Pondicherry Engineering College, Puducherry – 605014

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

Curriculum and Syllabi
for
B.Tech. (Information Technology)

(With Effect from Academic year 2018-19)

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

CURRICULUM

The Curriculum of B. Tech. (Information Technology) is designed to fulfil the Program Educational Objectives (PEO) and the Program Outcomes (PO) listed below.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1	**Core Competence:** To provide students a solid foundation in mathematical, scientific and engineering approaches along with core fundamentals of IT discipline.
PEO2	**Industry compliance:** To excel in development of real world / inter disciplinary applications with the acquired skills of analysis, design, implementation, testing and interpretation.
PEO3	**Professionalism:** To inculcate in student professional attitude and effective communication skills to groom them so as to work in any team.
PEO4	**Entrepreneurial skills:** To groom the undergraduate students with managerial skills and administrative skills in order to make them successful IT entrepreneurs.
PEO5	**Continuous Learning:** To motivate students in order to transform them as lifelong learners and innovators in their area of interest.

PROGRAM OUTCOMES (PO)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations..
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community 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	**Project management and finance**: 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	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1	Graduates should be able to clearly understand the concepts and principles in the field of information technology required for solving real-time problems of current trends.
PSO2	Graduates should be able to develop Innovative Ideas that will eventually motivate them to pursue *Higher Studies and Research* in the field of Information Technology.

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)	25.0	BSC
3	Engineering Science Courses (Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc.,)	17.5	ESC
4	Professional Core Courses	68.5	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	**156**	

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

Semester-wise Courses and Credits

Semester I

Course Code	Course	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	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
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	CCC	SET	Periods			Credits
				L	T	P	
EC233	Electronic Circuits	ESC	TY	3	-	-	3
IT201	Digital System Design	PCC	TY	3	-	-	3
IT202	Data Structures	PCC	TY	3	-	-	3
IT203	Object Oriented Programming using C++ & Java	PCC	TY	3	-	-	3
SH201	Biology for Engineers	BSC	TY	3			2
IT204	Digital Laboratory	PCC	LB	-	-	3	1.5
IT205	Data Structures Laboratory	PCC	LB	-	-	3	1.5
IT206	Object Oriented Programming Laboratory (C++ & Java)	PCC	LB	-	-	3	1.5
SH202	Indian Constitution	MCC	-	3	-	-	0
Total				18	-	9	**18.5**
				27			

Course Code	Open Elective/ Honors/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX	Open Elective	OEC	TY	3	-	-	3
ITH01	Programming Paradigms	PCC	TY	3	1	-	4
ITM01	Data Structures and Algorithms	PCC	TY	3	1	-	4

Semester IV

Course Code	Course	CCC	SET	Periods			Credits
				L	T	P	
MA206	Mathematics for Computing	BSC	TY	3	1	-	4
IT207	Operating Systems	PCC	TY	3	-	-	3
IT208	Computer Architecture	PCC	TY	3	-	-	3
IT209	Microprocessors and Applications	PCC	TY	3	-	-	3
IT210	Design and Analysis of Algorithms	PCC	TY	3	-	-	3
IT211	Operating Systems Laboratory with UNIX / Linux	PCC	LB	-	-	3	1.5
IT212	Microprocessor Laboratory	PCC	LB	-	-	3	1.5
IT213	Design and Analysis of Algorithms Laboratory	PCC	LB	-	-	3	1.5
Total				15	1	9	**20.5**
				25			

Course Code	Open Elective/ Honors/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX*	Open Elective	OEC	TY	3	-	-	3
ITH02	Advanced Data Structures	PCC	TY	3	1	-	4
ITM02	Java and Internet Programming	PCC	TY	3	1	-	4

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

Semester V

Course Code	Course	CCC	SET	Periods			Credits
				L	T	P	
IT214	Database Management System	PCC	TY	3	-	-	3
IT215	Resource Management and Graph Theory	PCC	TY	3	1	-	4
IT216	Computer Networks	PCC	TY	3	1	-	4
IT217	Information Coding Techniques	PEC	TY	3	-	-	3
ITYXX	Program Elective – I	PEC	TY	3	-	-	3
IT218	Database Management System Laboratory	PCC	LB	-	-	3	1.5
IT219	Computer Networks Laboratory	PCC	LB	-	-	3	1.5
IT220	Information Coding Techniques Laboratory	PCC	LB	-	-	3	1.5
SH203	Essence of Indian Traditional Knowledge	MCC	-	3	-	-	0
Total				18	2	9	**21.5**
				29			

Course Code	Open Elective/ Honors/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX	Open Elective	OEC	TY	3	-	-	3
ITH03	Biometrics	PCC	TY	3	1	-	4
ITM03	Data Communication and Computer Networks	PCC	TY	3	1	-	4

Semester VI

Course Code	Course	CCC	SET	Periods			Credits
				L	T	P	
IT221	Software Engineering	PCC	TY	3	-	-	3
IT222	Automata and Formal Languages	PCC	TY	3	1	-	4
IT223	Web Technology	PCC	TY	3	-	-	3
ITYXX	Program Elective – II	PEC	TY	3	-	-	3
ITYXX	Program Elective – III	PEC	TY	3	-	-	3
EP201	Entrepreneurship	PAC	TY	3	-	-	2
IT224	Web Technology Laboratory	PCC	LB	-	-	3	1.5
IT225	Software Engineering Laboratory	PCC	LB	-	-	3	1.5
Total				18	1	6	**21.0**
				25			

Course Code	Open Elective/ Honors/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX	Open Elective	OEC	TY	3	-	-	3
ITH04	Advanced Java Programming	PCC	TY	3	1	-	4
ITM04	Information Systems and Organization	PCC	TY	3	1	-	4

Semester VII

Course Code	Course	CCC	SET	Periods			Credits
				L	T	P	
IT226	Artificial Intelligence	PCC	TY	3	1	-	4
HS202	Industrial Economics and Management	HSM	TY	3	-	-	3
ITYXX	Program Elective – IV	PEC	TY	3	-	-	3
ITYXX	Program Elective – V	PEC	TY	3	-	-	3
IT227	Artificial Intelligence Laboratory	PCC	LB	-	-	3	1.5
IT228	Seminar	PAC	LB	3	-	-	1
IT229	Mini Project	PCC	PR	-	-	3	1.5
IT230	Professional Ethics	MCC	-	2	-	-	0
Total				17	1	6	**17**
				24			

Course Code	Open Elective/ Honors/ Minor Course	CCC	SET	Periods			Credits
				L	T	P	
ZZOXX	Open Elective	OEC	TY	3	-	-	3
ITH05	Introduction to Data Science	PCC	TY	3	1	-	4
ITM05	IoT and Python Programming	PCC	TY	3	1	-	4

Semester VIII

Course Code	Course	CCC	SET	Periods			Credits
				L	T	P	
SWOXX	Open Elective through SWAYAM	OEC	-	-	-	-	2
SWOXX	Open Elective through SWAYAM	OEC	-	-	-	-	2
IT231	Comprehensive Test	PAC	-	-	-	-	1
IT232	Internship	PAC	-	-	-	-	2
IT233	Project Work	PAC	PR	-	-	-	8
Total				-	-	-	**15**

List of Professional Electives

Professional Electives	Course Code	Course	Semester
Professional Elective –I	ITY01	Compiler Design	V
	ITY02	Object Oriented Analysis and Design	
	ITY03	Introduction to Business Intelligence	
	ITY04	Computer Hardware and Troubleshooting	
Professional Elective – II /III	ITY05	C# and .Net Programming	VI
	ITY06	Real-time Systems	
	ITY07	Mobile Computing	
	ITY08	Image Processing	
	ITY09	Cloud Computing	
	ITY10	Internet of Things	
Professional Elective – IV /V	ITY11	Big Data Analytics	VII
	ITY12	Software Project Management	
	ITY13	Data Mining and Data Warehousing	
	ITY14	Distributed Computing	
	ITY15	Information Security	
	ITY16	Introduction to Machine Learning	

List of Open Electives

Sl. No	Course Code	Course
1	ITO01	Business Process
2	ITO02	Object Oriented Software Engineering
3	ITO03	Introduction to Operating Systems
4	ITO04	Introduction to Database
5	ITO05	Web Engineering

Department : **First year**		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

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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 : **ECE**		Programme: **B. Tech. (IT)**						
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
EC233	**Electronic Circuits**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite	Nil							
Course Outcome	**CO1**	Understand the theory of diodes and their applications.						
	CO2	Acquire an in-depth knowledge about various transistor configurations and also could comprehend the need for proper biasing of devices.						
	CO3	Analyze the transistors at low frequencies and the need for power amplifiers.						
	CO4	Could acquire knowledge on oscillators and the condition required for oscillation to occur.						
	CO5	Examine the behaviour of operational amplifier and its application.						

UNIT – I	**Diodes**	**Periods: 9**
Diode current equation , V-I characteristics of PN junction diode – Half wave and Full wave rectifiers with and without filters - Derivation of ripple factors and rectification efficiency- Clippers, Clampers - Zener diode and its application, LED, LCD and photodiode – construction, working and characteristics.		**CO1**
UNIT-II	**Transistors**	**Periods: 9**
Construction, working & characteristics of BJT (CE, CB and CC configurations) and JFET, – operating point, Transistor biasing and BJT and FET bias circuits.		**CO2**
UNIT-III	**Amplifiers**	**Periods: 9**
'h' parameters- Small signal low frequency model of BJT -Analysis of CE, CB and CC amplifiers– Power Amplifier – Types – Transformer coupled Class A Amplifier – Class B Amplifier – Class C amplifiers.		**CO3**
UNIT-IV	**Oscillators**	**Periods: 9**
Feedback concept, general characteristics of positive feedback, Barkhausen Criterion-Construction, working ,characteristics and derivation of frequency of oscillation for Hartley, Colpitts and Wien bridge oscillators - crystal oscillator.		**CO4**
UNIT-V	**Operational Amplifier**	**Periods: 9**
Introduction to op-amp, Characteristics of op-amp, Op-amp parameters - Equivalent circuit - Applications: Inverting and non-inverting amplifier, summer, subtractor, voltage follower, differentiator, integrator, comparator, first order low pass and high pass active filters.		**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 ", Prentice Hall of India, 11th Edition, 2013.
3. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 5th Edition, 2008.
4. Theodore F. Bogart, **"**Electronic Devices and Circuits", Pearson Education India, 2011.
5. https://nptel.ac.in/courses/117103063/
6. Samuel Y. Liao, "Microwave Devices and Circuits", Prentice Hall, 3rd Edition, 1996.
7. S. Salivahanan and et.al., "Electronic Devices and Circuits", Tata Mcgraw Hill, Fifth Reprint, 2008.

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
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
IT201	**Digital System Design**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite:	**-**							
Course Outcome	**CO1**	Understand the binary number systems and Boolean algebra						
	CO2	Design any combinational logic using only of universal gates, MSI gates and PLDs						
	CO3	Design and implement sequential logic circuits of any complexity.						
	CO4	Understand the memory and programmable logic arrays						
	CO5	Simulate and validate the correctness of the digital circuits using VHDL packages						
UNIT-I	**Number Systems and Boolean Algebra**				**Periods: 9**			
Binary number systems and conversion - Binary arithmetic-Binary codes - Boolean algebra - Basic operations - Basic Theorems - Boolean functions-Canonical forms - Simplification of Boolean functions-Karnaugh maps - Tabulation method.								**CO1**
UNIT-II	**Combinational Logic**				**Periods: 9**			
Adders – subtractors – code converters – binary parallel adder –BCD adder – magnitude comparator – encoders – decoders – multiplexers – de-multiplexers- Binary Multiplier – Parity generator and checker.								**CO2**
UNIT-III	**Sequential circuits**				**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								**CO3**
UNIT-IV	**Memory and Programmable Logic**				**Periods: 9**			
Random access memory – memory decoding - error detection and correction – Read only memory – Programmable Logic Array – Programmable Array Logic- Sequential programmable devices Introduction to CPLDs, FPGAs. Design at the register transfer level: Register transfer level notation – Algorithmic State Machines (ASMs) - Design Example – Race free design – Latch free design								**CO4**
UNIT-V	**Introduction to VHDL**				**Periods: 9**			
Introduction – VHDL Design flow, program structure, types and constants, functions and procedures, libraries and packages-Data-Flow Descriptions: Highlights of Data flow descriptions, Structure of data-flow description, Data type-vectors. VHDL for combinational circuits.								**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books:

1. M. Morris Mano and Michael D. Ciletti, Digital Systems: With an Introduction to the Verilog HDL, Sixth Edition, Pearson, 2018.
2. Samir Palnitkar, VERILOG HDL – A Guide to Digital Design and Synthesis, Pearson Education Inc., Second Edition, 2012.
3. J. Bhasker, VHDL Primer, Prentice Hall of India Pvt. Ltd, Third Edition, 2006.
4. Thomas L. Floyd and R.P. Jain, Digital Fundamentals, Pearson Education, Tenth edition, 2008.
5. Leach Malvino, Digital Principles and Applications, Tata McGraw Hill, Fifth edition, 2005.
6. Charles H. Roth, Fundamentals of Logic Design, Thomson Brooks/Cole, Fifth edition, 2003.
7. Thomas C Bartee, Computer Architecture and Logic Design, McGraw Hill, Singapore, 2002.

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Third**			Subject Category: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
IT202	**Data Structures**		**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite	**CS201 – Programming for Problem Solving**								
Outcome	**CO1**	Comparative study of sorting and searching algorithms and applying them in applications							
	CO2	To design, analyze and implement linear data structures using C							
	CO3	To design, analyze and implement non - linear data structures using C							
	CO4	Learn the basics of tree based search techniques needed for advanced courses							
	CO5	Identify and use appropriate data structure to solve a given problem							
UNIT – I	**Sorting And Searching Techniques**						**Periods: 9**		
Sorting algorithms – Insertion sort- selection sort – shell sort – bubble sort – quick sort – heap sort- merge sort – radix sort – searching – linear search – binary search. Comparison of sorting algorithms and searching algorithms									**CO1**
UNIT – II	**Lists**						**Periods: 9**		
Array implementation – linked list – doubly linked list – circular linked list – multi lists – applications of linked lists									**CO2, CO5**
UNIT – III	**Stacks and Queues**						**Periods: 9**		
Stack – array and linked implementation of stacks – queue – array and linked list implementation of queues – application of stacks and queues –expression evaluation – priority queues – double ended queues									**CO2, CO5**
UNIT – IV	**Non-Linear Data Structures**						**Periods: 9**		
Binary tree – array and linked implementation of binary trees – application of trees – tree traversals – graphs – representation – breadth first search – depth first search – spanning trees – application of graphs									**C03, CO5**
UNIT – V	**Advanced Search Techniques**						**Periods: 9**		
Binary search tree – B-tree indexing – B+ trees – Tree indexing – AVL trees - Hash table – hash functions – collision resolution and open addressing									**CO4, CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods:45**			

References

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
2. Richard Gilberg, Behrouz and A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second edition, India Edition 2005
3. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2010.
4. Venkatesan R and Lovelyn Rose S, —Data Structures, Wiley India Pvt Ltd, New Delhi, 2015.
5. Salaria R S, —Data Structures and Algorithms using C, Fifth Edition, Khanna Book Publishing, New Delhi, 2012.
6. D. Samanta, Classic Data Structures, 2nd Edition, PHI, 2009
7. Reema Thareja, Data Structures Using C, Oxford University Press, 2011.

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
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
IT203	**Object Oriented Programming using C++ and Java**		**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite:	**CS201 – Programming for Problem Solving**								
Course Outcome	**CO1**	Understands the basic Concepts of OOPs (C++)							
	CO2	Implements object oriented programs in C++							
	CO3	Understands the basics of Java							
	CO4	Learns Inheritance and Polymorphism, Packages, Interfaces(Java)							
	CO5	Learns Exception Handling, Threads, Applets(Java)							
UNIT-I	**Basics of Object Oriented Programming**						**Periods: 9**		
Object Oriented Programming - Concepts – Objects – Classes – Methods - Messages –Abstraction - Encapsulation – Inheritance – Abstract Classes – Polymorphism. Introduction To C++ – Classes – Access Specifiers – Function and Data Members –Function Overloading – Friend Functions – Static Members – Objects – Pointers and Objects – Constant Object–Nested Class – Local Classes									**CO1**
UNIT-II	**Constructors and Overloading, Exception Handling, Inheritance and Polymorphism**						**Periods: 9**		
Constructors – Default Constructor – Parameterized Constructors – Constructor with Dynamic Allocation – Copy Constructor – Destructors – Operator Overloading – Overloading through Friend Functions – Exception Handling – Try-Catch-Throw Paradigm – Exception Specification – Terminate and Unexpected Functions – Uncaught Exception - Inheritance – Public, Private, and Protected Derivations – Multiple Inheritance – Virtual Base Class - Virtual Functions – Pure Virtual Functions									**CO2**
UNIT-III	**Basics of Java**						**Periods: 9**		
Creation of Java, importance of Java to internet, byte code, Java buzzwords, data types, declaring variables, dynamic initialization, scope and life time of variables, arrays, operators, control statements, type conversion and casting, compiling and running of simple Java program. Concepts of classes and objects, class fundamentals Declaring objects, assigning object reference variables, introducing methods, constructors, usage of static with data and methods, usage of final with data, access control, this key word, overloading methods and constructors, parameter passing - call by value, nested classes and inner classes, exploring the String class.									**CO3**
UNIT-IV	**Inheritance and Polymorphism, Packages, Interfaces (Java)**						**Periods: 9**		
Basic concepts, member access rules, usage of super key word, forms of inheritance, method overriding, abstract classes, dynamic method dispatch, using final with inheritance, the Object class. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.									**CO4**
UNIT-V	**Exception Handling, Threads, Applets (Java)**						**Periods: 9**		
Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes, Concepts of Multithreading, differences between process and thread, thread life cycle ,creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups. Applets - Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books:

1. Ira Pohl, “Object Oriented Programming using C++”, Pearson Education, Second Edition Reprint, 2004.
2. S. B. Lippman, Josee Lajoie, “Barbara E. Moo, “C++ Primer”, Fourth Edition, Pearson Education, 2005.
3. B. Stroustrup, “The C++ Programming Language”, Third Edition, Pearson Education, 2004.

