Pondicherry Engineering College, Puducherry – 605014

(An Autonomous Institution of Government of Puducherry affiliated to Pondicherry University)

Curriculum and Syllabi
for
B.Tech. (Computer Science and Engineering)

(With Effect from Academic year 2018-19)

(Approved in Fifth Academic Council Meeting held on 6th May 2019)

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	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	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	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communicate effectively on complex engineering activities with the engineering community and with 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	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	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	Attain the ability to provide decision support for solving real-world problems using data analytics.

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	
FY201	Induction Programme	MCC	-	-	-	-	0
MA201	Mathematics I	BSC	TY	3	1	0	4
PH201	Physics	BSC	TY	3	1	0	4
CY201	Chemistry	BSC	TY	3	1	0	4
HS201	English for Communication	HSM	TY	2	0	2	3
ME201	Workshop and Manufacturing Practice	ESC	LB	0	0	3	1.5
PH202	Physics Laboratory	BSC	LB	0	0	3	1.5
CY202	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	
MA202	Mathematics II	BSC	TY	3	1	0	4
EE201	Basic Electrical Engineering	ESC	TY	3	1	0	4
CS201	Programming for Problem Solving	ESC	TY	3	0	0	3
ME202	Engineering Graphics and Computer Aided Drawing	ESC	TY	2	0	4	3
CE201	Environmental Science	MCC	-	3	0	0	0
EE202	Basic Electrical Engineering Laboratory	ESC	LB	0	0	3	1.5
CS202	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	
SH201	Biology for Engineers	BSC	TY	3	0	0	2
EC235	Electronic Devices and Digital Systems	ESC	TY	3	0	0	3
CS203	Computer Organization and Architecture	PCC	TY	3	1	0	4
CS204	Data Structures	PCC	TY	3	0	0	3
CS205	Object Oriented Programming Languages	PCC	TY	3	0	0	3
EC236	Electronic Devices and Digital Systems Laboratory	ESC	LB	0	0	3	1.5
CS206	Data Structures Laboratory	PCC	LB	0	0	3	1.5
CS207	Object Oriented Programming Languages Laboratory	PCC	LB	0	0	3	1.5
SH202	Indian Constitution	MCC	-	3	0	0	0
Total				18	1	9	**19.5**
				28			

Course Code	Open Elective/Honours/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX*	Open Elective Course	OEC	TY	3	0	0	3
CSH01	Human Computer Interaction	PCC	TY	3	1	0	4
CSM01	Data Structures and Algorithms	PCC	TY	3	1	0	4

Semester IV

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
MA206	Mathematics for Computing	BSC	TY	3	1	0	4
CS208	Operating Systems	PCC	TY	3	0	0	3
CS209	Design and Analysis of Algorithms	PCC	TY	3	0	0	3
CS210	Database Management Systems	PCC	TY	3	0	0	3
CS211	Software Engineering	PCC	TY	3	1	0	4
CS212	Operating System Laboratory	PCC	LB	0	0	3	1.5
CS213	Design and Analysis of Algorithms Laboratory	PCC	LB	0	0	3	1.5
CS214	Database Management Systems Laboratory	PCC	LB	0	0	3	1.5
Total				15	2	9	**21.5**
				26			

Course Code	Open Elective/Honours/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX*	Open Elective Course	OEC	TY	3	0	0	3
CSH02	Advanced Data Structure and Algorithms	PCC	TY	3	1	0	4
CSM02	Principles of Operating Systems	PCC	TY	3	1	0	4

***ZZ in ZZOXX is the Department Code of the department offering Open Elective**

Semester V

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
HS202	Industrial Economics and Management	HSM	TY	3	0	0	3
CS215	Platform Technologies	PCC	TY	3	0	0	3
CS216	Computer Networks	PCC	TY	3	0	0	3
CS217	Automata Theory and Compiler Design	PCC	TY	3	1	0	4
CSYXX	Professional Elective Course - I	PEC	TY	3	0	0	3
CS218	Platform Technologies Laboratory	PCC	LB	0	0	3	1.5
CS219	Computer Networks Laboratory	PCC	LB	0	0	3	1.5
SH203	Essence of Indian Traditional Knowledge	MCC	-	3	0	0	0
Total				18	1	6	**19**
				25			

Course Code	Open Elective/Honours/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX*	Open Elective Course	OEC	TY	3	0	0	3
CSH03	Advanced Software Design	PCC	TY	3	1	0	4
CSM03	Principles of Database Management	PCC	TY	3	1	0	4

Semester VI

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
EP201	Entrepreneurship	PAC	TY	3	0	0	2
CS220	Microprocessors and Microcontrollers	PCC	TY	3	0	0	3
CS221	Web Technologies	PCC	TY	3	0	0	3
CS222	Information Security	PCC	TY	3	1	0	4
CSYXX	Professional Elective Course - II	PEC	TY	3	0	0	3
CSYXX	Professional Elective Course - III	PEC	TY	3	0	0	3
CS223	Microprocessors and Microcontrollers Laboratory	PCC	LB	0	0	3	1.5
CS224	Web Technologies Laboratory	PCC	LB	0	0	3	1.5
Total				18	1	6	**21**
				25			

Course Code	Open Elective/Honours/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX*	Open Elective Course	OEC	TY	3	0	0	3
CSH04	Advanced Security Concepts	PCC	TY	3	1	0	4
CSM04	Internet Programming	PCC	TY	3	1	0	4

Semester VII

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
CS225	Artificial Intelligence	PCC	TY	3	0	0	3
CS226	Parallel and Distributed Systems	PCC	TY	3	1	0	4
CS227	Data Science Essentials	PCC	TY	3	1	0	4
CSYXX	Professional Elective Course - IV	PEC	TY	3	0	0	3
CSYXX	Professional Elective Course - V	PEC	TY	3	0	0	3
CS228	Artificial Intelligence Laboratory	PCC	LB	0	0	3	1.5
CS229	Seminar	PAC	-	0	0	2	1
CS230	Professional Ethics	MCC	-	2	0	0	0
Total				17	2	5	**19.5**
				24			

Course Code	Open Elective/Honours/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX*	Open Elective Course	OEC	TY	3	0	0	3
CSH05	Deep Learning	PCC	TY	3	1	0	4
CSM05	Network Technology	PCC	TY	3	1	0	4

Semester VIII

Course Code	Course Name	CCC	SET	Periods			Credits
				L	T	P	
SWOXX	Open Elective through SWAYAM	OEC	-	-	-	-	2
SWOXX	Open Elective through SWAYAM	OEC	-	-	-	-	2
CS231	Comprehensive Test	PAC	-	-	-	2	1
CS232	Internship	PAC	-	-	-	-	2
CS233	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	CSY01	Graphics and Image Processing	V
	CSY02	Software Design and Testing	
	CSY03	Python Programming	
Professional Elective – II /III	CSY04	Data warehousing and Data Mining	VI
	CSY05	Internet of Things	
	CSY06	Mobile Application Development	
	CSY07	Mobile Communication and Computing	
Professional Elective – IV /V	CSY08	Embedded Systems	VII
	CSY09	Cloud Computing	
	CSY10	Machine Learning	
	CSY11	Business Intelligence	

List of Open Electives Courses (OEC)

Course Code	Course Name
CSO01	Introduction to Python Programming
CSO02	Java Programming
CSO03	Fundamentals of RDBMS
CSO04	Essentials of Mobile Application Development
CSO05	Introduction to Data Science

Courses offered under various categories:

CCC	Course Code	Course Name	Semester	Credit	Total Credit
BSC	MA201	Mathematics I	I	4	25
	PH201	Physics	I	4	
	CY201	Chemistry	I	4	
	PH202	Physics Laboratory	I	1.5	
	CY202	Chemistry Laboratory	I	1.5	
	MA202	Mathematics II	II	4	
	SH201	Biology for Engineers	III	2	
	MA206	Mathematics for Computing	IV	4	
ESC	ME201	Workshop and Manufacturing Practice	I	1.5	19
	EE201	Basic Electrical Engineering	II	4	
	CS201	Programming for Problem Solving	II	3	
	ME202	Engineering Graphics & Computer Aided Drawing	II	3	
	EE202	Electrical Engineering Laboratory	II	1.5	
	CS202	Programming Laboratory	II	1.5	
	EC235	Electronic Devices and Digital Systems	III	3	
	EC236	Electronic Devices and Digital Systems Laboratory	III	1.5	
PCC	CS203	Computer Organization and Architecture	III	4	69
	CS204	Data Structures	III	3	
	CS205	Object Oriented Programming Languages	III	3	
	CS206	Data Structures Laboratory	III	1.5	
	CS207	Object Oriented Programming Languages Laboratory	III	1.5	
	CS208	Operating Systems	IV	3	
	CS209	Design and Analysis of Algorithms	IV	3	
	CS210	Database Management Systems	IV	3	
	CS211	Software Engineering	IV	4	
	CS212	Operating System Laboratory	IV	1.5	
	CS213	Design and Analysis of Algorithms Laboratory	IV	1.5	
	CS214	Database Management Systems Laboratory	IV	1.5	
	CS215	Platform Technologies	V	3	
	CS216	Computer Networks	V	3	
	CS217	Automata Theory and Compiler Design	V	4	
	CS218	Platform Technologies Laboratory	V	1.5	
	CS219	Computer Networks Laboratory	V	1.5	
	CS220	Microprocessors and Microcontrollers	VI	3	
	CS221	Web Technologies	VI	3	
	CS222	Information Security	VI	4	
	CS223	Microprocessors and Microcontrollers Laboratory	VI	1.5	
	CS224	Web Technologies Laboratory	VI	1.5	
	CS225	Artificial Intelligence	VII	3	
	CS226	Parallel and Distributed Systems	VII	4	
	CS227	Data Science Essentials	VII	4	
	CS228	Artificial Intelligence Laboratory	VII	1.5	

PEC	CSYXX	Professional Elective Course – I	V	3	**15**
	CSYXX	Professional Elective Course – II	VI	3	
	CSYXX	Professional Elective Course – III	VI	3	
	CSYXX	Professional Elective Course – IV	VII	3	
	CSYXX	Professional Elective Course – V	VII	3	
OEC	ZZOXX	Open Electives offered by other Departments	III - VII	6	**10**
	SWOXX	Open Electives offered under SWAYAM	-	4	
PAC	EP201	Entrepreneurship	VI	2	**14**
	CS229	Seminar	VII	1	
	CS231	Comprehensive Test	VIII	1	
	CS232	Internship	VIII	2	
	CS233	Project Work	VIII	8	
HSM	HS201	English for Communication	I	3	**6 + 3*/ 2***
	HS202	Industrial Economics and Management	V	3	
	HSOXX	Humanities Open Elective offered by HSS Department	**-**	3*	
	SWOXX	Humanities Open Elective offered under SWAYAM	**-**	2*	
Total					**158**

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

Department : **HSS**		Programme: **B.Tech**						
Semester : **First**		Course Category Code: **MCC**				Semester Exam Type: -		
Course Code	Course	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
FY201	**Induction Programme**	-	-	-	Non-Credit	-	-	-
Prerequisite	**-**							
Course Outcome	The course will enable the student to							
	CO1 Acquire social awareness & knowledge for self-development							
	CO2 Be aware of nature & environment conscious and of Innovative nature.							
	CO3 Develop holistic attitude and harmony in the individual, family, and society							
	CO4 Know about the art and culture, language and literature of this vast secular nation							
	CO5 Integrating technical Education for betterment of society							
UNIT-I	**Proficiency in English**				**Periods: 12**			
Communication skills – Diagnostic test on Grammar – Synonyms, Antonyms, Tenses, Sentence Completion, Idioms & Phrases, One word substitution, Homophones, Homonyms, Use of Prepositions, Subject-verb agreement – Writing – Paragraph writing, Letter writing, Essay writing, Story Development.								**CO1**
UNIT-II	**Bridge course in Mathematics**				**Periods: 12**			
Fundamentals of differential and integral calculus: Theory, Practice & Test. Limit of function-Fundamental results on limits-Continuity of a function- Concept of differentiation- Concept of derivative- Slope of a curve-Differentiation Techniques- Derivatives of elementary functions from first principle-Derivatives of inverse functions-Logarithmic differentiation- Method of substitution- Differentiation of parametric functions-Differentiation of implicit functions- Higher order derivatives. Integrals of functions containing linear functions-Method of integration (Decomposition method, method of substitution, integration by parts) - Definite integrals. Simple definite integrals- Properties of Definite integrals- Reduction formulae-Area and volume- Length of curve- surface area of a solid.								**CO2**
UNIT-III	**Universal human values**				**Periods: 12**			
Current Status of the society (Sources of fear)-Reformation through education-Sanskar-What is success (getting good marks, college admission, Job etc)-What is aim of life (happiness, Prosperity and continuity of happiness and prosperity)-What is required for happiness (relationship, physical facilities)-Relationship involves all emotions and feelings-Physical facility-material things required for life-Difference between animal and human consciousness-Animal consciousness-depending on money, accumulating money by wrong means etc.-Human consciousness-right thinking, right understanding, right feeling-Happiness through Harmony in the individual, family, society and nature, leading to fearlessness in the society is the purpose of holistic education or value education.								**CO3**
UNIT-IV	**Literary activities**				**Periods: 12**			
Team building activities – Quiz – Oral Exercises – Group discussion, Debate, Extempore, Role play.								**CO4**
UNIT-V	**Creative arts**				**Periods: 12**			
Introduction to painting & renowned artworks – Documentary & Short films – Music – Vocal, Instrumental – Dance – Classical, Cinematic – Mimicry – Mime.								**CO5**
Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 60**			
Reference Books								
-								

