PUDUCHERRY TECHNOLOGICAL UNIVERSITY
PUDUCHERRY –605014

(A Technological University of Gover*nment of Puducherry)*

NOTES ON AGENDA

of

the fifth meeting of

BOARD OF STUDIES

In

COMPUTER SCIENCE AND ENGINEERING

(Both offline and virtual mode)

Held on Wednesday, 30th August 2023

Venue: Department of Computer Science and Engineering
Puducherry Technological University

Time: 2:30 pm

I N D E X

1	For Approval

Item 1.1	Curriculum and Syllabi for B.Tech – Computer Science and Engineering offered in Constituent and Affiliated Colleges under Puducherry Technological University *(Effective from the Academic Year 2022 – 23)*

The curriculum and syllabi of B.Tech. (Computer Science and Engineering) programme offered in Constituent and Affiliated Colleges under Puducherry Technological University have been prepared and placed for approval of BoS. The same is enclosed in Annexure I.

Item 1.2	Course Outcomes (COs) and CO-PO Articulation Matrix revised for all subjects in the B.Tech- CSE Syllabi of both PTU and Constituent / Affiliated Colleges

The course outcomes(COs) and course outcome - program outcome (CO-PO) articulation matrix have been revised for all courses in the B.Tech –CSE syllabi of both PTU and Constituent/affiliated Colleges according to modified Bloom's taxonomy and placed for approval of BoS. The same is enclosed in Annexure I.

2	Annexure

Annexure I	Curriculum and Syllabi of B.Tech – Computer Science and Engineering offered in Constituent / Affiliated Colleges under PTU *(Effective from the Academic Year 2022 – 23)*

Annexure I

Curriculum and Syllabi of B.Tech – Computer Science and Engineering offered in Constituent / Affiliated Colleges under PTU *(Effective from the Academic Year 2022 – 23)*

PUDUCHERRY TECHNOLOGICAL UNIVERSITY

Applicable to the Constituent and Affiliated Colleges of
Puducherry Technological University

REGULATIONS 2022-2023

B.TECH. COMPUTER SCIENCE AND ENGINEERING
CURRICULUM

The Curriculum of B.Tech. (Computer Science and Engineering) is designed to fulfil the Program Educational Objectives (PEO) and the Program Outcomes (PO) listed below:

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1	Provide a strong foundation required to comprehend, analyse, design and develop solutions to real world computing problems.
PEO2	Expose the students to industry practices for providing computing solutions using current models and techniques.
PEO3	Enable the students to pursue higher studies and active research.
PEO4	Foster sustained professional development through life-long learning to adapt new computing technologies.

PROGRAMME OUTCOMES (PO)

PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problemsreaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processesthat meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT toolsincluding prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legaland cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community andwith society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles andapply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1	Ability to apply their skills in the field of algorithms, networking, web design, cloud computing and databases.
PSO2	Ability to develop and deploy software solutions for real world problems.
PSO3	Gain knowledge in diverse areas of Computer Science and experience an environment conducive in cultivating skills for successful career, entrepreneurship, research and higher studies.

Distribution of credits among the subjects grouped under various categories:

Courses are grouped under various categories and the credits to be earned in each category of courses are as follows:

Sl. No.	Category	Credits	Course Category Code (CCC)
1	Humanities, Social Sciences and Management Courses	6 + 2 / 3 *	HSM
2	Basic Science Courses (Mathematics, Physics, Chemistry and Biology)	25	BSC
3	Engineering Science Courses (Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc.,)	19	ESC
4	Professional Core Courses	69	PCC
5	Professional Elective Courses (from chosen discipline)	15	PEC
6	Open Elective Courses (from other technical/emerging disciplines)	10	OEC
7	Professional Activity Courses (Project Work, Entrepreneurship, Seminar, Internship, Comprehensive Test)	14	PAC
8	Mandatory non-Credit Courses (Environmental Sciences, Induction, Indian Constitution, Essence of Indian Traditional Knowledge, Professional Ethics)	Non-credit	MCC
	Total	**158**	

***included in the 10 credits under open elective category**

Semester-wise Courses and Credits

Semester I

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
FYA101	Induction Programme	MCC	-	-	-	-	0
MAA101	Mathematics I	BSC	TY	3	1	0	4
PHA101	Physics	BSC	TY	3	1	0	4
CYA101	Chemistry	BSC	TY	3	1	0	4
HSA101	English for Communication	HSM	TY	2	0	2	3
MEA101	Workshop and Manufacturing Practice	ESC	LB	0	0	3	1.5
PHA102	Physics Laboratory	BSC	LB	0	0	3	1.5
CYA102	Chemistry Laboratory	BSC	LB	0	0	3	1.5
Total				11	3	11	**19.5**
				25			

Semester II

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
MAA102	Mathematics II	BSC	TY	3	1	0	4
EEA101	Basic Electrical Engineering	ESC	TY	3	1	0	4
CSA101	Programming for Problem Solving	ESC	TY	3	0	0	3
MEA102	Engineering Graphics and Computer Aided Drawing	ESC	TY	2	0	4	3
CEA101	Environmental Science	MCC	-	3	0	0	0
EEA102	Basic Electrical Engineering Laboratory	ESC	LB	0	0	3	1.5
CSA102	Programming Laboratory	ESC	LB	0	0	3	1.5
Total				14	2	10	**17**
				26			

CCC - Course Category Code, **SET** – Semester Exam Type, **TY** – Theory, **LB** – Laboratory, **PR** - Project

Semester III

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
SHA101	Biology for Engineers	BSC	TY	3	0	0	2
ECA135	Electronic Devices and Digital Systems	ESC	TY	3	0	0	3
CSA103	Computer Organization and Architecture	PCC	TY	3	1	0	4
CSA104	Data Structures	PCC	TY	3	0	0	3
CSA105	Object Oriented Programming Languages	PCC	TY	3	0	0	3
ECA136	Electronic Devices and Digital Systems Laboratory	ESC	LB	0	0	3	1.5
CSA106	Data Structures Laboratory	PCC	LB	0	0	3	1.5
CSA107	Object Oriented Programming Languages Laboratory	PCC	LB	0	0	3	1.5
SHA102	Indian Constitution	MCC	-	3	0	0	0
Total				18	1	9	**19.5**
				28			

Course Code	Open Elective	CCC	SET	Periods			Credits
				L	T	P	
ZZA3XX	Open Elective Course	OEC	TY	3	0	0	3

Semester IV

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
MAA106	Mathematics for Computing	BSC	TY	3	1	0	4
CSA108	Operating Systems	PCC	TY	3	0	0	3
CSA109	Design and Analysis of Algorithms	PCC	TY	3	0	0	3
CSA110	Database Management Systems	PCC	TY	3	0	0	3
CSA111	Software Engineering	PCC	TY	3	1	0	4
CSA112	Operating System Laboratory	PCC	LB	0	0	3	1.5
CSA113	Design and Analysis of Algorithms Laboratory	PCC	LB	0	0	3	1.5
CSA114	Database Management Systems Laboratory	PCC	LB	0	0	3	1.5
Total				15	2	9	**21.5**
				26			

Course Code	Open Elective	CCC	SET	Periods			Credits
				L	T	P	
ZZA3XX	Open Elective Course	OEC	TY	3	0	0	3

Semester V

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
HSA102	Industrial Economics and Management	HSM	TY	3	0	0	3
CSA115	Platform Technologies	PCC	TY	3	0	0	3
CSA116	Computer Networks	PCC	TY	3	0	0	3
CSA117	Automata Theory and Compiler Design	PCC	TY	3	1	0	4
CSA2XX	Professional Elective Course - I	PEC	TY	3	0	0	3
CSA118	Platform Technologies Laboratory	PCC	LB	0	0	3	1.5
CSA119	Computer Networks Laboratory	PCC	LB	0	0	3	1.5
SHA103	Essence of Indian Traditional Knowledge	MCC	-	3	0	0	0
Total				18	1	6	**19**
				25			

Course Code	Open Elective	CCC	SET	Periods			Credits
				L	T	P	
ZZA3XX	Open Elective Course	OEC	TY	3	0	0	3

Semester VI

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
EPA101	Entrepreneurship	PAC	TY	3	0	0	2
CSA120	Microprocessors and Microcontrollers	PCC	TY	3	0	0	3
CSA121	Web Technologies	PCC	TY	3	0	0	3
CSA122	Information Security	PCC	TY	3	1	0	4
CSA2XX	Professional Elective Course - II	PEC	TY	3	0	0	3
CSA2XX	Professional Elective Course - III	PEC	TY	3	0	0	3
CSA123	Microprocessors and Microcontrollers Laboratory	PCC	LB	0	0	3	1.5
CSA124	Web Technologies Laboratory	PCC	LB	0	0	3	1.5
Total				18	1	6	**21**
				25			

Course Code	Open Elective	CCC	SET	Periods			Credits
				L	T	P	
ZZA3XX	Open Elective Course	OEC	TY	3	0	0	3

Semester VII

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
CSA125	Artificial Intelligence	PCC	TY	3	0	0	3
CSA126	Parallel and Distributed Systems	PCC	TY	3	1	0	4
CSA127	Data Science Essentials	PCC	TY	3	1	0	4
CSA2XX	Professional Elective Course - IV	PEC	TY	3	0	0	3
CSA2XX	Professional Elective Course - V	PEC	TY	3	0	0	3
CSA128	Artificial Intelligence Laboratory	PCC	LB	0	0	3	1.5
CSA129	Seminar	PAC	-	0	0	2	1
CSA130	Professional Ethics	MCC	-	2	0	0	0
Total				17	2	5	**19.5**
				24			

Course Code	Open Elective	CCC	SET	Periods			Credits
				L	T	P	
ZZA3XX	Open Elective Course	OEC	TY	3	0	0	3

Semester VIII

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
SWA3XX	Open Elective through SWAYAM	OEC	-	-	-	-	2
SWA3XX	Open Elective through SWAYAM	OEC	-	-	-	-	2
CSA131	Comprehensive Test	PAC	-	-	-	2	1
CSA132	Internship	PAC	-	-	-	-	2
CSA133	Project Work	PAC	PR	-	-	8	8
Total				-	-	10	**15**
				10			

List of Professional Elective Courses (PEC)

Professional Elective Courses	Course Code	Course Name	Semester
Professional Elective – I	CSA201	Graphics and Image Processing	V
	CSA202	Software Design and Testing	
	CSA203	Python Programming	
Professional Elective – II /III	CSA204	Data warehousing and Data Mining	VI
	CSA205	Internet of Things	
	CSA206	Mobile Application Development	
	CSA207	Mobile Communication and Computing	
Professional Elective – IV /V	CSA208	Embedded Systems	VII
	CSA209	Cloud Computing	
	CSA210	Machine Learning	
	CSA211	Business Intelligence	

List of Open Electives Courses (OEC)

Course Code	Course Name
CSA301	Introduction to Python Programming
CSA302	Java Programming
CSA303	Fundamentals of RDBMS
CSA304	Essentials of Mobile Application Development
CSA305	Introduction to Data Science
CSA306	C# and .Net programming

Courses offered under various categories:

CCC	Course Code	Course Name	Semester	Credit	Total Credit
BSC	MAA101	Mathematics I	I	4	25
	PHA101	Physics	I	4	
	CYA101	Chemistry	I	4	
	PHA102	Physics Laboratory	I	1.5	
	CYA102	Chemistry Laboratory	I	1.5	
	MAA102	Mathematics II	II	4	
	SHA101	Biology for Engineers	III	2	
	MAA106	Mathematics for Computing	IV	4	
ESC	MEA101	Workshop and Manufacturing Practice	I	1.5	19
	EEA101	Basic Electrical Engineering	II	4	
	CSA101	Programming for Problem Solving	II	3	
	MEA102	Engineering Graphics & Computer Aided Drawing	II	3	
	EEA102	Electrical Engineering Laboratory	II	1.5	
	CSA102	Programming Laboratory	II	1.5	
	ECA135	Electronic Devices and Digital Systems	III	3	
	ECA136	Electronic Devices and Digital Systems Laboratory	III	1.5	
PCC	CSA103	Computer Organization and Architecture	III	4	69
	CSA104	Data Structures	III	3	
	CSA105	Object Oriented Programming Languages	III	3	
	CSA106	Data Structures Laboratory	III	1.5	
	CSA107	Object Oriented Programming Languages Laboratory	III	1.5	
	CSA108	Operating Systems	IV	3	
	CSA109	Design and Analysis of Algorithms	IV	3	
	CSA110	Database Management Systems	IV	3	
	CSA111	Software Engineering	IV	4	
	CSA112	Operating System Laboratory	IV	1.5	
	CSA113	Design and Analysis of Algorithms Laboratory	IV	1.5	
	CSA114	Database Management Systems Laboratory	IV	1.5	
	CSA115	Platform Technologies	V	3	
	CSA116	Computer Networks	V	3	
	CSA117	Automata Theory and Compiler Design	V	4	
	CSA118	Platform Technologies Laboratory	V	1.5	
	CSA119	Computer Networks Laboratory	V	1.5	
	CSA120	Microprocessors and Microcontrollers	VI	3	
	CSA121	Web Technologies	VI	3	
	CSA122	Information Security	VI	4	
	CSA123	Microprocessors and Microcontrollers Laboratory	VI	1.5	
	CSA124	Web Technologies Laboratory	VI	1.5	
	CSA125	Artificial Intelligence	VII	3	
	CSA126	Parallel and Distributed Systems	VII	4	
	CSA127	Data Science Essentials	VII	4	
	CSA128	Artificial Intelligence Laboratory	VII	1.5	

PEC	CSA2XX	Professional Elective Course – I	V	3	**15**
	CSA2XX	Professional Elective Course – II	VI	3	
	CSA2XX	Professional Elective Course – III	VI	3	
	CSA2XX	Professional Elective Course – IV	VII	3	
	CSA2XX	Professional Elective Course – V	VII	3	
OEC	ZZA3XX	Open Electives offered by other Departments	III - VII	6	**10**
	SWA3XX	Open Electives offered under SWAYAM	-	4	
PAC	EPA101	Entrepreneurship	VI	2	**14**
	CSA129	Seminar	VII	1	
	CSA131	Comprehensive Test	VIII	1	
	CSA132	Internship	VIII	2	
	CSA133	Project Work	VIII	8	
HSM	HSA101	English for Communication	I	3	**6 + 3*/ 2***
	HSA102	Industrial Economics and Management	V	3	
	HSA3XX	Humanities Open Elective offered by HSS Department	**-**	3*	
	SWA3XX	Humanities Open Elective offered under SWAYAM	**-**	2*	
Total					**158**

***included in the 10 credits under Open Elective category**

III SEMESTER

Department: **Chemistry**		Programme: **B.Tech., (EE)**						
Semester: **Third**		Subject Category: **BSC**			Semester Exam Type: **TY**			
Course Code	Course	Period / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
SHA101	**Biology for Engineers**	3	-	-	2	25	75	100
Prerequisite	-							

Course Outcome	**Course Outcome Statement**	**Level**
CO1	Classify the basic biological principles and organizational structure of living systems at molecular level.	Understand
CO2	Explain the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring	Understand
CO3	Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine	Understand
CO4	Outline understanding of enzyme action and factors affecting their activity.	Understand
CO5	Identify and classify microorganisms.	Understand

UNIT-I	**Classification**	**Periods: 9**
Classification outline based on (a) cellularity- Unicellular or multicellular (b) ultrastructure prokaryotes or eukaryotes (c) Energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitats- acquatic or terrestrial (e) Molecular taxonomy three major kingdoms of life.		CO1
UNIT-II	**Genetics**	**Periods: 9**
Mendel's laws, Concept of segregation & independent assortment. Concept of allele. Recessiveness, and dominance. Single gene disorders in humans – Sickle cell disease, Phenylketonuria.		CO2
UNIT-III	**Biomolecules**	**Periods: 9**
Carbohydrates: Types, Structural & functional importance. Lipids: Classification - Simple, compound, & derived, Importance of lipid soluble vitamins. Amino acids – general structure, essential amino acids. Proteins - Levels of protein structure, structural & functional importance of proteins, Enzymes- Definition, Enzyme Activity & Units, Specific Activity, Specificity, Factors affecting enzyme activity. Nucleic acids: Types and importance.		CO3
UNIT-IV	**Metabolism**	**Periods: 9**
Introduction: Food chain & energy flow. Definitions - Anabolism & Catabolism. Photosynthesis: Reaction and importance. Glycolysis & TCA cycle. ATP – the energy currency of cells		CO4
UNIT-V	**Microbiology**	**Periods: 9**
Concept of single celled organisms. Concept of species & strains. Identification & classification of microorganisms. Virus – Definition, types, examples.		CO5

Total Contact Hours: 45	**Tutorial Hours: -**	**Practical Hours: 00**	**Total Hours: 45**

Reference Book:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freemanand Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman andcompany, DistributedbySatish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers.

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	-	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	-	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	-	-	-	-	-	-	-
AV	-	-	-	-	-	1	2	-	-	-	-	-	-	-

Department: **Electronic and Communication Engineering**		Programme: **B.Tech.(CS)**						
Semester : **Third**		Course Category Code: **ESC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
ECA135	**Electronic Devices and Digital Systems**	3	-	-	3	25	75	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Understand the theory of diodes and their applications						
	CO2	Acquire an in-depth knowledge and apply the characteristics of BJTs and FETs in realizing them as basic building blocks of logic gates						
	CO3	Gain knowledge on Boolean logic and simplification of Boolean functions. Acquire the ability to develop any combinational logic functions and design combinational circuit						
	CO4	Understand the behaviour of synchronous sequential circuits to develop the practical digital circuit design techniques						
	CO5	Write Verilog HDL for the combinational and sequential circuits						
UNIT-I	**Diode and its Applications**				**Periods: 9**			
PN junction diode, Diode equivalent circuit, Diode as a switch –Zener diode, Applications of diode – AND/OR gates using diodes, Clippers and clampers – Voltage doubler and tripler – Voltage regulation – Series and shunt voltage regulators.								**CO1**
UNIT-II	**Transistors – Types and applications**				**Periods: 9**			
NPN and PNP junction characteristics, Transistor types: BJTs, FETs and MOSFETs, Biasing techniques – CB, CE, CC; Transistors as switch, amplifier, buffer and one-bit memory cell; logic gates using transistors, output types: totem pole and open collector – Integrated Circuits – SSI, MSI, LSI and VLSI.								**CO2**
UNIT-III	**Boolean Algebra and Combinational Logic**				**Periods: 9**			
Boolean algebra -Basic operations -Basic Theorems -Boolean functions-Canonical forms -Simplification of Boolean functions-Karnaugh maps - Tabulation method. Adders – subtractors – code converters – binary parallel adder –decimal adder – magnitude comparator – encoders – decoders – multiplexers – de-multiplexers- Binary Multiplier.								**CO3**
UNIT-IV	**Sequential Circuits and Memory**				**Periods: 9**			
Sequential Circuits-latches –flip flops –analysis of clocked sequential circuits –state reduction and assignments. Registers and Counters: Registers – shift registers – ripple counters – synchronous counters – other counters. Random access memory – memory decoding - Read only memory – Programmable Logic Array – Programmable Array Logic.								**CO4**
UNIT-V	**Digital Logic Design Using Verilog HDL**				**Periods: 9**			
Lexical Conventions – Data Types – System tasks –Module definition – Port Declaration – Gate Level modeling using basic Verilog gate primitives – Dataflow Modeling – Continuous Assignments – Operator Types – Delay Specification – Behavioral Modeling – Structured Procedures – always and initial block – blocking and non-blocking assignments – conditional statements – multi-way branching – loops – sequential and parallel block – Subprogram Declaration – Tasks and Function.								**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books

1. J. Millman, C. Halkias and Satyabrata, Electronic devices and Circuits, Third Edition, McGraw Hill, 2010.
2. Robert L. Boylestead and Louis Nashelsky, Electron Devices and Circuits Theory, Eleventh Edition, Prentice Hall of India, 2013.
3. M. Morris Mano and Michael Ciletti, Digital Design, Sixth Edition, Pearson India Education Services, Pvt. Ltd., 2018.
4. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design, Tata McGraw-Hill Publishing Company Ltd., 2006.