4. D. S. Malik, “C++ Programming: From Problem Analysis to Program Design”, 2012.
5. E. Balaguruswamy, “Object-Oriented Programming with C++”, Sixth Edition, TMH,2013.
6. The Complete Reference Java J2SE 5th Edition, Herbert Schildt, TMH Publishing Company Ltd, NewDelhi, 2002.
7. Big Java 2nd Edition, Cay Horstmann, John Wiley and Sons, 2005.
8. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI, 2004.
9. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education, 2002.
10. Core Java 2, Vol 2, Advanced Features, Cay. S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education, 2004.

Department : **Chemistry**		Programme: **B. Tech.**						
Semester : **Third**		Subject Category: **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	-							
Outcomes	After studying the course, the student will be able to:							
	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 as diverse 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	**Bio-molecules**	**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. Freemanand Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman andcompany, 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: **Information Technology**		Programme: **B. Tech. (IT)**						
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
IT204	**Digital Laboratory**	**-**	**-**	**3**	**1.5**	**40**	**60**	**100**
Prerequisite	-							
Course Outcome	**CO1**	To perform fundamental operations on digital circuits.						
	CO2	To design combinational digital circuits						
	CO3	To design sequential circuits						
	CO4	Design complex digital circuits using VHDL						

Cycle 1 **Implementation of logic circuits using gates** • Full adder/full subtractor • Implementation of logic functions using universal gates only	**CO1&**

• Code converters • Parity generator and Checker • Design of priority encoder • Implementation of Boolean functions using MUX • Design of decoder, Demultiplexer	**CO2**
Cycle 2 **Implementation of circuits using MSI** • Synchronous counters • Asynchronous counters • Binary multiplier • Decimal Adder • Universal shift register • Design of Arithmetic unit	**CO3**
Cycle 3 • Design and Implementation of combinational circuits using Verilog Hardware Description Language (VHDL) - Adder/ Subtractor, Binary multiplier.	**CO4**

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

Reference Books

1. M. Morris Mano and Michael D. Ciletti, Digital Systems: With an Introduction to the Verilog HDL, Sixth Edition, Pearson, 2018.
2. Samir Palnitkar, VERILOG HDL – A Guide to Digital Design and Synthesis, Pearson Education Inc., Second Edition, 2012.

Department: **Information Technology**		**Programme : B. Tech.(IT)**						
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
IT205	**Data Structures Laboratory**	**-**	**-**	**3**	**1.5**	**40**	**60**	**100**
Prerequisite								
Course Outcome	Able to understand and implement basic data structures using C Able to apply linear and non-linear data structures in problem solving							

Choice of 10-12 experiments from the following

Implementation of:

1. Sorting algorithms
2. Searching algorithms
3. Singly Linked List operations
4. Doubly Linked List operations
5. An application using linked list
6. Stack operations using any of the representation
7. Queue operations using any of the representation
8. An application using Stack / Queue
9. Binary Tree operations using any one of the representation
10. Binary tree traversal algorithms
11. An Application using Binary Tree
12. Graph Traversals using any one of the representation
13. An Application using Graph
14. An Application using Binary Search Tree
15. Hashing: Collision Resolution Techniques

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

Department :**Information Technology**			**Programme : B. Tech.(IT)**						
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
IT206	**Object Oriented Programming Laboratory (C++ and Java)**		**-**	**-**	**3**	**1.5**	**40**	**60**	**100**
Prerequisite									
Course Outcome	**CO1**	Learns the Basics of C++ and Java							
	CO2	Learns the Programming features of C++ and Java							
	CO3	Learns Advanced C++ Programming and Java							

LIST OF EXPERIMENTS

C++ Programs 1. Implement Programs to demonstrate the use of Classes, Objects, Constructor and Destructor, Control Structures, Arrays and Pointers. 2. Implement Programs to demonstrate the use of different types of overloading and type casting. 3. Implement Programs to demonstrate the use of Virtual Base Classes, Pure Virtual Function and various types of Inheritance. 4. Implement Programs to demonstrate the use of different types of Polymorphism 5. Implement Programs to demonstrate the use of Exception Handling Java Programs 6. Implement Programs to demonstrate the use of Packages 7. Implement Programs to demonstrate the use of Interfaces 8. Implement Programs to demonstrate the use of Event Handling (if necessary) 9. Implement Programs to demonstrate the use of Thread Handling 10. Implement Programs to demonstrate the use of Applets	**CO1, CO2, CO3**

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

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

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 Butter worths 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 PratapBhanu 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. quot; INDIAN POLITY & quot, McGraw-Hill Education & quot; Constitution of India & quot;. Ministry of Law and Justice, Govt. of India.

Department : Mathematics		Programme : B. Tech.(IT)						
Semester: Fourth		Course Category Code: **BSC**			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	--							

Course Outcome		
	CO1	Develop knowledge of logical connectivity, compound propositions, formal symbols of propositional logic and find exact value of expressions.
	CO2	Use the formal symbol 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 QUEUEING 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: 45	Tutorial Periods: 15	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 : **Information Technology**		**Programme : B. Tech.(IT)**						
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
IT207	**Operating Systems**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite:	-							

Course Outcome		
	CO1	Able to grasp fundamental understanding of operating systems
	CO2	Understand fundamental operating system abstractions such as processes, threads, files, semaphores and method of handling deadlocks
	CO3	Understand the role of OS as resource manager to support virtual memory concept and functions
	CO4	Understand basic file management techniques and security
	CO5	Understand the design principles of practical operating systems Linux and Windows

UNIT-I	**Introduction**	**Periods: 7**	
Operating system structure – operations – Services – system calls – Protection and Security - Distributed and Special purpose systems – Virtual machine – Operating System debugging – Operating system generation.			**CO1**
UNIT-II	**Process Management**	**Periods: 11**	
Processes – Threads: Multicore programming – Multithreading models –CPU Process scheduling– Process synchronization-Deadlocks			**CO2**
UNIT-III	**Memory Management**	**Periods: 10**	
Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging -Virtual Memory–Demand Paging–Page Replacement–Allocation of frames–Thrashing			**CO3**
UNIT-IV	**Storage management and Security**	**Periods: 8**	
Mass storage structure - File-system interface – File-system implementation – I/O systems – System protection – System security			**CO4**
UNIT-V	**Case Study**	**Periods: 9**	
Linux system: Design principles – Kernel modules – Process management- Scheduling – Memory management – File system – Input and output - Inter process communication– Network structure – Security. Windows OS: Design principles –System components –Terminal services and fast user switching File system – Networking–Programmer Interface			**CO5**

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

Reference Books:

1. Abraham Silber schatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2012.
2. William Stallings, Operating System: Internals and Design Principles, Prentice Hall of India, 8th Edition, 2014.
3. Harvey M. Deitel, Paul Deitel and David R. Choffnes, Operating Systems, Third Edition, Pearson Education Pvt. Ltd, 2003.
4. Andrew S. Tannenbaum and Herbert Bos, Modern Operating Systems, Fourth Edition, Prentice Hall, 2014.
5. Gary J. Nutt, Operating Systems, Third Edition, Addison Wesley,2003.

Department : **Information Technology**		**Programme : B. Tech.(IT)**						
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
IT208	**Computer Architecture**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite:								

Course Outcome	**CO1**	Able to understand the basic components and the design of CPU, ALU and Control Unit.
	CO2	Ability to understand Processor implementation by both hardwired and Micro programmed control.
	CO3	Ability to understand memory hierarchy and its impact on computer cost/performance.
	CO4	Able to understand the fundamentals of I/O systems and their interaction with the processor
	CO5	Ability to understand the advantage of instruction level parallelism and pipelining for high performance processor design

UNIT-I	**Basic Computer Organization and Design**	**Periods: 9**
Register Transfer Language and Micro operations: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit Basic Computer Organization and Design: Instruction Codes – Computer Registers – Computer Instructions – Computer Instructions – Timing and Control – Instruction Cycle- – Memory reference Instructions - Input – Output and Interrupt		**CO1**
UNIT-II	**Micro-programmed Control and Central Processing unit**	**Periods: 9**
Control Memory-Address sequencing- Micro program Example – Design of control unit. Processor Organization: general register organization – stack organization – instruction formats – addressing modes – data transfer and manipulation – program control. Computer Arithmetic: Addition, Subtraction, Multiplication, Division algorithms, Floating point arithmetic operations- Decimal arithmetic operations		**CO2**
UNIT-III	**Memory Organization**	**Periods: 9**
Memory hierarchy – main memory – auxiliary memory –Associate memory – Cache memory – Virtual memory.		**CO3**
UNIT-IV	**Input-Output Organization**	**Periods: 9**
Input-output interface – asynchronous data transfer - modes of transfer – priority interrupt – DMA – IOP – serial communication.		**CO4**
UNIT-V	**Pipeline and Vector Processing**	**Periods: 9**
Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors, Multi processors:: Characteristics or Multiprocessors, Interconnection Structures, Inter processor Arbitration. Inter Processor Communication and Synchronization Cache Coherence. Shared Memory Multiprocessors.		**CO5**

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

Reference Books:

1. M. Morris Mano, Computer System Architecture, Prentice-Hall of India, Pvt. Ltd., Third edition, 2008.
2. William Stallings, Computer Organization and Architecture, Prentice-Hall of India, Pvt. Ltd., Seventh edition, 2005.
3. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, Computer Organization, McGraw-Hill, Fifth edition, 2011.
4. John P. Hayes, Computer Architecture and Organisation, McGraw Hill, 1998.
5. P. Pal Chaudhuri, Computer Organization and Design, Prentice-Hall of India, Pvt. Ltd., Second edition, 2002.

Department : **Information Technology**			**Programme : B. Tech.(IT)**						
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
IT209	**Microprocessors and Applications**		**2**	**1**	**0**	**3**	**40**	**60**	**100**
Prerequisite:									
Course Outcome	**CO1**	To learn 8085 Architecture and Programming							
	CO2	To learn the need and working of various supporting programmable chips							
	CO3	To learn how to interface I/O and memory to Microprocessor							
	CO4	To learn 8086 Architecture and Programming and compare with 8085							
	CO5	To learn how to design simple applications using Microprocessors							
UNIT-I	**Intel 8085 Microprocessor**					**Periods: 9**			
Introduction - Need for Microprocessors – Intel 8085 Hardware - Architecture – Internal Registers – Arithmetic and Logic Unit – Control Unit – Instruction word size - Addressing modes – Instruction Set – Assembly Language Programming - Stacks and Subroutines - Timing Diagrams.									**CO1**
UNIT-II	**Intel 8085 Interrupts and DMA**					**Periods: 9**			
8085 Interrupts – Software and Hardware Interrupts – 8259 Programmable Interrupt Controller - Data Transfer Techniques – Synchronous, Asynchronous and Direct Memory Access (DMA) and 8257 DMA Controller									**CO2**
UNIT-III	**Memory & I/O Interfacing**					**Periods: 9**			
Types of memory – Memory mapping and addressing – Concept of I/O map – types – I/O decode logic – Interfacing key switches and LEDs – 8279 Keyboard/Display Interface - 8255 Programmable Peripheral Interface – Concept of Serial Communication – 8251 USART – RS232C Interface.									**CO3**
UNIT-IV	**Intel 8086 Microprocessor**					**Periods: 9**			
Introduction-Intel 8086 Hardware – Architecture – Internal Registers – Arithmetic and Logic Unit – Control Unit – Addressing modes – Instruction Set – Assembler Directives. Assembly Language Programming - Subroutines -External memory Addressing – Interrupt Processing.									**CO4**
UNIT-V	**Microprocessor based System Design**					**Periods: 9**			
Traffic light control- Temperature control- Water level monitoring									**CO5**
Lecture Periods: 30	**Tutorial Periods: 15**		**Practical Periods:**				**Total Periods:45**		

Reference Books:

1. Ramesh S. Gaonkar, “Microprocessor Architecture, Programming and Applications with 8085”, Penram International Publications, Fifth Edition.
2. Barry B. Brey, “The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386 and 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III Pentium 4 – Architecture, Programming and Interfacing, 8th Edn., Pearson Education, 2009.
3. Krishna Kant, “Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096”, PHI, 2008.

Department **: Information Technology**			Programme : **B. Tech.(IT)**						
Semester **: Fourth**			Subject Category : **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
IT210	**Design and Analysis of Algorithms**		3	-	-	3	40	60	100
Prerequisite									
Course Outcome	**CO1**	Compute time complexity of any recursive and non-recursive algorithm and analyse							
	CO2	Learn the design methods greedy and divide and conquer to apply for suitable problems							
	CO3	Learn the design method dynamic programming to apply for suitable problems							
	CO4	Learn the design method back tracking to apply for suitable problems							
	CO5	Learn the design methods branch and bound to apply for suitable problems							
UNIT – I						**Periods: 9**			
Introduction: Algorithm – efficiency of algorithms – best, worst and average case analysis – the order of – asymptotic notations –solving recurrences – homogeneous recurrences – inhomogeneous recurrences **Divide and Conquer method:** Introduction, Binary Search - finding maximum and minimum.									CO1, CO2
UNIT – II						**Periods: 9**			
Divide and Conquer method: – merge sort – quick sort – strassen's matrix multiplication. **Greedy method:** – General method – Knapsack problem – job sequencing with deadlines – Prim's algorithm – Kruskal's algorithm – Dijkstra's algorithm									CO2
UNIT – III						**Periods: 9**			
Dynamic Programming: - General Method – Principle of optimality – multi stage graph – all pairs shortest paths – Warshall's and Floyd's algorithm – Optimal Binary Search Tree – 0/1 Knapsack Problem – Travelling salesman problem									CO3
UNIT – IV						**Periods: 9**			
Back tracking: General method – n queen's problem – sum of the subsets – graph colouring – Hamiltonian cycle – knapsack problem									CO4
UNIT – V						**Periods: 9**			
Branch and Bound: Least Cost Search – 15 puzzle: an example - control abstractions for LC search – bounding – FIFOBB and LCBB– LC branch and bound and FIFO branch and bound solutions for knapsack problem & Travelling salesman problem									CO5
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

References

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, —Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2011.
2. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2010.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2009.
4. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, —Introduction to Algorithms, MIT Press, England, 2009.
5. Jon Kleinberg and Eva Tardos, —Algorithm Design, Pearson Education, 2006.
6. Jeffrey J McConnell, —Analysis of Algorithms, Jones and Bartlett Publishers, 2008.
7. Parag Himanshu Dave and Himanshu Bhalchandra Dave, —Design and Analysis of Algorithms, Pearson Education, 2008

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT211	**Operating System Laboratory with UNIX / Linux.**		-	-	3	1.5	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Able to write shell programs in UNIX/LINUX OS							
	CO2	Able to implement scheduling algorithms, solutions to synchronization problems using semaphores							
	CO3	Able to implement virtual memory concept and file system							
	CO4	Able to develop kernel of an OS							
	CO5	Able to develop utilities for an OS							

1. Study of basic Unix/Linux commands. 2. Shell Programming Programs using the following system calls of Unix / Linux operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir Programs using the I/O system calls of UNIX operating system (open, read, write, etc)	**CO1**
3. Implementation of scheduling algorithms (CPU and Disk) 4. Implementation of synchronization problems using Semaphore	**CO2 & CO4**
5. Implementation of basic memory management schemes 6. Implementation of virtual memory management schemes 7. Implementation of file systems	**CO3, CO4 & CO5**

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

Reference Books

1. William Stallings, Operating System, Prentice Hall of India, 6th Edition, 2009.
2. Harvey M. Deitel, Operating Systems, Second Edition, Pearson Education Pvt. Ltd, 2002.
3. Gary J. Nutt, Operating Systems: A Modern Perspective, Second Edition, Addison Wesley, 2001.
4. A. Tannenbaum, Modern Operating Systems, 2nd Edition, Prentice Hall, 2001.
5. Charles Crowley, Operating System-A Design-Oriented Approach, Tata McGraw-Hill, 1999.