Department : **Mathematics**		Programme: **B.Tech.**						
Semester : **First**		Course Category Code: **BSC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
MA201	**Mathematics-I**	3	1	-	4	40	60	100
Prerequisite:	-							

Course Outcome	**CO1**	To apply differential calculus to notions of curvature, evolutes and involutes and they will have a basic understanding of Beta and Gamma functions
	CO2	The mathematical tools needed in evaluating multiple integrals and their usage.
	CO3	The effective mathematical tools for the solutions of differential equations that model physical processes
	CO4	Able to solve simultaneous linear differential equations
	CO5	Understands Vector calculus and its applications

UNIT-I	**Differential Calculus**	**Periods: 12**
Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.		**CO1**
UNIT-II	**Multi variable calculus**	**Periods: 12**
Multiple Integrals, change of order of integration in double integrals, Applications: Plane areas (double integration), Change of variables (Cartesian to polar), Double and triple integrations, Volumes by triple integration – Mass, Center of mass and Gravity (constant and variable densities).		**CO2**
UNIT-III	**First order Ordinary Differential Equation**	**Periods: 12**
Exact equations, First order linear equations, Bernoulli's equation, Equations not of first degree, equations solvable for p, equations solvable for y, equations solvable for x - Clairaut's type - simple applications, orthogonal trajectories, growth and decay.		**CO3**
UNIT-IV	**Higher Order Ordinary Differential Equation**	**Periods: 12**
Linear differential equations of higher order - with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients, simultaneous linear differential equations, solution by variation of parameters method.		**CO4**
UNIT-V	**Vector Calculus**	**Periods: 12**
Gradient, divergence and curl, their properties and relations. Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integral, Theorems of Green, Stokes and Gauss divergence (without proof). Simple applications involving cubes, sphere and rectangular parallelepipeds.		**CO5**

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

Reference Books:

1. Veerarajan T, Engineering Mathematics I , McGraw-Hill Education(India) Private Limited, 2014
2. Veerarajan T, Engineering Mathematics II , McGraw-Hill Education(India) Private Limited, 2015
3. Venkataraman M.K., Engineering Mathematics, Vol. I&II, The National Publishing Company, Chennai, 2008.
4. Erwin Kreyszig, Advanced Engineering Mathematics (9 th Ed), John Wiley & Sons, New Delhi, 2011.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, Eleventh Reprint, 2010.
6. Bali N. and Goyal M., Advanced Engineering Mathematics, Laxmi Publications Pvt. Ltd., New Delhi, 9thEdition, 2011.

Department : **Mathematics**			Programme : **B.Tech**						
Semester : **Second**			Course Category Code: **BSC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
MA202	**Mathematics-II**		3	1	-	4	40	60	100
Prerequisite:	-								
Course Outcome	**CO1**	Understands Matrix theory							
	CO2	The tool of Fourier series for learning advanced Engineering Mathematics							
	CO3	The tool of Fourier transform for learning advanced Engineering Mathematics							
	CO4	The tools of differentiation of functions of a complex variable that are used in various techniques dealing engineering problems.							
	CO5	The tools of integration of functions of a complex variable that are used in various techniques dealing engineering problems.							

UNIT-I	**Matrices**	**Periods: 12**
Inverse and rank of a matrix, System of linear equations, Symmetric, Skew Symmetric and Orthogonal matrices, Eigenvalues and Eigenvectors of a real matrix, Characteristic equation, Properties of Eigenvalues. Cayley-Hamilton Theorem (statement only), Diagonalization of matrices.		**CO1**
UNIT-II	**Fourier Series**	**Periods: 12**
Dirichlet's conditions - Expansion of periodic functions into Fourier series- Change of interval- Half-range Fourier series. Complex form of Fourier series - Root mean square value - Parseval's theorem on Fourier coefficients - Harmonic analysis.		**CO2**
UNIT-III	**Fourier Transform**	**Periods: 12**
Fourier Integral Theorem(statement only)- Fourier transform, Inverse Fourier transform, definition and properties - Evaluation of integrals- Fourier cosine and sine transform, definitions and evaluation of integrals using cosine and sine transforms.		**CO3**
UNIT-IV	**Complex Valued function and Conformal Mapping**	**Periods: 12**
Definition of a Complex valued function f(z) and its derivative - Analytic functions -Necessary condition for a function f(z) to be analytic (in Cartesian) - Cauchy-Riemann equation - statement of C-R equation in polar form -sufficient condition for f(z) to be analytic(statement only)- harmonic function- Harmonic and orthogonal properties of analytic function – Construction of analytic functions. Conformal mapping – Simple and standard transformations like $w = z^2$, e^z, z+c, cz, sinz, 1/z, Bilinear transformation (excluding Schwarz- Christoffel transformation).		**CO4**
UNIT-V	**Complex Integration**	**Periods:12**
Cauchy's Integral theorem, Cauchy's integral formula (without proof) and problems, Taylor's and Laurent's theorem (without proof), Classification of singularities. Residues and evaluation of residues – Cauchy's Residue theorem, Contour integration – Evaluation of real integrals – unit circle and semi-circular contour (excluding poles on boundaries).		**CO5**

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

Reference Books:

1. Veerarajan T., Engineering Mathematics II , McGraw-Hill Education(India) Private Limited, 2018
2. Veerarajan T., Transforms and Partial Differential Equations , McGraw-Hill Education(India) Private Limited, 2016
3. Venkataraman M.K., Engineering Mathematics, Vol. II and III, The National Publishing Company, 2008.
4. Erwin Kreyszig, Advanced Engineering Mathematics (Ninth Edition), John Wiley & Sons, New Delhi, 2011
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, Eleventh Reprint, 2010.
6. Bali N. and Goyal M., Advanced Engineering Mathematics, Laxmi Publications Pvt. Ltd., New Delhi, Ninth Edition, 2011.

Department : **Physics**			Programme : **B.Tech.**						
Semester : **First/Second**			Course Category Code: **BSC**			Semester Exam Type: **TY**			
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
PH201	**Physics**		3	1	-	4	40	60	100
Prerequisite	-								
		The course will enable the student to:							
Course Outcome	**CO1**	Understand electric and magnetic field & potential							
	CO2	Study the basics of dielectric materials and its importance							
	CO3	Understand the concepts of wave mechanics and its applications							
	CO4	To study the optical phenomena arising due to interference, diffraction and polarization							
	CO5	To discuss the fundamentals of Lasers, fiber optics and its real time applications							
UNIT-I	**Electromagnetic theory**					**Periods: 12**			
Brief review of electrostatics, electric field and potential – divergence and curl of electrostatic field – Gauss law and its applications, Laplace's equation in one, two and three dimension. Brief review of magnetostatics, Biot-Savart law – divergence and curl of static magnetic field – Ampere's law – magnetic vector potential – comparison of electrostatics and magnetostatics.									**CO1**
UNIT-II	**Dielectrics**					**Periods: 12**			
Dielectric polarization and its mechanisms – dielectric loss – dielectric breakdown – calculation of electronic polarizabilities and ionic polarizabilities – temperature and frequency dependence of polarization – internal field in solids – Clausius-Mossotti relation – ferroelectricity – ferroelectric hysteresis.									**CO2**
UNIT-III	**Quantum mechanics**					**Periods: 12**			
Matter Waves – de Broglie hypothesis – uncertainty principle – Schrödinger wave equations – time dependent – time independent – physical significance of wave function – application to particle in a one dimensional potential box – concept of quantum mechanical tunneling (without derivation) – applications of tunneling (qualitative) to alpha decay, tunnel diode, scanning tunneling microscope.									**CO3**
UNIT-IV	**Wave optics**					**Periods: 12**			
Interference: airwedge – Newton's rings – Michelson's interferometer – types of fringes – determination of wavelength of a light source. **Diffraction:** concept of resolution of spectral lines – Rayleigh's criterion – resolving power of grating, prism & telescope. **Polarisation:** Basic concepts of double refraction – circular and elliptical polarization – quarter and half wave plates – optical rotation – specific rotatory power – Laurent's half shade polarimeter.									**CO4**
UNIT-V	**Lasers and Fiber optics**					**Periods: 12**			
Lasers: Principles of laser – spontaneous and stimulated emissions – Einstein's theory of matter radiation interaction – A and B coefficients – population inversion and laser action – optical resonators(qualitative) – types of lasers –Nd:YAG, CO2 laser, GaAs laser – industrial & medical applications of lasers (any two). **Fiber optics:** Principle and propagation of light in optical fiber – numerical aperture and acceptance angle – step index and graded index fiber – qualitative ideas of attenuation in optical fibers – fiber optic communication (schematic), active and passive fiber optic sensors, endoscope.									**CO5**
Lecture Periods: 45		**Tutorial Periods: 15**			**Practical Periods: -**			**Total Periods: 60**	
Reference Books									

1. David Griffiths, Introduction to Electrodynamics, 3rd Edition, Eastern Economy Edition., 2011
2. A.S. Vasudeva, Modern Engineering Physics, S. Chand & Co, 2006.
3. D. J. Griffiths, "Quantum mechanics", Pearson Education, 2014.
4. V. Rajendran, Engineering Physics, 2nd Edition, TMH, New Delhi 2011
5. Avadhanulu M. N. , Engineering Physics, S. Chand & Co, 2007
6. David Halliday, Robert Resnick and Jearl Walker, Fundamentals of Physics, Wiley publications, 2013
7. H.J. Pain, The physics of vibrations and waves, Wiley publications, 2005
8. Ajoy Ghatak, Optics, 5th Edition TMH, New Delhi, 2012
9. Orazio Svelto, 2nd Edition, plenum Press, Principles of Lasers, 1982.
10. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2nd Edition, Springer 2010.

Department : **Physics**			Programme : **B.Tech.**						
Semester : **First/Second**			Course Category Code: **BSC**			Semester Exam Type: **LB**			
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
PH202	**Physics Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	-								
	The students will learn to experimentally measure:								
Course Outcome	**CO1**	Optical parameters related to the concepts included in theoretical curriculum							
	CO2	Characteristic parameters of Laser and optical fiber							
	CO3	Thermal conductivity and pressure coefficients							
	CO4	Magnetic field, electrical conductivity and Hall coefficient							
	CO5	Young's modulus, Rigidity modulus and acceleration due to gravity							

Choice of 10-12 experiments from the following

1. Radius of curvature of a Lens - Newton's rings 2. Thickness of a thin object by air – wedge 3. Spectrometer – resolving power of a prism 4. Spectrometer – resolving power of a transmission grating 5. Spectrometer - hollow prism / ordinary & extraordinary rays by calcite prism* 6. Lorent's Half shade polarimeter – determination of specific rotatory power	**CO1**
7. Determination of wavelength of a laser source using transmission grating, reflection grating (vernier calipers) & particle size determination 8. Determination of numerical aperture & acceptance angle of an optical fiber 9. Determination of optical absorption coefficient of materials using laser* 10. Michelson's interferometer*	**CO2**
11. Coefficient of thermal conductivity - radial flow method 12. Coefficient of thermal conductivity – Lee's disc method 13. Jolly's bulb apparatus experiment – determination of α*	**CO3**
14. Magnetism: I – H curve 15. Field along the axis of a coil carrying current 16. Vibration magnetometer – calculation of magnetic moment & pole strength 17. Electrical conductivity of semiconductor – two probe / four probe method* 18. Hall effect in a semiconductor*	**CO4**
19. Determination of Young's modulus and rigidity modulus 20. Acceleration due to gravity - compound pendulum *Demonstration experiments	**CO5**

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

Reference Books

1. Physics Practical Observation Manual, Department of Physics, Pondicherry Engineering College.

Department : **Chemistry**		Programme : **B.Tech**						
Semester : **First/Second**		Course Category Code: **BSC**			Semester Exam Type: **TY**			
Course Code	Course	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CY201	**Chemistry**	3	1	-	4	40	60	100
Prerequisite:	-							
Course Outcome	The course will enable the student to:							
	CO1	Analyse microscopic chemistry in terms of orbitals, structure and intermolecular forces						
	CO2	Rationalize the bulk properties and processes						
	CO3	Study the concepts of electrochemistry and its applications						
	CO4	Understand the mechanism of chemical reactions and synthesis of molecules						
	CO5	Comprehension of the concepts of analytical techniques.						