Department: Computer Science and Engineering			Programme: **B.Tech. Computer Science and Engineering**						
Semester: III			Course Category Code: PCC						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA103	**Computer Organization and Architecture**		3	1	0	4	25	75	100
Prerequisite:	-								
Course Outcome	**CO1**	Interpret the typical computer instruction execution on a basic processor and pipelined architectures							Understand
	CO2	Make use of the data representations and computer arithmetic techniques for designing and implementing faster and efficient application							Apply
	CO3	Identify and compare different methods for computer I/O							Apply
	CO4	Measure the computer performance based on the architecture, instruction set and memory hierarchy							Evaluate
UNIT-I	**Basic Structures of Computers**					**Periods: 12**			
Computer Types, Functional Units, Basic Operational Concepts, Number Representation and Arithmetic Operations, Character Representation, Performance, Historical Perspective, Memory Locations and Addresses, Memory operations, Instructions and Instruction Sequencing, Addressing modes, Assembly Language, Stacks and Queues, Subroutines, Shift and Rotate Instructions, CISC Instruction Sets, RISC Vs CISC.									**CO1 CO2**
UNIT-II	**Basic Processing Unit and Pipelining**					**Periods: 12**			
Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors, Pipelining: Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Resource Limitations, Performance Evaluation, Superscalar Operation.									**CO1 CO2**
UNIT-III	**Computer Arithmetic**					**Periods: 12**			
Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.									**CO2**
UNIT-IV	**Memory System**					**Periods: 12**			
Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual memories, Memory Management requirements, Secondary Storage.									**CO4**
UNIT-V	**Input / Output Organization**					**Periods: 12**			
Accessing I/O Devices : I/O Device Interface, Program-Controlled I/O, Interrupts: Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Behaviour, Processor Control Registers, Exceptions, Bus Structure, Bus Operation, Arbitration, Interface Circuits, Interconnection Standards: USB, FireWire, PCI Bus, SCSI.									**CO3 CO4**
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods: 0**			**Total Periods: 60**			

Reference Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, TataMcGraw Hill , 2012 (Unit 1 –V)
2. John P. Hayes, Computer Architecture and Organization, Third edition, Tata McGraw Hill, 2013.
3. William Stallings, Computer Organization and Architecture – Designing for Performance, Tenth Edition, Pearson education, 2016.
4. John Hennessy David Patterson, Computer Architecture **-** A Quantitative Approach, 6th Edition, Morgan Kaufmann, 2017.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1										2	1		2
CO2	2	2	2				1					2	2	1	2
CO3	2	2	1				1					2	1		2
CO4	2	2	2	1		1	1					2	2	1	2
Avg.	**1.75**	**1.75**	**1.66**	**1**		**1**	**1**					**2**	**1.5**	**1**	**2**

Department: **Computer Science and Engineering**			Programme: **B.Tech. CSE**						
Semester: **Third**			Course Category Code: **PCC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA104	**Data Structures**		**3**	**-**	**-**	**3**	**25**	**75**	**100**
Prerequisite:	NIL								
Course Outcome	**CO1**	Represent the basic concepts of algorithms and data structures using searching and sorting techniques							**Understand**
	CO2	Explain the concept of linear data structures and non-linear data structures with necessary applications							**Understand**
	CO3	Explain the linear data structures with illustrations							**Analyse**
	CO4	Explain the non-linear data structures with illustrations							**Analyse**
	CO5	Construct relevant new data structures for the given application							**Create**
UNIT-I	**Introduction**					**Periods: 9**			
Algorithmic notation – Programming principles –Analyzing algorithms. Arrays: One dimensional array, multidimensional array, pointer arrays. Searching: Linear search, Binary Search, Fibonacci search. Sorting techniques: Internal sorting - Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Heap Sort and Merge Sort.									CO1
UNIT-II	**Stack, Queue and Linked lists**					**Periods: 9**			
Stacks: Definition – operations - applications of stack. Queues: Definition - operations - Priority queues – De-queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, linked stacks, Linked queues, Applications of Linked List – Dynamic storage management.									CO2 CO3 CO5
UNIT-III	**Tree**					**Periods: 9**			
Tree: Definition - Binary tree – Terminology – Representation – operations - Applications – Binary search tree – AVL tree. B Trees: B Tree indexing - operations on a B Tree - B + Tree Indexing. Trie - Trie operations – Introduction to Patricia Tree.									CO2 CO4 CO5
UNIT-IV	**Graph**					**Periods: 9**			
Graph: Definition – Terminology – Representation - Traversals – Applications - spanning tree, shortest path and Transitive closure, Topological sort. Set: Definition - Representation - Operations on sets – Applications.									CO2 CO4 CO5
UNIT-V	**Hash Table**					**Periods: 9**			
Tables: Rectangular tables - Jagged tables – Inverted tables - Symbol tables – Static tree tables - Dynamic tree tables - Hash tables. Files: Sequential organization – Index organization									CO2 CO4 CO5
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			
Reference Books:									
1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Pvt. Ltd., 2004. 2. D. Samanta, Classic Data Structures, Second Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.									

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	-	2	-			1	1		2	3	1	2
CO2	1	1	3	-	2	-			1	1		2	3	2	1
CO3	1	1	3	-	2	2			1	1		2	3	3	3
CO4	1	1	3	-	2	2			1	1		2	3	3	3
CO5	1	2	2	2	2	2			1	1		2	3	3	3
Avg.	**1.2**	**1.2**	**2.8**	**0.4**	**2**	**1.2**	**-**	**-**	**1**	**1**	**-**	**2**	**3**	**2.4**	**2.4**

Department: Computer Science and Engineering			Programme:**B.Tech.**						
Semester:Third			Course Category Code: PCC						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA105	**Object Oriented Programming Languages**		3	-	-	3	25	75	100
Prerequisite:									
Course Outcome	**CO1**	Paraphrasing the basic object-oriented features for building simple C++ applications					Understanding		
	CO2	Integrating object-oriented concepts for building large scale complex system using C++					Apply		
	CO3	Illustrating various Java constructs, features, collections and libraries for building Java application					Analysing		
	CO4	Building GUI based applications using Java with database connection establishment.					Creating		
UNIT-I	**Introduction to C++ Programming Languages**					**Periods: 9**			
Programming paradigms, C++–data types – stream classes –Manipulators– Control structure. Inline functions – Recursion–function overloading. Classes and objects - array of objects – friend functions– overloading member functions. Constructors and Destructors.									**CO1**
UNIT-II	**Object Oriented Features of C++**					**Periods: 9**			
Overloading unary operators and binary operators –type conversion. Inheritance – Types of Inheritance – Virtual base classes – abstract classes. Pointer to class and object – pointer to derived classes and base classes –Arrays. Memory-Memory models – new and delete operators – dynamic objects. Binding, Polymorphism and Virtual Functions –Virtual functions - Strings –Templates- Exception Handling.									**CO2**
UNIT-III	**Java Basics**					**Periods: 9**			
Java features –Java Platform –Java Fundamentals –Data Types – Variables and Arrays - Expressions, Operators, and Control Structures – Classes and Objects -Methods - Constructors – Destructors - Inheritance – Types Packages, Polymorphism- Abstract classes and Interfaces -Overloading.									**CO3**
UNIT-IV	**GUI and Database**					**Periods: 9**			
Swing Controls - Layout Managers - Panel-Dialog, JDBC Introduction - JDBC Architecture - Types of Drivers - Statements - ResultSet - PreparedStatement - Multithreading - Concurrency.									**CO4**
UNIT-V	**Collections and Java 8**					**Periods: 9**			
Strings, IO, collections-ArrayList-Vector-LinkedList-HashSet-TreeMap-Iterator- Comparator, Lambdas and Streams, JavaFX, Java Time API.									**CO3**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods:-**			**Total Periods:45**			

Reference Books:

1. Deitel and Deitel, C++ How to program, Ninth Edition, Prentice Hall, 2014.
2. Deitel and Deitel, JAVA How to Program, Eleventh Edition, Prentice Hall, 2017.
3. Herbert Schildt, Java SE 6: The Complete Reference, Eleventh Edition, McGraw-Hill, 2018.
4. Cay S. Horstmann, Core Java: Volume II-Advanced Features, Eleventh Edition, Prentice Hall, 2019.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	2	3	1	1	0	0	0	0	0	1	1			
CO2	3	2	3	1	1	0	0	0	0	0	1	1			
CO3	3	2	3	1	1	0	0	0	0	0	1	1			
CO4	3	2	3	1	1	0	0	0	0	0	1	1			
Avg	3	2	3	1	1	0	0	0	0	0	1	1			

Department: **Electronic and Communication Engineering**			Programme: **B.Tech. (CS)**						
Semester : **Third**			Course Category Code: **ESC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ECA136	**Electronic Devices and Digital Systems Laboratory**		-	-	3	1.5	25	75	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Study and thoroughly analyze the working of diodes and their applications							
	CO2	Understand the characteristics of BJT and FET and also able to determine its parameters							
	CO3	Understand the application of transistor as an amplifier and also analyze its Frequency response characteristics							
	CO4	Design the adders and subractors using basic logic gates and also able to apply the Boolean algebra to simplify the Boolean expressions to realize the given functions using Multiplexers and Decoders							
	CO5	Write Verilog HDL for the combinational and sequential circuits and verify its functionality							

1. VI characteristics of LED and Zener diodes. 2. Application of Diodes - Clippers, Clampers, AND gate and OR gate.	**CO1**
3. Input and Output Characteristics of Common Emitter transistor configuration and determination of h-parameters. 4. Drain characteristics of JFET and determination of Drain resistance, Mutual conductance and Amplification factor.	**CO2**
5. Frequency Response of RC-coupled amplifier and determination of input and output impedances.	**CO3**
6. Verification of DeMorgan's theorems using basic logic gates and design and implementation of adders and subtractors. 7. Design and implementation of simplified Boolean expressions using Multiplexers and decoders.	**CO4**
8. Verification of the design functionality of Adder, Subtractor and Carry Look-Ahead Adder using Verilog HDL. 9. Verification of the design functionality of Parity Generator/Checkers and Magnitude Comparators using Verilog HDL. 10. Verification of the design functionality of flip flops, ripple counters and shift registers using Verilog HDL.	**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. David A. Bell, Electronic Devices and Circuits, Fifth Edition, Prentice Hall of India, 2008.
2. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design, Tata McGraw-Hill Publishing Company Ltd., 2006.

Department:**Computer Science and Engineering**			Programme:**B.Tech. CSE**						
Semester: **Third**			Course Category Code: **PCC**			Semester Exam Type: **LB**			
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA106	**Data Structures Laboratory**		**-**	**-**	**3**	**1.5**	**25**	**75**	**100**
Prerequisite	NIL								
Course Outcome	**CO1**	Develop programs for search and sorting algorithms using arrays					**Apply**		
	CO2	Experiment with the functions of linear data structures and their applications					**Apply**		
	CO3	Experiment with the functions of non-linear data structures and their applications					**Apply**		
	CO4	Design new algorithms for the given application using appropriate linear or non linear data structures					**Create**		

1. Searching Algorithms (With the Number of Key Comparisons) : - Sequential, Binary and Fibonacci Search Algorithms on an Ordered List 2. Sorting Algorithms (Any Five): Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort.	**CO1** **CO2**
3. Implementation of Stack and Its Operations. 4. Application of Stack for Converting an Arithmetic Expression into Postfix Form and Evaluation of Postfix Expression. 5. Implementation of Queue, Circular Queue, Priority Queue, Dequeue and Their Operations. 6. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List.	**CO2** **CO4**
7. Implementation of Binary Tree and Binary Traversal Techniques.	**CO3** **CO4**
8. Implementation of Graph Traversal Techniques. 9. Dijkstra's Algorithm to Obtain the Shortest Paths.	**CO3** **CO4**
10. Implementation of Hash Tables and Its Operations.	

LecturePeriods: -	**Tutorial Periods: -**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Pvt. Ltd., 2004.
2. D. Samanta, Classic Data Structures, Second Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1								3	3	3
CO2	2	2	2	3	2							1	3	3	3
CO3	2	2	2	3	2							1	3	3	3
CO4			3	3	2	2	2	2	1	1	1	2	3	3	3
Avg	**1.75**	**1.5**	**2.25**	**3**	**1.75**	**0.5**	**0.5**	**0.5**	**0.25**	**0.25**	**0.25**	**1.0**	**3**	**3**	**3**

Department: **Computer Science and Engineering**		Programme:**B.Tech.**						
Semester:**Third**		Course Category Code: PCC				Semester Exam Type:LB		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA107	**Object Oriented Programming Languages Laboratory**	-	-	3	1.5	25	75	100
Prerequisite:								

Course Outcome		
CO1	Implementing object-oriented concepts for developing solutions for real world problems using C++	Apply
CO2	Exploring various Java constructs, features, collections and libraries for building Java application	Apply
CO3	Devising GUI based applications using Java with database connection establishment.	Create

Programming Using C++	
1. Program to implement classes and objects. 2. Program to implement constructors and destructors with array of objects. 3. Program to demonstrate function overloading. 4. Program to implement strings and Exception handling 5. Program to implement different types of inheritances like multiple, Multilevel and hybrid. 6. Programs to implement virtual functions to demonstrate the use of run time polymorphism. 7. Program to implement class and function templates.	**CO1**
Programming Using Java	
1. Study of execution of simple Java programs. 2. Programs to implement classes and objects in java. 3. Programs to implement constructors and destructors in Java 4. Programs to demonstrate wrapper classes, inheritance and interfaces in Java. 5. Program to demonstrate exception handling technique. 6. Program to design and implement swing concepts. 7. Program to design and implement JDBC. 8. Program to design an event handling event for simulating a simple calculator. 9. Programs to explore collection classes in java. 10. Programs to demonstrate Java 8 features in application.	**CO2** **CO3**

Lecture Periods: -5	**Tutorial Periods: -**	**Practical Periods:- 45**	**Total Periods:45**

Reference Books:

1. Deitel and Deitel, C++ How to program, Ninth Edition, Prentice Hall, 2014.
2. Deitel and Deitel, JAVA How to Program, Eleventh Edition, Prentice Hall, 2017.
3. Cay S. Horstmann, Core Java: Volume II-Advanced Features, Eleventh Edition, Prentice Hall, 2019.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	1	1							1	1	3	1
CO2	2	2	2	1	1							1	3	3	3

CO3	2	2	3	1	2				1		1	2	2	3	1
Avg	**2.00**	**2.00**	**2.67**	**1.00**	**1.33**	**0.00**	**0.00**	**0.00**	**0.33**	**0.00**	**0.33**	**1.33**	**2.00**	**3.00**	**1.67**

Department: **Humanities and Social Science**			Programme: **B.Tech., (EE)**						
Semester: **Third**			Subject Category: **MCC**			Semester Exam Type: **-**			
Course Code	Course		Period / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
SHA102	**INDIAN CONSTITUTION**		3	-	-	-	-	-	-
Prerequisite	-								

Course Outcome	**Course Outcome Statement**	**Level**
CO1	Outline the essence and significance of the constitution	Understand
CO2	Recognize one's fundamental duties and rights	Understand
CO3	Appreciate the structure and functions of legislature, executive and judiciary	Understand
CO4	Explain the functioning of state governments and union territories	Understand
CO5	Describe the centre-state relations and functioning of constitutional bodies	Understand

UNIT-I	**Introduction of Indian Constitution**	**Periods: 09**
The Making of Indian Constitution - The Constituent Assembly - Sources of Indian Constitution - Preamble and the Supreme Court's Judgments on Preamble.		**CO1**
UNIT-II	**State, Rights and Duties**	**Periods: 09**
State and Union Territories – Citizenship - Fundamental Rights - Directive Principles of State Policy - Fundamental Duties.		**CO2**
UNIT-III	**Union Government**	**Periods: 09**
Union Government - The Powers and Functions of the President, Vice–President, Council of Ministers, Prime Minister, Judiciary, Supreme Court - Judicial Review - Judicial Activism- Public Interest Litigation - Power and Functions of the Parliament - Budget Power and Functions of Parliament, Speaker of Lok Sabha.		**CO3**
UNIT-IV	**State Governments**	**Periods: 09**
State Governments – Governor - State Council of Ministers - Chief Minister- Legislative Assembly- High Courts - Union Territories - Panchayati Raj Institutions - 73th and 74th Constitutional Amendment - Gram Panchayats - Block Panchayats - Municipalities.		**CO4**
UNIT-V	**Union- State Relations, Constitutional Bodies**	**Periods: 09**
Centre – State Relations - Public Service - Election Commission - NITI Ayog, Emergency Powers of the President- Constitution Amendment Procedure- Right to Information Act - Right to Education. Major Constitutional Amendments and their impact on Indian Political System.		**CO5**

Total Contact Hours: 45	**Tutorial Hours:00**	**Practical Hours: 00**	**Total Hours:45**

Reference Book:

1. Austin, Granville. The Indian Constitution: Cornerstone of a Nation. Oxford University Press, 1999.
2. Basu, Durga Das, et al. Introduction to the Constitution of India. 20th ed., Thoroughly Rev, Lexis NexisButterworthsWadhwa Nagpur, 2008.
3. Choudhry, Sujit, et al., editors. The Oxford Handbook of the Indian Constitution. Oxford University Press,2016.
4. Bakshi, ParvinraiMulwantrai, and Subhash C. Kashyap, The Constitution of India (Universal Law Publishing, 2016)
5. Bhargava, Rajeev, 'Politics and Ethics of the Indian Constitution', 2009
6. Rajeev Bhargava - 'The Promise of India's Secular Democracy', 2010
7. Chakrabarty, Bidyut, India's Constitutional Identity: Ideological Beliefs and Preferences (Routledge, 2019)
8. Jayal, Niraja Gopal, and Pratap Bhanu Mehta, The Oxford Companion to Politics in India, Oxford University Press, 2010
9. Kashyap, Subhash C., Our Constitution: An Introduction to India's Constitution and Constitutional Law (NBTIndia, 1994)
10. Kashyap, Subhash C. Our Parliament: An Introduction to the Parliament of India. Revised edition, National Book Trust, India, 2011.
11. Subhash C. Kashyap Our Constitution Paperback –. (NBT India, 2012).
12. Laxmikanth, M. "INDIANPOLITY". McGraw-Hill Education "Constitution of India".

Ministry of Law and Justice, Govt. of India.

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	-	-	-	-	-	-	-
AV	-	-	-	-	-	1	-	-	-	-	-	-	-	-

IV SEMESTER

Department : **Mathematics**		Programme: **B.Tech. (CS)**						
Semester : **Fourth**		Course Category Code: **BSC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
MAA106	**Mathematics for Computing**	3	1	-	4	25	75	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Develop knowledge of logical connectivity, compound propositions, formal symbols of propositional logic and find exact value of expressions.						
	CO2	Understand the formal symbols to predicate logic						
	CO3	Knowledge of Inference theory of the predicate calculus						
	CO4	Construct sample spaces of random experiments and identify the distributions.						
	CO5	Stochastic processes and solve Queuing theory problems						

UNIT-I	**Mathematical Logic**	**Periods: 12**
Connectives, Statement formulae, well-formed formulae-Tautologies. Equivalence of Statement formulae, Duality law-Tautological implications- Functionally complete set of connectives-NAND and NOR connectives.		**CO1**
UNIT-II	**Normal Forms and Inference Theory**	**Periods: 12**
Principal conjunctive and disjunctive normal forms Inference calculus-validity of conclusion using truth table-Rules of inference -Derivation process-Conditional proof-Indirect method of proof- Derivation of validity of conclusion by these methods.		**CO2**
UNIT-III	**Predicate Calculus**	**Periods: 12**
Predicate calculus: Predicates, the statement function, variables and quantifiers-Predicate formulas-symbolizing the statement. Inference theory of the predicate calculus-Rules of specification and generalization-Derivation of conclusion using the rules of inference theory.		**CO3**
UNIT-IV	**Discrete and Continuous Distributions**	**Periods: 12**
Random Variables and their event spaces - Probability mass function, Distribution functions, Special discrete distributions: Bernoulli, Binomial, Poisson, Geometric, Hyper geometric, Negative Binomial, Discrete Uniform, Constant and Indicator - Characteristic function. Reliability, Failure density and Hazard function - Some important Continuous distributions: Exponential, Hypo exponential, Erlang, Gamma, Hyper exponential, Weibull, Gaussian, Uniform and Pareto distributions.		**CO4**
UNIT-V	**Stochastic Processes and Poisson Queuing Models**	**Periods: 12**
Stochastic Processes: Definition, Classification of Stochastic Processes - Bernoulli Process, Poisson process, Markov Process, Markov Chain. The Birth and Death process: M/M/1, M/M/c, M/M/1/N, M/M/c/N (c < N), M/M/c/c, M/M/∞ models only - derivation of mean number of customer in the system, queue and waiting time - Simple applications.		**CO5**

Lecture Periods: 48	**Tutorial Periods: 12**	**Practical Periods: -**	**Total Periods: 60**

Reference Books

1. J.P.Tremblay and R.Manohar, Discrete Mathematical Structures with Applications to Computer science, Tata McGraw-Hill Publishing company pvt. Ltd., New Delhi, 2002.
2. Kishore S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, John Wiley & Sons Inc. Second Edition, 2012.
3. D.Gross and C.M.Harris, Fundamentals of Queuing Theory, Wiley Students Edition, Third Edition, 2012.
4. J.Medhi, Stochastic models in Queuing Theory, Academic Press, Second Edition, 2012.
5. J. Medhi, Stochastic Processes, New Age International (P) Ltd., Second Edition, 2012.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Fourth**		Course Category Code: **PCC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA108	**Operating Systems**	3	-	-	3	25	75	100
Prerequisite	**Nil**							

Course Outcome			
	CO1	Explain the operating system structure and its services for different computing environment	L2 Understand
	CO2	Identify challenges involved in the design operating system to a given computing environment	L3 Apply
	CO3	Analyze various algorithms and techniques used for managing resources of the operating system	L4 Analyze

UNIT-I	**Introduction to Operating System**	**Periods: 9**
Computer System Organization, Architecture – Operating System Structure, Operations – Process, Memory, Storage Management, Protection and Security – Computing Environments – Open Source Operating Systems – OS Services – User Operating System Interface – System Calls – Types – System Programs – OS Structure – OS Generation – System Boot– Case Study : Linux –History, Design Principles.		**CO1**

UNIT-II	**Process Communication and Scheduling**	**Periods: 9**
Process Concept – Scheduling – Operations on Processes – Cooperating Processes –Inter-Process Communication – Threads-Multithreading Models -Thread Libraries-Threading Issues-Scheduling Criteria – Scheduling Algorithms –Algorithm Evaluation- Case Study: Linux- Scheduling.		**CO2, CO3**

UNIT-III	**Process Synchronization and Deadlocks**	**Periods: 9**
The Critical-Section Problem – Peterson's Solution – Synchronization Hardware – Mutex Locks - Semaphores – Classic Problems of Synchronization– Critical Regions – Monitors –Deadlocks – System Model – Deadlock Characterization – Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery From Deadlock- Case Study : Linux- Process Management.		**CO2, CO3**

UNIT-IV	**Memory Management**	**Periods: 9**
Swapping – Contiguous Memory Allocation – Paging – Segmentation- Structure of the Page Table - Virtual Memory- Background – Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing- Case Study : Linux- Memory Management.		**CO2, CO3**