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT212	**Microprocessor Laboratory**				3	1.5	40	60	100
Prerequisite									
Course Outcome	**CO1**	To learn assembly language programming using 8085 instruction set							
	CO2	To learn how to interface 8085 with Supporting Chips 8255, 8251, 8259, 8253, 8257 and 8259							
	CO3	To learn assembly language programming using 8086 instruction set							

LIST OF EXPERIMENTS	
Assembly Language Programming Using 8085 Microprocessor 1. Study of 8085 Microprocessor Trainer Kit 2. 8-bit Arithmetic Operations (Addition, Subtraction, Multiplication and Division) 3. Block Operations (Move, Exchange, Compare, Insert and Delete) 4. Code Conversions 5. Digital Clock simulation 6. Moving Display	**CO1**
Interfacing Experiments Using 8085 Microprocessor 1. Music Synthesizer Interface 2. Stepper motor control 3. Elevator Simulation 4. Traffic Light Control 5. Keyboard and SSD Interface	**CO2**
Assembly Language Programming Using 8086 Microprocessor 1. Study of 8086 Microprocessor Trainer Kit 2. 8-bit Arithmetic Operations (Addition, Subtraction, Multiplication and Division) 3. Block Operations (Move, Exchange, Compare, Insert and Delete) 4. Code Conversions 5. Digital Clock simulation	**CO3**

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

Department : **Information Technology**		Programme : **B. Tech.(IT)**						
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
IT213	**Design and Analysis of Algorithms Laboratory**	-	-	3	1.5	40	60	100
Prerequisite								
Outcome	Choose appropriate technique to solve a given problem analysing its characteristics Apply C++ / Object oriented features in implementing the algorithm techniques using C++							

Choice of 10-12 experiments from the following

Implementation of

1. Divide and Conquer technique for finding Maximum and Minimum
2. Quick sort algorithm
3. Merge sort algorithm
4. Improved merge sort algorithm
5. Greedy technique for Knapsack problem solution
6. Prim's algorithm
7. Kruskal's algorithm
8. Dijkstra's algorithm
9. Dynamic programming technique for All pairs shortest path algorithm
10. Backtracking Technique for 8 queen's problem
11. Backtracking Technique for sum of the subsets problem
12. Backtracking Technique for Graph colouring problem
13. Backtracking Technique for Hamiltonian Cycle
14. 0/1 knapsack problem solution
15. 15 puzzle problem solution

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

Department: **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT214	**Database Management Systems**		3	-	-	3	40	60	100
Prerequisite:									
Course Outcome	**CO1**	Learn the Concepts of Database Management System							
	CO2	Understand the Data Model							
	CO3	Specify Query with Constraints							
	CO4	Know about Normalization of Database Management System							
	CO5	Know about Transactions Concepts and Concurrency							
UNIT-I	**Database Management System Concepts**					**Periods: 9**			
Introduction- Significance of Database- Database System Applications- Data Independence- Data Modelling for a Database- Entities and their Attributes- Entities- Attributes- Relationships and Relationships Types, Advantages and Disadvantages of Database Management System- DBMS Vs RDBMS Architecture.									**CO1**
UNIT-II	**Database Models**					**Periods: 9**			
Data Model and Types of Data Models- Relational Data Model- Hierarchical Model-Network Data Model- Object/Relational Model- Object-Oriented Model- Entity-Relationship Model- Modeling using E-R Diagrams- Notation used in E-R Model- Relationships and Relationship Types- Associative Database Model.									**CO2**
UNIT-III	**SQL**					**Periods: 9**			
Categories of SQL Commands- Data Definition- Data Manipulation Statements- SELECT- Basic Form- Sub-queries- Functions- GROUP BY Feature- Updating the Database- Data Definition Facilities Views- Embedded SQL- Declaring Variables and Exceptions- Embedding SQL Statements.									**CO3**
UNIT-IV	**Normalization**					**Periods: 9**			
Functional Dependency- Anomalies in a Database- Properties of Normalized Relations- First Normalization- Second Normal Form Relation- Third Normal Form- Boyce-Codd Normal Form (BNCF)- Fourth Normal Form.									**CO4**
UNIT-V	**Transaction and Concurrency**					**Periods: 9**			
Concept – Transaction State- ACID Vs BASE Transactions– Implementation of Atomicity and Durability – Concurrent Executions – Serializability. Concurrency Control: Lock-Based Protocols. Recovery System: Failure Classification – Storage Structure – Recovery and Atomicity – Log-Based Recovery – Shadow Paging.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

Reference Books:

1. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", McGraw Hill Education, 6th edition, 2017.
2. RamezElmasri, Shamkant B. Navathe, "Database Systems: Models, Languages, Design and Application Programming", 6th edition, 2013.

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT215	**Resource Management and Graph Theory**		3	1	-	4	40	60	100
Prerequisite									
Course Outcome	Upon Completion of the course, the students should be able to:								
	CO1	Apply integer programming and linear programming to solve real-life applications							
	CO2	Solve optimization problems and Use PERT and CPM for problems in project management							
	CO3	Identify different types of graphs							
	CO4	Solve problems involving vertex and edge connectivity, planarity and edge coloring							
	CO5	Understand the principle of inclusion and exclusion							

UNIT – I	**LINEAR AND INTEGER PROGRAMMING**	**Periods: 15**
Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis - Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.		CO1
UNIT – II	**CLASSICAL OPTIMIZATION THEORY AND OBJECT SCHEDULING**	**Periods: 15**
Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems - Network diagram representation – Critical path method – Time charts and resource levelling – PERT		CO2
UNIT – III	**INTRODUCTION TO GRAPH THEORY**	**Periods: 8**
Definitions and Examples, Sub-graphs, Complements, Graph Isomorphism, Degree, Directed and undirected graphs, weighted and un weighted graphs		CO3
UNIT – IV	**CYCLES, PLANARITY AND COLORING**	**Periods: 10**
Walk, Trail, Path, Cycle, Euler Trails and Circuits, Planar Graphs, Hamilton Paths and Cycles, Vertex coloring, Edge coloring, Chromatic Polynomials.		CO4
UNIT – V	**PRINCIPLE OF INCLUSION AND EXCLUSION**	**Periods: 12**
The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.		CO5

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

Reference Books:

1. H.A. Taha, "Operations Research – An Introduction", Pearson, 10th Edition, 2019.
2. Paneer Selvam, 'Operations Research', Prentice Hall of India, 2nd Edition, 2018
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, PHI, 2011

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT216	**Computer Networks**		3	1	-	4	40	60	100
Prerequisite:									
Course Outcome	**CO1**	Learn about networking concepts							
	CO2	Ability to communicate using network protocols and sockets							
	CO3	Know the transport layer functions							
	CO4	Learn about switching and routing techniques							
	CO5	Know error detection and correction, medium access							

UNIT-I	**Periods: 12**
Need for Networking - Service Description –connectionless and Connection-Oriented Services – Circuit and Packet Switching – Access Networks and Physical Media – Wireless Links and Characteristics – Queuing Delay and Packet Loss – Internet Protocol stack – OSI Reference Model - Service Models – History of Computer Networking and the Internet.	**CO1**
UNIT-II	**Periods: 12**
Principles of Network Applications – The Web and HTTP – FTP – Electronic Mail – SMTP – Mail Message Formats and MIME – DNS – Socket Programming with TCP and UDP. Multimedia Networking: Internet Telephony – RTP – RTCP – RTSP.	**CO2**
UNIT-III	**Periods: 12**
Transport Layer Services – Multiplexing and De-multiplexing – UDP – Reliable Data Transfer – Go-Back-N and Selective Repeat. Connection-Oriented Transport: TCP – Segment Structure – RTT estimation – Flow Control – Connection Management – Congestion Control – TCP Delay Modelling – SSL and TLS. Integrated and Differentiated Services: Intserv – Diffserv.	**CO3**
UNIT-IV	**Periods: 12**
Circuit Switching - Packet Switching Virtual Circuit Switching – IP – ARP – DHCP – ICMP – Routing – RIP – OSPF – Sub netting – CIDR – Inter domain Routing – BGP – IPV6 Basic Features – Inter Domain Multicast – Congestion Avoidance in Network Layer.	**CO4**
UNIT-V	**Periods: 12**
Layer Services– Framing - Error correction and detection – Link Level Flow Control – Medium Access – Ethernet – Token Ring –FDDI – Wireless LAN – Bridges and Switches.	**CO5**

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

Reference Books:

1. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Fourth Edition, Pearson Education, 2008.
2. William Stallings, “Data and Computer Communications”, Ninth Edition, Pearson Education, 2011.
3. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.

Department :**Information Technology**		Programme : **B. Tech.(IT)**						
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
IT217	**Information Coding Techniques**	3	-	-	3	40	60	100
Prerequisite								

Course Outcome		
	CO1	To have fundamentals and relation among information, entropy and probability.
	CO2	To understand the basic lossless encoding techniques
	CO3	To have basics of image and audio representation, coding and applications in standards.
	CO4	To have basics of video representation, coding and applications in standards.
	CO5	To know about various error control coding techniques

UNIT-I	**Introduction**	**Periods: 9**
Information – Entropy - Properties of information and Entropy- Relation between information and probability- Mutual and Self-Information - Coding theory- Code Efficiency and Redundancy- Shannon's theorem – Construction of basic codes.		**CO1**
UNIT-II	**Data Coding**	**Periods: 9**
Shannon and Fano coding - Huffman coding– Arithmetic coding - Predictive coding - Run-length Encoding - Ziv-Lempel Coding – Predictive Coding.		**CO2**
UNIT-III	**Image and Audio Coding**	**Periods: 9**
Image Coding: Image representation - Transformation – Quantization – Image Coding Standards: JPEG and JPEG 2000. Audio Coding: types – Linear Predictive Coding (LPC) – Code Excited LPC – Perceptual Coding - MPEG Audio Coding.		**CO3**
UNIT-IV	**Video Coding**	**Periods: 9**
Video Coding: Motion Estimation and Compensation – Types of Frames – Encoding and Decoding of Frames – Video Coding Standards: H.261, h.263, MPEG-1, MPEG-2, MPEG-4.		**CO4**
UNIT-V	**Error Control Coding**	**Periods: 9**
Linear Block Codes – Cyclic Codes – BCH Codes - Convolutional Codes.		**CO5**

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

Reference Books:

1. Ze-Nian Li, Mark S. Drew and Jiang Chuan Liu, Fundamentals of Multimedia, Springer Edition, 2014.
2. Ranjan Bose, Information theory, coding and cryptography, Tata McGraw Hill, 2008.
3. Andrew J. Viterbi, "Information Theory and Coding", McGraw Hill, 1982.

Department : **Information Technology**		Programme : **B. Tech.(IT)**						
Semester : **Fifth**		Course Category Code: **PCC**				Semester Exam Type: **LB**		
Course Code	Course Name	Periods / Week			Credits	Maximum Marks		
		L	T	P	C	CA	SE	TM
IT218	**Database Management System Laboratory**	-	-	3	1.5	40	60	100
Prerequisite	-							
Course Outcomes	**CO1**	Design Database for Real-Time Applications						
	CO2	Create Data Models and Entity- Relationship (E-R) Diagram						
	CO3	Hands-on experience to familiarize ORACLE						
	CO4	Use Normalization Rules and Principles						
	CO5	Familiarize students the knowledge of JDBC and ODBC connectivity						

1. Creation of a Database and writing SQL queries to retrieve information from the database. 1.1 Data Definition Language (DDL). a. CREATE d. TRUNCATE b. ALTER e. RENAME c. DROP f. COMMENT 1.2 Data Manipulation Language (DML) a. INSERT b. UPDATE c. DELETE d. SELECT	
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	**CO1**
3. Creation of Views 3.1. Implementation of Views.	**CO2**
4. Creating a Database to set various constraints. (a) Primary Key, (e) Null, (i). Disable Constraints (b) Foreign Key, (f) Not null, (j). Drop Constraints (c) Check, (g) Default, (d) Unique, (h) Enable Constraints,	**CO3**
5. Creating Relationship between the Databases. 5.1 Implementation of Set Operations 5.2. Implementation of Nested Queries / Subqueries 5.2. Implementation the Join Operations	**CO4**
6. Creation of Database triggers and functions 6.1 Implementation of Triggers and its application 6.2 JDBC and ODBC Connectivity	**CO5**
7. Mini project (Application Development using Oracle) a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System	

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

Reference Books

1. Silberts, "Database System Concepts", 6th Edition, McGraw Hill Education, 2017.
2. Elmasri Ramez, Navathe Shamkant, "Fundamentals of Database System", 7th Edition, Pearson Education, 2017.
3. Johannes Gehrke Raghu Ramakrishnan, "Database Management", McGraw Hill Education, 2014.

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT219	**Computer Networks Laboratory**		-	-	3	1.5	40	60	100
Prerequisite	-								
Course Outcomes	**CO1**	Learn about socket programming Able to know communication details over TCP connection							
	CO2	Ability to communicate using UDP							
	CO3	Know the packet route within a network							
	CO4	Apply RPC in real-time applications							
	CO5	Ability to manage network traffic using different routing algorithms							

1. Applications using TCP Sockets like a. Echo client and echo server b. File transfer c. Date and time client & server d. Chat	**CO1**
2. Applications using UDP Sockets like a. DNS b. SNMP	**CO2**
3. Applications using Raw Sockets like a. Ping b. Trace route	**CO3**
4. Programs using different types of RPC	**CO4**
5. Experiments using simulators like OPNET: a. Performance comparison of MAC protocols b. Performance comparison of Routing protocols like i. Shortest path routing ii. Flooding iii. Link State iv. Hierarchical c. Study of TCP/UDP performance 6. Mini-project in implementing network protocols	**CO5**

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

Reference Books

1. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Fourth Edition, Pearson Education, 2008.
2. William Stallings, “Data and Computer Communications”, Ninth Edition, Pearson Education, 2011.

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT 220	**Information Coding Laboratory**		-	-	3	1.5	40	60	100
Prerequisite									
Course Outcomes	**CO1**	Learns the Basics of File formats and Matlab							
	CO2	Learns the fundamentals of basic text, audio, image and video coding techniques							
	CO3	Learns the image and video coding standards							
	CO4	Learns the error control coding standards							

LIST OF EXPERIMENTS

Cycle-1: 1. Study of multimedia file formats 2. Study of Matlab/Python 3. Implementation of Shannon-Fano coding 4. Implementation of Huffman coding 5. Implementation of Arithmetic coding 6. Implementation of Dictionary-based coding 7. Implementation of Linear Predictive coding **Cycle-2:** 8. Study of JPEG image coding standard 9. Study of JPEG-2000 image coding standard 10. Study of H.26x video coding standards 11. Study of MPEG-x video coding standards 12. Study of Error Control Coding methods	**CO1, CO2, CO3, CO4**

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

Department : **Humanities and Social Sciences**			Programme : **B. Tech.(IT)**						
Semester : **Fifth**			Subject Category: **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	-								
Course Outcomes	The course will enable the student to:								
	CO1	understand connect up and explain basics of Indian traditional knowledge in modern scientific perspective							
UNIT-I						**Periods: 12**			
Basic structure of Indian knowledge system, Modern science and Indian knowledge system, Yoga and holistic health care.									**CO1**
UNIT-II						**Periods: 12**			
Philosophical tradition, Indian linguistic tradition, Indian artistic tradition.									
Lecture Periods:	**Tutorial Periods:**		**Practical Periods:**			**Total Periods:**			

Reference Books:

1. N. Sivarama krishnan (Ed.) Culteral Heritage of India – Course Materal, Bharatiya Vidya Bhavan, Mumbai 5th edition, 2014.
2. Swami Jitatman and, Modern Physics and Vedanta, Bharatiya Vidya Bhavan.
3. Fritzof 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 : **Information Technology**		Programme : **B. Tech.**						
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
IT221	**Software Engineering**	3	-	-	3	40	60	100
Prerequisite								

Course Outcome		
	CO1	Understand the Software Model and able to Identify appropriate **model** for given domain.
	CO2	Obtain adequate knowledge about software process models and estimation techniques.
	CO3	Able to perform work breakdown structure and arrive to decomposed design.
	CO4	Could be able to Test project.
	CO5	Could know the Apply software standards for small real-time projects.