UNIT-I	**Chemical bonding and isomerism**	**Periods: 12**
Chemical bonding-valence bond theory, overlapping of orbitals. Hybridization in carbon compounds-sp, sp^2 and sp^3. Electron pair repulsion. Hybridization and shape of water and ammonia molecules. Molecular orbital theory-combination of atomic orbitals. Bond order. Molecular orbital diagrams for homonuclear diatomic molecules-(hydrogen to neon). Ionic, dipolar and van der Waals interactions. Structural and stereo isomerism-geometrical isomerism in alkenes. Optical isomerism-optical activity, chiral carbon. Optical isomerism in lactic acid and tartaric acid. Enantiomers, diastereomers and meso compounds. Resolution of racemic mixtures, racemization, asymmetric synthesis, Walden inversion.		**CO1**
UNIT-II	**Water chemistry and reaction kinetics**	**Periods: 12**
Water chemistry-hard and soft water, removal of hardness by ion exchange and zeolite processes. Determination of hardness by EDTA method. Desalination-Reverse osmosis. Adsorption-adsorption of gases on solids-Freundlich and Langmuir adsorption isotherms. Factors affecting adsorption of gases on solids. Chemical kinetics-rate of a reaction, factors affecting rate of reaction, first and second order rate equations. Half-life of reactions.		**CO2**
UNIT-III	**Electrode potential and corrosion**	**Periods: 12**
Electrode potential, electromotive force, reference electrodes-hydrogen, Ag/AgCl, calomel and glass electrodes. Nernst equation and applications. Electrolyte concentration cell. Batteries-Primary and secondary batteries. Dry cell, alkaline battery, Ni-Cd battery and lead-acid battery. Fuel cell-Hydrogen-oxygen fuel cell. Corrosion-dry and wet corrosion, mechanism of electrochemical corrosion, galvanic, pitting and concentration cell corrosion. Factors influencing corrosion. Corrosion control by cathodic protection. Anodization.		**CO3**
UNIT-IV	**Introduction to reaction mechanism**	**Periods: 12**
Introduction to reaction mechanism-factors influencing a reaction, homolytic and heterolytic bond fission. Reaction intermediates-carbonium ion, carbanion, free radicals and carbenes. Electrophiles and nucleophiles. Mechanism of free radical substitution-chlorination of methane. Mechanism of electrophlic substitution-bromination of benzene. Nucleophilic substitution-S_N2-hydrolysis of methyl bromide, S_N1-hydrolysis of t-butyl bromide. Elimination reactions-E1 and E2. Addition reactions-nucleophilic and electrophilic. Synthesis of aspirin, paracetamol, sulfanilamide and chloroquine.		**CO4**
UNIT-V	**Analytical techniques**	**Periods: 12**
Absorption and emission of radiation. Beer-Lamberts law. Ultraviolet and visible spectroscopy-basic principles and instrumentation. Basic principles and instrumentation of atomic absorption spectrometry, hollow cathode lamp. Conductivity-equivalent and molar conductance, cell constant. Conductometric titration-types of conductometric titrations. Potentiometry-principle of acid base titration. Chromatography- Principles and instrumentation of gas Chromatograph.		**CO5**

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

Reference Books

1. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 2016.
2. S.S. Dara and S.S Umare, A Textbook of Engineering Chemistry, S. Chand & Co., Ltd. New Delhi, 2013.
3. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S. Chand and Company Ltd, New Delhi, 2016
4. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, S. Chand and Company Ltd, New Delhi, 2011
5. B.R. Puri, L.R. Sharma and K.C Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi, 2007
6. G.R. Chatwal and S.K. Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House Pvt Ltd, New Delhi, 2005
7. D.A. Skoog, F.J. Holler and T.A. Nieman, Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd, Singapore, 2004.

Department : **Chemistry**		Programme : **B.Tech.**						
Semester : **First/Second**		Course Category Code: **BSC**				Semester Exam Type: **LB**		
Course Code	Course	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CY202	**Chemistry Laboratory**	-	-	3	1.5	40	60	100
Prerequisite	-							
Course Outcome	The students will learn to:							
	CO1	Determine rate constants and order of reactions						
	CO2	Measure molecular/system properties such as surface tension, viscosity, partition coefficient, hardness of water, adsorption, saponification value and acid value						
	CO3	Analyze quantitatively the contents of samples						
	CO4	Use conductivity, potentiometric and chromatographic techniques						
	CO5	Analyse a salt sample						

Choice of 10-12 experiments from the following:

1. Kinetic study of acid hydrolysis of ethyl acetate	**CO1**
2. Determination of surface tension and viscosity 3. Partition of benzoic acid between benzene and water 4. Total hardness of water - Determination by EDTA method 5. Freundlich adsorption isotherm - Adsorption of acetic acid on charcoal 6. Saponification value and acid value of an oil	**CO2**
7. Chloride content of water - Determination by Mohr's method 8. Determination of oxalic acid by permanganometry 9. Determination of ferrous by permanganometry 10. Determination of ferrous and ferric by dichrometry 11. Determination of carbonate and bicarbonate in a mixture 12. Beer-Lamberts law - Determination of ferrous by colorimetry 13. Magnesium content in water - Determination by EDTA method 14. Acetic acid content in vinegar 15. Dissolved oxygen content in water - Determination by Winkler's method. 16. Determination of available chlorine in bleaching powder.	**CO3**
17. Conductometric titration 18. Potentiometric titration 19. Thin layer chromatography	**CO4**
20. Chemical analysis of salt for cations and anions	**CO5**

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

Reference Books

1. Lab Manual, Department of Chemistry, Pondicherry Engineering College, Puducherry, 2018.
2. V. Venkateswaran, R. Veeraswamy and A.R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, 2001.
3. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas, Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi, 2002.

Department : **Humanities and Social Sciences**		Programme : **B.Tech**						
Semester : **First/Second**		Course Category Code: **HSM**			Semester Exam Type: **TY**			
Course Code	Course	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
HS201	**English for Communication**	2	-	2	3	40	60	100
Prerequisite	-							
Course Outcome	**CO1**	To help the learners to develop their technical communication skills						
	CO2	To equip the learners with skills required for developing their reading prowess.						
	CO3	To enhance the writing skills of learners by providing practice in writing.						
	CO4	To instil confidence in learners to develop their speaking skills and enable them to articulate with ease.						
	CO5	To facilitate vocabulary enhancement and grammatical correctness in communication.						

UNIT-I	**TECHNICAL COMMUNICATION**	**Periods: 12**
Nature of Technical communication – Forms of Technical Communication – General and Technical Communication – Importance and need –Organization in Technical Communication – Style – ABC of Technical Communication –Technical Communication Skills.		**CO1**
UNIT-II	**COMPREHENSION AND ANALYSIS**	**Periods: 12**
Technical and Non-Technical passages – Reading methods – Skimming – Scanning– Extensive and Intensive reading – Inferring – Contextual meaning – summary – note making.		**CO2**
UNIT-III	**PRACTICE IN WRITING**	**Periods: 12**
Sentence Structures – Use of phrases and clauses in sentences – coherence in writing – principles for paragraph writing –Essay Writing – describing – defining – classifying – Business letters – memorandum – instructions – E-mail –reports.		**CO3**
UNIT-IV	**SPEAKING PRACTICE**	**Periods: 12**
Pronunciation –Basics of Phonetics– Conversations and dialogues –formal presentations – Group Discussions – Extempore speaking – Debates- Role Plays– interview skills.		**CO4**
UNIT-V	**GRAMMAR AND VOCABULARY BUILDING**	**Periods: 12**
Word formation – root words from foreign languages and their use in English – Prefixes and suffixes –subject-verb agreement – Articles – voice – preposition– importance of punctuation – Redundancies – synonyms, Antonyms and standard abbreviations– Indianisms.		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Reference Books

1. Sudarshana, N.P and C. Savitha. English for Technical Communication. Noida: CUP, 2016.
2. Shoba, K N and Lourdes Joavani Rayen. Communicative English. Chennai: CUP, 2017.
3. Rizvi, Ashraf, M. Effective Technical Communication. New Delhi: McGraw, 2017.
4. Daniel Jones. English Pronouncing Dictionary. Cambridge University Press, 2003.
5. Dutt, Kiranmai P and Geetha Rajeevan. Basic Communication Skills. New Delhi: CUP,2013
6. Sanjay Kumar and Pushpalata. Communication Skills. New Delhi: OUP, 2011.
7. Mohan, Krishna and Meera Banerji. Developing Communication Skills. 2nd edition. Delhi: Macmillan, 2012.
8. Relevant material from newspapers, magazines and journals will be used for integrated practice.

Department : **Mechanical Engineering**			Programme : **B.Tech**						
Semester : **First/Second**			Course Category Code: **ESC**				Semester Exam Type: **LB**		
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ME201	**Workshop and Manufacturing Practice**		0	0	3	1.5	40	60	100
Prerequisite									
Course Outcome	**CO1**	To convey the basics of mechanical tools used in carpentry section and establish hands on experience in making the different carpentry joints							
	CO2	To gain knowledge on types of tools and machines used in sheet metal shop and perform some exercises							
	CO3	To develop basic welding and fitting joints using the hand tools and establish the importance of joints and fitting in engineering applications							
	CO4	To gain knowledge of the different machines used in manufacturing processes which are commonly employed in the industry, to fabricate components using different materials							
	CO5	To carry out simple manufacturing operations in lathe, drilling and shaping machine							
UNIT-I	**Carpentry**					**Periods: 9**			
Study of tools and machines in carpentry Practice on :1.Half Lap joint 2.Corner Mortise joint and 3.Dovetail joint									**CO1**
UNIT-II	**Sheet Metal**					**Periods: 9**			
Study of tools and machineries in sheet metal shop 1.Frustum of cone 2.Waste collection tray and 3.Rectangular box									**CO2**
UNIT-III	**Welding and Fitting**					**Periods: 9**			
Lectures/demonstrations/videos on Welding and fitting operations with simple exercise. 1. Filing and Job preparation 2. V-Fitting and 3. Simple lap joint									**CO3**
UNIT-IV	**Study of tools and machines**					**Periods: 6**			
Study of tools and machines in manufacturing lab 1. Lathe machine 2.Drilling machine and 3.Shaping machine									**CO4**
UNIT-V	**Simple Exercises in Lathe/Drilling machine/Shaper**					**Periods: 12**			
Simple operations in lathe, drilling and shaping 1.Facing and Turning 2.Step Turning 3.Drilling in a flat plate with different drill dimensions and 4.Cube in Shaping									**CO5**
Lecture Periods: 3	**Tutorial Periods: -**		**Practical Periods: 42**			**Total Periods: 45**			

Reference Books

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. H.N.Gupta, R.C.Gupta and Arun Mittal, Manufacturing Processes, New Age Publications, 2001.

Department : **Mechanical Engineering**			Programme : **B.Tech**						
Semester : **First/Second**			Course Category Code: **ESC**			Semester Exam Type: **TY**			
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ME202	**Engineering Graphics and Computer Aided Drawing**		2	-	4	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Students learn to properly dimension and annotate engineering drawings as per standards of engineering drawing practice.							
	CO2	Students are made to follow and understand the basics of engineering drawing with simple solids.							
	CO3	Students can properly apply and produce sectional views.							
	CO4	Students are able to properly create multi-view orthographic drawings from three dimensional diagrams. Students are able to present a drawing in orthographic and isometric projections.							
	CO5	Students learn the application of engineering graphics through computer-aided drafting.							
UNIT-I						**Periods: 18**			
Introduction to Engineering graphics, Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning, Projection of Lines, Projection of Planes									**CO1**
UNIT-II						**Periods: 18**			
Projections of simple solids									**CO2**
UNIT-III						**Periods: 18**			
Sections of solids and Development of surfaces									**CO3**
UNIT-IV						**Periods: 18**			
Isometric Projections and Orthographic Projections									**CO4**
UNIT-V						**Periods: 18**			
Introduction to Computer Graphics and Drafting, Auto CAD, 2-D diagrams of simple geometries using Auto-CAD script.									**CO5**
Lecture Periods: 30		**Tutorial Periods: -**			**Practical Periods: 60**			**Total Periods: 90**	

Reference Books

1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.
2. K.Venugopal, Engineering Drawing & Graphics + Auto CAD, 4th edition, New Age Int'lPublication Ltd., 2004.
3. BIS, Engineering Drawing practices for Schools & College, SP 46: 2003.
4. T. Jeyapoovan, Engineering Graphics using AUTOCAD, 7th edition, VIKAS Publishing House (P) Ltd., 2015.
5. N.D. Bhatt, Engineering Drawing, 49th edition, Charotar Publishing House, 2014.
6. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers, 2006.
7. M. B. Shah and B. C. Rana, Engineering Drawing, 2nd edition, Pearson Publications, 2018.
8. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
9. http://www.3ds.com/products/catia/
10. http://en.wikipedia.org/wiki/CATIA

Department : **Electrical and Electronics Engineering**			Programme : **B.Tech**						
Semester : **First/Second**			Course Category Code: **ESC**			Semester Exam Type: **TY**			
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
EE201	**Basic Electrical Engineering**		3	1	-	4	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	To understand the basic concepts of DC circuits and theorems.							
	CO2	To explain the concepts of AC circuits and resonance.							
	CO3	To understand the basic concepts of magnetic circuits and transformer.							
	CO4	To explain the working principle, construction, applications of electrical machines.							
	CO5	To Gain knowledge of working of power plants and fundamentals of switch gear and earthing.							