UNIT-V	**Storage and I/O Management**	**Periods: 9**
Overview Of Mass Storage Structure-Disk Structure- Disk Scheduling And Management-File System Interface – File Concept - Access Methods -Directory and Disk Structure- Directory Implementation-Allocation Methods- I/O Systems – I/O Hardware- Application I/O Interface- Kernel I/O Subsystem - Case Study : Linux- File System, Input and Output.		**CO2, CO3**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating Systems Concepts, Ninth Edition, Wiley, 2012.
2. William Stallings, Operating Systems: Internals and Design Principles, Ninth Edition, Prentice-Hall, 2018.
3. Andrew Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall, 2009.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	1	1	1	2
CO2	3	1	2	1	-	-	1	-	-	-	-	1	2	1	1
CO3	2	3	1	2	-	-	-	-	-	-	1	1	1	2	2
Avg.	2.33	1.67	1.00	1.00	0.00	0.00	0.33	0.00	0.00	0.00	0.33	1.00	1.33	1.33	1.67

Department: **Computer Science and Engineering**			Programme: **B.Tech. (CSE)**						
Semester: **Fourth**			Course Category Code: **PCC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA109	**Design and Analysis of Algorithms**		**3**	**-**	**-**	**3**	25	75	**100**
Prerequisite:	**Nil**								
Course Outcome	**CO1**	Formulate and solve the recurrence equation to find the time complexity of an algorithm using standard methods.							**Understanding**
	CO2	Design an algorithm using appropriate algorithmic techniques for solving a problem.							**Applying**
	CO3	Analyze the best, average worst-case running time of an algorithm using asymptotic analysis.							**Analyzing**
	CO4	Interpret between deterministic and non -deterministic algorithms.							**Understanding**

UNIT-I	**Introduction to Searching, Sorting and Analysis**	**Periods: 9**
Definitions and Notations: Standard Notations - Asymptotic Notations – Worst Case, Best Case and Average Case Analysis; Big Oh, Small Oh, Omega and Theta Notations; Analyzing Control Structures. Analysis of Sorting and Searching: Heap, Shell, Radix, Insertion, Selection and Bubble Sort; Sequential, Binary and Fibonacci Search. Recursive Algorithms, Analysis of Non-Recursive and Recursive Algorithms, Solving Recurrence Equations.		**CO1**
UNIT-II	**Divide and Conquer, Greedy**	**Periods: 9**
Divide and Conquer: General Method – Binary Search – Maximum and Minimum – Merge Sort - Quick Sort – Strassen's Matrix Multiplication. Greedy Method: General Method – Knapsack Problem – Minimum Spanning Tree Algorithms – Single Source Shortest Path Algorithm – Scheduling, Optimal Storage on Tapes, Optimal Merge Patterns.		**CO2, CO3**
UNIT-III	**Dynamic Programming**	**Periods: 9**
General Method – Multi-Stage Graphs – All Pair Shortest Path Algorithm – 0/1 Knapsack and Travelling Salesman Problem – Chained Matrix Multiplication. Basic Search and Traversal Techniques for Binary Trees and Graphs – AND/OR Graphs – Bi-connected Components –Topological Sorting.		**CO2, CO3**
UNIT-IV	**Backtracking**	**Periods: 9**
The General Method – 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycle – Knapsack Problem.		**CO2, CO3**
UNIT-V	**Branch and Bound**	**Periods: 9**
Least Cost (LC) Search – The 15-Puzzle Problem – Control Abstractions For LC-Search – Bounding – FIFO Branch and-Bound - 0/1 Knapsack Problem – Travelling Salesman Problem. Introduction to NP-Hard and NP-Completeness.		**CO2, CO3, CO4**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, Galgotia Publications, Pvt. Ltd., 2008.
2. Gilles Brassard and Paul Bratley, Fundamentals of Algorithmics, Theory and Practice PHI, 2010.
3. Thomas H. Corman, Charles E. Leiserson, Ronald and L. Rivest, Introduction to Algorithms, Second Edition, Prentice-Hall of India, 2003.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	2	3	1	1
CO2	3	3	3	1	2	2	-	-	1	1	1	2	3	2	2
CO3	3	2	2	-	1	1	-	-	-	-	-	2	3	2	2
CO4	2	1	1	1	-	-	-	-	-	-	-	1	1	1	1
Avg.	**2.5**	**2**	**1.75**	**1**	**1.5**	**1.5**	**-**	**-**	**1**	**1**	**1**	**1.75**	**2.5**	**1.5**	**1.5**

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Computer Science and Engineering**			Programme:**B.Tech.**						
Semester: **Fourth**			Course Category Code: **TY**						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA110	**Database Management Systems**		3	-	-	3	25	75	100
Prerequisite:	NIL								
Course Outcome	**CO1**	Design a database system using ER model for a specific application by transforming it to a relational model							
	CO2	Normalize relations to solve queries using SQL,PL/SQL for a specific application domain							
	CO3	Examine concurrency control protocols for transaction processing							
	CO4	Appraise Data mining ,query optimization, hashing/indexing techniques for efficient Information retrieval							
UNIT-I	**Database Concepts and Data Model**		**Periods: 9**						
Database System: Definition, Purpose, Application, Data Abstraction, Database Architecture, Database Users, Database Administrators, Instances & Schema, Data Models Entity Relationship Model:Overview, Definitions, ER diagram, Mapping Cardinalities, Reduction to Relational Schema, Extended ER Features. Relational Model: Structure of Relational Database, Keys (Primary, Foreign, Candidate, Super). Relational Query Languages: Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.									CO1
UNIT-II	**Database Design and Querying**		**Periods: 9**						
Relational Database Design: Overview, Features, Normalization, Normal Forms (First, Second, Third, Boyce Codd), Decomposition using Functional Dependencies and Multi-Valued Dependencies. SQL: Definition, Basic Structure, Data types, Basic Operations (DDL, DML, DCL), Set Operations, Aggregate Functions, Nested Sub-queries, Join Expression, Views, Transactions, Integrity Constraints,Authorization. PL-SQL: Definition, Basic Structure, Procedures, Functions, Cursors, Triggers, Packages.									CO2
UNIT-III	**Query Processing and Fast Retrieval**		**Periods: 9**						
Query Processing: Basic Steps, Measures of Query Cost, Query Optimization, Equivalent Expression and Query Evaluation Plan. Indexing: Definition, Purpose, Types of Indexing, B Tree and B+ Tree. Hashing: Basic Concepts, Hash Function, Static and Dynamic Hashing, Comparison of Indexing and Hashing. Transaction: Overview, Transaction States, ACID properties, Implementation of ACID properties, Serializability.									CO4
UNIT-IV	**Concurrency Control and DB Architecture**		**Periods: 9**						
Concurrency Control: Overview, Lock Types, Lock based Protocols, Deadlock Conditions and Handling. Recovery Systems: Failure Classification, Storage, Recovery Algorithms. Parallel Databases: Parallelism (I/O, Inter-query, Intra-query, Intra-operation, and Interoperation) Distributed Databases: Homogeneous vs Heterogeneous, Transaction System Architecture, Concurrency control.									**CO3**
UNIT-V	**Data Mining and Information Retrieval**		**Periods: 9**						
Data Mining: Association Rules, Classification, Clustering. Data warehouse: Architecture and Schemes.Information Retrieval: Ranking (keyword based, Relevance based), Retrieval Effectiveness measures, Web Crawling and Indexing. Introduction to Spatial Databases, Temporal Databases, Multimedia Databases. Case Study: Oracle.									**CO4**
Lecture Periods:	**Tutorial Periods:**	**Practical Periods:**	**Total Periods:**						
Reference Books:									

1. Abraham Silberschatz, Henry F. Korth and S.Sudarshan, Database System Concepts, Sixth Edition, McGraw-Hill International, Inc., 2011.
2. Elmasri and Navathe, Fundamentals of Database Systems, Seventh Edition, Addison-Wesley, 2012.
3. Fred R McFadden, Jeffery A. Hoffer and Mary B. Prescott, Modern Database Management, Addison Wesley, 2000.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PSO3
CO1	3	2	3	-	2	-	-	-	2	2	2	-	2	2	2
CO2	3	2	3	-	2	-	-	-	2	2	2	-	2	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg.	**2.5**	**2.25**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**1.7**	**2**	**2**

Department: Computer Science and Engineering			Programme:**B.Tech.**						
Semester: Fourth			Course Category Code: PCC						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA111	**Software Engineering**		3	1	-	4	25	75	100
Prerequisite:	NIL								
Course Outcome	**CO1**	Illustrate the software process models suitable for variety of real-life software development problems					**Understand**		
	CO2	Develop software plan, requirement specification document and design models using function oriented approach					**Analyze**		
	CO3	Design test cases and test plan for a specific testing activity					**Evaluate**		
	CO4	Explain the software maintenance process and international quality standards for software systems					**Remember**		
UNIT-I	**Introduction to Software Engineering**					**Periods: 12**			
Software Engineering Discipline – Evolution and Impact – Software Development Projects – Emergence of Software Engineering – Computer System Engineering – Software Life Cycle Models – Classic Waterfall Model – Iterative Life Cycle Model – Prototyping Model – Evolutionary Model – RAD Model – Agile Development Models – Spiral Model – Comparison of Software Life Cycle Models – Introduction to DevOps – DevOps Lifecycle – DevOps Vs Agile – DevOps Automation Tools.									**CO1**
UNIT-II	**Software Project Management and Requirements Analysis**					**Periods: 12**			
Responsibilities of a Software Project Manager – Project Planning – Metrics for Project Size Estimation – Empirical Estimation Techniques – COCOMO – Halstead's Software Science – Staffing Level Estimation – Scheduling –Organization and Team Structures – Staffing – Risk Management – Software Configuration Management –Requirements Gathering and Analysis – Software Requirements Specification.									**CO2**
UNIT-III	**Software Design**					**Periods: 12**			
Outcome of a Design Process – Characteristics of a Good Software Design – Cohesion and Coupling – Approaches to Software Design – Function Oriented Software Design Approaches – Structured Analysis –Data Flow Diagrams – Applying DFD to Real Time Systems – Structured and Detailed Design – Brief Overview of UML Diagrams.									**CO2**
UNIT-IV	**Coding and Software Testing**					**Periods: 12**			
Coding Standards and Guidelines – Code Review – Software Documentation – Testing – Unit Testing – Black Box Testing – White Box Testing – Debugging – Program Analysis Tools – Integration Testing – System Testing – Issues with Testing.									**CO3**
UNIT-V						**Periods: 12**			
Characteristics of Software Maintenance – Reverse Engineering – Software Maintenance Process Models – Estimation of Maintenance Cost – Software Quality – Quality Management System – ISO 9000 – SEI CMM – Personal Software Process – Six Sigma.									**CO1, CO4**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods:-**				**Total Periods: 60**			
Reference Books:									
1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, PHI Learning Pvt. Ltd., 2018. 2. Roger S. Pressman, Software Engineering: A Practitioner's Approach, Seventh Edition, McGraw-Hill, 2014. 3. Ian Sommerville, Software Engineering, Tenth Edition, Pearson Publishers, 2016.									

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	-	-	1	-	1	2	2	1	-
CO2	3	3	3	1	2	2	-	2	3	3	3	2	3	2	1
CO3	3	3	3	2	2	2	-	2	3	2	3	2	2	2	1
CO4	1	2	3	1	-	-	-	1	1	1	1	1	-	-	-
Avg.	**2.25**	**2.5**	**2.75**	1.25	**1**	1	**-**	**1.25**	**2**	**1.5**	**2**	**2.25**	1.75	1.25	.25

Score: 3 – High; 2 – Medium; 1 – Low

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Fourth**		Course Category Code: **PCC**				Semester Exam Type: **LB**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA112	**Operating System Laboratory**	-	-	3	1.5	25	75	100
Prerequisite	**Nil**							

Course Outcome		
	CO1 Demonstrate the Linux working environment by using commands and scripts	L2 Understand
	CO2 Interpret the usage of various system calls using C libraries	L2 Understand
	CO3 Develop programs to manage operating system resources using C libraries	L3 Apply
	CO4 Compare the performance by implementing various process, memory and disk management techniques	L4 Analyze

1. Study of basic Linux Commands 2. Implementation of Shell Programming a. Script to check if the given input is a directory and display its contents. b. Script to check if the given inputs are files and copy the contents of one file to another file. c. Scripts to execute basic commands using case construct. d. Script to check if the given input is a file and change the permission of the file. e. Script to display the file with maximum size for the given list of files.	**CO1**
3. Implementation of System Calls a. Implementation of Directory related system calls such as opendir(), closedir(), readdir() etc. b. Implementation of File related system calls such as open(), close(), read(), write, lseek() etc. c. Implementation of Process related system calls such as fork(), exec(), wait(),getpid()system calls. d. Program to implement forking of multiple child process.	**CO2**
4. Implementation of Inter-Process Communication mechanism a. Implementation of parent and child process communication using pipes. b. Implementation of parent and child process communication using shared memory. 5. Implementation of various CPU Scheduling Algorithms 6. Implementation of Process Synchronization using semaphores a. Implementation of Producer – Consumer Problem using semaphores. b. Implementation of Reader-Writer Problem using semaphores. c. Implementation of Dining-Philosopher Problem using semaphores.	**CO2, CO3, CO4**
7. Implementation of various Page Replacement Strategies.	**CO3, CO4**
8. Implementation of Disk Scheduling Techniques.	**CO3, CO4**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating Systems Concepts, Ninth Edition, Wiley, 2012.
2. William Stallings, Operating Systems: Internals and Design Principles, Ninth Edition, Prentice-Hall, 2018.
3. Andrew Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall, 2009.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	2	-	1	-	-	-	1	1	1		1
CO2	2	1	1	1	-	-	-	-	-	-	-		1	1	1
CO3	2	2	3	1	-	-	-	-	-	-	-	1	2	2	1
CO4	1	3	1	1	-	-	-	-	-	-	-	1	1	1	2
Avg	1.75	1.75	1.5	0.75	0.5	0	0.25	-	-	-	0.25	0.75	1.25	1	1.25

Score: **3** – High; **2** – Medium; **1** – Low

Department: **Computer Science and Engineering**			Programme: **B.Tech. (CSE)**						
Semester: **Fourth**			Course Category Code: **PCC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA113	**Design and Analysis of Algorithms Laboratory**		**-**	**-**	**3**	**1.5**	25	75	**100**
Prerequisite	**Nil**								
Course Outcome	**CO1**	Demonstrate the relevant searching and sorting algorithms for the given input.						**Understanding**	
	CO2	Implement algorithms using appropriate design techniques such as divide and conquer, greedy, dynamic programming and backtracking.						**Applying**	
	CO3	Analyze the performance of the implemented algorithms with order of growth.						**Analyzing**	

1. Searching: Implementation of Sequential Search, Binary Search and Fibonacci Search. 2. Sorting: Implementation of Bubble Sort, Selection Sort, Insertion Sort and Heap Sort.	**CO1, CO3**
3. Divide-and-Conquer: Implementation of Binary Search, Merge Sort, Quick Sort and Max-min Problem.	**CO2, CO3**
4. Greedy: Implementation of Knapsack, Minimum Cost Spanning Tree, Single-Source-Shortest Path and Scheduling.	**CO2, CO3**
5. Dynamic Programming: Implementation of Multi-Stage Graphs, All-Pairs Shortest Path, Travelling Salesman, Basic Search Traversals of Tree and Graph.	**CO2, CO3**
6. Backtracking: Implementation of N-Queen, Sum-of-Subsets, Graph-Coloring.	**CO2, CO3**

LecturePeriods: -	**Tutorial Periods: -**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Galgotia Publications, Pvt. Ltd., 2008.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	2	2	-	-	1	1	1	2	3	2	2
CO2	3	3	3	1	2	2	-	-	1	1	1	2	3	2	2
CO3	3	2	2	-	1	1	-	-	-	-	-	2	3	2	2
Avg.	**3**	**2.33**	**2.33**	**1**	**1.67**	**1.67**	**-**	**-**	**1**	**1**	**1**	**2**	**3**	**2**	**2**

Department:Computer Science and Engineering				Programme:**B.Tech.**						
Semester: Fourth				Course Category Code: PCC				Semester exam type : LB		
Course Code	Course			Periods / Week			Credit	Maximum Marks		
				L	T	P	C	CA	SE	TM
CSA114	**Database Management Systems Laboratory**			-	-	3	1.5	25	75	100
Prerequisite	Nil									
Course Outcome	**CO1**	Formulate queries to perform transactions using SQL,PL/SQL related to a specific application								
	CO2	Transform ER database design to relational model for a specific application domain								
	CO3	Demonstrate DBA commands to fine tune database performance								

1.	Study of Database Concepts: Relational model – table – operations on tables – index – table space – clusters – synonym – view – schema – data dictionary – privilege – role – transactions.	CO3
2.	Study of SQL: Primitive Data Types – User Defined data Types – create, alter, drop, select, insert,delete, update, commit, rollback, save point, grant, revoke - Built-in Functions – IntegrityConstraint – Authorization – Transactions.	**CO1,CO3**
3.	Study of Query Types: Queries involving Set Operators: Union, Intersection, Difference, Cartesianproduct, and Divide Operations – Sub Queries – Join Queries – Nested Queries – Correlated,Queries – Recursive Queries.	**CO1**
4.	Study of Procedural Query Language: Blocks, Exception Handling, Functions,Procedures, Cursors, Triggers, Packages.	**CO1**
5.	Design and develop the following application: a. Library Information System b. Hospital Management System c. Students' Information System d. Employee Information System.	**C02**

	LecturePeriods:	**Tutorial Periods:**	**Practical Periods: 45**	**Total Periods: 45**

	Reference Books
1.	Abraham Silberschatz, Henry F. Korth and S.Sudarshan, Database System Concepts, Sixth Edition,McGraw-Hill International Inc., 2011.
2.	https://www.tutorialspoint.com/
3.	https://www.w3schools.com/

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PSO3
CO1	2	3	-	-	3	-	-	-	1	-	-	1	2	1	1
CO2	3	3	-	-	3	-	-	-	3	-	-	2	2	2	2
CO3	1	-	-	-	2	-	-	-	-	-	-	2	2	2	2
Avg.	2.33	2	-	-	2.67	-	-	-	2	-	-	1.67	2	1.67	1.67

V SEMESTER

Department: **Humanities Social Science and Management Course.**		Programme: **B.Tech., (EE)**						
Semester: **Fifth**		Subject Category: **PCC**			Semester Exam Type: **TY**			
Course Code	Course	Period / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
HSA102	**Industrial Economics and Management**	3	-	-	3	25	75	100
Prerequisite	-							

Course Outcome	**Course Outcome Statement**	**Level**
CO1	Outline the industrial micro economics/macroeconomics.	Understand
CO2	Explain various management techniques based on the needs.	Understand
CO3	Explain various investment evaluation based on the needs	Understand
CO4	Explain the steps in production, process planning, scheduling and despatch.	Understand
CO5	Discuss the various marketing strategy.	Understand

UNIT-I	**Micro And Macro Economics and Its Applications**	**Periods: 09**
Nature and Scope of Economic science: Micro – Macro Economics, Economic decisions and Technical decisions. Demand and Supply concepts: Types of Demand, Determinants of Demand and Supply, concept of Equilibrium, Elasticity of Demand, cost components, Concepts of ISO-Quant – Break Even Analysis – Market structure – Price of Product Nature of pricing in different types of competition Small Scale Industries – Role of SSI in Indian Economy. Macro Economics: Nature and functions of Money – National Income – GNP and Savings – Inflation and Deflation concept – Business Cycle – Foreign Trade and Balance of payment.		**CO1**
UNIT-II	**Management Techniques**	**Periods: 09**
Types and Principles of Management – Elements of Management – Planning, Organising, Staffing, Directing, Coordinating Controlling - Scope of Management – Types of Organization Merits and Demerits – Types of (Ownership) of a firm Merits and Demerits.		**CO2**
UNIT-III	**Industrial Finance**	**Periods: 09**
Need for Finance – Types of finance – Sources of finance – Types of Investment – Evaluation of Investment – Preparation of Trading, Profit and loss Account and Balance Sheet – types of accountingand significance of each type.		**CO3**
UNIT-IV	**Production Management**	**Periods: 09**
Theory of Production Function – Types of Production Merits and Demerits – Process Planning – Routing – Scheduling – Material Control Concepts of Productivity – Measurement of Productivity – Inspectionand Dispatches.		**CO4**
UNIT-V	**Marketing Management**	**Periods: 09**
Core Concepts of Marketing - Needs – Wants – Demand, Marketing Vs Selling – Products and Markets – Pricing and related factors – Channels of Distribution – Promotion Advertising – Market Research VsMarketing Research		**CO5**

Total Contact Hours: 45	**Tutorial Hours:00**	**Practical Hours: 00**	**Total Hours:45**

Reference Book:

1. Varshney Maheswari “Managerial Economics” S Chand & Co, New Delhi 2011
2. Dutt & Sundaram, “Indian Economy” S Chand & Co New Delhi 2015
3. Pandey I.M, “Elements of Financial Management” Wiley Eastern Ltd New Delhi 2015
4. H.L. Ahuja, “Macro Economics for Business and Management, S Chand & Company Ltd 2011
5. O.P Khanna, “Industrial Engineering and Management, DhanpatRai and Sons, 2009.
6. Philip B Kotler, “Marketing Management, Mac Millan, New York 2011.