UNIT-I	**Introduction to Software Engineering**	**Periods: 9**
The Software Engineering Discipline – Evolution and Impact – Software Development projects – Emergence of Software Engineering – Computer System Engineering **Software Life Cycle Models:** classic Waterfall model – Iterative Lifecycle model – prototyping model – Evolutionary model –spiral model – Introduction to Agile. **Case study:** Identify appropriate **model** for given domain- Importance of agile in real-time system..		**CO1**
UNIT-II	**Software Project Management**	**Periods: 9**
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 Analysis and Specification:** Requirements Gathering and Analysis – Software Requirements specification – Formal System Specification – Axiomatic Specification - Algebraic Specification – 4GL. **Case study:** Prepare **SRS report** for given domain.		**CO2**
UNIT-III	**Software Design**	**Periods: 9**
Outcome of a Design Process – Characteristics of a Good Software Design – Coupling and Cohesion – Approaches to Software Design – Object Oriented Vs Function Oriented Software Design approaches **Function Oriented Software Design:** Structured Analysis – Data Flow Diagrams – Applying DFD to Real time systems – Structured and Detailed Design-ER relation-Use case design **Case study:** Prepare **SDS report** for given domain with DFD/ER/Use Case		**CO3**
UNIT-IV	**Coding and Testing**	**Periods: 9**
Coding – Software Documentation – Testing – Unit Testing – Black Box testing – White Boxtesting –BVA-Structural Testing – Test Coverage Criteria Based On Data Flow Mechanisms – Regression TestingDebugging – Program Analysis tools – Integration testing – Testing Object Oriented programs – System Testing –Issues. **Case study:** Apply **Test case** generation for given domain.		**CO4**
UNIT-V	**Software Reliability and Quality**	**Periods: 9**
Software Reliability – Software Quality – ISO 9000 – SEI CMM – Six Sigma. Measures And Measurements – Software Metric-ZIPF's Law – Software Cost Estimation – Function Point Models –COCOMO Model – Delphi Method – Scheduling –Software reverse engineering – Risk Management– Software maintenance process **Case study:** Apply software standards for small real-time projects.		**CO5**

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

1. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning, Fourth Edition, 2014.
2. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill International Edition, Eighth edition, 2010.
3. S. L. Pfleeger and J.M. Atlee, "Software Engineering Theory and Practice", Pearson Education, Third edition, 2009.
4. PankajJalote, "An Integrated Approach to Software Engineering", Narosa, Third edition, 2008.
5. Ian Sommerville, "Software Engineering", Pearson Education, ninth edition, 2011.

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
Semester : **Sixth**			Subject Category Code: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
IT222	**Automata and Formal Languages**		3	1	-	4	40	60	100
Prerequisite									
Course Outcome	**CO1**	Design finite state machines							
	CO2	Apply pumping lemma for regular languages							
	CO3	Construct parse trees for CFG and able to minimize and find equivalence of automata							
	CO4	Construct push Down automata							
	CO5	Design Turing machine and analyze undecidability							

UNIT-I	**Automata**	**Periods: 12**
Introduction to Finite Automata- Deterministic and Non-Deterministic Finite Automata, Finite Automata with ε-moves – equivalence of NFA and DFA, two-way finite automata, minimization of finite automata, Moore and Mealy machines-applications of finite automata.		**CO1**
UNIT-II	**Regular Expressions and Languages**	**Periods: 12**
Finite automata and regular expressions, Arden's theorem, construction of Finite automata equivalent to regular expression, Equivalence of two finite automata, Pumping lemma for regular languages, Applications of pumping lemma, Closure properties of Regular Languages.		**CO2**
UNIT-III	**Context Free Language**	**Periods: 12**
Context Fee languages and Derivation Tree, Ambiguity in Context Free Grammar, Simplification of Context Free Grammar, Normal forms for Context Free Grammar, Pumping lemma for Context Free Languages, Decision Algorithms for Context free Languages.		**CO3**
UNIT-IV	**Push Down Automata**	**Periods: 12**
Acceptance by Push Down Automata, Push Down Automata and context Free Language, Parsing and Push down Automata – Top Down Parsing, Bottom up Parsing		**CO4**
UNIT-V	**Turing Machines**	**Periods: 12**
Elements of Turing Machine, Representation of Turing Machine, Design of Turing Machine, Techniques for Turing machine construction, Decidability and Recursively Enumerable languages: Decidability, Decidable languages, undecidable languages, Halting problem of Turing Machine, Post correspondence problem		**CO5**

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

Reference Books:

1. Vivek Kulkarni, "Theory of Computation", Oxford University press, 2013.
2. K.L.P. Mishra and NM.Chandrasekaran, "Theory of Computer Science-Automata Languages and Computation", third edition, PHI Learning Private Ltd, 2009.
3. John E. Hopcroft and Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Publishers, 2002.
4. Michael Sipser, Introduction to the Theory of Computations, Brooks/Cole Thomson Learning, 1997.
5. John c. Martin, Introduction to Languages and the Theory of Computation, Tata McGraw-Hill, 2003.

Department : **Information Technology**		Programme : **B. Tech.(IT)**						
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
IT223	**Web Technology**	3	-	-	3	40	60	100
Prerequisite								

Course Outcome	**CO1**	Learn about internet protocols, web browsers and servers
	CO2	Know about Scripting languages
	CO3	Create XML documents and include ActiveX Controls
	CO4	Web design using multimedia for E-Commerce
	CO5	Develop Web services and ajax programming

UNIT-I	**Periods: 09**
Introduction to Internet Principles and Components: History of the Internet and World Wide Web- HTML - protocols – HTTP, SMTP, POP3, MIME, IMAP. Domain Name Server, Web Browsers and Web Servers, Dynamic HTML.	**CO1**
UNIT-II	**Periods: 09**
Client Side and Server Side Programming: Introduction to Java Scripts and VB Scripts– Object Based Scripting for the web. Programming Java Script and VB Script - Structures – Functions – Arrays – Objects, Regular Expression in java script. Java Server Pages - Session and Application management - Session tracking and cookies – Access a database from JSP.	**CO2**
UNIT-III	**Periods: 09**
XML and ActiveX: Well-formed XML documents - XML markup-working with elements and attributes - Creating valid documents-XML objects and DOM. ActiveX controls: OLE and ActiveX -ActiveX Documents, Server side Active-X Components, ActiveX DLL and ActiveX Exe.	**CO3**
UNIT-IV	**Periods: 09**
Multimedia and Web Application: Multimedia in web design, Audio and video speech synthesis and recognition - Electronic Commerce – E-Business Model – E-Marketing – Online Payments and Security. Search and Design: Working of search engines -Optimization-Search interface.	**CO4**
UNIT-V	**Periods: 09**
Web Services: Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services. Ajax – Improving web page performance using Ajax, Programming in Ajax.	**CO5**

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

Reference Books:

1. N.P. Gopalan and J. Akilandeswari, “Web Technology: A Developer’s Perspective”, Second Edition, Prentice-Hall of India, 2014.
2. Deitel and Deitel, Goldberg, “Internet and World Wide Web – How to Program”, Fifth Edition, Pearson Education Asia, 2011.
3. Eric Newcomer, “Understanding Web Services: XML, WSDL, SOAP, and UDDI”, Addison-Wesley, 2007.
4. https://books.google.co.in/books/about/WEB TECHNOLOGY.html

Department : **IEDC**			Programme : **B. Tech.**						
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
EP201	**Entrepreneurship**		3	0	-	2	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	The student will gain conceptual understanding of Entrepreneurship and design thinking.							
	CO2	The students will become knowledgeable about business model development and MVP							
	CO3	The students will gain knowledge about costing and revenue.							
	CO4	The students will learn about marketing and sales.							
	CO5	Student will get understanding of 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).		
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.		
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.		
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, targets. Unique Sales Proposition (USP), sales pitch, Follow-up and closing a sale.		
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.		

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

Reference Books:

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

Department : **Information Technology**			Programme : **B. Tech.(IT)**						
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
IT224	**Web Technology Laboratory**		-	-	3	2	40	60	100
Prerequisite									
Course Outcome	**CO1**	Learn about HTML file formatting and linking Able to know about Scripting languages							
	CO2	Know Configuration of web servers Link and embed with different documents							
	CO3	Apply JSP for data accessing and session tracking							

	CO4	Learn about Server Side Scripting
	CO5	Develop Web Applications

1. Creation of HTML Files with CSS 2. Working with Client Side Scripting 2.1 VBScript 2.2 JavaScript	**CO1**
3. Configuration of web servers 3.1 Apache Web Server 3.2 Internet Information Server (IIS) 4. Working with ActiveX Controls in web documents	**CO2**
5. Experiments in Java Server Pages 5.1 Data Access Programming (using ADO) 5.2 Session and Application objects	**CO3**
6. Working with other Server Side Scripting 6.1 Active Server Pages 6.2 Java Servlets 6.3 PHP	**CO4**
7. Experiments in Ajax Programming 8. Developing Web Services 9. Developing any E-commerce application (Mini Project)	**CO5**

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

Reference Books

1. N.P. Gopalan and J. Akilandeswari, "Web Technology: A Developer's Perspective", Second Edition, Prentice-Hall of India, 2014.
2. Deitel and Deitel, Goldberg, "Internet and World Wide Web – How to Program", Fifth Edition, Pearson Education Asia, 2011.
3. Eric Newcomer, "Understanding Web Services: XML, WSDL, SOAP, and UDDI", Addison-Wesley, 2007.
4. https://books.google.co.in/books/about/WEB TECHNOLOGY.html
5. https://www.w3schools.com

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
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
IT225	**Software Engineering Laboratory**	-	-	3	1.5	40	60	100
Prerequisite								
Course Outcome	**CO1**	Can be able to produce SRS with DFD/ER/Use case to the end user.						
	CO2	Obtain practical knowledge for SDS with decomposed designing						
	CO3	Can practice real time test generation for the mini project						
Cycle-I	**Software Requirement Specification Report**				**Periods: 9**			
Mini Project: Literature Survey to identify the problem, project scope, Abstract/objectives, High level Architecture diagram, Functional and Non-Functional requirement, identification of activities, DFD/ER/Use Case, Activity chart oriented cost estimation and time scheduling. **Note:** 2 students per batch**.** Every batch should do unique Mini project and complete SRS Report in IEEE format.								**CO1**
Cycle -II	**Software Design Specification Report**				**Periods: 9**			
Decomposition of Modules. Detail diagram of every decomposed module with documentation. Implementation to be done by adopting software engineering methodology. Real time tools/Mobile App are to be used to explore to latest updated technologies. Verification Testing should be done from activity to Module level. **Note:** Every Mini project should consists minimum of 3 modules with SDS report in IEEE format.								**CO2**
Cycle -III	**Software Testing**				**Periods: 9**			
Prepare test plan, perform validation testing, Coverage analysis, Design the Test Strategy, Define the Test Objectives, Define Test Criteria, Plan Test Environment, Test case Schedule & Estimations, Unit testing, integrated testing, Determine Test Deliverables Complete Software Test report with output results in IEEE format								**CO3**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
Semester : **Seventh**		Subject Category: **PCC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
IT226	**Artificial Intelligence**	3	1	-	4	40	60	100
Prerequisite								

Course Outcome	**CO1**	Apply heuristic concepts to design efficient algorithms that help to attain the goals in satisfactory manner
	CO2	Able to design different Knowledge Representation schemes for typical AI problems.
	CO3	Understand the concept of Fuzzy logic
	CO4	Able to design and implement a typical AI problem to be solved Using Machine Learning Techniques.
	CO5	Capability to develop intelligent systems

UNIT-I	Introduction	**Periods: 12**
Overview of AI, Problems, Problem space and searching techniques, Definition production system, Control strategies, Heuristic search techniques. Game Playing: Minmax search procedure-Adding alpha-beta cutoff Intelligent agents: Agents and environment – structure of agents and its functions- simple reflex agent- goal based agent – utility based agent – learning agents, Knowledge- Based Agent.		**CO1**
UNIT-II	Knowledge representation	**Periods: 12**
Approaches and issues in knowledge representation, Predicate logic, propositional logic, Forward and backward reasoning - Unification- Resolution- Weak slot-filler structure – Strong slot-filler structure		**CO2**
UNIT-III	**Reasoning under uncertainty**	**Periods: 12**
Logics of non-monotonic reasoning-Implementation- Basic probability notation - Bayes rule – Certainty factors and rule based systems-Bayesian networks – Dempster - Shafer Theory - Fuzzy Logic.		**CO3**
UNIT-IV	**Planning and Learning**	**Periods: 12**
Planning with state space search-partial order planning-planning graphs-conditional planning-continuous planning-Multi-Agent planning. Forms of learning- Learning from observation - Inductive learning – Decision trees –Explanation based learning – Statistical Learning methods - Reinforcement Learning -Neural Net learning and Genetic learning		**CO4**
UNIT-V	Applications and AI Languages	**Periods: 12**
Expert System: Representation-Expert System shells-Knowledge Acquisition. AI Languages: Introduction to LISP, expressions, functions, Recursion. Introduction to Prolog-Knowledge representation and reasoning using Prolog.		**CO5**

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

Reference Books:

1. Elaine Rich and Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2009.
2. Ben Coppin, “Artificial Intelligence Illuminated”, Jones and Bartlett Publishers, 1st edition, 2004.
3. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education Asia, II edition, 2003.
4. N.P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2nd edition, 2005.
5. I. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
6. Deepak Khemani “Artificial Intelligence”, Tata McGraw Hill Education 2013.

Department : **Humanities & Social Sciences**		Programme: **B. Tech. (IT)**						
Semester : **Seventh**		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:	-							
Course Outcome	The course will enable the students:							
	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	Case studies on General, Production and Financial management.						

UNIT-I	**MICRO AND MACRO ECONOMICS AND ITS APPLICATIONS**	**Periods: 09**
Nature and Scope of Economic science: Micro – Macro Economics, Economic decisions and Technical decisions. Demand and Supply concepts: Types of Demand, Determinants of Demand and Supply, concept of Equilibrium, Elasticity of Demand, cost components, Concepts of ISO-Quant – Break Even Analysis – Market structure – Price of Product Nature of pricing in different types of competition Small Scale Industries – Role of SSI in Indian Economy. Macro Economics: Nature and functions of Money – National Income – GNP and Savings – Inflation and Deflation concept – Business Cycle – Foreign Trade and Balance of payment.		**CO1**
UNIT-II	**MANAGEMENT TECHNIQUES**	**Periods: 09**
Types and Principles of Management – Elements of Management – Planning, Organising, Staffing, Directing, Coordinating Controlling - Scope of Management – Types of Organization Merits and Demerits – Types of (Ownership) of a firm Merits and Demerits.		**CO2**
UNIT-III	**INDUSTRIAL FINANCE**	**Periods: 09**
Need for Finance – Types of finance – Sources of finance – Types of Investment – Evaluation of Investment – Preparation of Trading, Profit and loss Account and Balance Sheet – types of accounting and significance of each types.		**CO3**
UNIT-IV	**PRODUCTION MANAGEMENT**	**Periods: 09**
Theory of Production Function – Types of Production Merits and Demerits – Process Planning – Routing – Scheduling – Material Control Concepts of Productivity – Measurement of Productivity – Inspection and Dispatches.		**CO4**
UNIT-V	**MARKETING MANAGEMENT**	**Periods: 09**
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 : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Seventh**			Subject Category: **PCC**			Semester Exam Type: **LB**			
Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
IT227	**Artificial Intelligence Laboratory**		-	-	3	1.5	40	60	100
Prerequisite									
Course Outcome	**CO1**	Apply heuristic concepts to design efficient algorithms using Python							
	CO2	Able to implement game playing algorithms in Python.							
	CO3	Able to develop Expert system using Python							
	CO4	Able to develop AI problems using LISP							
	CO5	Able to design and implement Knowledge representation using Prolog							

To develop following programs in Python 1. Implement Breadth First Search (for 8 puzzle problem) 2. Implement Depth First Search (for Water Jug problem) 3. Implement A* algorithm 4. To implement AO* Algorithms	CO1
5. Implement Single Player Game (Using Heuristic Function) 6. Implement Two Player Game (Using Heuristic Function) 7. To implement constraint satisfaction technique 8. Implement Certainty Factor problem	CO2
9. Implement Syntax Checking of English sentences-English Grammar 10. Develop an Expert system for Medical diagnosis. 11. Develop any Rule based system for an application of your choice.	CO3
To design and develop programs in Lisp 12. Knight's tour problem 13. Crossword puzzle	CO4
Problems in Prolog 14. Resolution in Propositional Logic 15. Resolution in Predicate Logic	CO5

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

<table>
<tr><td colspan="3">Department : Information Technology</td><td colspan="5">Programme: B. Tech. (IT)</td></tr>
<tr><td colspan="3">Semester : Seventh</td><td colspan="3">Subject Category: PAC</td><td colspan="2">Semester Exam Type: -</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="2">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>SE</td><td>TM</td></tr>
<tr><td>IT228</td><td>Seminar</td><td>3</td><td>-</td><td>-</td><td>1</td><td>100</td><td>-</td><td>100</td></tr>
<tr><td>Prerequisite</td><td colspan="8">-</td></tr>
<tr><td>Course Outcome</td><td>CO1</td><td colspan="7">The students able to work independently and get exposure in latest technologies.</td></tr>
<tr><td colspan="8">• The Seminar topic shall be chosen in consultation with a faculty member who would be the guide.
• Each student has to make a critical review of literature and prepare a report.
• The student has to present a seminar.</td><td>CO1</td></tr>
<tr><td colspan="2">Lecture Periods: 45</td><td colspan="2">Tutorial Periods: -</td><td colspan="2">Practical Periods: -</td><td colspan="2">Total Periods: 45</td></tr>
</table>

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Seventh**			Subject Category: **PCC**			Semester Exam Type: **PR**			
Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
IT229	**Mini Project**		-	-	3	1.5	40	60	100
Prerequisite									
Course Outcome	**CO1**	Students able to work in groups and develop projects for real time problems.							