UNIT-I	**DC Circuits**	**Periods: 12**
Electrical circuit elements (R, L and C) - Definition of Voltage, Current, Power and Energy – Ohm's law, Kirchoff current and voltage laws, analysis of simple circuits with DC voltage – Division of current in series and parallel circuits – Star-delta conversion – Node and mesh method of analysis of DC circuits – Network Theorems: Thevenin, Norton and Superposition Theorems.		**CO1**
UNIT-II	**AC Circuits**	**Periods: 12**
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Resonance: Series and parallel resonance. Three-phase balanced circuits: voltage and current relations in star and delta connections – Power measurement by two Wattmeter method.		**CO2**
UNIT-III	**Transformers**	**Periods: 12**
Laws of Electromagnetic induction – Ampere's circuital law, Faraday's law and Lenz law – Dot rule. Magnetic materials, B-H characteristics. Single phase transformer: Construction and working, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.		**CO3**
UNIT-IV	**Electrical Machines**	**Periods: 12**
Elementary concept of rotating machines – Flemming's right hand and left hand rule – DC Machines: Construction and working of DC Machines - Generator and Motors – Emf equation of DC generator and back emf of DC motor –characteristics - Types of DC Machines. AC Machines: Construction and working of Single phase & three phase induction motors and synchronous generator (qualitative approach only).		**CO4**
UNIT-V	**Power Plants and LT Switch gear**	**Periods: 12**
Power Plants: Layout of thermal, hydro and nuclear power generation (block diagram approach only). Components of AC transmission and distribution systems – One-line diagram. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables. Earthing. Elementary calculations for energy consumption.		**CO5**

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

Reference Books

1. D. P. Kothari and L. J. Nagrath, "Basic Electrical Engineering", 3rd Edition, Tata McGraw Hill, 2017.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2011.
3. Rajendra Prasad, "Fundamentals of Electrical Engineering", 3rd Edition, PHI Learning Private Limited, 2014.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Department : **Electrical and Electronics Engineering**			Programme : **B.Tech**						
Semester : **First/Second**			Course Category Code: **ESC**			Semester Exam Type: **LB**			
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
EE202	**Basic Electrical Engineering Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	To understand the principles of domestic wiring and electrical components.							
	CO2	To illustrate handling of measuring instruments and demonstrate the concepts of network theorems							
	CO3	To analyze RL,RC,RLC circuits							
	CO4	To introduce concepts of single/three phase circuits							
	CO5	To demonstrate the working principle of electrical machines							

Any 10 experiments

1. Study of: Basic safety precautions. Concepts of domestic wiring- wires, switches, plugs, sockets, fuses and lamp holders. 2. Study of fan and tube light connections and earthing 3. Stair case wiring. 4. Bedroom wiring.	**CO1**
5. Use of measuring instruments. Verification of Kirchoff's voltage and current law 6. Verification of Thevenin and Norton theorems 7. Verification of Superposition Theorem.	**CO2**
8. Impedance calculation of R-L, R-C & R-L-C circuits and verification. 9. Measurement of power & power factor in a single phase AC circuit using three Ammeter Method 10. Resonance: Series and parallel.	**CO3**
11. Measurement of various line and phase quantities for a three phase star/delta ac circuit. 12. Measurement of three phase power using two wattmeter method. 13. Energy measurement using single phase energy meter.	**CO4**
14. Load test on a single phase transformer. 15. Load test on a single phase induction motor.	**CO5**

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

Reference Books

1. Laboratory Manual, Department of Electrical and Electronics Engineering, Pondicherry Engineering College.

Department : **Computer Science and Engineering**			Programme : **B.Tech**						
Semester : **First/Second**			Course Category Code: **ESC**			Semester Exam Type: **TY**			
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CS201	**Programming for Problem Solving**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Understood the phases of problem solving techniques for simple problems.							
	CO2	Able to write programs using the basic language constructs.							
	CO3	Able to build a larger programs using function oriented approaches.							
	CO4	Could write efficient programs using advanced concepts to optimize the memory.							
	CO5	Could write programs to access data from the secondary storage efficiently.							

UNIT-I	**Algorithmic Problem Solving**	**Periods: 9**
History and Classifications of Computers – Components of Computer – Working Principle of Computer – Hardware – Software and its Types – Applications of Computers. Generations of Programming Languages – Introduction to Number System. Problem solving techniques: Program development life-cycle – Algorithms – building blocks of algorithms - Algorithmic problem solving-Flowchart– Pseudo code.		**CO1**
UNIT-II	**Data, Expressions, Statements**	**Periods: 9**
Introduction to C –C Program Structure – C Tokens: Keyword, Identifiers, Constants, Variables and Data types (simple and user-defined) – Operators and its types – Operator Precedence – Expression Evaluation – Type Conversion –Managing Input/output operations-Branching Statements – Looping Statements.		**CO2**
UNIT-III	**Arrays and Functions**	**Periods: 9**
Arrays – Two dimensional arrays, Multidimensional arrays. Character arrays. Functions: Function Prototype, Passing Arguments to Function – Call by Value and Call by Reference – Nested function call – Library Functions – User-defined Functions – Recursion. Strings – String I/O functions, String Library functions – Storage classes.		**CO3**
UNIT-IV	**Structures, Unions and Pointers**	**Periods: 9**
Structures – Arrays and structures – Nested structures – Structure as argument to functions–Union. Pointers – Declaration, Initialization and Accessing Pointer variable – Pointers and arrays – pointers as argument and return value – Pointers and strings - Pointers and structures.		**CO4**
UNIT-V	**File Management**	**Periods: 9**
Introduction to File Concepts in C – File types – I/O operations on files – File modes – Random access to files – Command line arguments. Dynamic Memory Allocation: MALLOC, CALLOC, FREE, REALLOC. Introduction to preprocessor: Macro substitution directives – File inclusion directives –Compiler Control directives – Miscellaneous directives.		**CO5**

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

Reference Books

1. Balagurusamy. E, “Programming in ANSI C”, Tata McGraw Hill, Seventh Edition, 2017.
2. Byron Gottfried & Jitender Chhabra, “Programming with C”, Schaum's Outlines Series, 2017.
3. Brian W. Kernighan & Dennis Ritchie. “The C Programming Language”, Pearson Education India; Second Edition, 2015.
4. Ashok N Kamthane, “Computer Programming”, Pearson education, Second Edition, 2012.

Department : **Computer Science and Engineering**			Programme : **B.Tech**						
Semester : **First/Second**			Course Category Code: **ESC**				Semester Exam Type: **LB**		
Course Code	Course		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CS202	**Programming Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Understood the program editing and compilation environment.							
	CO2	Able to write simple C programs using most frequently used control structures.							
	CO3	Apply the methods problems using arrays and functions.							
	CO4	Learnt to handle data processing using structures for simple applications.							
	CO5	Write programs that could handle file i/o and pointers.							

Programming Using C

1. Study of Compilation and execution of simple C programs 2. Basic C Programs a. Arithmetic Operations b. Area and Circumference of a circle c. Swapping with and without Temporary Variables	**CO1**
3. Programs using Branching statements a. To check the number as Odd or Even b. Greatest of Three Numbers c. Counting Vowels d. Grading based on Student's Mark 4. Programs using Control Structures a. Computing Factorial of a number b. Fibonacci Series generation c. Prime Number Checking d. Computing Sum of Digit	**CO2**
5. Programs using Arrays a. Sum of 'n' numbers b. Sorting an Array c. Matrix Addition, Subtraction, Multiplication and Transpose 6. Programs using Functions a. Computing nCr b. Factorial using Recursion c. Call by Value and Call by Reference	**CO3**
7. Programs using String Operations a. Palindrome Checking b. Searching and Sorting Names 8. Programs using Structure a. Student Information System b. Employee Pay Slip Generation c. Electricity Bill Generation	**CO4**
9. Programs using Pointers a. Pointer and Array b. Pointers as argument and return value c. Pointer and Structure 10. Programs using File Operation a. Counting No. of Lines, Characters and Black Spaces b. Content copy from one file to another c. Reading and Writing Data in File	**CO5**

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

Reference Books

-

Department : **Civil Engineering**		Programme : **B.Tech**						
Semester : **First/Second**		Course Category Code: **MCC**			Semester Exam Type: -			
Course Code	Course	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CE201	**Environmental Science**	3	-	-	Non-Credit	-	-	-
Prerequisite	-							

Course Outcome		
	CO1	Able to understand about the environment and natural resources available
	CO2	Able to design the Rainwater harvesting and adopting the methods for recycle and reuse of domestic water
	CO3	Able to address the environmental issues namely pollution, depletion of natural resources and degrading ecosystem
	CO4	Able to develop models for resource and energy management, which are environmental friendly and work for sustainable development of the humanity.
	CO5	Able to participate in the Green initiatives in the society i.e. Energy conservation and Tree plantation.
	CO6	Able to make the solid waste segregation and conduct events related environmental issues.

Activity – 1	**Periods: 9**	**CO1**
Water resources- Water Cycle, Distribution, Groundwater flow, Demand for water, Water pollution- causes and effects, Water Act (1974).		
Activity – 2	**Periods: 9**	**CO2**
Rainwater Harvesting-Methodology, components, design of rainwater harvesting system for a single house (as per IS:15797-2008)		
Activity – 3	**Periods: 9**	
Domestic waste water- Definition, Characteristics, Recycling and Reuse of domestic waste water.		
Activity – 4	**Periods: 9**	**CO3**
Air Pollution- definition, classification, causes, Sources, effects and control measures, Air Act (1981)		
Activity – 5	**Periods: 9**	
Solid Waste management – Causes- effects and control measures of Urban and industrial waste, Waste management initiatives in India for human well-being.		
Activity – 6	**Periods: 9**	**CO4**
Renewable and non-renewable energy resources- use of alternating energy sources – Energy management.		
Activity – 7	**Periods: 9**	**CO5**
Green Buildings- Definition, Importance, building envelope, Problems in existing buildings, Energy use in Buildings, Greenhouse gas emissions and indoor air pollution, green construction materials, Green building assessment system, Case study		
Activity – 8	**Periods: 9**	
Importance of Tree Plantation, Display of usefulness of trees, Method of tree planting, Identify the trees available in the PEC campus, Mass Plantation inside/outside the campus in association with the H2EC /NSS of PEC, Store the trees to the planted by the dignitaries with the help of horticulture of PEC.		
Activity – 9	**Periods: 9**	**CO6**
Collection and segregation of solid waste in the PEC campus in association with the H2EC /NSS of PEC		
Activity – 10	**Periods: 9**	
Invite guest Lectures from the Environmental experts of DSTE (for environmental issues)/REAP (for energy efficient buildings)/Town and Country Planning/PWD of Puducherry, conducting competitions to students in the topics of slogan making, poster and seminar presentations, debate and observing the important national and international days on environmental issues to bring awareness among the students and public.		

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

Reference Books

1. P.Yugananth, R.Kumaravelan, Environmental Science and Engineering, Scitech Publications (Inida) P.Ltd., Delhi, 2017.
2. John Pichtel, Waste Management Practices: Municipal, Hazardous and Industrial, CRC Press,2014
3. V.S.K.V.Harish, Arunkumar, Green Building Energy Simulation and Modeling, Elsevier Science & Technology,2018

4. Anubha Kaushik and C.P.Kaushik, Environmental Science and Engineering, New Age International (P) Ltd., New Delhi, 2010.
5. S.S.Dara, A text book of Environmental Chemistry and Pollution Control, S.Chand and Company Ltd., New Delhi, 2014.
6. IS:15797:2008, Roof Top Rainwater Harvesting-Guidelines, BIS, New Delhi
7. Energy Conservation Building Code, 2017, Bureau of Energy Efficiency, Ministry of Power, Government of India.

Department : **Chemistry**		Programme: **B.Tech.**						
Semester : **Third**		Course Category Code: **BSC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
SH201	**Biology for Engineers**	3	-	-	2	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological						
	CO2	Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring						
	CO3	Convey that all forms of life have the same building blocks and yet the manifestations are asdiverse as one can imagine						
	CO4	Gain a basic understanding of enzyme action and factors affecting their activity						
	CO5	Identify and classify microorganisms						
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**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books

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. Freeman and Company.
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers.

