept, public, private, protected inheritance, inheritance type, Virtual base class, method overriding, static variable, static function, friend function, friend class	2
IV	**Polymorphism:** Pointers basics of memory management, New and delete operators, Pointer to object, Pointer to data members, this pointer. Need of Polymorphism, concept, Compile time polymorphism or early binding: function over loading and operator overloading, overloading - unary, binary, arithmetic operators, relational operators, Run time polymorphism or late binding using Virtual function, pure virtual function, Abstract class, Type conversion	3
V	**Files and Streams:** Concept of Streams, concept of File, opening and closing a file, detecting end-of-file, file modes, file pointer, reading and writing characters, strings and objects to the file, operations to move file pointers i.e seekg, seekp, tellg, tellp	2
VI	**Advanced C++ features:** Introduction to Generic Programming using Templates: Function template and class template, Introduction to Standard Template Library (STL), containers, iterators and algorithms, study of container template classes for vectors and stacks and related algorithms Exception handling: Introduction, syntax for exception handling code: try-catch-throw, Multiple Exceptions, Exceptions with arguments	2

Reference Books

i)	C++: The Complete Reference Fourth Edition - Herbert Schildt (McGraw-Hill) , 4th edition
ii)	C++ programming: From Problem Analysis to Program Design Fifth Edition -D.S. Malik (Cengage Learning)
iii)	C++ Programming with language –Bjarne Stroustrup (AT & T), 4th edition
iv)	Object Oriented Programming with C++ Fourth Edition-E Balguruswamy (McGraw-Hill), 4th edition
v)	Object oriented Programming in C++ 3rd Edition-R.Lafore (Galgotia Publications), 3rd Edition
vi)	C++ programming –John Thomas Berry(PHI), 2nd Edition
vii)	Object –Oriented Analysis & Design: Understanding System Development with UML 2.0 , Docherty, Wiley India Ltd.
viii)	http://www.spoken-tutorial.org/ NMEICT Project of Govt. Of India.

Experiment No.	Experiment Title/Objective	Hours
1.	Write a program to demonstrate concept of class. For example: create class matrix, class string, class car, class date, class time, class person etc.	02
2.	Write a program to demonstrate following Function concepts a. Function overloading b. Constructors of all types c. Default parameters, returning by reference id. Demonstration of friend function e. Demonstration of static function	02
3.	Write a program to demonstrate a. Operator overloading –for unary as well as binary operation. b. Apply above concept on matrix and string classes created above	02
4.	Write a program to demonstrate C++ s capability of all types of inheritance a. Single, multiple, multivalued b. Virtual function. c. Abstract class d. Runtime polymorphism	02
5.	Write a program for new and delete operators, pointers to objects.	02
6.	Write a program for pointers to pointers, this pointer.	02
7.	Write a program for Templates, Exception handling.	02
8.	Write a program for Stack and Queue.	02
9.	Write a program for the linked list,	02
10.	Write a program for Binary tree, Traversal of a Binary tree.	02

Year, Program, Semester	**S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV**				
Course Code	**IKS221**				
Course Category	**Indian Knowledge Systems**				
Course title	**Introduction to Performing Arts**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	01	**-**	**-**	**01**	**--**
Evaluation Scheme	IE at Course in charge end				
Course Rationale:	The course "Introduction to Performing Arts" seeks to broaden the horizons of engineering students by integrating the rich and diverse realm of performing arts into their curriculum. By exploring various performing arts forms, students will not only develop a deeper understanding of human expression but also enhance their creativity, communication skills, and cultural awareness. This interdisciplinary approach aligns with NEP 2020's vision of holistic education and fosters the development of well-rounded individuals equipped to thrive in a rapidly evolving world.				
Course Objectives	The Course is aimed to- 1. Introduce fundamental concepts, history, and theoretical frameworks of various performing arts forms. 2. Cultivate appreciation for cultural, social, and aesthetic dimensions of performing arts. 3. Develop critical thinking and analytical skills through performance analysis. 4. Enhance communication and presentation skills through practical exercises. 5. Foster creativity and imagination through exploration of diverse performing arts mediums.				
Course Outcomes	Upon completion of this course, student should be able to – 1. Identify and analyze key elements and techniques across theater, dance, music, and visual arts. 2. Demonstrate understanding of historical, cultural, and social contexts in performing arts. 3. Critically evaluate performances using appropriate terminology. 4. Apply performance principles to effectively communicate ideas and emotions. 5. Engage in creative expression through original performances.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	2		2		2								
CO2						3	2								
CO3							2		3	3					
CO4						2		2	3	3					
CO5											3				