1. Preparing a project – brief proposal including • Problem Identification • Developing a model for solving the problem • A statement of system / process specifications proposed to be developed (Data Flow Diagram) • List of possible solutions including alternatives and constraints • Time line activities 2. A report highlighting the design finalization [based on functional requirements & standards 3. A presentation including the following • Implementation phase (Hardware / Software / both) • Testing & Validation of the developed system • Learning in the project 4. Consolidated report preparation	CO1

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

<table>
<tr><td colspan="3">Department : Information Technology</td><td colspan="5">Programme: B. Tech. (IT)</td></tr>
<tr><td colspan="3">Semester : Seventh</td><td colspan="3">Subject Category: MCC</td><td colspan="2">Semester Exam Type: -</td></tr>
<tr><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">Course Name</td><td colspan="3">Hours / Week</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>SE</td><td>TM</td></tr>
<tr><td>IT230</td><td colspan="2">Professional Ethics</td><td>2</td><td>-</td><td>-</td><td>0</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Prerequisite</td><td colspan="8">-</td></tr>
<tr><td rowspan="2">Course Outcome</td><td>CO1</td><td colspan="7">The students will have a clear vision about the relationship among self, society and nature.</td></tr>
<tr><td>CO1</td><td colspan="7">The students will realize their importance in the society (in particular in their professional)</td></tr>
<tr><td colspan="8">The course should cover the following topics by way of Seminars, Expert Lectures and Assignments:
Human Values and Attitudes, Ethical Living and Duty Consciousness
Life, Body and Mind, Philosophy of Life, Analysis of Thought and Neutralization of Anger
Ethical Theories, Profession and Professionalism, Engineering Ethics – Moral issues, Ethical theories and their uses
Engineering as Experimentation – Code of Ethics, Engineer’s responsibility for safety and Responsibilities and rights
Global issues of engineering ethics and World Peace.</td><td>CO1</td></tr>
<tr><td colspan="2">Lecture Periods: 30</td><td colspan="2">Tutorial Periods: -</td><td colspan="2">Practical Periods: -</td><td colspan="2">Total Periods: 30</td></tr>
</table>

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Eighth**			Subject Category: **PAC**			Semester Exam Type: **-**			
Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
IT231	**Comprehensive Test**		-	-	3	1	100	-	100
Prerequisite:									
Course Outcome	**CO1**	To refresh all the IT related subjects studied							
	CO1	To face the placement tests conducted for the campus recruitment							
• The students are provided with tutorial sessions to update their knowledge in all the IT related subjects they have studied from the 3rd to 7th semester. • A comprehensive test, preferably with objective type questions, will be conducted. • A comprehensive viva voce examination (external) will be conducted.									CO1
Lecture Periods: -	**Tutorial Periods: -**		**Practical Periods: 45**			**Total Periods: 45**			

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Eighth**			Subject Category: **MCC**			Semester Exam Type: **PR**			
Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
IT233	**Project Work**		2	-	-	0	60	40	100
Prerequisite									
Course Outcome	**CO1**	The students will have a clear vision about the relationship among self, society and nature.							
	CO1	The students will realize their importance in the society (in particular in their professional)							

The project group is required to do the following 1. Literature Survey, 2. Problem formulation 3. Forming a methodology of arriving at the solution of the problem. 4. Documentation of each step 5. Master a programming language or software tool used for implementation 6. Test the project and compare it with benchmark standards 7. Prepare Project Report 8. Develop Presentation skills 9. Develop ability to work in a Group 10. Publish a paper in a reputed Conference or Journal.	CO1

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

Program Elective Courses

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
Semester : **Fifth**		Subject Category: **PEC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
ITY01	**Compiler Design**	3	-	-	3	40	60	100
Prerequisite	CS201 – Programming for Problem Solving IT203 – Object Oriented Programming							
Course Outcome	**CO1**	Able to learn the various phases of compiler.						
	CO2	Design a lexical analyzer for a sample language.						
	CO3	Apply different parsing algorithms to develop the parsers for a given grammar.						
	CO4	Understand syntax-directed translation and run-time environment						
	CO5	Learn to implement code optimization techniques and a simple code generator.						

UNIT-I	**Introduction to Compilers**	**Periods: 9**
Translators-Compilation and Interpretation – The phases of Compiler-Errors encountered in different phases-The grouping of phases – cousins of the compiler-Compiler construction tools – A simple one-pass compiler– Context Free Grammars-Derivation– Reduction and Ambiguity..		**CO1**
UNIT-II	**Lexical Analysis**	**Periods: 9**
Need and role of lexical analyzer – Lexical errors-Expressing tokens by Regular Expression – Converting regular expression to DFA – Minimization of DFA – Language for specifying lexical analyzers – LEX-Design of lexical analyzer for a sample language.		**CO2**
UNIT-III	**Syntax Analysis**	**Periods: 9**
Need and role of the parser – Context Free Grammars – Top Down parsing –General strategies – Recursive Descent Parser – Predictive Parser – LL(1) Parser – Shift Reduce Parser – LR Parser – LR (0) item – Construction of SLR Parsing table – Introduction to LALR Parser – Error handling and recovery in syntax analyzer – YACC – Design of a syntax analyzer for a sample language.		**CO3**
UNIT-IV	**Syntax Directed Translation and Type Checking**	**Periods: 9**
Definitions – Construction of syntax trees –Bottom-up evaluation of S-attributed and L-attributed definitions – Top down translation –Bottom up evaluation – Forms of intermediate code – Translation of Assignment, Boolean Expression and Control statements – Back patching type systems – Specification of a simple type checker –equivalence of type expressions – Type conversions.		**CO4**
UNIT-V	**Code Optimization and Code Generation**	**Periods: 9**
Principal sources of Optimization – DAG –Optimization of basic blocks – Global data flow analysis – Efficient dataflow algorithms –Source language issues – Storage organization – Symbol tables – Dynamic storage allocation –Issues in design of a code generator – A simple code generator algorithm.		**CO5**

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

Reference Books:

1. Alfred V. Aho, Ravi Sethi Jeffrey D. Ullman, “Compilers- Principles, Techniques, and Tools”, Pearson Education Asia, 2007.
2. David Galles, “Modern Compiler Design”, Pearson Education Asia, 2007
3. Steven S. Muchnick, “Advanced Compiler Design & Implementation”, Morgan Kaufmann Pulishers, 2000
4. C. N. Fisher and R. J. LeBlanc “Crafting a Compiler with C”, Pearson Education, 2000.

Department : **Information Technology**		Programme: **B. Tech.(IT)**						
Semester : **Fifth**		Subject Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
ITY02	**Object Oriented Analysis and Design**	3	-	-	3	40	60	100
Prerequisite	CS201 – Programming for Problem Solving IT203 – Object Oriented Programming							
Course Outcome	**CO1**	To familiarize the students to carry out object oriented analysis and design for developing object oriented software projects						
	CO2	Design a lexical analyzer for a sample language.						
	CO3	Apply different parsing algorithms to develop the parsers for a given grammar.						
	CO4	Understand syntax-directed translation and run-time environment						
	CO5	Learn to implement code optimization techniques and a simple code generator.						

UNIT-I	**OOAD Basics**	**Periods: 9**
Introduction – Overview of object oriented system development – Object basics-The Unified Process – Modeling concepts – Modeling as a design technique – Analysis and modeling – UML diagrams – Use case Modeling – Class modeling – State modeling – Interaction Modeling.		**CO1**
UNIT-II	**Requirements and Modelling**	**Periods: 9**
Object Constraint Language - Inception – Evolutionary Requirements– Domain Models – System Sequence Diagrams – Operation Contracts.		**CO2**
UNIT-III	**Design and Principles of Design**	**Periods: 9**
Requirements to Design –Design Patterns – Logical Architecture – Package diagram – Design patterns – Model, View, Control pattern – Detailed design – Object design with GRASP pattern – Detailed class diagram with Visibility.		**CO3**
UNIT-IV	**Mapping to code**	**Periods: 9**
Mapping designs to code – Test Driven development and refactoring – UML Tools and UML as blueprint		**CO4**
UNIT-V	**Patterns**	**Periods: 9**
More Patterns – Analysis update – Objects with responsibilities – Applying design patterns – Architectural Analysis – Logical Architecture Refinement – Package Design –Persistence framework with patterns		**CO5**

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

Reference Books:

1. Michael Blaha and James Rumbaugh, “Object-oriented modelling and design with UML”, Prentice-Hall of India, 2005.
2. Craig Larman. “Applying UML and Patterns – An introduction to Object-Oriented Analysis and Design and Iterative Development”, 3rd ed, Pearson Education, 2005.
3. Ali Bahrami, “Object Oriented Systems Development”, McGraw-Hill, 1999.
4. Booch, Grady. Object Oriented Analysis and Design. 2nd ed. Pearson Education 2000.
5. Fowler, Martin. UML Distilled. 3rd ed. Pearson Education. 2004.
6. Lunn, Ken. Software development with UML. Palgrave Macmillan. 2003.
7. O‟Docherty, Mike. Object-Oriented Analysis & Design. Wiley. 2005.

Department: **Information Technology**			Programme: **B. Tech. (IT)**						
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
ITY03	**Introduction to Business Intelligence**		3	-	-	3	40	60	100
Prerequisite:	-								
Course Outcome	**CO1**	Understand Basics of BI							
	CO2	Know about BI Delivery Issues							
	CO3	Analyze Efficiency Measures							
	CO4	Learn about BI Applications							
	CO5	Get a feel of Future of BI							

UNIT-I	**Introduction to Business Intelligence**	**Periods: 9**
Understanding Basics of BI-Efficient Data Storage: key to Business Intelligence– Business Intelligence Queries – Types of BI Users - Advantages of Business Intelligence - BI System Disadvantages – Example of Business Intelligence.		**CO1**
UNIT-II	**Trends in Business Intelligence Delivery**	**Periods: 9**
Data Quality Management- Data Discovery- Artificial Intelligence- Predictive and Prescriptive Analytics Tools- Connected Clouds- Data Governance and Trust- Security – Digital Ethics and Privacy- Collaborative Business Intelligence		**CO2**
UNIT-III	**Efficiency**	**Periods: 9**
Efficiency Measures –CCR Model: Definition of Target Objectives- Peer Groups – Identification of Good Operating Practices; Cross Efficiency Analysis – Virtual Inputs and Outputs –Pattern Matching – Cluster Analysis-Outlier Analysis		**CO3**
UNIT-IV	**Business Intelligence Applications**	**Periods: 9**
Marketing Models – Logistic and Production Models – Real-time Case Studies in Different Domains		**CO4**
UNIT-V	**Future of Business Intelligence**	**Periods: 9**
Future of BI – Emerging Technologies-Machine Learning- Predicting Future– Advanced Visualization –Beyond Technology.		**CO5**

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

Reference Books:

1. Gerardus Blokdyk, “Business Intelligence Development”, 5starcooks, Third Edition, 2019
2. Grossmann, Wilfried, Rinderle-Ma, Stefanie, “Fundamentals of Business Intelligence” , 2015
3. Rick Sherman, “Business Intelligence Guidebook: From Data Integration to Analytics”, 2014.
4. Jeremy Kolb, “Business Intelligence in Plain Language: A practical guide to Data Mining and Business Analytics”, 2013.

Department :**Information Technology**		Programme: **B. Tech. (IT)**						
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
ITY04	**Computer Hardware and Troubleshooting**	3	-	-	3	40	60	100
Prerequisite	IT201 - Digital System Design IT208 - Computer Architecture							
Course Outcome	**CO1**	To familiarise with the various types and parts of the computer						
	CO2	To learn the various bus standards and network components of a computer						
	CO3	To learn the working mechanism of various peripheral devices connected to a computer.						
	CO4	To study the various mounted and portable mass storage devices						
	CO5	To study the basic hardware diagnostic tools and troubleshooting						
UNIT-I	**PC Hardware Overview**	**Periods: 9**						
Introduction – Basic Parts of PC – Functional block diagram – system board – Microprocessor – Interrupts – DMA – SMPS – BIOS – POST sequence - System configuration- Memory – Mass storage – I/O interface standards		**CO1**						
UNIT-II	**Bus Standards and Networking**	**Periods: 9**						
ISA – PCI – SCSI – IDE – USB – comparative study and characteristics – Network Interface Cards – Cables and connectors - MODEM – AT command set		**CO2**						
UNIT-III	**Peripheral Devices & Display Adapters**	**Periods: 9**						
Functional descriptions of keyboard – mouse – printers – joystick – scanners – CGA – SVGA.		**CO3**						
UNIT-IV	**Mass Storage Devices**	**Periods: 9**						
Floppy disk and drive – Hard disk and drive – MFM and RLL recording standards – CD technology – DVD technology – pen drives – tape drives		**CO4**						
UNIT-V	**Troubleshooting tools**	**Periods: 9**						
In-Circuit Emulators – Logic State/Timing Analyzers – Digital Multimeters – CROs – Signature Analyzers – Troubleshooting problems of system boards, add on cards and peripherals.		**CO5**						
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books:

1. Dr. Ajay Rana **and** Dr. Ajit Mittal**,** *Mastering PC Hardware & Networking, latest edition, Khanna Publishers*
2. Balasubramanian D, Computer Installation and Servicing 2nd Edition , McGraw hill Publications, 2010
3. Hans Peter Messmer, Indispensable PC Hardware Book, Pearson Education, 4th edition, 2003.
4. Scott Muller, Upgrading and Repairing PCs, 15th edition, 2002.

Department : **Information Technology**		Programme : **B. Tech. (IT)**						
Semester : **Sixth**		Subject Category: **PEC**			Semester Exam Type: **TY**			
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
ITY05	**C# and .Net Programming**	3	-	-	3	40	60	100
Prerequisite	IT203 – Object Oriented Programming IT216 – Computer Networks							
Course Outcome	**CO1**	Debug, compile, and run a simple application.						
	CO2	Analyze the basic OBJECT ORIENTED ASPECTS OF C#						
	CO3	Develop programs using C# on .NET.						
	CO4	Design and develop Web based applications on .NET						
	CO5	Analyze the CLR and its security issues						

UNIT-I	**Introduction to C#**	**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, String, String Builder, Structure, Enumerations, boxing and unboxing.		**CO1**
UNIT-II	**Analyze the basic 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, events, errors and exception, Threading.		**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, Data Set, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, 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, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.		**CO4**
UNIT-V	**CLR and .NET framework**	**Periods: 9**
Assemblies, Versioning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET		**CO5**

Total contact Hours: 45	**Total Tutorials: -**	**Total Practical Classes:-**	**Total Hours: 45**

Reference Books:

1. 1. Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2012.
2. 2. Christian Nagel et al. “Professional C# 2012 with .NET 4.5”, Wiley India, 2012.
3. Andrew Troelsen, “Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
4. Ian Griffiths, Matthew Adams, Jesse Liberty, “Programming C# 4.0”, Sixth Edition, O‟Reilly, 2010.

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
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
ITY06	**Real-time Systems**		3	-	0	3	40	60	100
Prerequisite	IT207 - Operating Systems IT216 – Computer Networks								
Course Outcome	**CO1**	Understand the concept of real-time system and able to differentiate between general purpose and real-time systems							
	CO2	Understand real-time scheduling with resource and data dependency in uniprocessor, multi-processor and distributed systems							
	CO3	Understand the role of real-time operating system							
	CO4	Understand need for real-time communication and able to design real-time communication protocols							
	CO5	Understands the need for real-time databases and its design concepts							
UNIT-I	**Introduction**					**Periods: 9**			
Introduction to Real-Time system – Characteristics – Types of Real-Time tasks – Timing constraints – Real-Time Scheduling:- Basic concepts and classification of Algorithms–Clock-Driven Scheduling– Event-Driven Scheduling– Hybrid schedulers–EDF Scheduling–RM Scheduling and its Issues									**CO1**
UNIT-II	**Real-time Scheduling**					**Periods: 12**			
Resource Sharing and Dependencies among Real-Time tasks: Resource sharing in Real Time tasks, Priority Inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol, Handling Task dependencies Scheduling Real-time tasks in Multiprocessor and Distributed Systems									**CO2**
UNIT-III	**Real-time Operating System (RTOS)**					**Periods: 6**			
Time Services – Features of Real-time Operating System – UNIX RTOS – UNIX based RTOS – Windows as RTOS – POSIX – Survey of Contemporary RTOS – Bench Marking real-time Systems									**CO3**
UNIT-IV	**Real-time Communication**					**Periods: 12**			
Examples of Real-time Communication in Applications – Soft and Hard Real-time Communication in LAN – Bounded Access Protocol –Real-time Communication over Internet – Routing and Multicasting - Real-Time Communications over Packet Switched Networks – QoS Models									**CO4**
UNIT-V	**Real-time Databases**					**Periods: 6**			
Applications – Design issues – Characteristics of Temporal Data – Concurrency control – Commercial Real-time Databases									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

Reference Books:

1. Rajib Mall, Real-Time Systems Theory and Practice, Pearson Education, India, 2012.
2. C. Siva Ram Murthy and G. Manimaran, Resource Management in Real-Time Systems and Networks, Prentice-Hall of India, 2005.
3. Jane W.S.Liu, Real-Time Systems, Pearson Education, 2006.
4. Stuart Bennelt, Real-time computer control and introduction, Pearson Education, 2003.
5. C.M.Krishna and Kang G Shin, Real-time systems, McGraw-Hill, 1997.