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
EC235	**Electronic Devices and Digital Systems**	3	-	-	3	40	60	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. (CS)**						
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
CS203	**Computer Organization and Architecture**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Understand computer types, instructions and instruction sequencing						
	CO2	Demonstrate the theory and architecture of processing unit and pipeline processing						
	CO3	Make use of the arithmetic techniques for solving problems						
	CO4	Understand memory hierarchy and its impact on computer cost/performance						
	CO5	Explain the different ways of communicating with i/o devices and standard i/o interfaces						
UNIT-I	**Basic Structures of Computer**				**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**
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.								**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.								**CO3**
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.								**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**			**Total Periods: 60**			

Reference Books

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.
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 and David Patterson, Computer Architecture, A Quantitative Approach, Sixth Edition, Morgan Kaufmann, 2017.

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
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
CS204	**Data Structures**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Ability to comprehend the basics of algorithms and sorting process using arrays							
	CO2	Understand the linear data structures and its applications							
	CO3	Ability to realize the tree and how it is used for searching in large database							
	CO4	Build graph data structure for various applications							
	CO5	Develop algorithms for hash table operations							
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**
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.									**CO3**
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.									**CO4**
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.									**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.									

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
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
CS205	**Object Oriented Programming Languages**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Adapt C++ Programming concepts to construct application						
	CO2	Experiment object oriented features and work with memory models						
	CO3	Understand and Apply basics of java programming language						
	CO4	Design application using controls and database						
	CO5	Experiment latest concepts of java programming model						
UNIT-I	**Introduction to C++ Programming Language**				**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 JDBC**				**Periods: 9**			
Swings-controls- LayoutManagers -Panel-Dialog, JDBC Introduction-JDBC Architecture-Types of Drivers-Statement-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.								**CO5**
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.

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
EC236	**Electronic Devices and Digital Systems Laboratory**		-	-	3	1.5	40	60	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. (CS)**						
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
CS206	**Data Structures Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Ability to write programs for search and sorting algorithms							
	CO2	Able to write simple c programs using most frequently used control structures							
	CO3	Apply the methods problems using arrays and functions							
	CO4	Learnt to handle data processing using structures for simple applications							
	CO5	Write programs that could handle file i/o and pointers							

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**
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**
7. Implementation of Binary Tree and Binary Traversal Techniques.	**CO3**
8. Implementation of Graph Traversal Techniques.	**CO4**
9. Dijkstra's Algorithm to Obtain the Shortest Paths.	**CO5**
10. Implementation of Hash Tables and Its Operations.	**CO5**

Lecture Periods: -	**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.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
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
CS207	**Object Oriented Programming Languages Laboratory**	-	-	3	1.5	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Experiment C++ Programming concepts to construct application						
	CO2	Develop C++ application with Object Oriented features						
	CO3	Experiment basics of java programming language						
	CO4	Design and implement application using controls and database						
	CO5	Experiment latest concepts of java programming model						

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** **CO2**
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.	**CO3** **CO4** **CO5**

Lecture Periods: -	**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.

Department : **Humanities and Social Sciences**		Programme: **B.Tech.**						
Semester : **Third**		Course Category Code: **MCC**			Semester Exam Type: **-**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
SH202	**Indian Constitution**	3	-	-	-	-	-	-
Prerequisite	**Nil**							
Course Outcome	**CO1**	Understand the essence and significance of the constitution						
	CO2	Recognize ones fundamental duties and rights						
	CO3	Appreciate the structure and functions of legislature, executive and judiciary						
	CO4	Understand the functioning of state governments and union territories						
	CO5	Understand the centre-state relations and functioning of constitutional bodies						
UNIT-I	**Introduction of Indian Constitution**				**Periods: 9**			
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: 9**			
State and Union Territories – Citizenship - Fundamental Rights - Directive Principles of State Policy - Fundamental Duties.								**CO2**
UNIT-III	**Union Government**				**Periods: 9**			
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: 9**			
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: 9**			
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**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books

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 Nexis Butterworths Wadhwa Nagpur, 2008.
3. Choudhry, Sujit, et al., editors. The Oxford Handbook of the Indian Constitution. Oxford University Press, 2016.
4. Bakshi, Parvinrai Mulwantrai, 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 (NBT India), 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.

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
MA206	**Mathematics for Computing**	3	1	-	4	40	60	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
CS208	**Operating Systems**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Describe the basic concepts and functions of operating systems						
	CO2	Analyze various scheduling algorithms						
	CO3	Solve synchronization and deadlock issues						
	CO4	Compare various memory management schemes						
	CO5	Discuss file systems concepts and i/o management						

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**
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.		**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.		**CO4**
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.		**CO5**

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.

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
CS209	**Design and Analysis of Algorithms**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand and derive the time and space complexities of algorithms							
	CO2	Understand and design the divide-and-conquer and greedy techniques							
	CO3	Formulate and design the Dynamic Programming approach for the given problem							
	CO4	Design and apply Backtracking technique to the problems							
	CO5	Design and analyze the performance of problems with Branch and Bound technique							
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**
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.									**CO3**
UNIT-IV	**Backtracking**					**Periods: 9**			
The General Method – 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycle – Knapsack Problem.									**CO4**
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.									**CO5**
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.

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
CS210	**Database Management Systems**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand the concepts and features of database systems and mastering in different data models							
	CO2	Transforming an data model into a relational database schema by effectively organizing the data using Normalization and Formulating solutions using SQL							
	CO3	Master the basics of query processing, optimization and fast retrieval techniques using indexing and hashing with the familiarity of transaction processing							
	CO4	Understand the issues in concurrency control and familiarizing indifferent database architectures							
	CO5	Demonstrate an understand of data mining techniques and the principles of 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.									**CO3**
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.									**CO4**
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.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**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. 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.

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
CS211	**Software Engineering**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Compare various software life cycle models						
	CO2	Estimate project cost/effort and manage project schedule						
	CO3	Develop good software design for effective software development						
	CO4	Practice good coding and design test cases to test software systems						
	CO5	Discuss on the maintenance process and quality management standards						

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.		**CO3**
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.		**CO4**
UNIT-V	**Software Maintenance and Quality Management**	**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.		**CO5**

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.

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
CS212	**Operating System Laboratory**	-	-	3	1.5	40	60	100
Prerequisite	**Nil**							

Course Outcome		
	CO1	Practise Linux working environment
	CO2	Comprehend the usage of different system calls
	CO3	Experiment with various process management techniques
	CO4	Analyze different virtual memory management Strategies
	CO5	Compare the performance of Disk Scheduling Techniques

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.	**CO3**
7. Implementation of various Page Replacement Strategies.	**CO4**
8. Implementation of Disk Scheduling Techniques.	**CO5**

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.

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
CS213	**Design and Analysis of Algorithms Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Choose and implement the relevant searching/sorting							
	CO2	Implement the algorithm using a single technique							
	CO3	Implement the algorithm using more than one techniques							
	CO4	Analyze the complexities and the computation time of algorithms							
	CO5	Apply optimization measures in the technique							

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**
3. Divide-and-Conquer: Implementation of Binary Search, Merge Sort, Quick Sort and Max-min Problem.	**CO1 CO2 CO4**
4. Greedy: Implementation of Knapsack, Minimum Cost Spanning Tree, Single-Source-Shortest Path and Scheduling.	**CO1 CO2 CO5**
5. Dynamic Programming: Implementation of Multi-Stage Graphs, All-Pairs Shortest Path, Travelling Salesman, Basic Search Traversals Of Tree and Graph.	**CO2 CO3 CO5**
6. Backtracking: Implementation of N-Queen, Sum-of-Subsets, Graph-Coloring.	**CO3 CO4 CO5**

Lecture Periods: -	**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.

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
CS214	**Database Management Systems Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand the basic concepts database and its design principles							
	CO2	Formulate solutions to a broad range of query and data updateproblems using SQL							
	CO3	Master in SQL queries using advanced operators and concepts							
	CO4	Formulate Programming solutions for various queries using PL-SQL							
	CO5	Apply SQL query language for real time application							

1. Study of Database Concepts: Relational model – table – operations on tables – index – table space – clusters – synonym – view – schema – data dictionary – privilege – role – transactions.	**CO1**
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 – Integrity Constraint – Authorization – Transactions.	**CO2**
3. Study of Query Types: Queries involving Set Operators: Union, Intersection, Difference, Cartesian product, and Divide Operations – Sub Queries – Join Queries – Nested Queries – Correlated, Queries – Recursive Queries.	**CO3**
4. Study of Procedural Query Language: Blocks, Exception Handling, Functions, Procedures, Cursors, Triggers, Packages.	**CO4** **CO5**
5. Design and develop the following application: a. Library Information System b. Hospital Management System c. Students' Information System d. Employee Information System.	**CO5**

Lecture Periods: -	**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/

Department : **Humanities & Social Sciences**		Programme: **B.Tech.**						
Semester : **Fifth**		Course Category Code: **HSM**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
HS202	**Industrial Economics and Management**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Assess the knowledge of mathematics to understand industrial micro economics/macroeconomics						
	CO2	Implement various management techniques based on the needs						
	CO3	Implement various investment evaluation based on the needs						
	CO4	Apply formula and workout problem						
	CO5	Understand Case studies on General, Production and Financial management						

UNIT-I	**Micro and Macro Economics and its Applications**	**Periods: 9**
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: 9**
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: 9**
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 accounting and significance of each types.		**CO3**
UNIT-IV	**Production Management**	**Periods: 9**
Theory of Production Function – Types of Production Merits and Demerits – Process Planning – Routing – Scheduling – Material Control Concepts of Productivity – Measurement of Productivity – Inspection and Dispatches.		**CO4**
UNIT-V	**Marketing Management**	**Periods: 9**
Core Concepts of Marketing -0 Needs – Wants – Demand, Marketing Vs Selling – Products and Markets – Pricing and related factors – Channels of Distribution – Promotion Advertising – Market Research Vs Marketing Research.		**CO5**

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

Reference Books

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, Dhanpat Rai and Sons, 2009.
6. Philip B Kotler, Marketing Management, Mac Millan, New York 2011.

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
CS215	**Platform Technologies**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Relate the basic concepts of programming language with C#							
	CO2	Develop programs using object oriented programming concepts							
	CO3	Build window based applications using C#							
	CO4	Develop web based applications using .NET Framework							
	CO5	Appraise the .net framework with its advanced features							
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**
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.									**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.									**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.									**CO4**
UNIT-V	**CLR And .Net Framework**					**Periods: 9**			
Assemblies, Versioning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, Remoting.									**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.

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
CS216	**Computer Networks**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Demonstrate the software and hardware requirements of a network						
	CO2	Select the appropriate MAC protocol for a given network						
	CO3	Evaluation of networking conditions of a network						
	CO4	Propose the solutions to improve the end to end performance of the network.						
	CO5	Select various networking protocols required for the development of a network application						

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**
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.		**CO3**
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.		**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.		**CO5**

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.

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
CS217	**Automata Theory and Compiler Design**		3	1	-	4	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand the equivalence between non-deterministic finite state automata and deterministic finite state automata							
	CO2	Understand the equivalence between context-free grammars and non-deterministic pushdown automata							
	CO3	Appreciate the power of the turing machine, as an abstract automaton, that describes computation, effectively and efficiently							
	CO4	Able to design and implement the phases of compilers							
	CO5	Understand and apply code generation and code optimization techniques							
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** **CO3**
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.									**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.

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
Semester : **Fifth**			Course Category Code: **PCC**				Semester Exam Type: **LB**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CS218	**Platform Technologies Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Able to develop programs using c# language constructs							
	CO2	Apply object oriented concepts to write C# programs							
	CO3	Build window applications using .net framework using C#							
	CO4	Develop and analyze web based applications through C#							
	CO5	Grasp .net advanced concepts through application development							

Programming Using C#	
1. Programs using basic concepts like arrays, LINQ, strings, enumeration, etc.	**CO1**
2. Programs using the following concepts: • Class, constructers, properties, indexers • Inheritance, Polymorphism • Delegates, Exception handling • Multi-threading	**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	**CO3**
4. Developing web based applications to understand: • Web Application using ASP.Net • Creation of Web services • Accessing data from XML resources	**CO4**
5. Programs using to learn advanced concepts: • Assemblies • Reflection • Remoting	**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.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Fifth**		Course Category Code: **PCC**				Semester Exam Type: **LB**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CS219	**Computer Networks Laboratory**	-	-	3	1.5	40	60	100
Prerequisite	**Nil**							

Course Outcome		
	CO1	Apply the existing algorithms for error and flow control
	CO2	Experiment with the network simulation environment
	CO3	Experiment with socket programming
	CO4	Develop various applications using socket programming
	CO5	Design the necessary security and authentication algorithms

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	**CO2**
4. Implementation of a socket program for Echo/Ping/Talk commands.	**CO3**
5. Creation of a Socket between two Computers and Enable File Transfer between them. a. TCP b. UDP	**CO3**
6. Implementation of a Program for Remote Command Execution (Two M/Cs May Be Used).	**CO3**
7. Create a Socket For HTTP for Web Page Upload & Download.	**CO4**
8. Write a program to implement RCP. (Remote Capture Screen)	**CO4**
9. Implementation of Public Key Encryption.	**CO5**
10. Implementation of TELNET. (Remote Login)	**CO4**
11. Implementation of an Authentication algorithm to access a File.	**CO5**
12. Simulation of DNS server.	**CO5**

Lecture Periods: -	**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.