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	3	-	-	-
AV	-	-	-	-	-	-	-	-	-	-	3	-	-	-

Department: Computer Science and Engineering			Programme:**B.Tech.**						
Semester: V			Course Category Code: PCC						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA115	**Platform Technologies**		3	-	-	3	25	75	100
Prerequisite:	Knowledge of C, C++ and DBMS								
	At the end of this course, Students will be able to:								
Course Outcome	**CO1**	Identify Platform Technologies and basic concepts of programming language with C#							
	CO2	Develop a real time application programs using object-oriented programming concepts							
	CO3	Create windows-based applications in .NET Framework							
	CO4	Design database driven ASP.NET web applications and web services with security features.							
	CO5	Understand revolutionary concept on how software should be developed and deployed							
UNIT-I	**Introduction**					**Periods: 9**			
Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, LINQ, String, String Builder, Structure, Enumerations, boxing and unboxing.									**CO1 CO2**
UNIT-II	**Object Oriented Aspects Of C#**					**Periods: 9**			
Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, event handling, lambdas, exception handling, Threading, C# best practices.									**CO1 CO2**
UNIT-III	**Application Development on .Net**					**Periods: 9**			
Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, Dataset, typed dataset, Data Adapter, handling exceptions, validating controls, transactions, connection pooling, windows application configuration.									**CO1 CO2 CO3**
UNIT-IV	**Web Based Application Development on .Net**					**Periods: 9**			
Programming web application with web forms, ASP.NET introduction, working with XML and .NET, session management techniques, web.config, creating web services, handling transaction, handling exceptions.									**CO3 CO4**
UNIT-V	**CLR And .Net Framework**					**Periods: 9**			
Assemblies, Versioning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, Remoting.									**CO2 CO4 CO5**
Lecture Periods: 45		**Tutorial Periods:**		**Practical Periods:**			**Total Periods: 45**		

Reference Books:

1. Herbert Schildt, The Complete Reference: C# 4.0, Tata McGraw Hill, 2012.
2. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson and Morgan Skinner, Professional C# 2012 and .NET 4.5, John Wiley & Sons Inc., 2012.
3. Ian Griffiths, Matthew Adams and Jesse Liberty, Programming C# 4.0, Sixth Edition, O'Reilly, 2010.
4. Paul Deitel and Harvey Deitel, C# 6 for Programmers, Sixth Edition, Deitel® Developer Series, 2016.

Course Articulation Matrix. (Mapping CO with PO/PSO)

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	3	-	2	-	-	-	-	-	-	-	-	3	-	2
CO2	-	1	3	-	2	-	-	-	-	-	-	-	1	3	2
CO3	-	-	2	-	3	-	-	-	-	-	-	-	-	3	2
CO4	-	-	3	1	2	-	-	-	-	-	-	-	2	3	2
CO5	1	1	3	2	2	-	-	-	-	-	-	-	2	3	3
Average	1.00	1.67	2.75	1.66	2.25	-	-	-	-	-	-	-	2	3	2.2

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Computer Science and Engineering**			Programme: **B.Tech. (CSE)**						
Semester: Fifth			Course Category Code: **PCC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA116	Computer Networks		**3**	**-**	**-**	**3**	25	75	**100**
Prerequisite:	**Nil**								
Course Outcome	**CO1**	Explain the principles, protocols, and significance of Layers in OSI and TCP/IP							
	CO2	Analyse the issues and solutions related to subnet communication							
	CO3	Analyse the issues and solutions related to end to end host based communication							
	CO4	Analyse the requirements for a given organizational structure and select appropriate network protocol and architecture.							
UNIT-I	**Physical Layer**					**Periods: 9**			
Introduction – Uses – Network Hardware – Software – Reference Models – Theoretical Basis For Communication – Transmission Media – Wireless Transmission – Electromagnetic Spectrum – Radio Transmission – Digital Modulation – Baseband Transmission.									**CO1**
UNIT-II	**Data Link Layer**					**Periods: 9**			
Data Link Layer – Design Issues – Services - Framing - Error Control - Flow Control - Error Detection and Correction Codes – Hamming Code – Cyclic Redundancy Check - Data Link Layer Protocols -Simplex Protocol – Sliding Window Protocols. Medium Access Control Sublayer – Channel Allocation Problem – Multiple Access Protocols – ALOHA – CSMA Protocols - Collision-Free Protocols - Wireless LAN Protocols. Ethernet MAC Sublayer Protocol – 802.11 MAC Sublayer Protocol - Data Link Layer Switching - Uses of Bridges - Learning Bridges - Repeaters, Hubs, Bridges, Switches, Routers, and Gateways.									**CO2, CO4**
UNIT-III	**Network Layer**					**Periods: 9**			
Network Layer – Design Issues – Routing Algorithms - The Optimality Principle - Shortest Path Algorithm – Flooding - Distance Vector Routing - Link State Routing. Congestion Control – Approaches - Traffic-Aware Routing - Admission Control - Traffic Throttling - Load Shedding – Internetworking - Tunneling - Internetwork Routing - IPv4 - IP Addresses – IPv6.									**CO2, CO4**
UNIT-IV	**Transport Layer**					**Periods: 9**			
Transport Layer - Services - Berkeley Sockets -Example – Elements of Transport Protocols – Addressing - Connection Establishment - Connection Release - Flow Control and Buffering–UDP – TCP: Segment Header – Connection Establishment – Connection Release – Sliding Window - Timer Management - Congestion Control									**CO3, CO4**
UNIT-V	**Application Layer**					**Periods: 9**			
Application Layer – DNS – Name Space – Resource Records – Name Servers – E-Mail - Architecture and Services - User Agent - Message Formats - Message Transfer - Final Delivery – WWW – Architecture - HTTP – Content Delivery - Server Farms and Web Proxies - Peer-To-Peer Networks. Network Security: Introduction to Cryptography - Substitution Ciphers - Transposition Ciphers – Public Key Algorithms – RSA – Authentication Protocols - Authentication Using Kerberos..									**CO3, CO4**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

Reference Books:

1. Tanenbaum, A.S. and David J. Wetherall, Computer Networks, Fifth Edition, Prentice Hall, 2011
2. Larry L. Peterson and Bruce S. Davie, Computer Networks- A System Approach, Fifth Edition, Elsevier, 2012
3. Stallings, Data and Computer Communications, Tenth Edition., Prentice Hall Int. Ed., 2013

4. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Third Edition, Pearson Education, 2006.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	2	2	-	-	-	-	-	-	-	-	2	3	1	1
CO2	3	3	3	1	2	2	-	-	1	1	1	2	3	2	2
CO3	3	3	3	-	1	2	-	-	1	1	1	2	3	2	2
CO4	2	2	3	3	-	-	-	-	1	1	1	1	3	2	2
Avg.	2.5	2.5	2.75	2	1.5	2	-	-	1	1	1	1.75	3	1.75	1.75

Score: 3 – High; 2 – Medium; 1 – Low

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Fifth**		Course Category Code: **PCC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA117	**Automata Theory and Compiler Design**	3	1	-	4	25	75	100
Prerequisite	**Nil**							

Course Outcome		
	CO1	Design the language accepted by an automata or generated by a regular expression or a context-free grammar.
	CO2	Design automata, push down automata and Turing Machine for accepting or generating a certain language.
	CO3	Interpret various phases of compiler to undertake language translation
	CO4	Implement the compiler using different parsing techniques and syntax-directed translation schemes.
	CO5	Appraise various techniques for intermediate code and target code generation and optimization

UNIT-I	**Finite Automata and Regular Expressions**	**Periods: 12**
Formal Languages and Regular expressions, Deterministic and Non-Deterministic Finite Automata, Finite Automata with ε-moves, Equivalence of NFA and DFA, Minimization of Finite Automata, Two-way Finite Automata, Moore and Mealy machines, Applications of Finite Automata.		**CO1**
UNIT-II	**Grammars , PDA and Turing Machines**	**Periods: 12**
Chomsky hierarchy, Properties of regular sets, Pumping Lemma for regular languages, Context-Free Grammars – Derivation trees, Ambiguous and unambiguous grammars ,Chomsky Normal Forms and Greibach Normal Forms. Pushdown Automata and Context-Free Languages. Turing machines (TM) – Turing Machine constructions – Storage in finite control – Variations of TMs.		**CO2**
UNIT-III	**Phases of Compiler and Lexical Analyzer**	**Periods: 12**
Compilers - Analysis of the source program - The phases of a compiler - Cousins of the compiler - Compiler construction tools - Lexical Analysis - The role of the lexical analyzer -- Input buffering - Specification of tokens - Recognition of tokens -A language for specifying lexical analyzers - Design of a lexical analyzer.		**CO1 CO3**
UNIT-IV	**Syntax Analysis and Syntax-Directed Translation**	**Periods: 12**
The role of the parser - Context-free grammars - Top-down parsing - Bottom-up parsing - Operator-precedence parsing – automatic construction of efficient parser – predictive parser - LR parsers - Parser generators. Syntax-directed definitions -Construction of syntax trees - Bottom-up evaluation of S-attributed definitions -L-attributed definitions - Analysis of syntax-directed definitions.		**CO4**
UNIT-V	**Intermediate Code Generation and Code Generation**	**Periods: 12**
Intermediate languages-Declarations -Assignment statements -Boolean expressions -Back patching - Procedure calls. Issues in the design of a code generator - Run-time storage management -Basic blocks and flow graphs - The DAG representation of Basic Block- Next use information - simple code generator - Register allocation and assignment – Code Optimization-Peephole optimization - Generating code from DAGs.		**CO3 CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Reference Books

1. John E. Hopcroft and Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Third Edition, Pearson Publishers, 2007.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, Compilers: Principles, Techniques, and Tools, Second Edition, Pearson Education, Inc, 2006.
3. Michael Sipser, Introduction to the Theory of Computations, Thomson Learning, 1997.
4. John C. Martin, Introduction to Languages and the Theory of Computation, TMH, 2003.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	1	1	1	-	2	2	2
CO2	3	3	3	2	-	-	-	-	1	1	1	-	2	2	2
CO3	3	3	3	-	-	-	-	-	1	-	-	-	-	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	1	-	-	-	-	-	-	-	-	-	-	-
AVE	2.6	2.8	2.8	1.7	-	-	-	-	1	1	1	-	2	2	2

Department: Computer Science and Engineering			Programme:**B.Tech.**						
Semester: V			Course Category Code: PCC						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA118	**Platform Technologies Laboratory**		-	-	**3**	1.5	25	75	100
Prerequisite:	Knowledge of C and C++.								
	At the end of this course, Students will be able to:								
Course Outcome	**CO1**	Apply the knowledge of the structure and model of the programming language in C#							
	CO2	Extend the object oriented programming concepts and .Net collections.							
	CO3	Develop software in Windows-based and web-based applications using .NET Framework							
	CO4	Build interactive web applications using ASP.Net and C#							
	CO5	Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.							

Programming Using C#

1. Programs using basic concepts like arrays, LINQ, strings, enumeration, etc.	**CO1, CO2**
2. Programs using the following concepts: • Class, constructers, properties, indexers • Inheritance, Polymorphism • Delegates, Exception handling • Multi-threading	**CO1, CO2**
3. Develop window based applications to understand and demonstrate: • Windows application for any automation process • Menu, SDI and MDI concepts with essential components • Database connectivity with ADO • Data validation	**CO2, CO3, CO5**
4. Developing web based applications to understand: • Web Application using ASP.Net • Creation of Web services • Accessing data from XML resources	**CO3, CO4, CO5**
5. Programs using to learn advanced concepts: • Assemblies • Reflection • Remoting	**CO3, CO4, CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books:

1. Herbert Schildt, The Complete Reference: C# 4.0, Tata McGraw Hill, 2012.
2. Christian Nagel et al. Professional C# 2012 with .NET 4.5, Wiley India, 2012.
3. Ian Griffiths, Matthew Adams and Jesse Liberty, Programming C# 4.0, Sixth Edition, O'Reilly, 2010.
4. Paul Deitel and Harvey Deitel, C# 6 for Programmers, Sixth Edition, Deitel® Developer Series, 2016.

Course Articulation Matrix. (Mapping CO with PO/PSO)

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	3	1	3
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	1	3
CO3	-	1	3	2	3	-	-	-	-	-	-	-	2	3	2
CO4	-	1	3	2	3	-	-	-	-	-	-	-	2	3	2
CO5	-	3	2	2	1	-	-	-	-	-	-	-	1	2	3
Average	3.00	1.80	2	2	2.33	-	-	-	-	-	-	-	1.8	2	2.6

Score: 3 – High; 2 – Medium; 1 – Low

Department:Computer Science and Engineering			Programme:**B.Tech (CSE)**						
Semester: Fifth			Course Category Code: PCC						
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA119	**Computer Networks Laboratory**		-	-	3	1.5	25	75	100
Prerequisite	Nil								
Course Outcome	**CO1**	Develop programs for implementation of mechanisms related to Data link and network layer							
	CO2	Develop programs to implement socket programming							
	CO3	Develop applications related to security and remote login							

1. Implementation of a Program For CRC and Hamming Code for Error Handling.	**CO1**
2. Writing a Code for Simulating Sliding Window Protocols.	**CO1**
3. Implementation (Using NS2/Glomosim/ Your Simulation Program) and Performance Evaluation of the Following Routing Protocols: A) Shortest Path Routing B) Flooding C) Link State D) Hierarchical	**CO1**
4. Implementation of a socket program for Echo/Ping/Talk commands	**CO2**
5. Creation of a Socket between two Computers and Enable File Transfer between them. a. TCP b. UDP	**CO2**
6. Implementation of a Program for Remote Command Execution (Two M/Cs May Be Used).	**CO2**
7. Create a Socket For HTTP for Web Page Upload & Download.	**CO2**
8. Write a program to implement RCP. (Remote Capture Screen)	**CO2**
9. Implementation of Public Key Encryption.	**CO3**
10. Implementation of TELNET. (Remote Login)	**CO3**
11. Implementation of an Authentication algorithm to access a File.	**CO3**

LecturePeriods:	**Tutorial Periods:**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Tanenbaum, A.S. and David J. Wetherall, Computer Networks, Fifth Edition, Prentice Hall, 2011.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks- A System Approach, Fifth Edition, Elsevier, 2012.
3. Stallings, Data and Computer Communications, Tenth Edition, Prentice Hall Int. Ed., 2013.
4. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Third Edition, Pearson Education, 2006.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	**1**	**2**	**3**	**2**	**1**	**1**	**-**	**-**	**2**	**1**	**2**	**-**	**2**	**2**	**2**
CO2	**1**	**2**	**3**	**2**	**1**	**1**	**-**	**-**	**2**	**1**	**2**	**-**	**2**	**2**	**2**
CO3	**1**	**2**	**3**	**2**	**1**	**1**	**-**	**-**	**2**	**1**	**2**	**-**	**2**	**2**	**2**
Avg	**1**	**2**	**3**	**2**	**1**	**1**	**-**	**-**	**2**	**1**	**2**	**-**	**2**	**2**	**2**

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Humanities and Social Sciences**		Programme: **B.Tech., (EE)**						
Semester: **Fifth**		Subject Category: **MCC**			Semester Exam Type: **-**			
Course Code	Course	Period / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
SHA103	**Essence of Indian Traditional Knowledge**	3	-	-	-	-	-	-
Prerequisite	-							

Course Outcome	**Course Outcome Statement**	**Level**
CO1	Understand the basics of Indian traditional knowledge in modern scientificperspective	Understand

UNIT-I	**Periods: 23**
Basic structure of Indian knowledge system, Modern science and Indian knowledge system, Yoga and holistic health care.	**CO1**
UNIT-II	**Periods: 22**
Philosophical tradition, Indian linguistic tradition, Indian artistic tradition.	**CO1**

Total Contact Hours: 45	**Tutorial Hours:00**	**Practical Hours: 00**	**Total Hours:45**

Reference Book:

1. N. Sivaramakrishnan (Ed.) Culteral Heritage of India – Course Materal, BharatiyaVidyaBhavan, Mumbai5th edition, 2014.
2. Swami Jitatmanand, Modern Physics and Vedanta, BharatiyaVidyaBhavan.
3. Fritzof Capra, Tao of Physics.
4. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
5. R.N. Jha, Science of Conciousness Psychotherapy and yoga Practices, VidyanidhiPrakashan, Delhi 2016.
6. S.C Chaterjee and D.M Datta, An Introduction to Indian Philosophy, University of Calcutta, 1984.
7. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AV	-	-	-	-	-	-	-	-	-	-	-	-	-	-

VI SEMESTER

Department: **IEDC**		Programme: **B.Tech., (EE)**						
Semester: **Sixth**		Subject Category: **PAC**			Semester Exam Type: **TY**			
Course Code	Course	Period / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
EPA101	**Entrepreneurship**	3	-	-	2	25	75	100
Prerequisite	-							

Course Outcome	**Course Outcome Statement**	**Level**
CO1	Outline the basics of Entrepreneurship and design thinking.	Understand
CO2	Extend the knowledgeable to build business model and MVP	Create
CO3	Outline the costing and revenue.	Apply
CO4	Outline about marketing and sales.	Analyse
CO5	Explain about team formation and compliance requirements.	Remember

UNIT-I	**Problem and Customer**	**Periods: 09**
Effectuation, Finding the flow. Entrepreneurial style, business opportunity, problems worth solving, methods for finding problems, problem interviews. Design Thinking, Consumer and customer, market types, segmentation and targeting, early adopters, Gains, Pains and "Jobs-To be done", Value Proposition Canvas (VPC), Identifying Unique Value Proposition (UVP).		**CO1**
UNIT-II	**Business Model and Validation**	**Periods: 09**
Types of Business Models, Lean Canvas, Risks. Building solution demo, solution interviews, problem- solution test, competition, Blue Ocean Strategy. MVP- Build-Measure-Learn feedback loop, MVP Interviews, MVP Presentation.		**CO2**
UNIT-III	**Revenue and Cost**	**Periods: 09**
Revenue Streams-Income, costs, gross and net margins - primary and secondary revenue streams- Different pricing strategies - product costs and Operations costs; Basics of unit costing. Financing NewVenture- various sources - investor expectation- Pitching to Investors.		**CO3**
UNIT-IV	**Marketing and Sales**	**Periods: 09**
Difference between product and brand - positioning statement. Building Digital Presence, social media- company profile page –Sales Planning - buying decisions, Listening skills, and targets. Unique SalesProposition (USP), sales pitch, Follow-up and closing a sale.		**CO4**
UNIT-V	**Team and Support**	**Periods: 09**
Team Building - Shared leadership - role of a good team - team fit - defining roles and responsibilities -collaboration tools and techniques-project management, time management, workflow, delegation of tasks. Business regulations - starting and operating a business - compliance requirements.		**CO5**

Total Contact Hours: 45	**Tutorial Hours:00**	**Practical Hours: 00**	**Total Hours: 45**

Reference Book:

1. Nandan H, "Fundamentals of Entrepreneurship", Prentice Hall India, 2013.
2. LearnWISE–Digital learning platform by Wadhwani Foundation, www.learnwise.org
3. Khanka S.S, "Entrepreneurial Development", S Chand & Company, 2007.
4. Sangeetha Sharma, "Entrepreneurship Development"– Prentice Hall India, 2017.
5. Anil Kumar.S, "Entrepreneurship Development"– New Age Publishers, 2003.

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	3	1	2	1	-	-	2	2	-	-	-
CO2	2	3	1	3	1	1	1	-	1	2	2	-	-	-
CO3	1	-	2	2	-	2	1	-	1	2	-	-	-	-
CO4	-	-	2	3	-	2	3	2	1	3	1	-	-	-
CO5	-	2	-	2	-	3	-	-	-	2	2	2	-	-
AV	0.8	1.2	1.4	2.6	0.4	2	1.2	0.4	0.6	2.2	1.4	0.4	-	-

Department: **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester: Sixth		Course Category Code: **PCC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA120	**Microprocessors and Microcontroller**	3	-	-	3	25	75	100
Prerequisite:	Nil							
Course Outcome	CO1	Perceive the basic concepts, functions and programming aspects of 8085 and 8086 microprocessors						
	CO2	Demonstrate programming proficiency exploring the features of the target microprocessors and microcontrollers						
	CO3	Appraise the memory/peripheral interfacing concepts for microprocessors and microcontrollers						
	CO4	Design real time applications using appropriate Microprocessor/ or Microcontrollers to meet specific application requirements						

UNIT-I	**8-bit Microprocessor Architecture and Programming**	**Periods: 9**
Introduction - Evolution of Microprocessors- Intel 8085 Microprocessor Architecture – Pin Description - Addressing Modes – Instruction Set – Assembly Language Programming - Stacks and Subroutines - Timing Diagrams.		**CO1, CO2**
UNIT-II	**16-bit Microprocessor Architecture and Programming**	**Periods: 9**
Introduction - Intel 8086 Microprocessor Architecture – Pin description – External Memory Addressing – Bus Cycles. – Addressing Modes - Instruction Set – Directives – Assembly Language Programming - BIOS (11H to 14H) and DOS interrupt (21H) functions for console.		**CO1 CO2**
UNIT-III	**Memory, Peripheral Interfacing and Applications**	**Periods: 9**
Introduction - Memory Interfacing and I/O interfacing - Parallel communication interface and Serial communication interface using 8086 Microprocessor – D/A and A/D Interface - Timer – Interrupt controller – DMA controller using 8085 Microprocessor. Application of microprocessors: LCD display, Turbine Monitor and Traffic Light control System.		**CO3, CO4**
UNIT-IV	**Introduction to Microcontroller**	**Periods: 9**
RISC versus CISC – ARM Processor Fundamentals -ARM 7 Architecture – LPC2148 microcontroller introduction – Internal memory map –Thumb/ARM instructions – Assembly Language Programming. Peripheral details – Implementation of GPIO, Timer/Counter, UART, Interrupt architecture – ADC and DAC. SPI, I2C and USB features of LPC2148.		**CO3, CO4**
UNIT-V	**Programming and Applications of Microcontrollers**	**Periods: 9**
Firmware development using Embedded C – introduction to data types – conditional statements – loops – simple programs using embedded 'C'.Application of Microcontrollers: Traffic Light control system – DC Motor Speed control – Network Router.		**CO4**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Sixth Edition, Penram International Publications, 2013.
2. Krishna Kant, Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096, Second Edition, PHI Learning Pvt. Ltd., 2013.
3. A.K. Ray, K.M.Burchandi and A.K.Ray, Advanced Microprocessor and Peripherals, Third Edition, McGraw Hill International Edition, 2017.
4. Andrew N. Sloss Dominic Symes and Chris Wright, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaughmann/Elsevier Publishers, 2006.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3		2				2			1		1	1
CO2	2	3	3		2				1			1		1	1
CO3	2	3	3		2				2			2		2	2
CO4	3	3	3	2	2				2			2		2	2
Avg	2.25	3	3	2	2				1.75			1.5		1.5	1.5