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
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
ITY07	**Mobile Computing**	3	-	-	3	40	60	100
Prerequisite	IT216 – Computer Networks							
Course Outcome	**CO1**	To know the basics of mobile telecommunication system						
	CO2	Determine the functionality of MAC, network layer						
	CO3	Identify a routing protocol for a given Ad hoc network						
	CO4	To know the functionality of Transport and Application layers						
	CO5	Develop a mobile application using Android/Blackberry/ios/Windows SDK						

UNIT-I	**INTRODUCTION**	**Periods: 9**
Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA		**CO1**
UNIT-II	**MOBILE TELECOMMUNICATION SYSTEM**	**Periods: 9**
Introduction to Cellular Systems – GSM – Mobile services - System architecture - Radio interface -Protocols - Localization and calling - Handover - Security - New data services - GPRS- DECT – TETRA – UMTS and IMT 2000		**CO2**
UNIT-III	**MOBILE NETWORK LAYER**	**Periods: 9**
Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.		**CO3**
UNIT-IV	**MOBILE TRANSPORT AND APPLICATION LAYER**	**Periods: 9**
Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML		**CO4**
UNIT-V	**MOBILE PLATFORMS AND APPLICATIONS**	**Periods: 9**
Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues		**CO5**

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

Reference Books:

1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt. Ltd, New Delhi – 2012
3. Dharma Prakash Agarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile Computing, Springer, 2003.
5. Android Developers : http://developer.android.com/
6. Apple Developer : https://developer.apple.com/
7. Windows Phone Dev Center : http://developer.windowsphone.com
8. BlackBerry Developer : http://developer.blackberry.com

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
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
ITY08	**Image Processing**	3	-	-	3	40	60	100
Prerequisite:	-							

Course Outcome		
	CO1	To have fundamentals Image Processing steps
	CO2	To understand the spatial and frequency domain filters
	CO3	To have various image restoration and multi-resolution approaches.
	CO4	To have basics of colour image and various morphological operators applied in images.
	CO5	To know about various image segmentation, representation and description methods.

UNIT-I	**Periods: 9**
Digital Image Fundamentals: Digital image representation –fundamental steps involved in digital image processing – components of image processing system – image sensing and acquisition – image sampling and quantization – basic relationships between pixels –examples of fields that use digital image processing.	**CO1**
UNIT-II	**Periods: 9**
Filtering in the Spatial Domain: Background – Some Basic Intensity Transformation Functions - Histogram processing – Fundamentals of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – **Filtering in the Frequency Domain:** Basics of Filtering in the Frequency Domain – Image Smoothing using Frequency Domain Filters – Image Sharpening using Frequency Domain Filters – Selective Filtering.	**CO2**
UNIT-III	**Periods: 9**
Image Restoration: model of the image degradation/restoration process – noise models – restoration in the presence of noise only-spatial filtering – periodic noise reduction by frequency domain filtering – linear, position-invariant degradations – estimating the degradation function – inverse, wiener, constrained least square and geometric mean filtering – geometric transformations. **Multi-resolution processing:** background – Multi-resolution expansions – wavelet transforms in one dimension and two dimensions – fast wavelet transform – wavelet packets.	**CO3**
UNIT-IV	**Periods: 9**
Colour Image Processing: fundamentals – colour models – pseudo colour image processing – colour transformations – colour image smoothing and sharpening – colour segmentation – noise in colour images. **Morphological Image Processing:** preliminaries – dilation and erosion – opening and closing – hit-or-miss transform – some basic morphological algorithms.	**CO4**
UNIT-V	**Periods: 9**
Image Segmentation: detection of discontinuities – edge linking and boundary detection – thresholding – region based segmentation. **Representation and Description:** representation – boundary descriptors – regional descriptors – relational descriptors.	**CO5**

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

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education., 2014.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 2011.

Department :**Information Technology**		Programme: **B. Tech. (IT)**						
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
ITY09	**Cloud Computing**	3	-	-	3	40	60	100
Prerequisite	IT207 - Operating systems IT208 - Computer Architecture IT216 - Computer Networks							
Course Outcome	**CO1**	To impart the principles and paradigm of Cloud Computing and understand the Service Model with reference to Cloud Computing						
	CO2	To comprehend the Cloud Computing architecture and implementation						
	CO3	To realize the role of Virtualization Technologies and acquire knowledge of how hypervisors are used in Virtual Machines.						
	CO4	To secure and perform identity management in the Cloud and to access and use the services in the Cloud.						
	CO5	To familiarise with the popular Cloud Service Providers						
UNIT-I	**Introduction to Cloud Computing**				**Periods: 9**			
Overview, Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Assessing the role of Open Standards.								**CO1**
UNIT-II	**Cloud Architecture, Services and Applications**				**Periods: 9**			
Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, SaaS Vs. PaaS, Using PaaS Application Frameworks, Software as a Service, Identity as a Service, Compliance as a Service.								**CO2**
UNIT-III	**Abstraction and Virtualization**				**Periods: 9**			
Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context								**CO3**
UNIT-IV	**Managing & Securing the Cloud**				**Periods: 9**			
Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence								**CO4**
UNIT-V	**Case Studies**				**Periods: 9**			
Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services.								**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books:

1. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", First Edition, John Wiley & Sons, 2011.
2. Sosinsky B., "Cloud Computing Bible", First Edition, Wiley Edition, 2011.
3. Miller Michael, "Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online", Pearson Education India
4. Smooth S., Tan N., "Private Cloud Computing", Morgan Kauffman , First Edition, 2011.
5. Linthicium D., "Cloud Computing and SOA Convergence in Enterprise", Pearson Education India.

Department :**Information Technology**		Programme: **B. Tech. (IT)**						
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
ITY10	**Internet of Things**	3	-	-	4	40	60	100
Prerequisite	IT207 - Operating systems IT208 - Computer Architecture IT216 - Computer Networks							
Course Outcome	**CO1**	To understand the basics of Internet of Things and get an idea of some of the application areas where Internet of Things can be applied						
	CO2	To understand the need for Protocol standardization and IOT protocols						
	CO3	To understand the concept of Cloud of Things with emphasis on web of things						
	CO4	To Identify and design the new models for latest strategic interaction Design						
	CO5	To Design a middleware for IoT and analyze various protocols for IoT to design different models for network dynamics						

UNIT-I	**Introduction to IoT**	**Periods: 9**
Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security.		**CO1**
UNIT-II	**IoT Protocols and Applications**	**Periods: 9**
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security		**CO2**
UNIT-III	**Web of things**	**Periods: 9**
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture		**CO3**
UNIT-IV	**Integrated Internet of Things**	**Periods: 9**
Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects - Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon		**CO4**
UNIT-V	**Applications**	**Periods: 9**
The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging		**CO5**

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

Reference Books:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press 2012
2. Dieter Uckelmann, Mark Harrison, " Architecting the Internet of Things", Florian Michahelles (Eds.) – Springer – 2011
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press - 2010
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
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
ITY11	**Big Data Analytics**	3	-	-	3	40	60	100
Prerequisite	-							
Course Outcome	**CO1**	Acquire knowledge in the insight concept of Big Data Analytics						
	CO2	Able to store, create, extract , transfer and connect Big Data						
	CO3	Obtain adequate knowledge on Hadoop						
	CO4	Apply advance analytical platform						
	CO5	Could know the latest tools installation and deployment process of Big data						

UNIT-I	**Introduction To Big Data and Its Technologies**	**Periods: 9**
Big Data and its Importance – Four V's of Big Data – Drivers for Big Data –Introduction to Big Data Analytics – Big Data Analytics Applications-Hadoop's Parallel World – Data discovery Open Source Technology for Big Data Analytics – Cloud and Big Data		**CO1**
UNIT-II	**Processing Big Data**	**Periods: 9**
Integrating Disparate Data Stores - Mapping Data to Programming Framework- Connecting and Extracting Data From Storage - Transforming Data for Processing - Subdividing Data in Preparation for Hadoop Map Reduce		**CO2**
UNIT-III	**Hadoop Map Reduce**	**Periods: 9**
Employing Hadoop Map Reduce - Creating Components Of Hadoop Map Reduce Jobs - Distributing Data Processing Across Server Farms –Executing Hadoop Map Reduce Jobs - Monitoring Progress of Job Flows - The Building Blocks Of Hadoop Map Reduce - Distinguishing Hadoop Daemons -Investigating Hadoop Distributed File System		**CO3**
UNIT-IV	**Advanced Analytics Platform**	**Periods: 9**
Real-Time Architecture – Orchestration and Synthesis Using Analytics Engines– Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model.		**CO4**
UNIT-V	**Big Data latest Tools**	**Periods: 9**
Installing and Running Pig – Comparison with Databases – Pig Latin – User Defined Functions – Data Processing Operators – Installing and Running Hive– Hive QL – Tables – Querying Data – User-Defined Functions – Oracle Big Data		**CO5**

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

Reference Books

1. Michael Minelli, Michehe Chambers, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
2. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, 1st Edition, IBM Corporation, 2012.
3. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, 1st Edition, Wiley and SAS Business Series, 2012.
4. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'reilly 2012.
5. Wolfgang karl Hardle, Henry Horng-Shing Lu, Xiaotong Shen, Handbook of Big Data Analytics , Springer 2018

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
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
ITY12	**Software Project Management**		3	-	-	3	40	60	100
Prerequisite	IT221 - Software Engineering								
Course Outcome	**CO1**	Understand the Software Project Planning and Management principles while developing software.							
	CO2	Obtain adequate knowledge about software process models and estimation techniques.							
	CO3	Able to mitigate project risk.							
	CO4	Could manage, track and control project.							
	CO5	Could know the staff selection procedures and manage the staff in work environment .							
UNIT-I	**Project evaluation and planning**					**Periods: 9**			
Importance of Software Project Management – Product Process and project—Definition—product life Cycle—project Life cycle models—Process Models- Activities– Methodologies – Overview of Project Planning – Stepwise Project Planning-Cost-benefit evaluation technology –Strategic program Management – Stepwise Project Planning.									**CO1**
UNIT-II	**Life Cycle and Estimation**					**Periods: 9**			
Software process and Process Models – Choice of Process models – waterfall-incremntal-Rapid Application development –prototype–UML- Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes.									**CO2**
UNIT-III	**Activity planning and Risk Management**					**Periods: 9**			
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – Cost schedules.									**CO3**
UNIT-IV	**Management and Control**					**Periods: 9**			
Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.									**CO4**
UNIT-V	**Staffing**					**Periods: 9**			
Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures –Leadership.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

1. PankaJalote, Software Project Management in Practice, Pearson Education, New Delhi, Edition 2014.
2. Krish Rangarajan and Anil Misra, Working Capital Management, Excel Book, New Delhi, 2010.
3. Watts Humphrey, Managing the Software Process, Published by Pearson Education, New Delhi, 2010
4. Roger S Pressman, Software Engineering – A Practitioner's Approach, McGraw Hill International Edition, Singapore, Seventh Edition, 2009.
5. Hughes, Software Project Management, Tata McGraw-Hill, 2017.
6. Gopalaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), 2017.
7. Walker Royce "Software Project Management A Unified Framework", Pearson Education, 2017

Department : **Information Technology**		Programme: **B. Tech. (IT)**						
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
ITY13	**Data Mining and Data Warehousing**	3	-	-	3	40	60	100
Prerequisite	IT214 - Data Base Management Systems							
Course Outcome	**CO1**	Understand the insight concepts of data mining.						
	CO2	Understand multidimensional data and data warehouse						
	CO3	Able to Clean and pre-process data and Query with multidimensional data.						
	CO4	Apply various data mining techniques for projects.						
	CO5	Apply Web mining for real-time projects						

UNIT-I	**Introduction to Data Mining**	**Periods: 9**
Definition of data mining - data mining vs query tools – machine learning –taxonomy of data mining tasks – steps in data mining process – overview of data mining techniques		**CO1**
UNIT-II	**Data Warehousing**	**Periods: 9**
Definition – Multidimensional Data Model – Data Cube – Dimension Modelling– OLAP Operations – Warehouse Schema – Data Warehouse Architecture – Data Mart– Meta Data – Types of Meta Data – Data Warehouse Backend Process –Development Life Cycle.		**CO2**
UNIT-III	**Data cleaning and Pre-Processing**	**Periods: 9**
Data Cleaning – Pre-Processing techniques, Data Integration and Transformation –Data Reduction – Discretization and Concept Hierarchy Generation –Query Language – Generalization – Summarization		**CO3**
UNIT-IV	**Association Rule and Classification**	**Periods: 9**
Association Rule – Mining Multi-Dimensional data from Transactional Database and Relational Database. Classification – Decision Tree Induction – Bayesian Classification – Prediction –Back Propagation		**CO4**
UNIT-V	**Cluster analysis**	**Periods: 9**
Cluster Analysis – Types of Clustering-Hierarchical Method – Partitioning methods- Density Based Method – Grid Based Method – Outlier Analysis. Advanced topics: Web Mining-Difference between data mining and Web Mining – Web Content Mining – Structure and Usage Mining – Spatial Mining –Sequence Mining Applications : Case studies in Data Mining and web mining applications		**CO5**

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

Reference Books

1. Paulraj Ponnaiah, Data Warehousing Fundamentals, Wiley Publishers, 2001.
2. Jiawei Han, MichelineKamber, Data Mining: Concepts and Techniques, Morgan Kaufman Publishers, 2011.
3. UsamaM.Fayyad, Gregory Piatetsky Shapiro, Padhrai Smyth, RamasamyUthurusamy, Advances in Knowledge Discover and Data Mining, TheM.I.T.Press, 2012.
4. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit, John Wiley and Sons Inc., 3rd edition 2019.
5. Alex Berson, Stephen Smith, Kurt Thearling, Building Data Mining Applications for CRM, Tata McGraw Hill, 2009.
6. Daniel T. Larose John Wiley & Sons, Hoboken, Discovering Knowledge in Data: An Introduction to Data mining, New Jersey, 2005.
7. Hand, Mannila and Smyth, Principles of Data Mining, Prentice Hall of India, New Delhi, 2009.
8. Dunham, Data Mining- Introductory and Advanced Topics, Pearson Education, New Delhi, Third impression 2008.
9. Sean Kelly, Data warehousing in action, John wiley & sons, reprint 2008.
10. Sam Anahory, Dennis Murrary, Data warehousing in the real world, Addition Wesley, Fourth Impression 2009.

Department : Information Technology		Programme: **B. Tech. (IT)**						
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
ITY14	**Distributed Computing**	3	-	-	3	40	60	100
Prerequisite	IT207 - Operating System IT216 - Computer Networks							
Course Outcome	**CO1**	Able to understand the importance of communication in distributed environment.						
	CO2	Apply the distributed object concepts in real-time.						
	CO3	Ability to manage thedistributed file system.						
	CO4	Attain the knowledge of transactions concurrency control.						
	CO5	Know the details of distributed multimedia web services.						
UNIT-I	**Introduction**				**Periods: 9**			
Characteristics, Examples, Trends, Resource sharing Applications, Challenges – System models: Architectural models and Fundamental models – Network principles and Internet protocols– Inter-process communication: API, Marshalling, Client-server communication, Multicast communication – Case study: MPI.								**CO1**
UNIT-II	**Distributed objects and Remote Invocation**				**Periods: 9**			
Introduction to Distributed objects, Communication between distributed objects, Remote Procedure Call, Events and Notification, RMI, Case Study: CORBA – Operating System Support: Introduction, OS Layer, Protection, Processes and Threads synchronization, Operating system architecture.								**CO2**
UNIT-III	**Distributed File System**				**Periods: 9**			
File service architecture, Sun network and Andrew File system, Enhancements – Name Services: Domain Name System, Global Name Service, Directory services with a Case study – Time and Global States: Clocks, events and processes, Clock synchronization, Logical clocks, Global states – Election algorithms.								**CO3**
UNIT-IV	**Transactions and Concurrency Control**				**Periods: 9**			
Transactions and nested transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control – Distributed Transactions: Distributed deadlocks, Transaction recovery – Replication: Transactions with replicated data – Distributed Shared Memory: Design and implementation issues, Consistency models.								**CO4**
UNIT-V	**Distributed Multimedia Systems**				**Periods: 9**			
Characteristics of Distributed Multimedia Systems, Quality of service management, Resource management, Stream adaptation – Web Services: Introduction, Service descriptions and IDL, Directory service, XML Security, Coordination of web services – Case study: GOOGLE.								**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			

Reference Books

1. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, “Distributed Systems: Concepts and Design”, 5th Edition, Pearson Education, 2012.
2. Andrew S. Tanenbaum and Maarten Van Steen, “Distributed Systems: Principles and Paradigms”, 2nd Edition, Prentice-Hall, 2016.
3. Ajay D. Kshemkalyani and Mukesh Singhal, “Distributed Computing: Principles, Algorithms, and Systems”, 1st Edition, Cambridge University Press, 2011.