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Foundations of Performing Arts** • Introduction to Performing Arts: Definition, scope, and significance. • Historical overview: Evolution of performing arts across cultures and civilizations.	2
II	**Theatrical Arts** • Introduction to theater: Origins, elements, and dramatic conventions. • Major theatrical movements and styles: Realism, surrealism, absurdism, etc. • Analysis of selected plays and playwrights.	3
III	**Dance Forms** • Introduction to dance: Styles, techniques, and cultural contexts. • Exploration of classical, folk, and contemporary dance forms. • Practical exercises and choreography workshops.	3
IV	**Musical Expressions** • Introduction to music: Basic principles, genres, and traditions. • Appreciation of classical, folk, and popular music styles. • Analysis of musical compositions and performances.	2
V	**Visual Performing Arts** • Introduction to visual arts in performance: Set design, costume, and makeup. • Role of visual elements in enhancing the theatrical experience. • Case studies and practical demonstrations.	2
VI	**Performance and Presentation** • Practical application of performing arts principles: Group performances and presentations. • Rehearsal techniques, stage presence, and audience engagement. • Reflection and feedback on individual and group performances.	2

Reference Books

i)	Bharata Muni, *Natyashastra*, An ancient Indian treatise on performing arts covering various aspects of classical dance, music, and drama, composed between 200 BCE and 200 CE, influencing the theory and practice of Indian performing arts for centuries.
ii)	Girish Karnad. (2005). Collected Plays: Volume 1. Oxford University Press.
iii)	Mohan Khokar. (2000). Traditions of Indian Classical Dance. Clarion Books
iv)	Sunil Kothari. (2001). Kathak, Indian Classical Dance Art. Abhinav Publications.
v)	Sangeet Natak Akademi. (2005). Indian Music: Tradition and Trends. Sangeet Natak Akademi.

vi)	P. Sambamurthy. (2010). South Indian Music, Vol. 1. The Indian Music Publishing House.
vii)	Kapila Vatsyayan. (2007). Indian Classical Dance: Tradition in Transition. Publications Division, Ministry of Information and Broadcasting, Government of India.
viii)	Vijay Tendulkar. (2010). Collected Plays in Translation. Oxford University Press.
Useful Links	
i)	https://www.youtube.com/watch?v=W7bEzgZrN7s
ii)	https://www.youtube.com/watch?v=DQbNpx_CfJY
iii)	https://www.youtube.com/watch?v=eGiz50aVYWQ
Assessment	

For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested:

- Written Assignments: 20 Marks
- Practical Assessments: 20 Marks
- Class Participation and Engagement: 10 Marks

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV			
Course Code	MAC 221			
Course Category	Mandatory Audit Course			
Course title	**Aptitude Enhancement Course I**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	-	**01**	**-**	**01**
Evaluation Scheme	IE at Course in charge end			
Course Rationale	This Aptitude Enhancement Course I aims to nurture holistic development among second-year B. Tech. Engineering students by focusing on enhancing their critical thinking, problem-solving skills, creativity, and emotional intelligence. Aligned with the NEP 2020 and Outcome-Based Education (OBE) philosophy, the course seeks to empower students with essential aptitudes required for success in both academic and professional domains.			
Course Objectives	The Course is aimed to- 1. Equip students with critical thinking skills through analytical exercises and problem-solving tasks. 2. Foster creativity and innovation by engaging students in structured workshops and practical projects. 3. Develop students' emotional intelligence through self-awareness activities and stress management techniques. 4. Enhance collaborative skills and effective communication through group discussions and team-based projects.			
Course Outcomes	Upon completion of this course, student should be able to – 1. Demonstrate proficiency in critical thinking by analysing complex problems and proposing effective solutions. 2. Exhibit creativity through the development of innovative projects and solutions. 3. Display heightened emotional intelligence by managing stress, communicating empathetically, and resolving conflicts constructively. 4. Showcase collaborative skills by actively participating in group activities, contributing to team goals, and communicating ideas effectively.			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		3		3						2					
CO2		2			2	1									
CO3						3	2	3							
CO4									3	3	2	1			