Score: 3 – High; 2 – Medium; 1 – Low

Department: Computer Science and Engineering					Programme: **B.Tech(CS).**			
Semester: Sixth					Course Category Code: **PCC** :Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA121	**Web Technologies**	3	-	-	3	25	75	100
Prerequisite:	Nil							
Course Outcome	**CO1**	Familiarize the basic concepts of Internet, HTML and to represent the data in XML			Understand			
	CO2	Design an interactive web application using DHTML, PHP, Ajax and web Services			Create			
	CO3	Develop client side programs using Javascript			Create			
	CO4	Construct server side programs using Servlets and JSP			Apply			
UNIT-I	**Internet Protocols, HTML 5.0, and DHTML**				**Periods: 9**			
Internet Principles and Components: Internet protocols – HTTP, SMTP, POP3, MIME, and IMAP. Domain Name Server, Web Browsers and Web Servers, Web Client. HTML 5.0: Anatomy of HTML document, text basics, rules, images and multimedia, document layout and webs, formatted lists, cascading style sheets, forms, tables, frames, and executable content. DHTML: Document Object Model and Collections, Event Handling, Filters and Transitions					**CO1, CO2**			
UNIT-II	**Client-Side Programming**				**Periods: 9**			
Client-Side Programming: Java Script: An introduction to JavaScript–JavaScript DOM Model-DateSyntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers and Regular Expression					**CO3**			
UNIT-III	**Server Side Programming**				**Periods: 9**			
Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session HandlingUnderstanding Cookies- Installing and Configuring Apache Tomcat Web Server, Database Connectivity: JDBC perspectives, JDBC program example. JSP: Introduction-Components-Read Request InformationJSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code					**CO4**			
UNIT-IV	**PHP and XML**				**Periods: 9**			
PHP: Introduction to PHP- Variables- Program control- Built-in functions-Connecting to Database – JSON(basics) – MVC framework - XML: Basic XML-Attributes- Document Type Definition- ValidationDTD Elements-DTD Attributes-Entities-XSL					**CO1, CO2**			
UNIT-V	**Introduction To Ajax and Web Services**				**Periods: 9**			
AJAX: Introduction-Server response- Database Connectivity; Web Services: Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and Deploying web services					**CO2**			
Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**			**Total Periods:45**			
Reference Books:								
1. Deitel and Goldberg, Internet and World Wide Web – How to Program, Fifth Edition, Pearson Education Asia, 2011. 2. Uttam K.Roy, Web Technologies, First Edition, Oxford University Press, 2012. 3. Eric Newcomer, Understanding Web Services: XML, WSDL, SOAP, and UDDI, Addison-Wesley, Platinum Edition, 2002								

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2
CO2	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2
CO3	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2
CO4	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2
Avg	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: Computer Science and Engineering			Programme:**B.Tech.**						
Semester:Sixth			Course Category Code: PCC						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA122	**Information Security**		3	1	-	4	25	75	100
Prerequisite:									
Course Outcome	**CO1**	Articulate the best practices in the field of information security in the context of business needs							
	CO2	Explore the common legal issues , ethical issues, security models and frameworks, best practises and standards for formulating the Security Policies							
	CO3	Summarise the various security technologies for secure internet, IDS and modern cryptosystems							
	CO4	Factor the physical security threats faced by modern organizations							
	CO5	Enumerate how security policy affects and is affected personnel							
UNIT-I	**Introduction to Security and Needs**					**Periods: 12**			
Introduction to security - CNSS Security model-Components of an Information System – Balancing Information Security and access – Approaches to Information security Implementation- Security professionals and the organization - need of Security- Threats and attacks- Compromises to Intellectual property- Deviation in Quality of Service- Espionage – Human error – Software attacks- Hardware and software failures.									CO1
UNIT-II	**Legal Laws, Security Planning and Risk**					**Periods: 1212**			
Introduction – Laws and Ethics – Relevant U.S. Laws- International Laws and Legal Bodies – Code of Ethics of Professional Organizations- Planning for security – Planning and Governance – Security Policy, Standard and Practices- Information Security Blue print – Security Education, Training and Awareness Program- Risk Identification, Assessment and Control – Risk Management Practices- Risk Control Practices.									CO2
UNIT-III	**Security Technologies and Cryptography**					**Periods: 12**			
Introduction - Access Control – Firewall – Protecting Remote Connections- IDS – Honey pots and Padded Cell system – Foundations of Cryptography – Cipher methods- Cryptographic Algorithms – Cryptographic Tools- Protocols for Secure Communication.									CO3
UNIT-IV	**Physical Security**					**Periods: 12**			
Introduction – Physical Access Control – Fire safety and Security- Failure of Supporting Utilities – Structural Collapse- Interception of Data – Securing mobile and Portable systems – Special consideration for physical security. Implementing Information Security: IS Security project Management – Technical and Non technical Aspects of Implementation.									**CO4**
UNIT-V	**Security Personnel and Maintenance**					**Periods: 12**			
Positioning and Staffing the Security Function – Credentials for Information Security Professionals- Employment Policies and Practices – Security Management Maintenance Models – Digital Forensics.									**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods:-**			**Total Periods:60**			

Reference Books:

1) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Sixth Edition, Vikas Publishing House, New Delhi, 2018.
2) Micki Krause and Harold F. Tipton, Handbook of Information Security Management A Handbook, Sixth Edition, Auerbach Publication, Volume 2, 2018.
3) Matt Bishop, Computer Security Art and Science, Addison-Wesley Professional Pearson/PHI, 2002.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1								1	1		1	1		
CO2	2					3		3				1			
CO3	3		2		2							2	2		
CO4	1	1				2	1					2		2	
CO5		1				3	1	1		2	1	1			
Avg	1.75	1	2	0	2	2.7	1	2	1	1.5	1	1.4	1.5	2	

Score: 3 – High; 2 – Medium; 1 – Low

Department:Computer Science and Engineering		Programme:**B.Tech.**						
Semester: **Sixth**		Course Category Code:						
Course Code	Course	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA123	**Microprocessors and Microcontrollers Laboratory**	-	-	3	1.5	25	75	100
Prerequisite	Nil							

	CO1	Implement the fundamentals of assembly level programming using Microprocessors /Microcontrollers
	CO2	Develop the programming aspects for interfacing the peripheral devices with the target microprocessors/ Microcontroller
	CO3	Apply the concepts in the design of microprocessor/microcontroller based systems in real time applications

Experiments using 8085 kit	
1. Study of 8085 Microprocessor 2. Implementation of 8 bit and 16 bit Arithmetic operations 3. Implementation of Code Conversions 4. Implementation of Array Operations 5. Simulation of Digital Clock 6. Simulation of Rolling Display	**CO1** **CO2** **CO3**
Experiments Using 8086 Microprocessor with MASM	
7. Arithmetic operations: Multi-byte Addition, Subtraction, Multiplication, Division. 8. Searching and Sorting 9. String Operations 10. Traffic light control 11. Stepper motor control 12. Serial and Parallel Interface.	**CO1** **CO2** **CO3**
Experiments Using ARM Controller	
13. Implementation of Simple Programs in LPC2141 14. Implementation of Interrupts in LPC2148. 15. Implementation of UART features of ARM LPC2148. 16. Interfacing SD card and Graphical LCD using LPC2148. 17. Implementation of SPI and I2C communication using LPC2148. 18. Implementation of USB communication using LPC214	**CO1** **CO2** **CO3**

LecturePeriods:	**Tutorial Periods:**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Sixth Edition, Penram International Publications, 2013.
2. Krishna Kant, Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096, Second Edition, PHI Learning Pvt. Ltd., 2013.
3. A.K. Ray, K.M.Burchandi and A.K.Ray, Advanced Microprocessor and Peripherals, Third Edition, McGraw Hill International Edition, 2017.
4. Andrew N. Sloss Dominic Symes and Chris Wright, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaughmann/Elsevier Publishers, 2006

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	2	2	1	-		1		2					2	2
CO2	2	2	2	1	2		1		2					2	2
CO3	2	2	2	1	2		1		2					2	2
Avg	2	2	2	1	2		1		2					2	2

Score: 3 – High; 2 – Medium; 1 – Low

Department:Computer Science and Engineering			Programme:**B.Tech.**						
Semester: **Sixth**			Course Category Code:						
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA124	**Web Technologies Laboratory**		-	-	3	1.5	25	75	100
Prerequisite	Nil								
Course Outcome	**CO1**	Construct the web pages using HTML, XML and Javascript					**Apply**		
	CO2	Design an interactive web pages using PhP, JSP and Servlets					**Create**		
	CO3	Develop a dynamic E-Commerce applications using Ajax and Web services					**Create**		

1. Study of basic HTML tags 2. Creation of website using HTML	**CO1**
3. Implementation of Client Side Scripting in JavaScript	**CO1**
4. Implementation of Server Side Scripting in Java Servlets and JSP a. Establishing Data Base Access Programming b. Session and Application objects c. c. Database Connectivity	**CO2**
5. Designing a Website using PHP 6. Developing Web Applications using XML	**CO1, CO2**
7. Developing Web Services 8. Designing a website in Ajax 9. Developing E-commerce application using internet programming (Mini Project)	**CO3**

LecturePeriods:	**Tutorial Periods:**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Deitel and Goldberg, Internet and World Wide Web – How to Program, Fifth Edition, Pearson Education Asia, 2011.
2. Uttam K. Roy, Web Technologies, First Edition, Oxford University Press, 2012.
3. Eric Newcomer, Understanding Web Services: XML, WSDL, SOAP, and UDDI, Addison-Wesley, Platinum Edition, 2002

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2
CO2	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2
CO3	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2
Avg	1	1	2	3	1	1	-	-	3	1	2	-	2	2	2

***Score*: 3 – High; 2 – Medium; 1 – Low**

VII SEMESTER

Department: **Computer Science and Engineering**			Programme: : **B.Tech. CSE**						
Semester: **Seventh**			Course Category Code: **PCC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA125	**Artificial Intelligence**		**3**	**-**	**-**	**3**	**25**	**75**	**100**
Prerequisite:	**Nil**								
	CO	**CO statement**						**Level**	
Course Outcome	**CO1**	Analyse the blind and heuristic search techniques, and problem reduction techniques to find optimal solutions							
	CO2	Analyse the knowledge representation and reasoning systems used in both deterministic and uncertain environments.							
	CO3	Develop solutions to real world problems in various application domains of AI using the knowledge representation and search strategies.							
	CO4	Create autonomous intelligent models that use learning and planning strategies for decision making.							
UNIT-I	**Introduction to Search Techniques**						**Periods: 9**		
History of AI - Problem-solving through search: state-space - Blind search techniques: BFS, DFS, UCS, - Heuristic search techniques: Best-first search, Greedy search, A* search, AO* search- Adversarial search: Mini-max search - alpha-beta cut off - Problem reduction: AND-OR Graphs - Constraint satisfaction problem - Means Ends Analysis.									**CO1, CO3**
UNIT-II	**Knowledge Representation and Inference Techniques**						**Periods: 9**		
Types of Knowledge - Knowledge Engineering- Approaches for knowledge representation: Propositional Logic, Predicate logic, Representing knowledge using rules, Semantic Networks, Frames, Slots, Conceptual dependency, Scripts - Inference Techniques: Unification, Resolution, Forward and backward reasoning – Conflict Resolution.									**CO2, CO3**
UNIT-III	**Uncertain Knowledge Representation and Reasoning**						**Periods: 9**		
Non-Monotonic reasoning - Probabilistic Reasoning – Bayes rule – Bayesian Belief Networks – Causal Reasoning from Bayesian networks - Certainty factors – Fuzzy Logic: Fuzzification, Fuzzy Rule Base, Defuzzification -Reasoning using Fuzzy Logic – Dempster-Shafer Belief Update Theory.									**CO2, CO3**
UNIT-IV	**Planning and Learning**						**Periods: 9**		
Planning: State space planning - partial order planning - Planning graphs - Conditional planning- Continuous planning, Planning under uncertainty - Learning Types: Rote Learning, Learning by taking advice, Explanation based learning, Discovery, Analogy - Supervised and Unsupervised learning - Decision trees based learning – Reinforcement Learning.									**CO4**
UNIT-V	**Applications of Artificial Intelligence**						**Periods: 9**		
Expert Systems: Characteristics - Building blocks- Case Study, Intelligent agents: Agent Environment- Case Study - Robotics: Hardware, Perception, Planning - Natural Language Processing: Text classification, Information Retrieval and Information Extraction.									**CO3, CO4**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books:

1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education (India) Private Limited, 2013
2. Parag Kulkarni and Prachi Joshi, Artificial Intelligence: Building Intelligent Systems, PHI Learning Private Limited, 2015.
3. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education Asia, 2015.
4. Vinod Chandra S.S. and Anand Hareendran, Artificial Intelligence and Machine Learning, 1st Edition, PHI Learning Private Limited, 2014.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	1	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	2	-	2	-	1	2	2	-	3	3	3
CO4	3	3	3	2	2	-	2	-	1	2	2	-	3	3	3
Avg	3.0	3.0	3.0	3.0	1.5	-	2.0	-	1.0	2.0	2.0	-	2.5	2.5	2.5

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Computer Science and Engineering**		Programme: **B.Tech. CSE**						
Semester: **Seventh**		Course Category Code: **PCC**						
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA126	**Parallel and Distributed Systems**	**3**	**1**	**-**	**4**	**25**	**75**	**100**
Prerequisite: -	Nil-							

	CO	**CO statement**	**Level**
Course Outcome	**CO1**	Outline the architecture of parallel systems and identify the scope for parallelism in present day's processors like multicore.	**Understand**
	CO2	Analyse the various parallel computing models and the challenges involved in designing parallel algorithms.	**Analyze**
	CO3	Demonstrate the distributed system models, communication models, naming conventions and components of distributed system.	**Understand**
	CO4	Examine the collaborative operations and impacts of computers.	**Analyze**

UNIT-I	**Introduction to Parallel Computing Systems**	**Periods: 9**
Need of high-speed computing – increase the speed of computers – history of parallel computers and recent parallel computers; solving problems in parallel – temporal parallelism – data parallelism – comparison of temporal and data parallel processing – data parallel processing with specialized processors – inter-task dependency. Parallel Programming Platforms: Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.		**CO1**
UNIT-II	**Parallel Computation and Communication methods**	**Periods: 12**
Principles of Parallel Algorithm Design: Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models. Basic Communication Operations: One-to-all broadcast and allto-one reduction – all-to-all broadcast reduction – all-reduce and prefix-sum operations – scatter and gather – all-to-all personalized communication – circular shift – improving the speed of some communication operations		**CO2**
UNIT-III	**Introduction to Distributed Systems**	**Periods: 12**
Goals – Types of Distributed systems – Architecture styles – System Architecture. Architectures Versus Middleware – Self Management in distributed systems - Processes – Threads – Virtualization – Clients – Servers – Code Migration.		**CO3**
UNIT-IV	**Communication and Naming**	**Periods: 12**
Communication: Fundamentals - Remote Procedure Call – Stream oriented communication – Message oriented communication – Multicast communication. Naming – Names, Identifiers, and addresses – Flat Naming - Structured Naming – Attribute based Naming.		**CO3**
UNIT-V	**Synchronization, Consistency and Replication**	**Periods: 12**
Synchronization: Clock Synchronization – Logical clocks - Mutual Exclusion – Global positioning of nodes - Election Algorithms. Consistency and Replication: Introduction – Data centric consistency models – Client centric consistency models – Replica management – Consistency protocols.		**CO4**

Lecture Periods: 45	**TutorialPeriods:15**	**Practical Periods:**	**Total Periods:60**

Reference Books:

1. V. Rajaraman and C. Siva Ram Murthy, Parallel Computers – Architecture and Programming, Prentice-Hall of India, 2003.

2. Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar, Introduction to Parallel Computing, Second Edition, Pearson Education, 2004.
3. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems – Principles and Paradigms, Second Edition , Prentice- Hall of India, Pvt. Ltd, 2008
4. Pradeep K Sinha, Distributed Operating Systems, Prentice-Hall of India, New Delhi, 2001..

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	1	-	1	-	-	-	-	1	-	2	2
CO2	1	2	-	-	-	1	1	-	1	2	-	-	2	2
CO3	-	-	-	-	-	2	-	1	1	2	-	2	2	1
CO4	-	-	-	-	-	-	-	-	-	1	-	-	2	1
Ave	1.5	2	-	1	-	1.3	1	1	1	1.7	1	2	2	1.5

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Computer Science and Engineering**			Programme: **B.Tech. CSE**						
Semester: **Seventh**			Course Category Code: **PCC**						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA127	**Data Science Essentials**		**3**	**1**	**-**	**4**	**25**	**75**	**100**
Prerequisite:	Nil								
	CO	**CO statement**						**Level**	
Course Outcome	**CO1**	Use appropriate tool/model of analysis, assess the quality of input, derive insight from results							
	CO2	Demonstrate the performance of different supervised learning algorithms & Unsupervised learning algorithms.							
	CO3	Apply modern data science methods to one or more domains of application							
UNIT-I	**Introduction to Data Science**					**Periods: 12**			
Introduction: Data Science -Epicycles of Analysis-Stating and Refining the Question- Exploratory Data Analysis- Using Models to Explore Data-Inference: A Primer- Formal Modeling-Inference vs. Prediction : Implications for Modeling Strategy -Interpreting results.									**CO1**
UNIT-II	**Introduction to Programming Tools for Data Science**					**Periods: 12**			
Python Basics – Types - Expressions and Variables - String Operations - Python Data Structures – Lists and Tuples – Sets – Dictionaries - Python Programming Fundamentals - Conditions and Branching – Loops – Functions - Objects and Classes - Introduction of Essential Python Libraries – Numpy – Pandas – Matplotlib - Scikit-learn.									**CO1**
UNIT-III	**Supervised Learning**					**Periods: 12**			
Regression - Linear Regression - Logistic Regression - Reasons to Choose and Cautions – Additional Regression Models - Classification - Decision Trees – Na'ive Bayes – Diagnostics of Classifiers – Additional Classification Methods – Time Series Analysis – Overview of Time Series Analysis – ARIMA Model – Additional Methods – Case study with Python.									**CO2**
UNIT-IV	**Unsupervised Learning**					**Periods: 12**			
Clustering - Overview of Clustering – K-means - Additional Algorithms –Association Rules-Overview – A priori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Validation and Testing – Diagnostics - Text Analysis – Text Analysis Steps – Collecting Raw Text – Representing Text – Term Frequency-Inverse Document Frequency (TFIDF) - Categorizing Documents by Topics – Determining Sentiments – Gaining Insights - Case study with Python.									**CO2**
UNIT-V	**Big Data Analytics**					**Periods: 12**			
Data science in a Big Data world - Benefits and uses of data science and Big Data - Facets of data – The Big Data ecosystem and data science – Introduction of Hadoop - Handling large data on a single computer - The problems in handling large data - General techniques for handling large volumes of data - General programming tips for dealing with large datasets- Case study : Predicting malicious URLs, Recommender system - Steps in Big Data - Distributing data storage and processing with frameworks - Case study: Assessing loan risk.									**CO3**
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods:-**			**Total Periods:60**			

Reference Books:

1. Peng, R. D., & Matsui. E, The Art of Data Science- A Guide for Anyone Who Works with Data, Skybrude Consulting, 2015.
2. Martin Czygan, Phuong Vo.T.H, Getting Started with Python Data Analysis, Packt Publishing, 2015.
3. David Dietrich, Barry Heller & Beibei Yang, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, 2015.
4. Davy Cielen, Arno Meysman, Mohamed Ali, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Manning Publications, 2016.
5. Joel Grus, Data science from scratch: first principles with python, O'Reilly Media, Inc., 2015.
6. Steven S. Skiena, The Data Science Design Manual, First Edition, Springer, 2017.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	3			3							2	2	2	
CO2	1	1			2							2	2	2	
CO3	1	3	3	3	3	2	1	3	3	3	3	2	3	2	
Avg	1	2.3	3	3	2.7	2	1	3	3	3	3	2	2.3	2	

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Computer Science and Engineering**		Programme: **B.Tech. CSE**						
Semester: **Seventh**		Course Category Code: **PCC**				Semester Exam Type: **LB**		
Course Code	Course Name	Periods / Week		Credit		Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA128	**Artificial Intelligence Lab**	**-**	**-**	**3**	**1.5**	**25**	**75**	**100**
Prerequisite	Nil							

	CO	**CO statement**	**Level**
Course Outcome	**CO1**	Develop programs to represent knowledge about the given problem and infer solutions by querying the knowledge base using PROLOG language.	
	CO2	Create search based solutions for complex AI problems with constraints.	
	CO3	Build rule based expert systems to validate their results.	
	CO4	Develop a comprehensive solution for real-world problems in various application domains of AI.	