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
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
ITY15	**Information Security**		3	-	-	3	40	60	100
Prerequisite	MA206 - Mathematics for Computing IT202 - Data Structures								
Course Outcome	On successful completion of this course, the students will be able to:								
	CO1	Understand OSI security architecture and legal, ethical and professional issues in security							
	CO2	Identify risks and design security model							
	CO3	Understand security technology							
	CO4	Familiarize cryptographic techniques							
	CO5	Apply biometric security							

UNIT – I	**INTRODUCTION**	**Periods: 9**
Security Trends, OSI security architecture, Security attacks, security services, security mechanisms, - Security System Development Life cycle – Legal, Ethical and Professional issues.		CO1
UNIT – II	**SECURITY ANALYSIS AND DESIGN**	**Periods: 9**
Risk Management - Identifying and Assessing Risk - Assessing and Controlling Risk. Blueprint for Security Information Security Policy - Standards and Practices – ISO 17799/BS 7799 – NIST Models - VISA International Security Model-Design of Security Architecture.		CO2
UNIT – III	**PHYSICAL DESIGN**	**Periods: 9**
Security Technology – Intruders, Malicious software, Firewalls, Scanning and Analysis tools, Content filters.		CO3
UNIT – IV	**CRYPTOGRAPHY**	**Periods: 9**
Advanced Encryption standard, Principles of public-key cryptosystem, Key management, Message authentication and Hash functions, Digital signatures.		CO4
UNIT – V	**BIOMETRIC SECURITY**	**Periods: 9**
Biometrics: Definition – Types of Biometrics – Multi biometrics – Fusion methods - applications.		CO5

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

Reference Books:

1. Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2010.
2. William Stallings, Cryptography and Network security, Principles and Practices, Seventh Edition, Pearson Education, 2017.
3. John D. Wood Ward, Jr. Nicholas M. Orlans and Peter T. Higgm, Biometrics, Dream tech press, 2010.

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
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
ITY16	**Introduction to Machine Learning**		3	-	-	3	40	60	100
Prerequisite	MA206 – Mathematics for Computing								
Course Outcome	**CO1**	Able to explore basics of supervised learning							
	CO2	Able to understand various unsupervised learning algorithms							
	CO3	Able to understand various scalable learning algorithms							
	CO4	Able to understand different reinforcement learning algorithms							
	CO5	Able to apply various machine learning algorithms to real-time applications.							
UNIT-I						**Periods: 9**			
Supervised Learning: Regression/Classifications – Distance-based Methods – Nearest-Neighbours – Decision Trees – Nave Bayes – Linear Regression – Logistic Regression – Generalised Linear Models – Support Vector Machines – Non-linearity and Kernel Methods –Multi-class/Structured outputs – Ranking.									**CO1**
UNIT-II						**Periods: 9**			
Un Supervised Learning: Clustering: K-means/ Kernel; Dimensionality Reduction: PCA – Kernel PCA; Matrix Factorization and Matrix Completion; Generative Models..									**CO2**
UNIT-III						**Periods: 9**			
Scalable Machine Learning: Online Learning - Distributed Learning; Sparse Modeling and Estimation – Modeling Sequence/Time-series Data – Deep Learning –Feature Representation Learning; Semi-supervised Learning – Active Learning.									**CO3**
UNIT-IV						**Periods: 9**			
Reinforcement Learning: Q-learning – Non deterministic Rewards and Actions – Temporal Difference learning; Bayesian Learning and Inference.									**CO4**
UNIT-V						**Periods: 9**			
Applications: Robotic Control – Data Mining – Autonomous Navigation – Bioinformatics – Speech Recognition – Face Recognition – Text and Web Data Processing – IoT Applications.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books:

1. Tom M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, 2010.
3. Christopher Bishop, “Patter Recognition and Machine Learning”, Springer, 2006.
4. Kevin Murphy,” Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
5. Richard Duda, Peter Hart and David Stork, “Pattern Classification”, 2nd Edition, John Wiley & Sons, 2001.
6. Richard Sutton and Andrew Barto, “Reinforcement Learning: An Introduction”, 2nd Edition, MIT Press, 2018.

Honours Core Courses

Department : **Information Technology**			Programme: **B. Tech. (IT)-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
ITH01	**Programming Paradigms**		3	1	-	4	40	60	100
Prerequisite									
Course Outcome	CO1	Understand and Explain the syntax of a programming language using Grammars							
	CO2	Learn Imperative programming language constructs							
	CO3	Learn object oriented programming language constructs							
	CO4	Learn functional and logic programming language constructs							
	CO5	Understand, Identify and apply suitable programming paradigm for a given application							
UNIT – I	Language description						**Hours: 12**		
Introduction to programming languages - Expression Notations, Abstract Syntax Trees Lexical Syntax, Context - Free Grammars, Grammars for Expression									**CO1**
UNIT – II	Imperative Programming						**Hours: 12**		
Syntax - Directed Control Flow, Programming with Invariants, Proof rules for Partial Correctness, Basic Types, Arrays & Records, Unions & Sets, Pointers, Procedure Activations, Imperative Programming Languages									**CO2, CO5**
UNIT – III	Object - Oriented Programming						**Hours: 12**		
Constructs for Program Structuring, Object Model, parameter passing, Dynamic Allocation, Object - Oriented Programming Languages									**CO3, CO5**
UNIT – IV	Functional Programming						**Hours: 12**		
A Little Language of Expressions, Types and Expression Evaluation, Functional Programming with Lists									**C04, CO5**
UNIT – V	Other Paradigms						**Hours: 12**		
Introduction to Logic Programming, Basics of Prolog, Introduction to Concurrent Programming, Concurrency in ADA. Haskell, Ruby									**CO4, CO5**
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods: -**				**Total Periods: 60**		

References

1. Ravi Sethi, "Programming Languages: Concepts and Constructs", AT&T Bell Laboratories, 2nd edition, Addison Wesley, 2007.
2. Allen B. Tucker, Robert E. Noonan, "Programming Languages Principles and Paradigms" 2nd Edition, Tata McGraw Hill, 2007.
3. Turbak F A, Gifford D K and Sheldon M A, —Design concepts in Programming Languages, The MIT Press, Massachusetts, 2008.
4. Sebesta R W, —Concepts of Programming Languages, Addison-Wesley, 2012.
5. Friedman D P and Wand M, —Essentials of Programming Languages - Third edition, The MIT Press, 2008.
6. Harper R, —Practical Foundations for Programming Languages, Cambridge University Press, 2012.
7. Scott M L, —Programming Language Pragmatics, Morgan Kaufmann, 2009.

Department : **Information Technology**			Programme: **B. Tech. (IT)-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
ITH02	**Advanced Data Structures**		3	1	-	4	40	60	100
Prerequisite									
Course Outcome	**CO1**	Learning about various heap structures and their applications							
	CO2	Learning about various Tree structures and their applications							
	CO3	Learning various applications of graph structures							
	CO4	Understanding the string matching techniques and using them in advanced courses							
	CO5	Learning and practicing various geometric structures							
UNIT – I	Heap Structures						**Periods: 12**		
Single and double ended priority queue – Liftist Trees – Binomial Heaps – Fibonacci Heaps –Pairing Heaps – Symmetric Min-Max Heaps – Interval Heaps									**CO1**
UNIT – II	Tree Structures						**Periods: 12**		
Binary Search trees – Optimal binary search trees - AVL Trees – Red Black Trees –Splay Trees m-way search trees - B Trees – B^+ trees									**CO2**
UNIT – III	Graphs						**Periods: 12**		
Topological sort, Applications of depth first search, Undirected graphs, Biconnectivity, Euler circuits, Hamiltonian cycles, Isomorphism, Directed graphs, Finding strong components									**CO3**
UNIT – IV	String matching Techniques						**Periods: 12**		
Naïve string matching algorithm, Rabin Karp algorithm, String matching with finite automata, Knuth Morris Pratt algorithm.									**CO4**
UNIT – V	Multi-Dimensional Structures						**Periods: 12**		
K-D Trees - Point Quad Trees - MX-Quad Trees - R-Trees - TV Trees									**CO5**
Lecture Periods: 45		**Tutorial Periods: 15**			**Practical Periods: -**			**Total Periods: 60**	

References

1. E.Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data Structures in C++, Universities Press, 2nd Edition, 2007.
2. S.Sahni, Data Structures, Algorithms and Applications in C++, 2nd Edition, Universities Press, 2005.
3. Adam Drozdek, —Data Structures and Algorithms in C++, Cengage Learning, USA, 2013.
4. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, —Introduction to Algorithms‖, MIT Press, New Delhi, 2014.
5. Peter Brass, —Advanced Data Structures, Cambridge University Press, USA, 2008.
6. Venkatesan R and Lovelyn Rose S, —Data Structures, Wiley India Pvt. Ltd., New Delhi, 2015.

Department : **Information Technology**		Programme: **B. Tech. (IT)-Honours**						
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
ITH03	**Biometrics**	3	1	-	4	40	60	100
Prerequisite	-							

Course Outcome		
	CO1	To get an introduction to Biometric traits, its processing and applications
	CO2	To know the importance of physiological biometric traits and its operations
	CO3	To know more about behavioral and soft biometric traits and its operations
	CO4	To acquire knowledge in multi-biometrics and levels of fusion
	CO5	To apply the multi-biometric traits in real time applications

UNIT-I	**Introduction**	**Periods: 12**
Introduction to Biometrics: Operation of a Biometric System – verification vs. identification – performance of a biometric system – biometrics characteristics –biometrics traits - application of biometrics.		**CO1**
UNIT-II	**Physiological traits**	**Periods: 12**
Fingerprint – Face – Iris – Hand geometry – Ear – palm print – knuckle print – Hand vascular – DNA traits – sensor models of every trait – feature extraction techniques – matching – performance evaluation – test databases – applications		**CO2**
UNIT-III	**Behavioural and Soft traits**	**Periods: 12**
Key stroke – Signature – Voice – Gait – Driving Style – ECG – EEG - sensor models of every trait – feature extraction techniques – matching – performance evaluation – test databases – applications		**CO3**
UNIT-IV	**Multi-biometrics**	**Periods: 12**
Limitations of Biometric System - Multi-biometrics System Design - Level of Fusion: Sensor Level - Feature Level - Rank Level - Decision Level.		**CO4**
UNIT-V	**Applications**	**Periods: 12**
National ID Card (UID), Voter Registration, Welfare Disbursement, Border Crossing. **Forensic**: Corpse Identification, Criminal Investigation, Parenthood Determination. **Commercial**: ATM, Access Control, Mobile Phone, Banking, E-Commerce, Smart Card.		**CO5**

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

Reference Books:

1. Anil K. Jain, Patrick Flynn and Arun A. Ross, Handbook of Biometrics, Springer, 2008.
2. Arun A. Ross, Karthik Nandakumar and Anil K. Jain, Handbook of Multibiometrics, Springer, 2008
3. Davide Maltoni, Dario Maio, Anil K. Jain, SalilPrabhakar, Handbook of Fingerprint Recognition, 2nd Edition, Springer, 2009.
4. M.J. Burge and K.W. Bowyer, Handbook of Iris Recognition, Springer, 2013.
5. Stan Z. Li and Anil K. Jain, Encyclopedia of Biometrics, Springer, 2009.
6. Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior and Jonathan H. Connell, Guide to Biometrics, Springer, 2009.

Department: **Information Technology**			Programme: **B. Tech. (IT)-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
ITH04	**Advanced Java Programming**		3	1	-	4	40	60	100
Prerequisite									
Course Outcome	On completion of the course, students able to								
	CO1	Understand Java Classes							
	CO2	Implement GUI Programming							
	CO3	Understand Event Handling							
	CO4	Understand and do Data Base Programming							
	CO5	Understand and apply Java Technologies							
UNIT – I	**A Collection of Useful Classes**						**Periods: 12**		
Utility Methods for Arrays, Observable and Observer Objects, Date & Times, Using Scanner Regular Expression, Input/Output Operation in Java (java.io Package), Streams and the new I/O Capabilities, Understanding Streams, The Classes for Input and Output, The Standard Streams, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects.									**CO1**
UNIT – II	**GUI Programming**						**Periods: 12**		
Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package) The Collection Framework: Collections of Objects, Collection Types, Sets, Sequence, Map, Understanding Hashing, Use of Array List & Vector.									**CO2**
UNIT – III	**Event Handling**						**Periods: 12**		
Event-Driven Programming in Java, Event- Handling Process, Event-Handling Mechanism, The Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners, Adapter Classes as Helper Classes in Event Handling.									**CO3**
UNIT – IV	**Database Programming using JDBC**						**Periods: 12**		
Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.									**CO4**
UNIT – V	**Java Server Technologies Servlet**						**Periods: 12**		
Web Application Basics, Architecture and challenges of Web Application, Introduction to servlet, Servlet life cycle, Developing and Deploying Servlets, Exploring Deployment, Descriptor (web.xml), Handling Request and Response.									**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**					**Total Periods: 60**		

References

1. Herb Schildt, JAVA the Complete Reference, 8th Edition, July 2017.
2. Deitel & Deitel, "Java How to program", Prentice Hall, 9th Edition, 2016.
3. Gay Horstmann, BIG JAVA, 4th edition, 2010.

Department : **Information Technology**			Programme: **B. Tech. (IT)-Honours**						
Semester : **Seventh**			Course Category Code: **PEC**				Semester Exam Type: TA		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITH05	**Introduction to Data Science**		3	1	-	4	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Able to know the benefits of learning data science and its phases							
	CO2	Able to learn the various machine learning algorithms							
	CO3	Able to learn the various text mining and analytics techniques							
	CO4	Able to read and write simple Python programs.							
	CO5	Able to represent compound data using Python lists, tuples, dictionaries.							

UNIT-I	**Data science in a big data world**	**Periods: 12**
Benefits and uses of data science and big data-Facets of data-The data science process-The big data ecosystem and data science-The data science process		**CO1**
UNIT-II	**Machine learning Algorithm Fundamentals**	**Periods: 12**
What is machine learning and why should you care about it?- The modelling process-Types of machine learning- Naive Bayes- Decision Tree Classifiers- Boosting and Ensemble Learning- Support Vector Machines-Limitations of Machine learning		**CO2**
UNIT-III	**Text mining and text analytics**	**Periods: 12**
Text mining in the real world -Text mining techniques-Getting Data- Working with data- Data visualization to the end user Sample programs with Python		**CO3**
UNIT-IV	**Introduction to Python**	**Periods: 12**
Data types- variables, expressions, statements, tuple assignment, precedence of operators- Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.		**CO4**
UNIT-V	**Advanced constructs**	**Periods: 12**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages;		**CO5**

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

Reference Books:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science Big Data, Machine Learning, and More, using Python Tools, Manning Publications Co., 2016.
2. Steven S. Skiena, The Data Science Design Manual, Springer,2017
3. Joel Grus, Data Science from Scratch, O'Reilly Media, 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013

Minor Core Courses

Department : **Information Technology**			Programme: **B. Tech. (IT)-Minor**						
Semester **: Third**			**Subject Category: PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITM01	**Data Structures and Algorithms**		3	1	-	4	40	60	100
Prerequisite									
Course Outcome	CO1	Study of sorting and searching algorithms and applying them in applications							
	CO2	To design and implement linear data structures using C							
	CO3	To design and implement non - linear data structures using C							
	CO4	Learn about the algorithm analysis methods							
	CO5	Learn algorithm design methods							
UNIT – I	**Sorting And Searching Techniques**					**Periods: 12**			
Sorting algorithms – Insertion sort- selection sort – shell sort – bubble sort – quick sort – heap sort- merge sort – radix sort – searching – linear search – binary search.									**CO1**
UNIT – II	**Stacks and Queues**					**Periods: 12**			
Stack ADT – operations - implementation – application: expression evaluation Queue ADT – operations – implementation – application – priority queue									**CO2**
UNIT – III	**Trees and Graphs**					**Periods: 12**			
Binary tree – traversal methods – application – binary search tree Graph – traversal methods – Dijkstra's algorithm - application									**CO3**
UNIT – IV	**Algorithm analysis**					**Periods: 12**			
Introduction: Algorithm – efficiency of algorithms – best, worst and average case analysis – the order of – asymptotic notations –solving recurrences – homogeneous recurrences – inhomogeneous recurrences									**C04**
UNIT – V	**Algorithm design**					**Periods: 12**			
Strassen's Matrix multiplication –Greedy Knapsack problem solution – N queen's problem – all pairs shortest path algorithm									**CO5**
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods: -**			**Total Periods: 60**			

References

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
2. Richard Gilberg, Behrouz and A.Forouzan, "Data Structures: A Pseudocode Approach with C", Second edition, India Edition, 2005
3. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2010.
4. Venkatesan R and Lovelyn Rose S, —Data Structures, Wiley India Pvt Ltd, New Delhi, 2015.
5. Salaria R S, —Data Structures and Algorithms using C, Fifth Edition, Khanna Book Publishing, New Delhi, 2012.
6. Vijayalakshmipai G.A, —Data Structures and Algorithms: Concepts Techniques and Applications, McGraw Hill, 2009

Department **: Information Technology**			Programme: **B. Tech. (IT)-Minor**						
Semester **: Fourth**			**Subject Category: PCC**			Semester Exam Type: **TY**			
Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITM02	**Java and Internet Programming**		3	1	-	4	40	60	100
Prerequisite									
Course Outcome	CO1	Study of Java Fundamentals							
	CO2	Study and Implementation of Applets							
	CO3	Study of HTML Programming							
	CO4	Study of DHTM, XML and Active-X Controls							
	CO5	Study of Servlets							

UNIT – I	**Periods: 12**
Introduction to Object Oriented Programming – Java on the Internet – Multithreading and Persistence – Java keywords and flow control – Garbage collection – packages- Final declaration – Interfaces and inner classes – Java I/O classes – Run time type identification.	**CO1**
UNIT – II	**Periods: 12**
Introduction to Applets – How it differs from application –building applet code and Execution – Life cycle – Applet Tag – Adding Applet to HTML file – Passing Parameters to Applet – Displaying Numerical Values – Getting Input from the User – Debugging.	**CO2**
UNIT – III	**Periods: 12**
Foundations for Internet Programming: An overview of Internet Programming - WWW - HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications.	**CO3**
UNIT – IV	**Periods: 12**
Dynamic HTML – introduction – cascading style sheets – object model and collections – event model – filters and transition – data binding – data control – ActiveX control – handling of multimedia data - XML.	**C04**
UNIT – V	**Periods: 12**
Servlets communication – Interactive Java Servlets – Deployment of simple servlets – web server (Java web server / Tomcat / Web logic) – HTTP GET and POST requests – session tracking – cookies – JDBC – simple web applications – multi-tier applications.	**CO5**

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

References

1. Deitel, Deitel and Nieto, Internet and World Wide Web – How to program , Pearson Education Publishers, 2000.
2. E. Balagurusamy, Programming with Java – A Primer – 3 Edition, Tata McGraw Hill,
3. R. Krishnamoorthy & S. Prabhu, Internet and Java Programming , New Age International Publishers, 2004.
4. Thomno A. Powell, The Complete Reference HTML and XHTML, fourth edition, Tata McGraw Hill, 2003.
5. Naughton, The Complete Reference – Java2, Tata McGraw-Hill, 3rd edition, 1999.