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Inter-Personal & Inter-Organisational Communication	2
II	Creative & Critical Thinking	2
III	Group Dynamics & Decision-Making Techniques	2
IV	Emotional Intelligence & Stress Management	3
V	Assessment	5

Reference Books

i)	Chakravarthi T. Kalyana and Chakravarthi T. Latha, *Soft Skills for Managers* (Biztantra Publications, 2014 (ISBN: 978-81-7722-568-6))
ii)	Kumar Sanjay and Pushp Lata (2015), *Communication Skills*, 2nd Edition, Oxford University Press, (ISBN: 9780199457069)
iii)	P. D. Chaturvedi and Mukesh Chaturvedi (2017), *The Art and Science of Business Communication-Skills, Concepts, Cases and Applications*, 4th Edition, Pearson India Education Services Pvt. Ltd., (ISBN 978-93-325-8728-1)
iv)	Wright, L. (2001). Critical Thinking: An Introduction to Analytical Reading and Reasoning. Oxford University Press.
v)	Kallet, M. (2014). Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills. Wiley.
vi)	Bradberry, T., & Greaves, J. (2009). Emotional Intelligence 2.0. TalentSmart.
vii)	Dweck, C. S. (2007). Mindset: The New Psychology of Success. Ballantine Books.

Assessment

For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. The assessment will focus real-world scenarios that require the application of critical thinking, problem-solving, creativity, emotional intelligence, and teamwork. Following Evaluation Components are suggested:

1. Activity 1- Group Presentation (20 marks)
2. Activity 2- Group Discussion (20 marks)
3. Classroom Participation and Engagement (10 marks)

Active participation in class discussions, group activities and question-answer sessions.

Year, Program, Semester	**S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV**			
Course Code	**PBL221**			
Course Category	**Project Based Learning**			
Course title	**Mini Project II**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	-	**01**	**-**	**01**
Evaluation Scheme	IE at Course in charge end			
Pre-requisites(if any)	Basics of Programming Language and Computers			
Course Objectives	The Course is aimed to- 1. Create awareness among the students to express technical ideas, strategies and methodologies in written form. 2. Enable students to work as a responsible member and possibly a leader of a team in developing software solutions. 3. Motivate students to self-learn new tools, algorithms, and/or techniques that contribute to the software solution of the project 4. . Create awareness among the students of the characteristics of several domain areas where IT can be effectively used. 5. Improve the team building, communication and management skills of the students 6. Enable students to develop a design solution for a set of requirements			
Course Outcomes	Upon completion of this course, student should be able to – 1. Acquire practical knowledge within the chosen area of technology for project development 2. Identify, analyze and handle programming projects with a comprehensive and systematic approach 3. Contribute as an individual or in a team in development of technical projects 4. Develop effective communication skills for presentation of project related activities 5. Formulate and propose a plan for creating a solution for the problem identified 6. Report and present the findings of the study conducted in the preferred domain			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		2	2												
CO2		2	2	2											
CO3									2	2					
CO4							2								
CO5						2									
CO6											2	2			