1. Study about the fundamentals of Prolog programming.	**CO1**
2. Execute simple programs using Prolog. a. To represent facts and predicates. b. To read and write input. c. To use operators. d. To use loops. e. To perform list processing.	**CO1**
3. Solve the Water Jug Problem using DFS, BFS blind search algorithms.	**CO2**
4. Implement Mini-max adversarial search algorithm.	**CO2**
5. Implement the missionaries and cannibals problem using constraint satisfaction method.	**CO2**
6. Find the optimal path between two cities using best first search and A* heuristic algorithms.	**CO2**
7. Represent knowledge using Prepositional Logic and perform inference.	**CO1**
8. Represent knowledge using Predicate Logic and perform inference.	**CO1**
9. Apply unification on a set of facts.	**CO1**
10. Apply forward chaining and backward chaining to infer from a set of facts.	**CO1**
11. Develop an Expert System.	**CO3**
12. Mini project based on industry topics / real time problems.	**CO4**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Max Bramer, Logic Programming with Prolog, Springer, 2005.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	2	-	1	-	2	-	1	2	3
CO2	3	3	3	3	2	-	2	-	1	-	2	-	3	2	3
CO3	3	3	3	3	2	-	2	-	1	-	2	-	2	2	2
CO4	3	3	3	3	3	-	2	-	2	-	2	-	3	2	2
Avg	3.0	3.0	3.0	3.0	2.25	-	2.0	-	1.25	-	2.0	-	2.25	2.0	2.4

Department: **Computer Science and Engineering**			Programme: **B.Tech. CSE**					
Semester: **Seventh**			Course Category Code: **PAC**					
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA129	**Seminar**	**-**	**-**	**3**	**1**	**100**	**-**	**100**

Prerequisite:	Nil		
	CO	**CO statement**	**Level**
Course Outcome	**CO1**	Identify recent topic/ research domain which meets current requirement	**Apply**
	CO2	Outline the importance of the topic, considering the industry/research standards	**Understand**
	CO3	Compare the various technologies and identify the limitations in the chosen topic	**Analyze**
	CO4	Develop presentation skills , documentation and self-learning process.	**Apply**

The student will present a seminar on following:	
Select on a topic in an emerging area in his/her specialization of Computer Science and Engineering. Make a presentation for duration of 20 to 25 minutes. Submit a brief report running to 15 or 20 pages for the purpose of evaluation.	**CO1** **CO2** **CO3** **CO4**

Lecture Periods:	**Tutorial Periods:**	**Practical Periods:30**	**Total Periods:30**

Reference Books:

1. Books related to the Seminar title.
2. Papers published in reputed journals and conferences related to the seminar.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	-	1	-	-	1	1	-	-	1	1
CO2	2	2	1	-	-	1	1	1	2	2	-	-	2	1
CO3	2	1	-	1	-	1	1	-	1	1	-	-	2	1
CO4	2	1	-	-	-	1	1	-	2	1	-	-	2	1
Ave	2	1.3	1	1	-	1	1	1	1.5	2.3	-	-	1.8	1

Department : **Computer Science and Engineering**			Programme: **B.Tech. CSE**						
Semester : **Seventh**			Course Category Code: M**CC**				Semester Exam Type: -		
Course Code	Course Name		Periods / Week	Credit			Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA130	**Professional Ethics**		**2**	**-**	**-**	**0**	**-**	**-**	**-**
Prerequisite	**Nil**								
	CO	**CO statement**					**Level**		
Course Outcome	**CO1**	Distinguish among morals, values, attitudes, ethics, and their impact over engineering practices and professionalism.							
	CO2	Awareness of professional rights and responsibilities, safety and risk benefit analysis of an Engineer							
	CO3	Excelling in competitive and challenging environment to contribute to industrial growth.							

The course should cover the following topics by way of Seminars, Expert Lectures and Assignments: ● Human Values and Attitudes, Ethical Living and Duty Consciousness ● Life, Body and Mind, Philosophy of Life, Analysis of Thought and Neutralization of Anger ● Ethical Theories, Profession and Professionalism, Engineering Ethics – Moral issues, Ethical theories and their uses ● Engineering as Experimentation – Code of Ethics, Engineer's responsibility for safety and Responsibilities and rights ● Global issues of engineering ethics and World Peace.	**CO1, CO2, CO3**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	1	1	-	-	2	2	3	1	2	-	1	-	-	-
CO2	-	-	-	-	-	3	2	1	1	1	-	-	-	-	-
CO3	-	-	-	-	-	2	3	2	2	2	-	3	-	-	-
Avg	1	1	1	-	-	2.33	2.33	2	1.33	1.66	-	1.33	-	-	-

Score: 3 – High; 2 – Medium; 1 – Low

VIII SEMESTER

Department: Computer Science and Engineering			Programme: B.Tech.Computer Science and Engineering						
Semester: Eighth			Course Category Code: PAC						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA131	**Comprehensive Test**		-	-	2	1	-	-	100
Prerequisite:	-								
	CO	**CO statement**							**Level**
Course Outcome	**CO1**	Recall the concepts in the core subjects for the higher level in academic career							**Understand**
	CO2	Justify the knowledge obtained in the core subjects for industrial requirements							**Evaluate**
	CO3	Solve the problems in the core subjects by making use of the proficiency acquired to take up National level competitive examinations							**Create**
The students are provided with practice sessions to update and refresh their knowledge in all courses throughout the programme. Two comprehensive tests, preferably with objective type questions from all core courses will be conducted of GATE examination standard.									**CO1** **CO2** **CO3**
Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**					**Total Periods: 30**		
Reference Books:									
1. All Books related to the core courses. 2. NPTEL course materials and GATE previous years question bank 3. Papers published in reputed journals and conferences related to the core courses									

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1										2	2		3
CO2	3	3	2	2		1						2	2		3
CO3	3	2	2	2								2	3		3
AVE	2.6	2	2	2		1						2	2.3		3

Department: **Computer Science and Engineering**			Programme: **B.Tech. CSE**						
Semester: Eighth			Course Category Code: **PAC**						
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA132	**Internship**		**-**	**-**	**-**	**2**	**-**	**100**	**100**
Prerequisite:	NIL								
	CO	**CO statement**					**Level**		
Course Outcome	**CO1**	Define the best practices learnt during the internship period					**Understand**		
	CO2	Develop a professional outlook in various aspects to enhance career opportunities					**Apply**		
The student is required to undergo the internship in industry / research laboratory / higher learning institution for a minimum period of 6 weeks in a maximum of 3 spells during vacations. The student should get prior approval from the Head of the Department before undertaking the internship and submit a detailed report after completion for the purpose of assessment. This Internship is not to be combined with eighth semester project work.									**CO1 CO2**

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	1	2	1	1	-	1	1	2
CO2	3	3	3	1	2	2	-	2	3	2	3	-	3	2	2
Avg.	2.5	2.5	2.5	1	1.5	1	-	1.5	2.5	1.5	2	-	2	1.5	2

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Computer Science and Engineering**			Programme: **B.Tech. CSE**						
Semester: **Eight**			Course Category Code: **PAC**			Semester Exam Type: **PR**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA133	**Project Work**		**-**	**-**	**8**	**8**	**60**	**40**	**100**
Prerequisite:	Nil								
	CO	**CO statement**					**Level**		
Course Outcome	**CO1**	Choose an appropriate topic, clearly formulate a research problem for the chosen problem							
	CO2	Design engineering solutions for the selected problem utilising a systematic software engineering approach							
	CO3	Deliver seminar/review on the work being undertaken and specific contributions to that field							
	CO4	Prepare a formal report describing the work undertaken and results obtained							

The student is given an option to carry out project work either in the college or in an industry / research laboratory / higher learning institution. The student is required to do the following

1. Perform Literature survey
2. Problem Formulation
3. Forming a methodology of arriving at the solution of the problem.
4. Documentation of each step and present in review
5. Implement the project using a programming language or software tool
6. Test the project and compare it with benchmark standards
7. Prepare Project Report

Lecture Periods:	**Tutorial Periods: -**	**Practical Periods: 120**	**Total Periods: 120**

Reference Books:

1. Books related to the project title.
2. Papers published in reputed journals and conferences related to the project.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3		2		2	2	3	3	2	3	2	2	2	2
CO2	3	3	3	2	2	2	2	3	3	2	3	2	3	3	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2
CO4	1	1	2	2	2	2	2	2	2	2	2	2	1	1	1
Avg	2.25	2.25	2.33	2	2	2	2	2.5	2.5	2	2.5	2	1.75	2	1.75

Score: 3 – High; 2 – Medium; 1 – Low

PROFESSIONAL ELECTIVE COURSES (PEC)

Department: **Computer Science and Engineering**		Programme: **B.Tech.**						
Semester: **Fifth**		Course Category Code: **PEC**						
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA201	**Graphics and Image Processing**	3	-	-	3	25	75	100

Prerequisite:	Nil		
	CO	**CO statement**	**Level**
Course Outcome	**CO1**	Demonstrate the components of graphics and Graphical User Interfaces.	Level 2: Understanding
	CO2	Analyse the various Display Primitives and 2D graphical Transformations.	Level 4: Analyzing
	CO3	Illustrate the basic concepts of digital image and its various applications.	Level 2: Understanding
	CO4	Discuss the image enhancement and Restoration methods for graphical images.	Level 6: Creating
	CO5	Develop algorithms for various graphics and image processing applications.	Level 3: Applying

UNIT-I	**Graphics Systems and Graphical User Interface**	**Periods: 9**
Pixel – Resolution– Types of Video Display Devices – Graphical Input Devices – Graphical Output Devices – Hard Copy Devices – Direct Screen Interaction – Logical Input Function – GKS User Dialogue – Interactive Picture Construction Techniques.		**CO1 CO3**
UNIT-II	**Display Primitives and Transformations**	**Periods: 9**
Geometric Display Primitives and Attributes: Geometric Display Primitives – Points– Lines and Polygons – Point Display Method – Line Drawing Methods – Circle Methods. 2D Transformations and Viewing**:** Types of Transformations – Matrix Representation – Concatenation – Scaling– Rotation – Translation– Shearing – Mirroring– Homogeneous Coordinates Transformations. Window to View Port Transformations: Windowing And Clipping: Point – Lines– Polygons – Boundary Intersection Methods.		**CO2**
UNIT-III	**Digital Image Fundamentals**	**Periods: 9**
Nature of Image Processing and Its Applications – Image Representations – Image Types – Image Processing Operations – Image Acquisition – Image Sampling and Quantization – Image Quality – Image Storage and File Formats – Image Processing Operations – Need for Image Transforms – Fourier Transforms and Its Properties – Haar Transforms and Its Applications.		**CO1 CO3**
UNIT-IV	**Image Enhancement and Restoration**	**Periods: 9**
Need for Enhancements – Point operations – Histogram Techniques – Spatial filtering concepts – Frequency Domain Filtering – Image Smoothening – Image Sharpening - Image degradation and Noise Models – Introduction to Restoration Techniques.		**CO4 CO5**
UNIT-V	**Image Processing Activities**	**Periods: 9**
Image Compression: Compression Models and Measures – Coding Types – Types of Redundancy – Lossless Compression Algorithms – Lossy Compression Algorithms – Introduction to Compression Standards. Image Segmentation**:** Detection of Discontinuities – Edge Detection – Thresholding – Region Based Segmentation – Introduction to Color Image Processing – Introduction to Morphological Operations and Image Processing Framework**.**		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods:45**

Reference Books:

1. Donald D. Hearn, M. Pauline Baker, Computer Graphics C version, Pearson Education, 2014.
2. S. Sridhar, Digital Image Processing, First Edition, Oxford Press, 2011.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	1
CO3	-	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	-	-	1	-	-	-	-	-	-	-	-	-	2	2
CO5	1	-	2	-	-	1	-	-	-	-	-	-	2	2
Ave	0.8	0.4	0.6	0	0	0.2	0	0	0	0	0	0	2.2	1.4

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
SEMESTER : **Fifth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA202	**Software Design and Testing**	3	-	-	3	40	60	100
Prerequisite	**Software Engineering**							

Course Outcome			
	CO1	Explain the object oriented approach and UML models	Understand
	CO2	Construct conceptual diagrams using UML models for software systems	Apply
	CO3	Analyze various testing techniques used for software systems	Analyze
	CO4	Evaluate software applications using software testing tools	Evaluate

UNIT-I	**Unified Modeling Languages and Models**	**Periods: 9**
Rational Unified Process-Unified Modeling Languages -UML models – Introduction to the case study - Requirements for the Wheels case study system –Requirements engineering - Requirements elicitation - List of requirements for the Wheels system-Use cases- Use case diagram – Use case descriptions – Actor and actor descriptions - Use case relationship : communication association, include and extend - Boundary - Using the use case model in system development.		**CO1**
UNIT-II	**Class and State Diagrams**	**Periods: 9**
Basics – Object – classes - Relationships between classes - The class diagram- Stages in building a class diagram - Packages - Using the class diagram in system development. State Diagrams - States and events -Constructing a state diagram - Using state diagrams in system development.		**CO1, CO2**
UNIT-III	**Activity and Implementation Diagrams**	**Periods: 9**
Activity Diagrams Introduction - Modeling a sequence of activities - Modeling alternative courses of action - modeling iteration of activities - Modeling activities that are carried out in parallel – Swimlanes – Design - Architecture - Implementation diagrams The user interface Dealing with persistent data.		**CO1, CO2**
UNIT-IV	**Principles of Testing and Testing Strategies**	**Periods: 9**
Principles of Testing: Context of Testing in Producing Software- The Incomplete Car- Dijkstra's Doctrine -A Test in Time- Example - Test the Tests First-The Pesticide Paradox - Example Convoy, Rags, The Policemen, Pendualm, Men in Black - Automation Syndrome – White box testing: Static Testing - Static Analysis Tools-Structural Testing -Challenges in White Box Testing black box testing: When to do Black Box Testing- How to do Black Box Testing – Integration testing: Integration Testing as a Type of Testing -Integration Testing as a Phase of Testing - Scenario Testing - Defect Bash System and acceptance testing – The need-- Functional and Non-Functional Testing - Acceptance Testing.		**CO3**
UNIT-V	**Non-Functional Testing Techniques**	**Periods: 9**
Performance testing: Factors -Methodology -Tools for Performance Testing-Process - Challenges – Internationalization testing: Primer- Language -Character Set- Phases Enabling Testing - Locale – Validation- Fake Language and Language Testing – Localization. Object oriented testing- OO systems-Primer-Differences. Software test automation: Skills-Scope-Design and Architecture for Automation - Generic Requirements for Test Tool/Framework -Process Model- Process Model for Automation - Selecting a Test Tool.		**CO4**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Carol Britton and Jill Doake, Student Guide to Object - Oriented Development, Elsevier, 2007.
2. Srinivasan Desikan and Gopalaswamy Ramesh, Software testing –Principles and Practices, First Edition, Pearson Education, 2009.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	-	1	1	1	1
CO2	2	1	3	2	-	-	-	-	-	-	-	1	2	1	1
CO3	2	3	1	1	-	-	-	-	-	-	-	1	1	1	1
CO4	1	2	2	1	2	-	-	-	-	-	-	-	-	-	-
Avg.	1.5	1.75	1.5	1	0.5	-	-	-	-	-	-	0.75	1	0.75	0.75

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Fifth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA203	**Python Programming**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
Prerequisite	**Nil**							
Course Outcome	**CO1**	Develop basic programming skills of python programming language						
	CO2	Apply advanced python programming features for problem solving						
	CO3	Make use of standard libraries in python to control and handle system / OS level features						
	CO4	Develop socket and internet programming using client and server side scripts						
	CO5	Design and develop basic applications with database connectivity						

UNIT-I	**Core Python: Basics**	**Periods: 9**
Introduction to Python, Python Interpreter and its working, Syntax and Semantics, Data Types, operators, loops, Assignments and Expressions, Control Flow Statements. Illustrative problems: exchange the values of two variables, circulate the values of n variables, distance between two points, Guess an integer number in a range, Towers of Hanoi.		**CO1**
UNIT-II	**Core Python: Advanced Features**	**Periods: 9**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing. Functions and lambda expressions. Iterations and Comprehensions, Handling text files Modules, reading and writing files, Classes and OOP Exception Handling, Strings and Regular Expression. Packages. Illustrative programs: square root, gcd, exponentiation, sum of array values, linear search, binary search, selection sort, insertion sort, merge sort, histogram, word count, copy file.		**CO1 CO2**
UNIT-III	**System Programming**	**Periods: 9**
System tools: OS and System modules, Directory Traversal tools, Parallel System tools threading and queue, Program Exits.		**CO2 CO3**
UNIT-IV	**Network and Web Programming**	**Periods: 9**
Socket Programming: Handling Multiple Connections, Client Server Programming, Client Side Scripting, urlib, Server Side Scripting: CGI Scripts with User Interaction, Passing Parameters. Sending Mail: SMTP protocol – Sending Email using Python.		**CO4**
UNIT-V	**GUI Programming and Database Connectivity**	**Periods: 9**
Introduction to tkinter, Top Level Windows, Dialogs, Message and Entry Event Handling, Menus, Listboxes and Scrollbars, Text. Database – SQLDB – Database connection – Python code for Insert, Update, Delete operations, Database Transactions.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

Mark Lutz, Learning Python, O Reily, Fifth Edition, 2013.
Eric Matthes, Python Crash Course, Second Edition, No Starch Press, 2016.
Tim Hall and J-P Stacey, Python 3 for Absolute Beginners, 2009.
Magnus Lie Hetland, Beginning Python: From Novice to Professional", Second Edition, 2009.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	2	1	-	1	1	1	1	2	1	1	3	3	1	2
CO2	3	2	2	2	2	3	2	2	1	2	1	3	3	3	3
CO3	3	2	2	2	2	2	2	1	-	2	3	3	3	3	3
CO4	2	2	3	2	2	1	1	1	2	1	3	3	3	3	2
CO5	3	1	3	1	3	1	2	2	2	2	2	3	3	3	3
Avg	2.4	1.8	2.2	1.4	2	1.6	1.6	1.4	1.4	1.6	2	3	3	2.6	2.6

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Sixth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA204	**Data Mining and Data Warehousing**	3	-	-	3	25	75	100
Prerequisite	**Database management systems**							
Course Outcome	**CO1**	Measure the Data Quality and Convert into Realistic form to Analyze the same for converting into Knowledge.						
	CO2	Specification of various methods to convert the Quality Data into useful Pattern.						
	CO3	Classification and Prediction using various methods of the Realistic Data.						
	CO4	Models will be created using previous data and detection of outliers						
	CO5	Specify the data warehousing and online analytical processing Using Cube						
UNIT-I	**Introduction to Data Mining**				**Periods: 9**			
Data Mining, Kinds, Patterns, Technologies, Application, Issues, Data Objects and Attributes Types, Basic Statistical Description of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Pre-processing: An Overview, Data Cleaning, Data Integration, Reduction, Data Transformation and Data Discretization.								**CO1**
UNIT-II	**Association and Correlation Analysis**				**Periods: 9**			
Basic Concepts and Methods, Frequent Itemset Mining Methods, Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining, Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequency Pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate Pattern, Pattern Exploration and Application.								**CO2**
UNIT-III	**Classification and Prediction**				**Periods: 9**			
Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule- Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy. Classification Advanced Methods: Beyesian Belief Networks, Classification by Back propagation, Classification using Frequent Patterns, and Other Classification Methods.								**CO3 & CO4**
UNIT-IV	**Cluster Analysis Basic Concepts and Methods**				**Periods: 9**			
Cluster Analysis, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, and Evaluation of Clustering. Advanced Cluster Analysis: Probabilistic Model-Based Analysis. Clustering High-Dimensional Data, Clustering Graph and Network Data, Clustering with Constraints. Outlier Detection: Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Clustering-Based Approaches, Classification-Based Approaches, Outlier Detection in High-Dimensional Data.								**CO3 & CO4**
UNIT-V	**Data Warehousing and Online Analytical Processing**				**Periods: 9**			
Data Warehouse: Basic Concepts. Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation. Data Cube Technology: Data Cube Computation Concepts, Data Cube Computation Methods, Processing Advanced Kinds of Queues, Multidimensional Data Analysis in Cube Space.								**CO1 & CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, Third Edition, Morgan Kauffman Publishers, 2012.
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining and OLAP, Tata McGraw-Hill, 2004. Reprint 2014.
3. Pangning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson India Education Services, 2016.