Department : **Information Technology**		Programme: **B. Tech. (IT)-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
ITM03	**Data Communication and Computer Networks**	**3**	**1**	**-**	**4**	**40**	**60**	**100**

Prerequisite	---	
Course Outcome	**CO1**	Understand the basic layers and its functions in computer networks
	CO2	Understand the basics of how data flows from one node to another
	CO3	Analyze and design routing algorithms and evaluate the performance of a network
	CO4	Understand the Internet protocols
	CO5	Understand the working of various application layer protocols

UNIT-I	**Introduction and Physical Layer**	**Periods: 12**	
Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching			**CO1**
UNIT-II	**DATA LINK LAYER AND MEDIA ACCESS**	**Periods: 12**	
Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices			**CO2**
UNIT-III	**NETWORK LAYER**	**Periods: 12**	
Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.			**CO3**
UNIT-IV	**TRANSPORT LAYER**	**Periods: 12**	
Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP			**CO4**
UNIT-V	**APPLICATION LAYER**	**Periods: 12**	
WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.			**CO5**

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

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013
4. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
6. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

Department: **Information Technology**			Programme: **B. Tech. (IT)-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
ITM04	**Information Systems and Organization**		**3**	**1**	**-**	**4**	**40**	**60**	**100**
Prerequisite	**-**								
Course Outcome	**CO1**	Know the Concepts of Information Systems and Organization							
	CO2	Study the Importance of Decision Making							
	CO3	Understand the Fundamental Concepts MIS.							
	CO4	Impart the knowledge of MIS							
	CO5	Know the security issues of MIS							
UNIT-I	**CONCEPTUAL FOUNDATIONS**					**Periods: 12**			
Introduction to Basic Systems Concepts-Elements of System- Characteristics of System-Types of Systems- System Approach to Problem Solving - Information Systems: Definition and Characteristics-Types of Information Role of Information in Decision Making.									**CO1:**
UNIT-II	**DECISION MAKING**					**Periods: 12**			
Simon's Model of Decision Making- Concepts of Management Organization and Hierarchy of Management Activity- Structured Vs Unstructured Decisions- Formal Vs Informal Systems- Levels of Management - Kinds of Information Systems.									**CO2:**
UNIT-III	**MANAGEMENT INFORMATION SYSTEM**					**Periods: 12**			
Definition and Characteristics- History of MIS Components of MIS-Frame Work for Understanding MIS-Hardware Support for MIS- Structure of Management Information System.									**CO3:**
UNIT-IV	**DEVELOPING INFORMATION SYSTEMS**					**Periods: 12**			
Analysis and Design of Information Systems: Evaluation- Pitfalls in MIS Development. Functional MIS: A Study of Marketing- Personnel- Financial and Production MIS.									**CO4:**
UNIT-V	**SECURITY AND ETHICAL ISSUES**					**Periods: 12**			
Introduction- Control Issues in Management Information Systems- Security Hazards- Ethical Issues-Technical Solutions for Privacy Protection									**CO5**:
Lecture Periods: 45	**Tutorial Periods: 15**		**Practical Periods: -**				**Total Periods: 60**		

Reference Books:

1. C. Laudon Kenneth, P. Laudon Jane, "Management Information System", Pearson Education; 5th edition, 2018.
2. James A. O'Brien, George M. Marakas, Ramesh Behl, "Management Information Systems", McGraw Hill Education, 10thedition, 2017.
3. Parminder Kaur Seema Gupta, "Principles of Management Information System", Mewar University Press; 1stedition, 2015.

Department :**Information Technology**		Programme: **B. Tech. (IT)-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
ITM05	**IoT and Python Programming**	3	1	-	4	40	60	100
Prerequisite								

Course Outcome	**CO1**	Able to understand the basics of Internet of Things and get an idea of some of the application areas where Internet of Things can be applied
	CO2	Able to understand the need for Protocol standardization and IOT protocols
	CO3	Able to understand the concept of Cloud of Things with emphasis on web of things
	CO4	Able to read and write simple Python programs.
	CO5	Able to represent compound data using Python lists, tuples, dictionaries.

UNIT-I	**Introduction to IoT**	**Periods: 12**
Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security.		**CO1**
UNIT-II	**IoT Protocols and Applications**	**Periods: 12**
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture Applications - Smart Grid – Electrical Vehicle Charging		**CO2**
UNIT-III	**Web of things**	**Periods: 12**
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems - The Cloud of Things Architecture		**CO3**
UNIT-IV	**Introduction to Python**	**Periods: 12**
Data types- variables, expressions, statements, tuple assignment, precedence of operators- Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.		**CO4**
UNIT-V	**Advanced constructs**	**Periods: 12**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages;		**CO5**

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

Reference Books:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012
2. Dieter Uckelmann, Mark Harrison, " Architecting the Internet of Things", Florian Michahelles- (Eds.) – Springer – 2011
3. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013

Open Elective Courses

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Third**			Course Category Code: **OEC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITO01	**Business Process**		3	-	-	3	40	60	100
Prerequisite	**-**								
Course Outcome	**CO1**	Know about Business Process Basics							
	CO2	Learn about Business Process Platforms							
	CO3	Analyse about Process Modelling							
	CO4	Know about Business Process Tools							
	CO5	Know about Life Cycle of Business Process							
UNIT-I	**INTRODUCTION**					**Periods: 9**			
Introduction – Definition of Business Process- Need and Importance of Business Process – Examples of Business Process - Business Process Excellence.									**CO1**
UNIT-II	**BUSINESS PROCESS PLATFORMS**					**Periods: 9**			
Business Process Platforms – Specification and Modeling of Business Process – Integration of Business and Production Process – Integration of Business Process and Business Intelligence.									**CO2**
UNIT-III	**PROCESS MODELING**					**Periods: 9**			
Global View of Business Process – Local View of Business Process – Business Process Modelling – Events in Business Process Modeling – Semantics of Events.									**CO3**
UNIT-IV	**BUSINESS PROCESS TOOLS**					**Periods: 9**			
Decomposing Business Process – Motivation – Seamless Business Process – Business Process Specification – Tools for Process Specifications.									**CO4**
UNIT-V	**LIFE CYCLE OF BUSINESS PROCESS**					**Periods: 9**			
Life cycle of Business Process –– Classification of Business Process - Workflow Management – Business Process Management –Definition – Application- Life Cycle of Business Process Management.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books:

1. Dumas, M., La Rosa, M., Mendling, J., Reijers, "Fundamentals of Business Process", 2018.
2. Stiehl, Volker, "Process-Driven Applications with BPMN", 2014.
3. Brocke and Rosemann, Handbook on Business Process management 2 Strategic Alignment, Governance, People and Culture, Springer, 2012.

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Fourth**			Course Category Code: **OEC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITO02	**Object Oriented Software Engineering**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	To learn about Object oriented life cycle management							
	CO2	To compare various object oriented software engineering approaches							
	CO3	To learn how to use UML to represent static and dynamic aspects of a system							
	CO4	To learn the various approaches for Object oriented analysis							
	CO5	To learn the various approaches for object oriented design							

UNIT-I	**-**	**Periods: 9**	
Design Objects, Class Hierarchy, inheritance, polymorphism, object relationships and associations, aggregations and object containment, object persistence, meta -classes, Object-oriented systems development life cycle, Software development process object oriented systems development: a use-case driven approach.			**CO1**
UNIT-II		**Periods: 9**	
Object modeling techniques as software engineering methodology, Rumbaugh methodology, Jacobson methodology, Booch methodology, patterns, frameworks, the unified modeling language (UML).			**CO2**
UNIT-III	**Unified Modelling Language**	**Periods: 9**	
Class Diagrams- Sequence Diagrams- Object Diagrams- Deployment diagrams- Use Case Diagrams- State Diagrams- Activity Diagrams-Component Diagrams			**CO3**
UNIT-IV	**Object oriented Analysis**	**Periods: 9**	
Analysis Process, Use-Case Driven Object Oriented Analysis, Use-Case Model, Object Classification, Theory, Different Approaches for identifying classes, classes, responsibilities and Collaborators, identifying Object Relationships, attributes and Methods, super-sub Class Relationships, apart of Relationships-Aggregation , Class Responsibilities , Object Responsibilities.			**CO4**
UNIT-V	**Object Oriented Design**	**Periods: 9**	
Object Oriented design process, corollaries, design axioms, design patterns, object oriented design philosophy, UML Object Constraint Language, Designing Classes : The Process, Class Visibility, Refining Attributes, Designing Methods and Protocols, Packages and Managing classes, Designing interface objects, View layer interface design, Macro and Micro level interface design process.			**CO5**

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

Reference Books:

1. Bernd Bruegge& Allen H. Dutoit , Object-Oriented Software Engineering Using UML, Patterns, and Java™ Prentice Hall, Third Edition,2008.
2. Ali Bahrami , Object Oriented System Development,Tata McGraw-Hill Education Pvt. Ltd.2008.
3. Seidl, M., Scholz, M., Huemer, C., Kappel, G, UML @ Classroom An Introduction to Object-Oriented Modeling, Springer Publications, 2012.

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Fifth**			Course Category Code: **OEC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITO03	**Introduction to Operating Systems**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Able to grasp fundamentals of operating systems and to understand fundamental operating system abstractions such as processes, threads and IPC							
	CO2	Understand the concept of process scheduling, synchronization and system deadlock handling							
	CO3	Understand the role of OS as resource manager to support virtual memory concept and functions							
	CO4	Understand basic file and I/O management techniques.							
	CO5	Understand mass storage management and system security issues							
UNIT-I	**Introduction**					**Periods: 8**			
Introduction to operating systems – review of computer organization – operating system structures – system calls–system programs–system structure–virtual machines Processes: Process concept –Process scheduling– Operations on processes –Cooperating processes– Inter-process communication–Communication in client-server systems – Concept of threads									**CO1**
UNIT-II	**Processor Management**					**Periods: 10**			
CPU Scheduling: Scheduling criteria – Scheduling algorithms Process Synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance–Deadlock detection–Recovery from deadlock									**CO2**
UNIT-III	**Memory Management**					**Periods: 10**			
Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging Virtual Memory: Background – Demand paging – Process creation – Page replacement–Allocation of frames–Thrashing									**CO3**
UNIT-IV	**File and I/O Management**					**Periods: 9**			
File-System Interface: File concept – Access methods – Directory structure – File system mounting – Protection File-System Implementation: Directory implementation – Allocation methods – Free-space management – Efficiency and performance–Recovery–Log-structured file systems I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem – streams– performance									**CO4**
UNIT-V	**Storage Management and Security**					**Periods: 8**			
MassStorageStructure:Diskscheduling–Diskmanagement–Swap-spacemanagement–RAID–Diskattachment– Stable storage–Tertiary storage - System Protection and Security									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Ninth Edition, John Wiley & Sons(ASIA) Pvt. Ltd, 2012.
2. D. M. Dhamdhere, “Operating Systems: A concepts based approach”, Second Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.
3. Harvey M. Deital, “Operating Systems”, Third Edition, Pearson Education, 2004
4. Andrew S. Tannenbaum and Herbert Bos, Modern Operating Systems, Fourth Edition, Prentice Hall, 2014.

Department: **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Sixth**			Course Category Code: **OEC**			Semester Exam Type: **TY**			
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITO04	**Introduction to Database**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Know the Concepts of Database Management System							
	CO2	Design ER Model for Real Time projects							
	CO3	Specify Query with Constraints							
	CO4	Specify Nested Queries							
	CO5	Know about Transactions Concepts							
UNIT-I	**Introduction to Databases and Transactions**					**Periods: 9**			
Introduction to Database Systems: Overview – Data Models- Database System Architecture- Storage Management- Transaction Management- History of Database Systems. Introduction to Relational Model									**CO1**
UNIT-II	**Entity- Relationship Model**					**Periods: 9**			
Basic Concepts – Constraints – Keys – Design Issues – Entity Relationship Diagram –Entity Sets – Design of E-RDatabase Schema. Case study: ER Modelling									**CO2**
UNIT-III	**SQL**					**Periods: 9**			
Introduction to SQL - SQL Data-Definition language – Basic Query Structure-Create Table Command – Integrity Constraints- Set Operations.									**CO3**
UNIT-IV	**SQL**					**Periods: 9**			
Aggregate Functions – Null Values – Nested Sub-Queries – Views –Modification of Database –Joined Relations - Data-Definition Language.									**CO4**
UNIT-V	**Transaction Management and Concurrency**					**Periods: 9**			
Transaction Management: ACID Properties- Serializability and Concurrency Control: Lock-Based Protocols. Recovery System: Failure Classification – Storage Structure – Recovery and Atomicity.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			
Reference Books									
1. Avi Silberschatz, Henry F. Korth, S. Sudarshan "Database System Concepts", 7th Edition, March 5, 2019.									
2. C.J. Date, "An Introduction to Database Systems", 8thEdition,Jun 24, 2019									
3. Hugh Darwen, "Introduction to Relational Database Theory", 3rd edition, 2012.									

Department : **Information Technology**			Programme: **B. Tech. (IT)**						
Semester : **Seventh**			Course Category Code: **OEC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
ITO05	**Web Engineering**		3	-	-	3	40	60	100
Prerequisite	-								
Course Outcome	**CO1**	Able to apply the characteristics of web applications and acquire the knowledge of requirements engineering							
	CO2	Model architectures for web applications							
	CO3	Apply appropriate web design for applications							
	CO4	Understand the concept of testing web applications							
	CO5	Develop and manage web-based projects							
UNIT-I	**Introduction**					**Periods: 9**			
Introduction to Web Engineering and Requirements Engineering, Motivation, Categories of Web Applications, Characteristics of Web Applications, Evolution of web engineering – Requirements Engineering Activities, RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types									**CO1**
UNIT-II	**Web Application Architectures**					**Periods:9**			
Categorization of Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, Architectures for Web Document Management, Architectures for Multimedia Data Modelling Specifics in Web Engineering, Modelling Requirements, Hypertext Modelling, Relation to Hypertext Modelling, Customization Modelling									**CO2**
UNIT-III	**Web Application Design**					**Periods: 9**			
Web Design, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Inter action Design, Navigation Design, Designing Link Internals, Navigation and Orientation, Functional Design									**CO3**
UNIT-IV	**Testing Web Applications**					**Periods:9**			
Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Applying the Scheme to Web Applications, Test Methods and Techniques, Testing Security, Test-driven Development, Test Automation, Benefits and Drawbacks of Automated Test, Test Tools									**CO4**
UNIT-V	**Web Project Management**					**Periods:9**			
Understanding Scope, Refining Framework Activities, Building a Web Team, Managing Risks, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JavaScript – web sockets									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		

Reference Books:

1. GertiKappel, Birgit Proll, “Web Engineering”, John Wiley and Sons Ltd, 2006.
2. Roger S. Pressman, David Lowe, “Web Engineering: A Practitioner's Approach”, McGraw-Hill, 2009.
3. Guy W. Lecky-Thompson, “Web Programming”, Cengage Learning, 2008.
4. Chris Bates, “Web Programming: Building Internet Applications”, Third Edition, Wiley India Edition, 2007.
5. http://www.csun.edu