Department : **Humanities & Social Sciences**		Programme: **B.Tech.**						
Semester : **Fifth**		Course Category Code: **MCC**			Semester Exam Type: **-**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
SH203	**Essence of Indian Traditional Knowledge**	3	-	-	-	-	-	-
Prerequisite	**Nil**							
Course Outcome	**CO1**	Understand connect up and explain basics of Indian traditional knowledge in modern scientific perspective						
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**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books

1. N. Sivaramakrishnan (Ed.) Culteral Heritage of India – Course Materal, Bharatiya Vidya Bhavan, Mumbai, Fifth Edition, 2014.
2. Swami Jitatmanand, Modern Physics and Vedanta, Bharatiya Vidya Bhavan.
3. Fritz of Capra, Tao of Physics.
4. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
5. R.N. Jha, Science of Consciousness Psychotherapy and yoga Practices, Vidyanidhi Prakashan, 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.

Department : **IEDC**			Programme: **B.Tech.**						
Semester : **Sixth**			Course Category Code: **PAC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
EP201	**Entrepreneurship**		3	-	-	2	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Attain conceptual understanding of entrepreneurship and design thinking							
	CO2	Understand about business model development and MVP							
	CO3	Analyze about costing and revenue							
	CO4	Learn about marketing and sales							
	CO5	Realize about team formation and compliance requirements							
UNIT-I	**Problem and Customer**					**Periods: 9**			
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: 9**			
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: 9**			
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 New Venture- various sources - investor expectation- Pitching to Investors.									**CO3**
UNIT-IV	**Marketing and Sales**					**Periods: 9**			
Difference between product and brand - positioning statement. Building Digital Presence, Social media- company profile page – Sales Planning - buying decisions, Listening skills, and targets. Unique Sales Proposition (USP), sales pitch, Follow-up and closing a sale.									**CO4**
UNIT-V	**Team and Support**					**Periods: 9**			
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**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books

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

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
CS220	**Microprocessors and Microcontrollers**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Describe the basic concepts and functions and programming aspects of 8085 microprocessors							
	CO2	Understand and implement assembly language programs based on 8086 microprocessor							
	CO3	Interface microprocessor with different kinds of peripherals							
	CO4	Understand, design and execute programs based on microcontroller							
	CO5	Design and implement microcontroller based systems							
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**
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.									**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**
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.									**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.									**CO5**
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.

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
CS221	**Web Technologies**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Comprehend the basic concepts of internet, HTML tags						
	CO2	Create a client side programs using Javascript						
	CO3	Develop server side programs using servlets and JSP						
	CO4	Construct web pages in PHP and to represent data in XML format						
	CO5	Design a interactive web applications using AJAX and Web services						

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**
UNIT-II	**Client-Side Programming**	**Periods: 9**
Client-Side Programming: Java Script: An introduction to JavaScript–JavaScript DOM Model-Date-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers and Regular Expression.		**CO2**
UNIT-III	**Server Side Programming**	**Periods: 9**
Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling-Understanding Cookies- Installing and Configuring Apache Tomcat Web Server, Database Connectivity: JDBC perspectives, JDBC program example. JSP: Introduction-Components-Read Request Information-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.		**CO3**
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- Validation-DTD Elements-DTD Attributes-Entities-XSL.		**CO4**
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.		**CO5**

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.

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
CS222	**Information Security**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Understand the need of Information security						
	CO2	Familiar with the legal laws and regulatory bodies						
	CO3	Understand basic cryptographic algorithms and security issues						
	CO4	Analyze the various security technologies and predict the need of physical security						
	CO5	Understand the scope of security personnel and security management maintenance models						

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: 12**
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.

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
Semester : **Sixth**			Course Category Code: **PCC**				Semester Exam Type: **LB**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CS223	**Microprocessors and Microcontrollers Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand and apply the fundamentals of assembly level programming of microprocessors							
	CO2	Design and develop assembly language programs using 8085 and 8086							
	CO3	Interface 8085 and 8086 microprocessors with different kinds of peripherals							
	CO4	Analyze the programming aspects of ARM microcontroller							
	CO5	Train their practical knowledge through laboratory experiments							

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** **CO5**
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** **CO5**
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 LPC2148	**CO4** **CO5**

Lecture Periods: -	**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.

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
Semester : **Sixth**			Course Category Code: **PCC**			Semester Exam Type: **LB**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CS224	**Web Technologies Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Practise HTML working environment							
	CO2	Comprehend the usage of client side program in Javascript							
	CO3	Apply various server side programs using Java servlets and JSP							
	CO4	Design a web applicationsin PHP and XML							
	CO5	Developing ecommerce applications using Ajax and web services							

1. Study of basic HTML tags 2. Creation of website using HTML	**CO1**
3. Implementation of Client Side Scripting in JavaScript	**CO2**
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	**CO3**
5. Designing a Website using PHP 6. Developing Web Applications using XML	**CO4**
7. Developing Web Services 8. Designing a website in Ajax 9. Developing E-commerce application using internet programming (Mini Project)	**CO5**

Lecture Periods: -	**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.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
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
CS225	**Artificial Intelligence**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Identify the nature of problems suitable to apply artificial intelligence techniques						
	CO2	Acquire an insight into the different search techniques, knowledge representation and reasoning, planning, and learning strategies for solving Artificial Intelligence problems						
	CO3	Examine case studies on the applications of artificial intelligence techniques						
	CO4	Formulate solutions to real world problems by applying the acquired knowledge						
	CO5	Propose new algorithms on artificial intelligence techniques and validate their results						

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 CO2**
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**
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**
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.		**CO2**
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 CO5**

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

Reference Books

1. Deepak Khemani, A First Course in Artificial Intelligence, First Edition, MgGraw 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, Third Edition, Pearson Education Asia, 2015.
4. Vinod Chandra S.S. and Anand Hareendran, Artificial Intelligence and Machine Learning, First Edition, PHI Learning Private Limited, 2014.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
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
CS226	**Parallel and Distributed Systems**	3	1	-	4	40	60	100
Prerequisite	**Nil**							

Course Outcome		
	CO1	Understand the architecture of parallel systems and identify the scope for parallelism in present day's processors
	CO2	Realize and knowing the various parallel computing models and the challenges involved in designing parallel algorithms
	CO3	Study distributed system models and the components of distributed system
	CO4	Study the different communication models and naming conventions of distributed systems
	CO5	Know the collaborative operations of collections of computers and the impacts

UNIT-I	**Introduction to Parallel Computing Systems**	**Periods: 12**
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 all-to-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 CO4**
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.		**CO3 CO5**

Lecture Periods: 45	**Tutorial Periods: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.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
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
CS227	**Data Science Essentials**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Ability to have a broad insight, understanding and intuition of the data science life cycle						
	CO2	Demonstrate an ability to use Python to efficiently store retrieve and process data						
	CO3	Discuss in depth a variety of data mining techniques, and their applicability to various problem domains						
	CO4	Select and apply data mining technique to a practical case study						
	CO5	Understand the concept, challenge and technology of big data						
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.								**CO2**
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.								**CO3 CO4**
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.								**CO3 CO4**
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.								**CO5**
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.

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
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
CS228	**Artificial Intelligence Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Acquire knowledge on how to do logic programming using AI languages							
	CO2	Construct solutions to apply blind and heuristic search techniques to AI problems							
	CO3	Illustrate the representation of facts and knowledge in prepositional and predicate logic							
	CO4	Choose solutions to perform inference on the knowledge base created							
	CO5	Build expert systems for solving real world problems and validate the results							

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.	**CO3**
8. Represent knowledge using Predicate Logic and perform inference.	**CO3**
9. Apply unification on a set of facts.	**CO4**
10. Apply forward chaining and backward chaining to infer from a set of facts.	**CO4**
11. Develop an Expert System.	**CO5**
12. Mini project based on industry topics / real time problems.	**CO5**

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

Reference Books

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

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
Semester : **Seventh**			Course Category Code: **PAC**				Semester Exam Type: **-**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CS229	**Seminar**		-	-	2	1	100	-	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Improve oral and written communication skills							
	CO2	Identify, understand and discuss current technologies							
	CO3	Learn and integrate through independent learning and collaborative study							
	CO4	Distinguish and integrate differing forms of knowledge and academic disciplinary approaches							
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.									

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
Semester : **Eighth**			Course Category Code: **PAC**				Semester Exam Type: **-**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CS231	**Comprehensive Test**		-	-	2	1	100	-	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Take up competitive exams for higher studies							
	CO2	Able to confidently appear placement interviews							
	CO3	Understand all the concepts in core courses							
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. Papers published in reputed journals and conferences related to the core courses.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Eighth**		Course Category Code: **PAC**				Semester Exam Type: **PR**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CS233	**Project Work**	-	-	8	8	60	40	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Able to state problem definition clearly and develop a complete project						
	CO2	Prepare all the standard software engineering documents relevant to the project						
	CO3	Develop the presentation skills and ability to work in a team						
	CO4	Test the project and compare it with benchmark standards						

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 reviews	**CO1** **CO2** **CO3**
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	**CO2** **CO3** **CO4**

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.

Honours Courses

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Honours**						
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
CSH01	**Human Computer Interaction**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Ability to assimilate physiological and psychological factors of human and infer requirements of human computer interaction						
	CO2	Decompose a complex interactive system into simpler components, using appropriate design patterns and following interactive design standards						
	CO3	Analyse and choose an appropriate model for user interface design and develop prototypes to suit user behaviour with consideration of cognitive, psychological factors						
	CO4	Evaluate user interfaces and detect usability problems by doing usability studies (observations) with human subjects						
	CO5	Apply the human interaction concepts to design web interfaces and evaluate through evaluation metrics						

UNIT-I	**HCI – Basic Concepts**	**Periods: 12**
Human -Introduction-Input–Output Channels- Human Memory- Thinking: Reasoning and Problem Solving – Computer- The Computer- Introduction - Text Entry Devices -Design Focus-Display Devices- Devices for Virtual Reality and 3D Interaction- Physical Controls, Sensors and Special Devices- Smart-its – Making Using Sensors Easy- Printing and Scanning Design Focus: Readability of Text – Memory- Processing and Networks – Models of Interaction Video Recorder - Frameworks and HCI- Ergonomics-: Industrial Interfaces- Interaction Styles- Navigation In 3D and 2D- Elements of The WIMP Interface- Learning Toolbars- Interactivity- The Context of the Interaction-Paradigms for Interaction.		**CO1**
UNIT-II	**Interactive System Design Practices**	**Periods: 12**
Interaction Design Basics-Navigation Design-Screen Design And Layout-Iteration and Prototyping – HCI in the Software Process -Software Design Cycle-Usability Engineering-Iterative Design and Prototyping – Design Rules-Principles to Support Usability-Standards-Guidelines-HCI Patterns Implementation Support- Evaluation Techniques-Universal Design-User Support.		**CO2** **CO3**
UNIT-III	**Models for Interface Design Process**	**Periods: 12**
Cognitive Models – Socio-Organizational Issues and Stake Holder Requirements –Communication and Collaboration Models- Dialog Notations and Design-Modelling Rich Interaction.		**CO3**
UNIT-IV	**User Experience (UX) Evaluation**	**Periods: 12**
UX-Evaluation-Introduction-Formative-Summative Evaluation Methods-Types of Evaluation Data-Rapid Evaluation Methods –Design Walkthroughs and Reviews-UX Inspection-Quasi Empirical UX Evaluation-Evaluation Reporting.		**CO4**
UNIT-V	**Web Interfaces and Case Studies**	**Periods: 12**
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays Inlays, Virtual Pages, and Process Flow- Case Studies.		**CO2** **CO3** **CO4** **CO5**

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

Reference Books

1. Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale, Human Computer Interaction, Third Edition, Pearson Education, 2004.
2. Bill Scott and Theresa Neil, Designing Web Interfaces, First Edition, O`Reilly, 2009.
3. Rex Hartson and Pardha S Morgan Kaufmann, The UX Book: Process and Guidelines for Ensuring a Quality User Experience, Kindle Edition, 2012.
4. Ben Shneiderman, Catherine Plaisant Maxine Cohen, Steven Jacobs, Niklas Elmqvist and Nicholas Diakopoulos, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Sixth Edition, Pearson, 2017.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Honours**						
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
CSH02	**Advanced Data Structure and Algorithms**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Ability to analyze and determine the algorithms and its correctness and learn the advanced heap structures						
	CO2	Mastering the different tree data structures and their implementations						
	CO3	Learning and practicing various geometric structures						
	CO4	Knowledge of polygon structuring and linear programming models						
	CO5	Studying the query processing methodologies and positioning						
UNIT-I	**Algorithm Analysis and study of Heap Structures**				**Periods: 12**			
Analysis of recurrent and non-resurrect equations – Time and Space Complexity analysis – features of NP hard and NP Complete algorithms –Single and double ended priority queue – Liftist Trees – Binomial Heaps – Fibonacci Heaps –Pairing Heaps – Symmetric Min-Max Heaps – Interval Heaps.								**CO1**
UNIT-II	**Advanced Tree Structures**				**Periods: 12**			
Efficient Binary Search trees – Optimal binary search trees - AVL Trees – Red Black Trees –Splay Trees. Multiway search trees – m-way search trees - B Trees – B^+trees.								**CO2**
UNIT-III	**Geometric Structuring**				**Periods: 12**			
Introduction - Convex Hulls, Degeneracies and Robustness, Application Domains - Line Segment Intersection - The Doubly-Connected Edge List, Computing the Overlay of Two Subdivisions, Boolean Operations.								**CO3**
UNIT-IV	**Polygon Structures and Linear Programming Models**				**Periods: 12**			
Polygon Triangulation - Guarding and Triangulations, Partitioning a Polygon into Monotone Pieces, Triangulating a Monotone Polygon - Linear Programming- The Geometry of Casting – various linear programming models.								**CO4**
UNIT-V	**Database Querying and Path Planning**				**Periods: 12**			
Orthogonal Range Searching- querying the databases - point location – knowing the point location. Voronoi Diagrams – computations in Voronoi diagram - Robot Motion Planning.								**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**			**Total Periods: 60**			

Reference Books

1. G. Brassard and P.Bratley, Algorithmics: Theory and Practice, Prentice Hall of India, 2010.
2. E.Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data Structures in C++, Second Edition, Universities Press, 2007.
3. Mark de Berg, Otfried Cheong, Marc Van Kreveld and Mark Overmars, Computational Geometry Algorithms and Applications, Third Edition, Springer-Verlang, 2008.
4. S.Sahni, Data Structures, Algorithms and Applications in C++, Second Edition, Universities Press, 2005.