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Programme outcome(Pos)												Program Specific Outcomes (PSO)	
	PO1	**PO2**	**Po3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**POS12**	**PSO1**	**PSO2**
Co1	2	0											1	
Co2	2	0											1	
Co3	0	2											0	1
Co4	0	2											0	1
Co5	2	0	2										1	
AV	**1.2**	**0.8**	**0.4**										**0.6**	**0.4**

Department: **Computer Science and Engineering**			Programme: **B.Tech(CSE)**						
Semester: VI			Course Category Code:**PEC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P		CA	SE	TM
CSA205	**Internet of Things**		3	-	3	3	25	75	100
Prerequisite	**Computer networks**								
Course Outcome	**CO1**	Understand the basic terminologies, evolution and contemporary technologies.				**Understanding**			
	CO2	Learn the characteristics of sensors and actuators as Things, get a technical insight into the media access layer protocol standards				**Understanding**			
	CO3	Identify the key challenges in designing transport layer protocols and understand the existing standard protocols for IoT applications				**Understanding**			
	CO4	Apply the knowledge of embedded system design to design and develop IoT applications using state of the art platforms and tools				**Applying**			
	CO5	Able to relate the uses cases among the ocean of emerging IoT applications				**Creating**			

UNIT I	**IoT – Introduction, Evolution and Applications**	**Periods** : 9
Emergence of IoT – Impact of IoT – Architectures: oneM2M, IoTWF, OpenIoT standards, SOA based – API oriented - Core IoT Functional Stack –IoT and Cloud – Fog and Edge Computing – IoT Applications – Industry IoT – Cognitive IoT – Social and Semantic IoT.		**CO1**
UNIT II	**Enabling Technologies and Standards for IoT**	**Periods** : 9
Smart Objects – Sensors – Actuators – MEMS – WSNs – Communication Criteria – IEEE 802.15.4 a/g/e standards – IEEE 1901.2 and IEEE 802.11 ah standards – LoRAWAN – NB-IoT – LTE-M.		**CO2**
UNIT III	**IoT Network and Application Layer Protocols**	**Periods** : 9
Optimization of IP for IoT – 6LoWPAN – 6Lo – 6TiSCH – Authentication and Encryption on Constrained nodes – TinyTO- IP for Smart Objects – IoT Application Layer Protocols: CoAP, MQTT.		**CO3**
UNIT IV	**Design and Development of IoT**	**Periods** : 9
IoT design methodology – Case Study: Weather monitoring – IoT devices – Raspberry Pi –Intel's Auduino - interfaces – programming – WAMP – Xively cloud – RESTful web API – Amazon web services: EC2, SQS, DynamoDB – Hadoop Ecosystem – Netflow analytics.		**CO4**
UNIT V	**Use Cases and Advanced Topics**	**Periods** : 9
Industrial Automation Control Protocols: Ethernet/IP and CIP, PROFINET, MRP, Modbus/TCP. – Smart and Connected Cities: Connected Street Lighting – Smart Traffic Control – Smart Parking usecases – IoT architecture for Transportation.		**CO1, CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, First Edition, Pearson Education, 2017.
2. Arshdeep Bagha and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press (India), 2017.
3. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things– Principles and Paradigms, Morgan Kauffman, 2016.
4. Pethuru Raj, Anupama C. Raman, The Internet of Things – Enabling Technologies, Platforms and Use Cases, CRC Press, 2017.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	3	3	3	2	3	3	3
CO2	3	-	2	2	-	2	2	3	3	2	2	2
CO3	3	3	3	3	2	2	2	3	3	3	3	3
CO4	3	3	3	2	2	3	2	2	3	3	3	3
CO5	3	3	3	2	2	2	3	2	3	3	2	3
AVE	3	2.6	2.6	2	2	2.4	2.4	2.6	2.8	2.8	2.8	2.8

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Sixth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA206	**Mobile Application Development**	3	-	-	3	25	75	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Adapt unique features of Android in application development						
	CO2	Design android applications using fragments and controls						
	CO3	Demonstrate knowledge of different services of android						
	CO4	Build mobile applications with the technology of android storage						
	CO5	Make use of Multimedia, Messaging and Location based services						
UNIT-I	**Basics of Building Android Application**				**Periods: 9**			
Features, Android Development Environment Android Architecture: Android Software Stack, Linux Kernel, Android Runtime - Dalvik Virtual Machine, Gradle, Building blocks, Intent, Activity, Activity Lifecycle and Android Layout Managers.								**CO1**
UNIT-II	**Fragments and Controls**				**Periods: 9**			
Fragments- passing data, Interfragment communication, Custom Styles & Themes, Animation, Retrieving Data from Users - controls - common-Text- Button- Widgets, Alert Dialog, Toast, Menus, Event Handling.								**CO2**
UNIT-III	**Services and Broadcasting**				**Periods: 9**			
Android Manifest XML, Services, Android Broadcast Intent and Broadcast Receiver, Basics of networking in Android -Asynctask- HttpUrlConnection, Threading and handlers - Multithreading, Background Services, Android Job Scheduling Task, Notifications.								**CO1 CO3**
UNIT-IV	**Content Providers**				**Periods: 9**			
Access files in Assets, Access Resources, Saving or Loading data and files, SQLite Databases, Content Providers, Shared Preferences, Internal Storage, and External Storage.								**CO4**
UNIT-V	**Building Applications**				**Periods: 9**			
Telephony Services, SMS Messages, Sending Email, Introduction to Location-Based Service, **Multimedia:** Playing Audio- Video and Media player, Gaming, Android Security and Testing.								**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			
Reference Books								
1. Neil Smyth, Android Studio 3.0 Development Essentials – Android 8 Edition, 2017. 2. Barry Burd, Android Application Development All-in-One for Dummies, 2012. 3. Reto Meier and Ian Lake, Professional Android, Fourth Edition, John Wiley and Sons, 2018.								

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	3	2	1	3	2	2	3	2	2	1	3	2	3	3
CO2	1	1	3	-	3	-	2	1	2	1	2	2	3	2	-
CO3	2	2	2	2	3	1	-	1	-	-	1	1	2	3	1
CO4	2	1	2	2	3	2	1	2	1	-	-	1	2	3	1
CO5	2	1	2	1	3	3	1	2	2	-	1	2	2	3	2
Avg	1.8	1.6	2.2	1.2	3	1.6	1.2	1.8	1.4	0.6	1	1.8	2.2	2.8	1.4

Department: **Computer Science and Engineering**		Programme: **B.Tech(CSE)**						
Semester: VI		Course Category Code:**PEC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P		CA	SE	TM
CSA207	**Mobile Communication and Computing**	3	-	-	3	40	60	100
Prerequisite	**Computer networks**							

Course Outcome	**CO1**	Learn and understand the wireless and mobile communication fundamentals.	**Understand**
	CO2	Extend the concepts of wired LANS to wireless and learn the criteria for classifying the types of wireless LAN standards	**Understand**
	CO3	Recall the layered perspectives of computer networks and appraise the specific challenges in the design of routing and transport layer protocols	**Remember**
	CO4	Identify the specific challenges in building databases in mobile computing environment	**Apply**
	CO5	Illustrate the design challenges of mobile devices and m-commerce platforms	**Create**

UNIT I	**Mobile Communication Fundamentals**	**Periods** : 9
Wireless Communications – evolution – applications – reference model – frequencies for radio transmission – Signal propagation – multiplexing – modulation – spread spectrum –Medium Access – SDMA, TDMA, FDMA and CDMA.		**CO1**
UNIT II	**Wireless LAN and PAN**	**Periods** : 9
Infrastructure Vs. Ad-hoc Network – Hidden and Exposed Node problems - IEEE 802.11 a/b/g standards – Bluetooth – Layered architecture – Service Discovery – Profiles – IEEE 802.15 Zigbee – 6LoWPAN.		**CO2**
UNIT III	**Wireless Routing and Transport Layer**	**Periods** : 9
Mobile IP – Motivation – Tunneling – Encapsulation – DHCP – MANETs – DSDV – DSR – ZRP – AODV - LAR – Mobile TCP – STCP – Indirect TCP – Transaction-Oriented TCP.		**CO3**
UNIT IV	**Mobile Computing – Database Perspectives**	**Periods** : 9
Mobile Databases – Issues in transaction processing – Data Dissemination – Atomicity and Consistency Relaxation – Isolation and Durability relaxation – Data Replication – Mobile transaction models – Rollback process – Two-Phase Commit – Query Processing and Optimization.		**CO4**
UNIT V	**Mobile computing Platforms and Security**	**Periods** : 9
Mobile Devices and Web Clients – WAP – J2ME – Android Application Development – Mobile Commerce – B2C – B2B – Mobile Payment Systems – Security Issues.		**CO1, CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Jochen Schiller, Mobile Communications, Second Edition, Addison Wesley, 2012
2. Prasanth Kumar Patnaik and Rajib Mall, Fundamentals of Mobile Computing, Second Edition, Prentice Hall (India), 2016
3. M. Bala Krishna, Jaime Lloret Mauri, Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks, First Edition, CRC Press, 2016
4. Mazliza Othman, Principles of Mobile Computing and Communications, First Edition, Auerbach Publications, 2007
4. Pethuru Raj, Anupama C. Raman, The Internet of Things – Enabling Technologies, Platforms and Use Cases, CRC Press, 2017.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	-	3	2	3	1	2	-	2	1	-	-
CO2	2	2	2	2	-	2	2	3	2	2	-	2	1	-	1
CO3	2	2	2	2	2	2	2	3	2	3	-	3	-	-	1
CO4	3	3	3	2	2	3	2	2	3	2	1	3	2	-	1
CO5	3	3	3	2	2	2	3	2	3	3	2	3	1	1	1
Avg.	**2.4**	**2.4**	**2.5**	**2**	**2**	**2.6**	**2.2**	**2.6**	**2.2**	**2.4**	**1.5**	**2.6**	**1.25**	**0.25**	**1**

Score: **3** – High; **2** – Medium; **1** – Low

Department: **Computer Science and Engineering**		Programme: **B.Tech. (CSE)**						
Semester: VII		Course Category Code:PEC				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P		CA	SE	TM
CSA208	**Embedded Systems**	-	-	3	3	25	75	100
Prerequisite	**Microprocessors and Microcontrollers, Operating Systems**							

Course Outcome			
	CO1	Understand the concepts of embedded processors	**Understanding**
	CO2	Learn the programming details of embedded systems	**Remembering**
	CO3	Develop embedded systems for real world applications using ARM processors	**Applying**
	CO4	Understand the real time operating system concepts.	**Understanding**
	CO5	Design and development of basic embedded system using Intel and Arduino	**Creating**

UNIT I	**Introduction to Embedded Systems**	**Periods** : 9
Processor in Embedded System – Other Hardware Units in the Embedded System – Software Embedded into a System - ARM Architecture: ARM Design Philosophy - Registers - Program Status Register - Instruction Pipeline - Interrupts and Vector Table - Architecture Revision - ARM Processor Families.		**CO1**

UNIT II	**ARM Assembly Programming**	**Periods** : 9
Instruction Set - Data Processing Instructions - Addressing Modes - Branch, Load, Store Instructions -PSR Instructions - Conditional Instructions. Thumb Instruction Set - Register Usage - Other Branch Instructions - Data Processing Instructions - Single-Register and Multi Register Load-Store Instructions-Stack - Software Interrupt Instructions.		**CO2**

UNIT III	**ARM Programming using C**	**Periods** : 9
Optimizing Assembly Code - Profiling and Cycle Counting – Instruction Scheduling – Register Allocation – Conditional Execution – Looping Constructs – Bit Manipulation – Efficient Switches – Optimized Primitives. Simple C Programs using Function Calls – Pointers – Structures.		**CO2** **CO3**

UNIT IV	**Real Time Operating Systems**	**Periods** : 9
Fundamental Components, Simple Little Operating System, Cache Memory - Cache Architecture - Cache Policy -Coprocessor and Caches-Flushing and Cleaning Cache Memory -Cache Lockdown -Caches and Software Performance. Memory Protection Units-Protected Regions-Initializing the MPU, Caches, and Write Buffer -Demonstration of an MPU system. Memory Management - A Small Virtual Memory System.		**CO4**

UNIT V	**Basic Embedded System Developments**	**Periods** : 9
Intel Arduino features – Architecture – Instruction set – Arduino IDE –Programming using C – Introduction to Intel Galileo- Features. Programs for linking an LED without using thedelay() function, Controlling the Stepper Motor and Dimming a LED.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Andrew N Sloss, D. Symes and C. Wright, ARM System Developers Guide, Morgan Kaufmann/Elsevier, 2006.
2. Qing Li, Real Time Concepts for Embedded Systems –Elsevier, 2011.
3. Julien Bayle, C Programming for Arduino, Packt Publishing Ltd, 2013.
4. Wayne Wolf, Computer as Components: Principles of Embedded Computer System Design, Elsevier, 2006. McGraw-Hill International Inc., 2019.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	3	3	3	-	3	-	3
CO2	3	3	2	-	3	2	2	3	3	2	3	2
CO3	3	3	2	-	3	2	2	3	3	3	3	2
CO4	3	2	-	-	2	3	2	2	3	3	-	3
CO5	3	2	3	-	3	2	3	2	3	3	2	3
AVE	3	2.5	2.3	-	2.6	2.4	2.4	2.6	3	2.8	2.8	2.6

Score: **3** – High; **2** – Medium; **1** – Low

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Seventh**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA209	**Cloud Computing**	3	-	-	3	25	75	100
Prerequisite	**NIL**							
Course Outcome	**CO1**	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.						
	CO2	Apply the fundamental concepts in datacenters to understand the tradeoffs in power,Virtualization, efficiency and cost.						
	CO3	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing						
	CO4	Evaluate the various software Utility Application						
	CO5	Discuss various cloud security models						
UNIT-I	**Cloud Computing Architecture and Model**				**Periods: 9**			
Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models: Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public Vs Private Cloud – Cloud Solutions - Cloud Ecosystem – Service Management – Computing on Demand.								**CO1**
UNIT-II	**Virtual Machine**				**Periods: 9**			
Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures- Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management–Virtualization for Data-center Automation.								**CO2**
UNIT-III	**Cloud Infrastructure**				**Periods: 9**			
Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.								**CO3**
UNIT-IV	**Software Utility Application**				**Periods: 9**			
Software Utility Application Architecture – Characteristics of SaaS – Software Utility Application – Cost Versus Value – Software Application Framework – Common Enablers – Conceptual view to Reality – Business Profits – Implementing Database System for Multitenant Architecture.								**CO4**
UNIT-V	**Cloud Security**				**Periods: 9**			
Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security –Virtual Machine Security - Identity Management and Access Control – Autonomic Security.								**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books

1. Kai Hwang, Geoffrey C Fox and Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2016.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing Principles and Paradigms, Wiley Publications, 2017.
3. Alfredo Mendoza, Utility Computing Technologies, Standard, and Strategies Artech House INC, 2017.
4. Arshdeep Bahga, Vijay Madisetti, Cloud Computing, University Press, 2016.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	Po3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	POS12	PSO1	PSO2
CO1	2	2											1	
CO2	2	2											1	
CO3	2	2											1	
CO4	2	2											1	
CO5	2	2											1	
AV	**2**	**2**											**1**	

Department: **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Seventh**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods/ Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA210	**Machine Learning**	3	-	-	3	25	75	100
Prerequisite	**NIL**							

Course Outcome			
	CO1	Interpret machine learning techniques to solve real world issues using both complete and hidden data.	: Understand
	CO2	Analyze the hypothesis space and learning concepts involved in various probabilistic algorithms required for the model selection and their evaluation.	Analyze
	CO3	Analyze learning from multiple inputs and feature selection methods.	Analyze
	CO4	Evaluate learning from mixture of distributions and hierarchical data structure.	Evaluate
	CO5	Interpret and build an artificial neural network structure, training algorithms and usage of Markov models to model input sequences.	Create

UNIT-I	**Introduction to Machine Learning**	**Periods:9**
Introduction to Machine Learning – Applications – Learning Associations – Classification – Regression– Unsupervised Learning – Reinforcement Learning – Supervised Learning – Vapnik - Chervonenkis (VC) Dimension–Probably Approximately Correct(PAC) Learning–Noise–Learning multiple classes– Model selection and Generalization.		**CO1**
UNIT-II	**Bayesian Decision Theory and Parametric Methods**	**Periods:9**
Bayesian Decision Theory–Classification–Losses and Risks–Discriminant Functions–Parametric methods– Maximum Likelihood estimation–Bernoulli Density–Multinomial Density–Gaussian Density–Evaluating an Estimator: Bias and Variance–Tuning Model complexity: Bias/Variance Dilemma – Model selection procedures.		**CO2**
UNIT-III	**Multivariate Methods and Dimensionality Reduction**	**Periods:9**
Multivariate methods – Parameter estimation – Multivariate Normal Distribution – Tuning Complexity– Discrete Features–Multivariate regression–Dimensionality reduction–Subset selection– Principal component analysis–Factor analysis–Multidimensional scaling–Linear discriminant analysis.		**CO1 CO3**
UNIT-IV	**Clustering and Decision Trees**	**Periods:9**
Clustering – Mixture densities – k-Means clustering–Expectation-Maximization algorithm – Hierarchical clustering – non-parametric methods – Histogram estimator – Kernel estimator – k- Nearest neighbor estimator–Decision trees –Univariate trees–Pruning–Rule extraction from trees– Learning rules from data–Multivariate trees.		**CO1 CO4**
UNIT-V	**Multilayer Perceptrons and Hidden Markov Models**	**Periods:9**
Introduction- The perceptron – Training a perceptron – Back propagation algorithm – Local models – Competitive learning – Radial basis functions – Mixture of experts – Hidden Markov models – Discrete Markov processes – Evaluation problem – Finding the State sequence – Learning model parameters – Model selection in HMMs.		**CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods: 45**

Reference Books

1. Ethem Alpaydin, Introduction to Machine Learning,Third Edition,MIT Press, 2014.
2. Tom M. Mitchell. Machine Learning. McGraw Hill Education(India)Edition.2013.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO-PO Matrix															
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	2	-	-	-	2	-	2	2	3	2	3
CO2	3	2	2	2	2	-	-	-	2	-	2	1	2	2	3
CO3	3	2	2	2	2	-	-	-	2	-	2	2	2	3	3
CO4	3	2	2	2	2	-	-	-	2	-	2	2	2	2	3
CO5	3	1	1	2	2	-	-	-	2	-	2	1	1	1	3
Avg	**3**	**1.8**	**1.8**	**2**	**2**	**-**	**-**	-	**2**	**-**	**2**	**1.6**	**2**	**2**	**3**

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Seventh**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA211	**Business Intelligence**	3	-	-	3	25	75	100
Prerequisite	Knowledge of data collection protocol and software.							
Course Outcome	**CO1**	Understand the role of ethics, basics of Business Intelligence and Decision Support Systems.						
	CO2	Select the data using various technologies and strategies to make well-informed business decisions.						
	CO3	Define mathematical models, data mining and data preparation in Business Intelligence systems						
	CO4	Analysis the time series data in business intelligence						
	CO5	Explore marketing models, Logistic and production models and Data envelopment analysis						

UNIT-I	**Introduction to Business Intelligence**	**Periods: 9**
Effective and Timely Decisions, Data, Information and Knowledge, Role of Mathematical Models, Business Intelligence Architectures, Cycle of a Business Intelligence Analysis, Enabling Factors in Business Intelligence Projects, Development of a Business Intelligence System, Ethics and Business Intelligence.		**CO1 CO2**
UNIT-II	**Decision Support Systems**	**Periods: 9**
Definition of System, Representation of the Decision-Making Process, Rationality and Problem Solving, Decision-Making Process, Types of Decisions, Approaches to the Decision-Making Process, Evolution of Information Systems, Definition of Decision Support System, Development of a Decision Support System.		**CO1 CO2**
UNIT-III	**Mathematical Models for Decision Making**	**Periods: 9**
Mathematical Models for Decision Making- Data Mining- Definition of Data Mining - Representation of Input Data - Data Mining Process - Analysis Methodologies -Data Preparation- Data Validation - Data Transformation – Data Reduction –Data Exploration- Univariate Analysis- Bivariate Analysis- Multivariate Analysis - Regression – Structure of Regression Models- Simple Linear Regression- Multiple Linear Regression- Validation of Regression Models - Selection of Predictive Variables.		**CO1 CO2 CO3**
UNIT-IV	**Time Series Data in Business Intelligence**	**Periods: 9**
Definition of Time Series - Evaluating Time Series Models- Analysis of the Components of Time Series - Exponential Smoothing Models- Autoregressive Models- Combination of Predictive Models- The Forecasting Process.		**CO3 CO4**
UNIT-V	**Business Intelligence Applications**	**Periods: 9**
Marketing Models -Relational Marketing, Motivations and Objectives, Environment for Relational Marketing Analysis, Lifetime Value, Effect of Latency in Predictive Models, Acquisition, Retention, Cross-Selling and Upselling, Market Basket Analysis, Web Mining, Sales Force Management, Decision Processes in Sales Force Management, Models for Sales Force Management, Response Functions, Sales Territory Design, Calls and Product Presentations Planning, Business Case Studies.		**CO2 CO4 CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. John Wiley & sons and Carlo Vercellis, Business Intelligence, 2009.
2. Elizabeth Vitt, Michael Luckevich, Business Intelligence: Making Better Decision, Microsoft Press, 2002.
3. Larissa, T. Moss and ShakuAtre, Business Intelligence Roadmap: The Complete Project Life cycle for Decision Support systems, Addison – Wesley, 2008.
4. Turban, E. Sharda, R., and Delen, D., Decision Support and Business Intelligence Systems, Ninth Edition, Pearson, 2011.