Level of Mapping as: Low 1, Moderate 2, High

Course Content
Mini Project II is a continuation of the experiential learning journey initiated in Semester III. Building upon the foundations laid in Mini Project I, students will delve deeper into project activities related to their chosen area of interest within Computer Science and Technology. The course encompasses following component: 1. Mini Project II: Students will continue their project activities from the preceding semester, further refining their research objectives, conducting experiments, analyzing data, and presenting findings. Emphasis will be placed on applying advanced concepts and techniques to address specific challenges or opportunities identified in the chosen project area. The course will be conducted over the duration of one tutorial hour per week, with additional time allocated for project work as necessary. Assessment will be based on project presentations, reports, evaluating students' understanding, application, and integration of theoretical and practical knowledge. The mini-project should be undertaken preferably by a group of 3 students who will jointly work and implement the mini-project. The group will select a project with the approval of the guide. A batch of practical / Tutorial will be divided into mini project groups. Mini project topics and the work for these groups in the batch will be guided by a teacher for the batch, preferably on one of the topics like Compiler Construction, Database Engineering, Operating System, Computer Graphics and Multimedia, Advanced Programming and latest developments and trends in Computer Science and Technology. The teacher will periodically assess the performance of individual student in the mini project, jointly with a teacher of another batch. Project group will submit hardcopy project report along with project demonstration software in CD and/or project hardware gadget at the term end. The IOE of mini project will be jointly conducted by appointed examiners. Note: Use of Open source tools should be preferred.
Course Assessment Process
The course assessment process will be similar to that mentioned under Mini Project I.

Year, Program, Semester	**S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV**				
Course Code	**HSMEC221**				
Course Category	**Humanities, Social Science, Management Environment**				
Course title	**Environmental Studies**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	02	**-**	**-**	**02**	**00**
Evaluation Scheme	Even Semester End Exam: 60 marks , Project/Visit based IOE: 40 Marks				
Pre-requisites (if any)	HSMEC 211				
Course Rationale	The Course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature.				
Course Objectives	The course teacher will ensure to 1. Describe the various types and sources of environmental pollution. 2. Explore other global environmental issues, such as biodiversity loss, deforestation, and ocean acidification. 3. Explain key environmental laws and regulations at the national and international levels. 4. Explain the relationship between human society and the environment.				
Course Outcomes	Upon completion of this course, student should be able to 1. Classify different types of environmental pollutants and their sources. 2. Analyse the interconnections between climate change and other global environmental issues. 3. Understand the legal frameworks and regulations governing environmental protection and management. 4. Describe the socio-economic drivers of environmental degradation and inequality.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	-	-	-	-	3	3	-	-	-	-			
CO2	-	3	3	3	-	-	3	3	3	2	-	-			
CO3	-	2	3	3	-	-	3	3	3	3	-	-			
CO4	-	2	-	-	-	-	3	3	3	3	-	-			

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I.	**Environmental Pollution:** Definition: Causes, effects and control measures of: a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution, g) Nuclear hazards and their effects. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution	**07**

II.	**Understanding climate change and other global environmental issues:** -Structure of atmosphere; greenhouse gas emissions; Projections of global climate change, Importance of 1.5 °C and 2.0 °C limits to global warming; Carbon foot print, -Impacts of climate change: on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; -Mitigation of climate change: Green House Gas (GHG) reduction, sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policies for mitigation, net zero targets for the future; Energy efficiency measures; Renewable energy sources for carbon reduction; Carbon capture and storage, - Acid Rain: Causes, effects and mitigation - Ozone Layer Depletion: Causes, effects and mitigation.	**08**
III.	**Environmental legislation:** Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g), Environmental Protection Act., Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act	**06**
IV.	**Social Environment:** Environmental ethics, Environmental movements- Chipko Movement, Appiko Movement, Silent Valley Movement. Water conservation: rain water harvesting, watershed management, Disaster management: floods, earthquake, cyclone, tsunami and landslides.	**04**
	Nature Visits / Field Work /Field Tour/ Industrial visits / Activities related to Campus environmental management (5 Hrs.)	**05**

Text Books

1.	Agarwal, K. C. (2001), Environmental Biology, Nidi Publ. Ltd., Bikaner.
2.	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India.
3.	Brunner R. C., (1989), Hazardous Waste Incineration, McGraw Hill Inc. 480p.