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)-Honours**						
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
CSH03	**Advanced Software Design**		3	1	-	4	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Identify design goals; Design and Refine subsystem to address the design goals							
	CO2	Understand and Apply the Architectural Styles to System Design							
	CO3	Describe, design and analyze different architectural solutions							
	CO4	Understand and Apply the Architectural Patterns of System Design							
	CO5	Evaluate different design alternatives qualitatively and quantitatively							
UNIT-I	**Decomposing the System**					**Periods: 12**			
Software Design Thinking – Decomposing the system – A Floor Plan example – Specification of User and Developer attributes – Non-Functional requirements – Specification of quality attributes — Addressing Analysis Goals – Case Study – Arena (Game Playing Environment).									**CO1**
UNIT-II	**System Design Concepts**					**Periods: 12**			
Layers and Partitions – Architectural Styles – Pipe and Filter – Client/Server – Three Tier – Four Tier – Model/View/Controller – Repository – Main Program/Subroutine with Shared Data – Abstract Data Type – Implicit Invocation.									**CO2**
UNIT-III	**Design and Description of Architectural Solutions**					**Periods: 12**			
Keyword Frequency Vector (KFV) Case Study – Design solutions using various Architectural Styles – Analysis and Comparison – Description of Software Architectures – Visual notation – Description of Client server structure – Robot Soccer UNSW - Information System.									**CO3**
UNIT-IV	**Reusing Pattern Solutions**					**Periods: 12**			
Selecting Design Patterns and Components – Elements of Design Patterns – Abstract Factory Pattern – Command Design Pattern – Observer Design Pattern – Application of Patterns to Arena Case Study and Stock Monitoring System Case Study.									**CO4**
UNIT-V	**Software Design Evaluation**					**Periods: 12**			
SAAM Method -Process – Analyzing designs of Keyword Frequency Vector (KFV) Case Study – ATAM – Analysis Process – Analysis Activities – Weighted Sum Approach of Multi attribute decision making using Stock Monitoring system Case Study- Analytic Hierarchy Process priority calculation for design alternatives.									**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods: -**				**Total Periods: 60**		

Reference Books

1. Hong Zhu, Software Design Methodology: From Principles to Architectural Styles, Butterworth-Heinemann, 2005.
2. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering Using UML, Patterns, and Java, Third Edition, Pearson, 2013.
3. G. Zayaraz, Quantitative Approaches for evaluating Software Architectures: Frameworks and Models", VDM Verlag, 2010.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Honours**						
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
CSH04	**Advanced Security Concepts**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Familiar with the security concepts and their threats and vulnerabilities						
	CO2	Analyze the symmetric and asymmetric cryptosystems and their importance in the real time scenarios						
	CO3	Diverse knowledge on the importance of data security and methods to provide integrity						
	CO4	Apply and secure the integrity of data and security practices						
	CO5	Understand the practical real world problems						
UNIT-I	**Concepts on Network, Computer and Web Security**				**Periods: 12**			
Overview of Computer Security - OSI Security Architecture – Security Attacks – Security Mechanism – Fundamental design Principles – Attack surfaces and trees – Model for Network Security. Web Security in Nutshell – Web Security Problems – Credit Cards, Encryption and the Web.								**CO1**
UNIT-II	**Symmetric and Asymmetric Ciphers**				**Periods: 12**			
Symmetric: Classical Encryption techniques – Block Ciphers – Data Encryption Standard – Finite Fields – Advanced Encryption Standards – Pseudo Random Sequence Generators. Asymmetric Ciphers: Principles of Public Key cryptosystem –RSA – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography.								**CO2**
UNIT-III	**Authentication and Data Integrity**				**Periods: 12**			
Hash Functions – Hash Functions Based on Cipher Block Chaining – SHA – Requirement for of Message Authentication – Security of MAC – MAC Based on hash Functions – MAC Based on Block Ciphers – Digital Signatures – Elgamal Digital Signature – NIST Digital Signature – Elliptic Curve Digital Signature – Gost Digital Signature – Cellular Automata**.**								**CO3**
UNIT-IV	**Network and Internet Security**				**Periods: 12**			
Network Access Control – IEEE 802.1X Port Based Network Access Control – Cloud Computing: Risk and Control Measure –Data Protecting in the cloud. Web Server Security: Host and Site Security – Controlling Access to your Web – Secure CGI /API Programming. Wireless Security: Mobile device Security – IEEE 80211i Wireless LAN Security. E-mail Security: S/MIME – PGP – DNSSEC.								**CO4**
UNIT-V	**The Real World Implementation**				**Periods: 12**			
IBM Secret Key Management Protocol –MITRENET –SESAME – IBM Common Cryptographic Architecture – ISO Authentication Frame work – Universal Electronic payment System – AT & ampT Model 3600 Telephonic Security Device (TSD) – Internet Based payment System – evaluation of Credit Card Payment System. National Security Agencies – National Computer Security Center- ISO /IEC 999.								**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**			**Total Periods: 60**			

Reference Books

1. William Stallings, Cryptography and Network Security Principles and Practices, Seventh Edition, Pearson Publication, 2017.
2. Bruce Schneier, Applied Cryptography: Protocols, Algorithms and Source Code, John Wiley & Sons, Inc., 2015.
3. Simson Garfinkel & Eugene H. Spafford, Web Security and Commerce, O'REILLY Publications, 2001.
4. Charles PPfleeger, Security in Computing, Fifth Edition, Prentice-Hall International, 2015.

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)-Honours**						
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
CSH05	**Deep Learning**		3	1	-	4	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Acquire an insight into the basics of artificial neural networks							
	CO2	Identify the operation of various deep learning architectures							
	CO3	Learn the various platforms and software libraries for implementing deep learning architectures							
	CO4	Examine the applications of the deep learning models to solve real world problems							
	CO5	Formulate solutions to problems that are suitable to apply deep learning strategies and models							
UNIT-I	**Introduction to Artificial Neural Networks**					**Periods: 12**			
Basic Concepts – Model of Artificial Neuron – Activation Functions - Neural Network Architectures – Characteristics – Learning Methods – Perceptron – Multilayer Network – Training Neural Networks - Back Propagation Learning Algorithm- Tuning Parameters.									**CO1**
UNIT-II	**Introduction to Deep Learning**					**Periods: 12**			
Fundamentals of Deep Networks - Common Architectural Principles: Parameters, Layers, Activation Functions, Loss Functions, Optimization Algorithms, Hyper Parameters – Building Blocks of Deep Networks.									**CO2**
UNIT-III	**Deep Learning Architectures**					**Periods: 12**			
Unsupervised Pre-Trained Networks: Deep Belief Networks, Generative Adversarial Networks – Convolutional Neural Networks: Architecture, Layers – Recurrent Neural Networks: Architecture, LSTM Networks – Recursive Neural Networks: Architecture, Auto Encoders.									**CO2**
UNIT-IV	**Deep Learning Frameworks**					**Periods: 12**			
Introduction to Deep Learning Platforms and Software Libraries: H2O-Tensorflow- Pytorch- Caffe-Eclipse Deeplearning4j.									**CO3**
UNIT-V	**Deep Learning Applications**					**Periods: 12**			
Application of Deep Learning to Real-World Scenarios: Object Recognition and Computer Vision, Image and Video Processing, Text Analytics, Speech Recognition -Natural Language Processing									**CO4** **CO5**
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods: -**				**Total Periods: 60**		

Reference Books

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, Second Edition, PHI Learning Private Limited, 2017.
2. Josh Patterson and Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly Media Inc, 2017.
3. Rajiv Chopra, Deep Learning: A Practical Approach, Khanna Publishing, 2018.
4. Ian Good fellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Minor Courses

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Minor**						
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
CSM01	**Data Structures and Algorithms**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Choose appropriate searching and sorting techniques						
	CO2	Illustrate linear and non-linear data structures						
	CO3	Understand the algorithm design techniques						
	CO4	Analyze the performance of the algorithms						
	CO5	Understand the suitability of techniques for the given problems						
UNIT-I	**Introduction**				**Periods: 12**			
Algorithmic Notation - Big Oh - Analyzing Algorithms. Arrays: One Dimensional, Multidimensional Array, Pointer Arrays. Linked List: Singly, Doubly And Circular Linked Lists. Searching: Linear Search, Binary Search, and Fibonacci Search. Sorting: Insertion Sort, Selection Sort, Bubble Sort And Heap Sort.								**CO1**
Unit-II	**Stacks, Queues and Linked Data Structures**				**Periods: 12**			
Stacks: Definition – Operations - Applications of Stack. Queues: Definition - Operations - Priority Queues - De Queues – Applications of Queue. Linked Stacks, Linked Queues, Applications of Linked List – Dynamic Storage Management.								**CO2**
Unit-III	**Trees and Graphs**				**Periods: 12**			
Binary Tree, Terminology, Representation, Traversals, Applications – Binary Search Tree – Graph: Terminology, Representation, Traversals – Applications - Spanning Trees, Shortest Path And Transitive Closure, Topological Sort.								**CO1 CO3**
Unit-IV	**Divide and Conquer, Greedy & Dynamic Programming**				**Periods: 12**			
Divide and Conquer: General Method – Binary Search – Maximum and Minimum – Merge Sort - Quick Sort. Greedy Method: General Method – Knapsack Problem – Minimum Spanning Tree Algorithms – Single Source Shortest Path Algorithm. Dynamic Programming: General Method – Multi-Stage Graphs – Travelling Salesman Problem.								**CO4**
Unit-V	**Backtracking & Branch and Bound**				**Periods: 12**			
Backtracking: General Method – 8-Queens Problem – Sum of Subsets – Graph Coloring.Branch and Bound: Least Cost (LC) Search – 15-Puzzle Problem – Control Abstractions for LC-Search – FIFO Branch and-Bound - Travelling Salesman Problem.								**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**			**Total Periods: 60**			

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., 2012.
3. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Galgotia Publications Pvt. Ltd., 2008.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Minor**						
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
CSM02	**Principles of Operating Systems**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Demonstrate and understand of computer systems and operating systems functions						
	CO2	Distinguish between process and thread and classify scheduling algorithms						
	CO3	Solve synchronization and deadlock problems						
	CO4	Compare various memory management schemes						
	CO5	Explain file systems concepts and i/o management						
UNIT-I	**Introduction to Computer and Operating system**				**Periods: 12**			
Computer System Organization, Architecture – Operating System Structure, Operations – Process, Memory, Storage Management, Protection and Security – Computing Environments – Operating System Services – User Operating System Interface – System Calls – Types – System Programs – OS Structure – OS Generation – System Boot.								**CO1**
UNIT-II	**Process, Threads and Scheduling**				**Periods: 12**			
Process Concept – Scheduling – Operations on Processes – Cooperating Processes –Inter-Process Communication – Threads - Multithreading Models -Thread Libraries- Threading Issues - Scheduling Criteria – Scheduling Algorithms –Algorithm Evaluation.								**CO2**
UNIT-III	**Process Synchronization and Deadlocks**				**Periods: 12**			
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.								**CO3**
UNIT-IV	**Memory Management**				**Periods: 12**			
Introduction - 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.								**CO4**
UNIT-V	**Input/ Output and Files**				**Periods: 12**			
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.								**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**			**Total Periods: 60**			