Course Articulation Matrix. (Mapping CO with PO/PSO)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO	PSO1
CO1	-	-	-	-	-	1	-	3	2	1	-	-	CO1	3
CO2	1	-	-	3	-	2	-	-	-	-	-	-	CO2	3
CO3	3	2	-	1	-	2	-	-	-	-	-	-	CO3	2
CO4	2	3	-	2	3	-	1	-	-	-	-	-	CO4	3
CO5	1	3	3	2	1	-	-	-	-	-	-	-	CO5	2
Average	**1.4**	**1.6**	**0.6**	**1.6**	**0.8**	**1**	**0.2**	**0.6**	**0.4**	**0.2**	**0**	**0**	**Average**	**2.6**

OPEN ELECTIVE COURSES (OEC)

Department : **Computer Science and Engineering**		Programme: **B.Tech.**						
Semester : **-**		Course Category Code: **OEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA301	**Introduction to Python Programming**	3	-	-	3	25	75	100
Prerequisite	**Nil**							

	CO	**CO Statement**	**Level**
Course Outcome	**CO1**	Interpret the basic building blocks in python programming language to construct different applications	Level 2 : Understanding
	CO2	Examine Python syntax and semantics and be fluent in the use of Python operators and flow control	Level 4: Analyzing
	CO3	Create, run and manipulate Python programs using Core data structures like Lists, Tuples, and Dictionaries	Level 6 : Creating
	CO4	Extract and import packages and modules for developing different solutions for real time problems	Level 6 : Creating
	CO5	Interpret the concepts of object oriented programming using Python	Level 2 : Understanding

UNIT-I	**Introduction to Python**	**Periods: 9**
Introduction to Python: Overview – History of Python – Python features –Environment setup – Getting Python – Install Python – Setting up Path – Running Python –Basic Syntax – Interactive mode programming – Script mode Programming –Variables, Assignment , Keywords, Input-Output.		**CO1**
UNIT-II	**Programming Basics of Python**	**Periods: 9**
Programming Basics of Python: Basic Operators: Arithmetic Operators – Comparison (Relational) Operators – Assignment Operators – Logical Operators – Bitwise Operators – Membership Operators – Identity Operators – Loops: Types of loops – while – for Loops – Control statements: if else – for loop – break and continue.		**CO1** **CO2**
UNIT-III	**Core Python Programming**	**Periods: 9**
Programming with Python Lists: Accessing values in Lists – Updating Lists – Delete List elements– Built-in Lists functions & Methods – Tuples: Creating Tuples – Accessing Tuples –Updating Tuples – Deleting Tuples – Basic Tuple operations - Built-in Tuple functions – Dictionary: Access, Update and Delete dictionary elements– Built-in Dictionary Functions & Methods.		**CO3**
UNIT-IV	**Python Functions and Packages**	**Periods: 9**
Functions: Defining Functions, Calling Functions, Passing Arguments, Scope of the Variables in a Function. Modules: Creating modules, import statement, from import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages.		**CO3** **CO4**
UNIT-V	**Object Oriented Programming and Advanced concepts**	**Periods: 9**
Python Object Oriented Programming: Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, and Data hiding. Error and Exceptions: Handling Exception, try except block, Raising Exceptions, User Defined Exceptions, Advanced Concepts: Files I/O: Opening a file – Seek and Find a file – Other I/O functions.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Vamsi Kurama, Python Programming: A Modern Approach, Kindle Edition, Pearson, 2017.
2. Mark Lutz, Learning Python, O Reily, Fifth Edition, 2013.
3. Allen Downey and Green Tea Press, Think Python, Third Edition, 2012.
4. W.Chun, Core Python Programming, Second Edition, Pearson, 2009.
5. Kenneth A. Lambert and Cengage, Fundamentals of Python, Second Edition, Cengage Learning, 2017.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO-PO Matrix															
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	3	2	1	-	2	2	3	2	3	3	3
CO2	3	3	3	3	3	2	1	-	2	2	3	3	3	3	3
CO3	3	3	3	3	3	2	1	-	2	2	3	3	3	3	3
CO4	3	3	3	3	3	2	1	-	2	2	3	3	3	3	3
CO5	3	3	3	3	3	2	1	-	2	2	3	3	2	2	3
Avg	**3**	**2.8**	**3**	**2.8**	**3**	**2**	**1**	-	**2**	**2**	**3**	**2.8**	**2.8**	**2.8**	**3**

Department : **Computer Science and Engineering**		Programme: **B.Tech.**						
Semester : **-**		Course Category Code: **OEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA302	**Java Programming**	3	-	-	3	25	75	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Explain Object Oriented Programming paradigm						**Understand**
	CO2	Demonstrate the syntax and semantics of the language constructs in java for OOP paradigm						**Apply**
	CO3	Enumerate the libraries and the interfaces of the libraries for importing and using in the java programs in various domains and applications						**Apply**
UNIT-I					**Periods: 9**			
Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Classes and Objects, Constructors – Destructors.								**CO1 CO2**
UNIT-II					**Periods: 9**			
Packages and Interfaces – Overloading – Inheritance – Enumerations – Internationalization - Inner Classes - Polymorphism —– Exception Handling – Garbage Collection – Containers.								**CO1 CO2**
UNIT-III					**Periods: 9**			
GUI Components – Layouts – Event Driven Programming – AWT package – Applet Applications – Swing Classes and fundamentals.								**CO2 CO3**
UNIT-IV					**Periods: 9**			
Strings – I/O Streams – Collections –Date and Time – Java Database Connectivity: Manipulating database with JDBC – prepares statements – stored procedures – Transaction processing.								**CO2 CO3**
UNIT-V					**Periods: 9**			
Networking Basics - Java and the Net – InetAddress – TCP/IP Client Sockets – URL – URL Connection – TCP/IP Server - Sockets - A Caching Proxy HTTP Server – Datagrams – Remote Method Invocation.								**CO2 CO3**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			
Reference Books								
1. Herbert Schildt, Java - The Complete Reference, Eleventh Edition, Tata McGraw Hill, 2018. 2. Paul Deitel and Harvey Deitel, Java: How to Program, Eleventh Edition, Pearson, 2017.								

Course Articulation Matrix (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	1						1	1	3	3	2
CO2			1		3							1	3	3	2
CO3		1	2		3						1	1	3	3	2
Avg.	**1.00**	**1.33**	**1.33**	**0.67**	**2.33**						**0.67**	**1.00**	**3.00**	**3.00**	**2.00**

Department: **Computer Science and Engineering**			Programme: **B.Tech.**					
Semester: -			Course Category Code: **OEC**					
Course Code	Course Name		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CA	SE	TM
CSA303	**Fundamentals of RDBMS**		3	-	-	3	25	75	100
Prerequisite:	Nil							
	CO	**CO statement**					**Level**	
Course Outcome	**CO1**	Outline the fundamental concepts of the relational database model					Level 2: Understanding	
	CO2	Utilize the conceptual database modelling methods					Level 3: Applying	
	CO3	Identify functional dependencies and apply normal forms to evaluate the quality of a relational database design					Level 3: Applying	
	CO4	Apply SQL for database definition and manipulation					Level 3: Applying	
	CO5	Demonstrate transaction and concurrency control					Level 2: Understanding	
UNIT-I	**Introduction to Databases and Relational Model**					**Periods: 9**		
Traditional File Based Systems and their Limitations - Database Approach and its Components - Roles in the Database Environment - Advantages and Disadvantages of Database Systems - Distributed Databases. Relational Model - Definition of Relational Data Structures, Database Relations, Keys - Representation of Relational Database Schemas - Relational Algebra - Relational Integrity - Views.							**CO1**	
UNIT-II	**Database Model**					**Periods: 9**		
Entity–Relationship Modelling and Logical Database Design - Entity and Relationship Types -. Attributes - Structural Constraints - Multiplicity, Cardinality and Participation.							**CO2**	
UNIT-III	**Database Design**					**Periods: 9**		
Physical Database Design for Relational Databases - Comparison of Logical and Physical Database Design - Physical Database Design Methodology - Capacity Planning. Normalization - Update Anomalies - Functional Dependencies - First, Second, and Third Normal Forms.							**CO3**	
UNIT-IV	**Structured Query Language**					**Periods: 9**		
Data Manipulation - Querying, Sorting, Grouping of Data - Using Logical and List Operators - Single Row Numeric and String Functions - Group Functions - Joins - Sub-Queries - Inserting, Deleting and Updating Data-Data Definition - Creating, Altering and Dropping Database Objects: Tables, Views, Indexes, Synonyms, Constraints, Users - Creating Procedures and Functions - Creating Database Triggers.							**CO4**	
UNIT-V	**Transaction Management, Concurrency Control and Security**					**Periods: 9**		
Transaction Management -Transaction Support. Concurrency Control - Locking Methods - Time Stamping Methods. Security. Threats and Countermeasures. Granting And Revoking Privileges.							**CO5**	
Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**				**Total Periods:45**		

Reference Books:

1. Thomas Connolly and Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management, Sixth Edition, Pearson, 2014.
2. Elmasri, R., and Navathe, S. Fundamentals of Database Systems, Seventh Edition, Pearson, 2016.
3. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, Sixth Edition, McGraw-Hill, 2011.

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	2	-	2
CO2	-	2	-	-	-	1	-	1	1	-	-	-	2	-	2
CO3	-	-	-	-	-	1	-	1	1	-	-	-	2	-	1
CO4	-	-	3	-	-	2	2	1	1	1	1	1	2	1	2
CO5	-	1	-	1	-	2	2	-	2	2	2	2	2	1	2
Ave	1	1.5	3	1	-	1.5	2	1	1.2	1.5	1.5	1.5	2	1	1.8

Department : **Computer Science and Engineering**			Programme: **B.Tech.**						
Semester : **-**			Course Category Code: **OEC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA304	**Essentials of Mobile Application Development**		3	-	-	3	25	75	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Adapt unique features of android in application development							
	CO2	Design android applications using activity and fragments							
	CO3	Demonstrate knowledge of different android controls							
	CO4	Build applications with the technology of android services							
	CO5	Make use of messaging, multimedia and Location based services							
UNIT-I	**Basics of Building Android Application**					**Periods: 9**			
Features, Android Development Environment Android Architecture: Android Software Stack, Linux Kernel, Android Runtime - Dalvik Virtual Machine, Building blocks, Intent Implicit and Intent Explicit, and Android Layout Managers.									**CO1**
UNIT-II	**Activity and Fragments**					**Periods: 9**			
Activity, Activity Lifecycle, Fragments- passing data, Inter-fragment communication, Custom Styles & Themes, Animation.									**CO2**
UNIT-III	**Controls**					**Periods: 9**			
Retrieving Data from Users - controls - common-Text- Button- Widgets, Alert Dialog, Toast, Menus, WebView, ***Gallery View, and Grid View***. Event Handling, Android Manifest XML, and Access Resources.									**CO1 CO3**
UNIT-IV	**Services and Broadcasting**					**Periods: 9**			
Services, Android Broadcast Intent and Broadcast Receiver, Basics of networking in Android, Threading and handlers-Multithreading, Background Services-Android Job Scheduling Task.									**CO4**
UNIT-V	**Building Applications**					**Periods: 9**			
Content Providers –SQL Lite – Creating and Using Databases - Case Study –Telephony Services -SMS Message sending Email-Introduction to Location Based Service -Multimedia.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books

1. Neil Smyth, Android Studio 3.0 Development Essentials – Android 8 Edition, Createspace Independent Publishing Platform, 2017.
2. Donn Felker with Joshua Dobbs, Android Application Development for DUMMIES, Wiley Publishing, 2011.
3. Barry Burd, Hoboken, Android Application Development All-in-One for Dummies, John Wiley, 2012.
4. Reto Meier and lan Lake, Professional Android, Fourth Edition, Wrox Press Publisher: John Wiley & Sons, Inc., 2018.
5. Neil Smyth, Android Studio Development Essentials – Android 6 Edition, CreateSpace Independent Publishing Platform, 2015.

Course Articulation Matrix. (Mapping CO with PO/PSO)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	3	2	1	3	2	2	3	2	2	1	3	2	3	3
CO2	1	-	2	1	3	1	1	1	1	2	1	3	3	3	3
CO3	1	-	3	-	3	3	3	2	-	3	-	3	3	2	2
CO4	2	2	1	-	3	-	2	1	1	1	2	3	1	3	3
CO5	2	1	2	1	3	3	1	2	2	-	1	2	2	3	2
Avg	1.6	1.2	2	0.6	3	1.8	1.8	1.8	1.2	1.6	1	2.8	2.2	2.8	2.6

Department: **Computer Science and Engineering**			Programme: **B.Tech.**					
Semester:			Course Category Code: **OEC**					
Course Code	Course Name		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CA	SE	TM
CSA3O05	**Introduction to Data Science**		3	-	-	3	25	75	100
Prerequisite:	Nil								
	CO	**CO statement**						**Level**	
Course Outcome	**CO1**	Outline the broad insight and intuition of the data science life cycle						Level 2: Understanding	
	CO2	Demonstrate the Mathematical Foundations needed for Data Science						Level 2: Understanding	
	CO3	Discuss in depth a variety of data mining techniques, and their applicability to various problem domains						Level 6: Creating	
	CO4	Discuss the frameworks like Hadoop, MapReduce to efficiently store retrieve and process Data.						Level 6: Creating	
UNIT-I	**Introduction to Data Science**					**Periods: 9**			
Introduction: Data Science -Epicycles of Analysis-Stating and Refining the Question- Exploratory Data Analysis- Using Models to Explore Data-Inference: A Primer- Formal Modeling-Inference vs. Prediction : Implications for Modeling Strategy -Interpreting results.									**CO1**
UNIT-II	**Mathematical Foundations for Data Science**					**Periods: 9**			
Linear Algebra-Vectors-Matrices-Statistics-Describing a Single Set of Data- Correlation-Simpson's Paradox- Other Correlational Caveats- Correlation and Causation-Probability-Dependence and Independence- Conditional Probability- Bayes's Theorem- Random Variables-Continuous Distributions- The Normal Distribution-The Central Limit Theorem.									**CO2**
UNIT-III	**Supervised Learning**					**Periods: 9**			
Regression - Linear Regression - Logistic Regression - Reasons to Choose and Cautions - Additional Regression Models - Classification - Decision Trees – Na'ive Bayes – Diagnostics of Classifiers – Additional Classification Methods – Time Series Analysis – Overview of Time Series Analysis – ARIMA Model – Additional Methods.									**CO3**
UNIT-IV	**Unsupervised Learning**					**Periods: 9**			
Clustering - Overview of Clustering - Kmeans - Additional Algorithms –Association Rules-Overview - A priori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Validation and Testing – Diagnostics - Text Analysis – Text Analysis Steps – Collecting Raw Text – Representing Text – Term Frequency-Inverse Document Frequency (TFIDF) - Categorizing Documents by Topics – Determining Sentiments – Gaining Insights.									**CO3**
UNIT-V	**Data Engineering: MapReduce, Pregel, and Hadoop**					**Periods: 9**			
MapReduce-Word Frequency Problem-Other Examples of MapReduce-Pregel-On Being a Data Scientist-Economic Interlude: Hadoop-A Brief Introduction to Hadoop- Cloudera.									**CO4**
Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods:45**						

Reference Books:

1. Joel Grus, Data science from scratch: first principles with python, O'Reilly Media, Inc., 2015.
2. Peng, R. D., & Matsui. E, The Art of Data Science. A Guide for Anyone Who Works with Data, Skybrude Consulting, 2015.
3. David Dietrich, Barry Heller & Beibei Yang, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, 2015.
4. Schutt, Rachel, and Cathy O'Neil, Doing data science: Straight talk from the frontline, O'Reilly, 2014.
5. Annalyan Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publishers, 2018.
6. Steven S. Skiena, The Data Science Design Manual, First Edition, Springer, 2017

Course Articulation Matrix. (Mapping CO with PO/PSO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	1	1	-	2	-	2
CO2	2	1	2	-	-	-	1	-	-	-	-	1	2	-	1
CO3	1	1	2	2	-	-	1	-	-	-	-	1	3	2	2
CO4	1	1	1	-	2	-	-	-	-	-	-	-	2	1	1
Ave	1.3	1	1.7	2	2	-	1	-	2	1	1	1	2	1.5	1.5

Score: 3 – High; 2 – Medium; 1 – Low

Department : **Computer Science and Engineering**			Programme: **B.Tech.**						
Semester : **-**			Course Category Code: **OEC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSA306	**C# and .Net Programming**		3	-	-	3	25	75	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	To learn the .Net Framework developed by Microsoft					Understanding		
	CO2	To learn the fundamental concepts of C#					Understanding		
	CO3	To understand the programming constructs of C#					Understanding		
	CO4	To develop Graphical User Interface using C#					Applying		
	CO5	To learn Database Connectivity using ADO.NET					Understanding		
UNIT-I	**Introduction**					**Periods: 9**			
Common language Runtime (CLR) – Common Type System (CTS) – Common language Specification (CLS) - Compilation process – Assemblies – Namespaces – Command line compiler.									**CO1**
UNIT-II	**Fundamentals of C#**					**Periods: 9**			
# Class — Object — String Formatting — Types — Scope — Constants — C# Iteration — Control Flow —Operators – Array – String – Enumerations – Structures – Custom Namespaces.									**CO2**
UNIT-III	**Programming Constructs using C#**					**Periods: 9**			
Programming Constructs – Value Types and Reference Types – Object Oriented Concepts – Encapsulation –Inheritance – Polymorphism – Interfaces – Collections – Multithreading.									**CO3**
UNIT-IV	**Graphics and Windows Forms in C#**					**Periods: 9**			
Tool Box Controls – Container Control – Menu – Tool Bar – Tool Tip Controls During Design Time – Run -Graphics Programming GDI+.									**CO4**
UNIT-V	**Database Programming with C#**					**Periods: 9**			
Data Access with ADO.NET – Architecture – Data reader – Data Adapter – Command – Connection – DataSet – Data Binding – Data Grid Control – XML Based Data Sets.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books

1. Time Keogh, —J2EE The Complete Reference‖, Tata McGraw-Hill, 2015.
2. Herbert Schildt, —C# 3.0 The Complete Reference‖, McGraw-Hill Professional, Third Edition, 2009.
3. David Chappell, —Understanding .NET – A Tutorial and Analysis‖, Addison Wesley, 2002.
4. Joh Skeet - C# in depth, Manning publications, Third Edition, 2014.
5. Andrew Stellman and Jennifer Greene - Head First C#, Third Edition, O'Reilly, 2013.
6. Andrew Troelsen - Pro C# 5.0 and the .NET 4.5 Framework, Sixth edition, A Press, 2012.

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	2	1	1	-	2	1	1	1	-	1	1
2	2	2	2	3	2	1	1	-	-	1	1	1	-	1	1
3	3	2	3	2	2	2	1	-	-	2	1	2	-	1	2
4	2	2	2	2	2	1	1	-	2	1	1	1	-	3	3
5	3	2	1	2	2	2	1	-	3	2	1	2	-	2	3
Ave	2.6	2	2.2	2.2	2	1.4	1	-	2.3	1.4	1	1.4	-	1.6	2

Score: 3 – High; 2 – Medium; 1 – Low

OTHER DEPARTMENT COURSES

Department: **Computer Science and Engineering**		Programme: **B.Tech., (EC) / (EE)**						
Semester: **Third/Fourth**		Subject Category: **ESC**			Semester Exam Type: **TY**			
Course Code	Course	Period / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA134	**Data Structures and Object-Oriented Programming**	3	-	-	3	25	75	100
Prerequisite	-							

Course Outcome	**Course Outcome Statement**	**Level**
CO1	Choose appropriate Searching and Sorting techniques.	Apply
CO2	Compare and demonstrate Linear and Non-linear data structures.	Understand
CO3	Apply Linear and Non-linear data structures for a given problem.	Apply
CO4	Define Object-Oriented Programming concepts.	Understand
CO5	Develop C++ programs using the concepts of Inheritance and Polymorphism.	Apply

UNIT-I	**Arrays, Searching and Sorting**	**Periods: 09**
Algorithm: Characteristics –Representation – Efficiency of Algorithms– Data Structures: Characteristics –Types –Arrays: Introduction – Types – Representation –Operations – Applications: Sparse Matrix – Searching: Linear Search and Binary Search– Sorting techniques: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort and Heap Sort.		**CO1**
UNIT-II	**Linear Data Structures**	**Periods: 09**
Stacks: Introduction – Operations – Applications: Evaluation of Expressions – Queues: Introduction – Operations– Circular queues – Priority queues – Double ended queues – Applications: Job Scheduling– Linked List: Introduction – Singly Linked List –Circularly Linked List and Doubly Linked List– Applications: Polynomial Addition.		**CO2**
UNIT-III	**Non-Linear Data Structures**	**Periods: 09**
Trees: Introduction –Terminology – Binary tree –Representation – Traversals– Graph: Introduction – Terminology – Representation – Traversals – Single Source and All Pairs Shortest path algorithms.		**CO3**
UNIT-IV	**Introduction to Object-Oriented Programming**	**Periods: 09**
Basics Concepts of Object-Oriented Programming – Structure of C++ – Tokens-Expressions-Control Structures – Functions in C++: Inline Functions – Recursion– Function Overloading – Classes and Objects– Constructors and Destructors– Friend Functions.		**CO4**
UNIT-V	**Concepts of Object-Oriented Programming**	**Periods: 09**
Operators Overloading: Unary and Binary Operators– Type Conversions – Inheritance–Types – Polymorphism– Virtual Functions – Exception Handling: Basics and Mechanism.		**CO5**

Total Contact Hours: 45	**Tutorial Hours:00**	**Practical Hours: 00**	**Total Hours:45**

Reference Book:

1. E Balagurusamy, Data Structures, McGraw Hill Education (India) Private Limited, 2018.
2. G A VijayalakshmiPai, Data Structures and Algorithms: Concepts, Techniques and Applications, McGraw HillEducation (India) Private Limited, 2008.
3. Ellis Horowitz, Sartaj Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, Second Edition,Universities Press (India) Private Limited,2018.
4. E. Balagurusamy, Object Oriented Programming with C++, Seventh Edition, McGraw Hill Education (India)Private Limited,2017.

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	-	1	1	1	1
CO2	3	3	1	-	-	-	-	-	-	-	-	1	1	1	1
CO3	3	3	3	1	-	-	-	-	-	-	-	1	1	1	1
CO4	3	3	1	-	-	-	-	-	-	-	-	1	1	1	1
CO5	3	3	3	1	-	-	-	-	-	-	-	1	1	1	1
AV	3	3	1.8	1	-	-	-	-	-	-	-	1	1	1	1

Score: 3 – High; 2 – Medium; 1 – Low

Department: **Computer Science and Engineering**		Programme: **B.Tech., (EC)/(EE)**						
Semester: **Third/Fourth**		Subject Category: **ESC**			Semester Exam Type: **LB**			
Course Code	Course	Period / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSA135	**Data Structures and Object - Oriented Programming Laboratory**	-	-	3	1.5	25	75	100
Prerequisite	-							

Course Outcome	**Course Outcome Statement**	**Level**
CO1	Choose and implement appropriate Searching/sorting algorithms for an application	Apply
CO2	Implement data structures using C	Apply
CO3	Apply Linear and Non-linear data structures for a given problem.	Apply
CO4	Develop and implement C++ programs using of classes and objects, constructors and destructors.	Apply
CO6	Design C++ programs with inheritance and run time polymorphism.	Apply

Experiments for Cycle 1	
1. Implementation of Linear search and binary search.	**CO1**
2. Implementation Insertion sort, Selection sort, Bubble sort, Quick sort and Heap Sort.	
3. Array implementation of Stacks and Queues.	**CO2,3**
4. Implementation of Singly and Doubly Linked List.	
5. Implementation of Binary Tree Traversals.	**CO2,3**
6. Implementation of Graph Traversals and shortest path Algorithms.	
Experiments for Cycle 2	
7. Programs to implement classes and objects.	**CO4,5**
8. Programs to implement constructors and destructors.	
9. Programs to implement different types of inheritance.	**CO5**
10. Programs to implement virtual functions to demonstrate the use of run time polymorphism.	

Total Contact Hours: 00	**Tutorial Hours:00**	**Practical Hours: 45**	**Total Hours:45**

Course Articulation Matrix. (Mapping CO with PO/PSO)

COs	Program Outcomes (Pos)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	2	-	-	-	1	2	2	1
CO2	3	3	3	3	3	-	-	2	-	-	-	1	2	2	1
CO3	3	3	3	3	3	-	-	2	-	-	-	1	2	2	1
CO4	3	3	3	3	3	-	-	2	-	-	-	1	2	2	1
CO5	3	3	3	3	3	-	-	2	-	-	-	1	2	2	1
AV	3	3	3	3	3	-	-	2	-	-	-	1	2	2	1

Score: 3 – High; 2 – Medium; 1 – Low