Reference Books

1.	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T.,(2001), Environmental Encyclopedia, Jaico Publ. House, Mumbai.
2.	Gleick, H., (1993), Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p.
3.	Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
4.	Heywood, V. H. & Watson, R. T., (1995), Global Biodiversity Assessment, Cambridge Univ. Press.
5.	Jadhav, H. & Bhosale, V. M., (1995), Environmental Protection and Laws, Himalaya Pub. House, Delhi, 284p.
6.	Mckinney, M. L. & Schocl. R. M., (1996), Environmental Science Systems & Solutions, Web enhanced edition.
7.	Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co. (TB).
8.	Odum, E. P., (1971), Fundamentals of Ecology, W. B. Saunders Co. USA.
9.	Rao M. N. & Datta, A. K., (1987), Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.,
10.	Sharma B. K., (2001), Environmental Chemistry, Goel Publ. House, Meerut.
11.	Survey of the Environment, The Hindu (M).
12.	Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R)
13.	Wagner K. D., (1998), Environmental Management, W. B. Saunders Co. Philadelphia, USA.

Equivalence for the curriculum revision at B. Tech Computer Science and Technology

The above syllabus structure is a revised version of the Second Year B. Tech (Computer Science and Technology) Program being conducted by Shivaji University at its Technology Department. A special mention rather feature of this revision is, ***it is in line with New National Education Policy 2020 guidelines.*** This syllabus is to be implemented from June 2026, (Academic year 2026-27).

The Equivalence for the Courses of Computer Science and Technology at Second Year B Tech Semester III and IV pre-revised Program under the faculty of Science and Technology is as follows.

Semester III

Sr. No.	Second Year B. Tech Semester III Pre-revised syllabus	Second Year B. Tech Semester III Revised syllabus	Remark
1	Applied Mathematics-I	Applied Mathematics- I	Content is revised
2	Discrete Mathematical Structure	Discrete Mathematical Structure	No change in the subject content
3	Digital System and Microprocessor	Digital System and Microprocessor	No change in the subject content
4	Data Structures	Data Structures	No change in the subject content
5	Data Communication and Networking	Data Communication and Networking	No change in the subject content
6	Digital System and Microprocessor Lab	Digital System and Microprocessor Lab	No change in the subject content
7	Data Structures Lab	Data Structures Lab	No change in the subject content
8	Data Communication and Networking Lab	Data Communication and Networking Lab	No change in the subject content
9	Environmental Studies	Environmental Studies	Modified as per University suggested content. But there are no credits. The evaluation is at the end of Even Semester.
10	Soft Skills Development	Soft Skills Development	Content is revised and made it as a Credit course
11	------	Mini Project I	Newly

			introduced audit course.
12	Introduction to Performing Arts	------	Shifted to Sem IV

Semester IV

Sr. No.	Second Year B. Tech Semester IV Pre-revised syllabus	Second Year B. Tech Semester IV Revised syllabus	Remark
1	Theory of Computation	Theory of Computation	No change in the subject content
2	Advanced Microprocessor	Advanced Microprocessor	No change in the subject content
3	Computer Organization	Computer Organization	No change in the subject content
4	Software Engineering	Software Engineering	No change in the subject content
5	Applied Mathematics-II	Applied Mathematics-II	No change in the subject content
6	Advanced Microprocessor Lab	Advanced Microprocessor Lab	No change in the subject content
7	Linux and Shell Programming Lab	Linux and Shell Programming Lab	No change in the subject content
8	Object Oriented Programming Lab	Object Oriented Programming Lab	No change in the subject content
9	Environmental Studies Project Work	Environmental Studies	No change in the subject content. Only change in Title.
10	Soft Skills Development	------	Shifted to Sem III
11	-	Multidisciplinary Minor Course I	As per NEP feature, MDM is introduced.
12	------	Aptitude Enhancement Course -I	Newly introduced
13	------	Mini Project II	Newly introduced
14	------	Introduction to Performing Arts	Made it as audit course