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.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Minor**						
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
CSM03	**Principles of Database Management**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Understand the concepts and features of database systems and master in design principles						
	CO2	Transform an information model into a relational database schema and effectively organize the data using normalization						
	CO3	Formulate solutions to a broad range of query and data update problems using SQL						
	CO4	Master the basics of query processing, optimization and fast retrieval techniques with the familiarity of transaction processing						
	CO5	Understand the issues in concurrency control and familiarizing in different database architectures						
UNIT-I	**Introduction to Database Concepts**				**Periods: 12**			
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.								**CO1**
UNIT-II	**Relational Model and Design**				**Periods: 12**			
Relational Model: Structure of Relational Database, Keys (Primary, Foreign, Candidate, Super). Relational Algebra: Definition and Operations. Relational Database Design: Overview, Normalization, Normal Forms (First, Second, Third, Boyce Codd), Decomposition using Functional Dependencies and Multi-Valued Dependencies.								**CO2**
UNIT-III	**SQL**				**Periods: 12**			
SQL: Definition, Basic Structure, Datatypes, 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.								**CO1 CO3**
UNIT-IV	**Query Processing and Transaction**				**Periods: 12**			
Query Processing: Basic Steps, Measures of Query Cost, Query Optimization. Indexing: Definition, Purpose, Types of Indexing, B Tree and B+ Tree. Hashing: Basic Concepts, Hash Function, Static and Dynamic Hashing. Transaction: Overview, Transaction States, ACID properties, Implementation of ACID properties, Serializability.								**CO4**
UNIT-V	**Concurrency Control and System Architecture**				**Periods: 12**			
Concurrency Control: Overview, Lock Types, Lock based Protocols, Deadlock Conditions and Handling, Recovery Systems. Introduction to Parallel Databases, Distributed Databases, Data Mining and Data Warehouse								**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**			**Total Periods: 60**			

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.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Minor**						
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
CSM04	**Internet Programming**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Describe the basic concepts of internet and HTML tags						
	CO2	Create a Client side programs using Javascript						
	CO3	Develop Server side programs using Servlets and JSP						
	CO4	Construct web pages in PHP and to represent data in XML format						
	CO5	Design a interactive web applications using AJAX and Web services						

UNIT-I	**Internet Protocols, HTML 5.0**	**Periods: 12**
The Internet – Basic Internet protocols – HTTP, SMTP, POP3, MIME, and IMAP. Domain Name Server - World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – Web Browser. HTML: 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.		**CO1**
UNIT-II	**Client Side Programming**	**Periods: 12**
Client-Side Programming: Java Script: An introduction to JavaScript–JavaScript DOM Model-Date-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers and Regular Expression.		**CO2**
UNIT-III	**Server Side Programming**	**Periods: 12**
Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling-Understanding Cookies- Database Connectivity: JDBC perspectives, JDBC program example.JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.		**CO3**
UNIT-IV	**PHP and XML**	**Periods: 12**
PHP: An introduction to PHP- Variables- Program control- Built-in functions-Connecting to Database – JSON(basics) - XML: Basic XML- Document Type Definition- XML Schema, DOM.		**CO4**
UNIT-V	**Introduction To Ajax and Web Services**	**Periods: 12**
AJAX: Ajax Client Server Architecture; Web Services**:** Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services.		**CO5**

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

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, Platinum Edition, Addison-Wesley, 2002.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)-Minor**						
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
CSM05	**Network Technology**	3	1	-	4	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Identify the need for networking and understand the layered concept						
	CO2	Learn the basics of data and comprehend the network evaluation criteria						
	CO3	Classify the types of network and distinguish between them with regard to the layer 2 functionality						
	CO4	Understand the devices needed for networking and discover the addressing techniques						
	CO5	Learn various standard protocols at the application layer and network security						
UNIT – I	**Networking Fundamentals**				**Periods: 12**			
Need for networking – Types of Network – Internetworking – Network models – Layered architecture – OSI Protocol Stack – TCP/IP Protocol Suite – Addressing – Physical vs Logical – Port Addressing.								**CO1**
UNIT-II	**Data communication and Physical Medium**				**Periods: 12**			
Analog Vs Digital data – Transmission impairment – Data rate limits and performance – Transmission media – Guided Vs Unguided media – Characteristics – Virtual Circuit networks – Structure of a Switch.								**CO2**
UNIT-III	**Data Link Layer: Wired and Wireless**				**Periods: 12**			
Error detection and correction – Block coding - CRC - Flow and error control –Stop and Wait protocol – Go Back N ARQ protocol – Multiple Access – ALOHA – CSMA – CSMA/CD – CSMA/CA – FDMA – TDMA – CDMA –Ethernet Standard, Fast and Gigabit– IEEE standards - WLAN – IEEE 802.11 – Bluetooth.								**CO3**
UNIT-IV	**Network and Transport Layer Protocols**				**Periods: 12**			
Connecting Devices: Hubs – Repeaters – Bridges – Routers – 2/3 Layer Switches – Gateway –Network Layers: Logical Addressing – IPv4 Vs IPv6 – Internet Protocol –ARP – ICMP – IGMP – Unicast Vs Multicast – Transport Layer: UDP - TCP.								**CO4**
UNIT-V	**Application Layer and Network Security**				**Periods: 12**			
Domain Name System – DNS records – Telnet – Email – FTP – WWW: Client Server – HTTP – SNMP – Network Security Services - IPSec – SSL – HTTPS – Firewalls – PGP.								**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**			**Total Periods: 60**			

Reference Books

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition, McGraw Hill, 2016.
2. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education, 2012.
3. James F. Kurose, Keith W. Ross, Computer Networks–Top-down Approach, Third Edition, Pearson Education, 2013.
4. Andres S. Tanenbaum, David J. Wetherall, Computer Networks, Fifth Edition, Prentice Hall, 2011.

Professional Elective Courses

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
CSY01	**Graphics and Image Processing**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand the components of graphics and image processing applications.							
	CO2	Develop design and implement 2D graphical structures.							
	CO3	Understand the intricacies of graphics and image processing							
	CO4	Convert verbal descriptions to graphical images and vice versa for various applications							
	CO5	Develop algorithms for various graphics and image processing applications							
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 CO4**
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.									**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.									

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
CSY02	**Software Design and Testing**		3	-	-	3	40	60	100
Prerequisite	**Software Engineering**								
Course Outcome	**CO1**	Understand the object oriented approach and UML models							
	CO2	Understand the relationship between class diagram and design class and state diagram							
	CO3	Develop activity diagrams for and to apply the implementation diagrams to develop architecture							
	CO4	Understand testing principles and apply basic testing techniques for a given programme							
	CO5	Understand the use software tools and apply testing techniques to object oriented programs							
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.									**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.									**CO3**
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.									**CO4**
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.									**CO5**
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.

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
CSY03	**Python Programming**	3	-	-	3	40	60	100
Prerequisite	**Nil**							

Course Outcome		
	CO1	Select the basic and advanced features of core language built-ins
	CO2	Apply core and standard python programming features for problem solving
	CO3	Select standard libraries 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

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

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
CSY04	**Data Mining and Data Warehousing**	3	-	-	3	40	60	100
Prerequisite	**Database management systems**							
Course Outcome	**CO1**	Describe the basic concepts, issues and applications of data mining						
	CO2	Comprehend association and correlation analysis from single dimension to high dimensional data						
	CO3	Explain classification and prediction using various methods						
	CO4	Understand cluster analysis and detection of outliers						
	CO5	Develop 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**
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.		**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.		**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.

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
CSY05	**Internet of Things**	3	-	-	3	40	60	100
Prerequisite	**Computer networks**							

Course Outcome	**CO1**	Understand the basic terminologies, evolution and contemporary technologies.
	CO2	Learn the characteristics of sensors and actuators as Things, get a technical insight into the media access layer protocol standards
	CO3	Identify the key challenges in designing transport layer protocols and understand the existing standard protocols for IoT applications
	CO4	Apply the knowledge of embedded system design to design and develop IoT applications using state of the art platforms and tools
	CO5	Able to relate the usescases among the ocean of emerging IoT applications

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.

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
CSY06	**Mobile Application Development**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Adapt unique features of Android in application development						
	CO2	Model android applications using fragments and controls						
	CO3	Demonstrate knowledge of different services of android						
	CO4	Design applications with the technology of android storage						
	CO5	Develop and test real time applications with android						
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.								

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
CSY07	**Mobile Communication and Computing**	3	-	-	3	40	60	100
Prerequisite	**Computer networks**							

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

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.		**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

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
CSY08	**Embedded Systems**	3	-	-	3	40	60	100
Prerequisite	**Microprocessors and Microcontrollers, Operating Systems**							
Course Outcome	**CO1**	Understand the concepts of embedded processors						
	CO2	Learn the programming details of embedded systems						
	CO3	Develop embedded systems for real world applications using ARM processors						
	CO4	Understand the real time operating system concepts.						
	CO5	Design and development of basic embedded system using Intel Arduino						

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 BranchInstructions - 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.

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
CSY09	**Cloud Computing**	3	-	-	3	40	60	100
Prerequisite	**NIL**							
Course Outcome	**CO1**	Describe the basic concept and characteristics of cloud computing						
	CO2	Understand the concept of virtualization and data center automation						
	CO3	Discuss the architectural design of computer						
	CO4	Analyze the different cloud software utility architecture						
	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.

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
CSY10	**Machine Learning**	3	-	-	3	40	60	100
Prerequisite	**NIL**							
Course Outcome	**CO1**	Demonstrate understanding of different types of learning algorithms						
	CO2	Discuss decision making under uncertainty and estimate probabilities						
	CO3	Analyze learning from multiple inputs and feature selection methods						
	CO4	Evaluate learning from mixture of distributions and hierarchical data structure						
	CO5	Understand artificial neural network structure, training algorithms and usage of Markov models to model input sequences						

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.		**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.		**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.

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
CSY11	**Business Intelligence**	3	-	-	3	40	60	100
Prerequisite	**NIL**							

Course Outcome		
	CO1	Demonstrate understanding of business intelligence
	CO2	Ability to develop decision support systems
	CO3	Select appropriate dm tools and methods to manipulate
	CO4	Study and analysis the time series data in business intelligence
	CO5	Understand the operation procedures of bi projects in an organization

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**
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.		**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.		**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.		**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.		**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.

Open Elective Courses

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
CSO01	**Introduction to Python Programming**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Define python programming concepts						
	CO2	Select and compare appropriate python operators and loops						
	CO3	Adequately use standard programming constructs: repetition, selection, composition, modules, aggregated data (tuples, lists, etc.)						
	CO4	Apply the core python features and advanced features for problem solving						
	CO5	Examine various object oriented features for application development						

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.

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
CSO02	**Java Programming**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Learn the fundamental syntax and semantics of java programming language pertaining to structured and object oriented programming							
	CO2	Learn the constructs of higher programming features of java language							
	CO3	Learn to develop GUI and Event Driven Programming based applications							
	CO4	Use database in real world application development							
	CO5	Applying the network programming concept							
UNIT-I						**Periods: 9**			
Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Classes and Objects, Constructors – Destructors.									**CO1**
UNIT-II						**Periods: 9**			
Packages and Interfaces – Overloading – Inheritance – Enumerations – Internationalization - Inner Classes - Polymorphism –– Exception Handling – Garbage Collection – Containers.									**CO2**
UNIT-III						**Periods: 9**			
GUI Components – Layouts – Event Driven Programming – AWT package – Applet Applications – Swing Classes and fundamentals.									**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.									**CO4**
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.									**CO5**
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.

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
CSO03	**Fundamentals of RDBMS**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand the fundamental concepts of the relational database model							
	CO2	Apply conceptual database modelling methods							
	CO3	Identify functional dependencies and apply normal forms to evaluate the quality of a relational database design.							
	CO4	Apply SQL for database definition and manipulation							
	CO5	Understand transaction and concurrency control							
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.

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
CSO04	**Essentials of Mobile Application Development**			3	-	-	3	40	60	100
Prerequisite	**Nil**									
Course Outcome	**CO1**	Adapt unique features of android in application development								
	CO2	Model android applications using activity and fragments								
	CO3	Demonstrate knowledge of different android controls								
	CO4	Design applications with the technology of android services								
	CO5	Develop real time applications with android								
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, 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, 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.

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
CSO05	**Introduction to Data Science**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Ability to have a broad insight, understanding and intuition of the data science life cycle							
	CO2	Demonstrate understanding of the Mathematical Foundations needed for Data Science							
	CO3	Discuss in depth a variety of data mining techniques, and their applicability to various problem domains							
	CO4	Select from, and apply, data analysis, data visualisation and data mining techniques to a practical case study							
	CO5	Demonstrate an ability to use frameworks like Hadoop, MapReduce to efficiently store retrieve and process Data.							
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.									**CO1 CO3 CO4**
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.									**CO1 CO3 CO4**
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.									**CO5**
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.