Curriculum for B.Tech. in Information Technology

(Applicable from the academic session 2024-2025)

Department of Information Technology

Government College of Engineering & Ceramic Technology

(An Autonomous Institution under MAKUT)

73, A.C Banerjee Lane

Kolkata-700010

Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

UG COURSE STRUCTURE

1st SEMESTER							
Mandatory Induction Program- 3 Weeks duration							
SL. NO.	**TYPE OF COURSE**	**COURSE CODE**	**COURSE TITLE**	**HOURS PER WEEK**			**Credit**
				Lecture	**Tutorial**	**Practical**	
THEORY							
01	Basic Science course	BS(CS/IT) 101	Mathematics – I	3	0	0	3
02	Basic Science course	BS(CS/IT) 102	Physics	3	0	0	3
03	Engineering Science Course	ES(CS/IT) 101	Basic Electrical Engineering	3	0	0	3
04	Humanities & Social Sciences	HS(CS/IT) 101	English	2	0	0	2
SESSIONAL/PRACTICAL							
01	Basic Science course	BSL(CS/IT) 103	Physics Laboratory	0	0	2	1
02	Engineering Science Course	ESL(CS/IT) 102	Basic Electrical Engineering Laboratory	0	0	2	1
03	Engineering Science Course	ESL(CS/IT) 103	Engineering Graphics & Design	1	0	2	2
04	Humanities & Social Sciences	HSL(CS/IT) 102	English Communication Lab.	0	0	2	1
TOTAL				**12**	**0**	**8**	**16**

2nd SEMESTER							
SL. NO.	**TYPE OF COURSE**	**COURSE CODE**	**COURSE TITLE**	**HOURS PER WEEK**			**Credit**
				Lecture	**Tutorial**	**Practical**	
THEORY							
01	Basic Science course	BS(CS/IT) 204	Mathematics – II	3	0	0	3
02	Basic Science course	BS(CS/IT) 205	Chemistry	3	0	0	3
03	Engineering Science Course	ES(CS/IT) 204	Programming for Problem solving	3	0	0	3
04	Engineering Science Course	ES(CS/IT) 205	Analog and Digital Electronics	3	0	0	3
05	Humanities & Social Sciences including Management	HS(CS/IT) 203	Universal Human Values	2	0	0	2
SESSIONAL/PRACTICAL							
01	Basic Science course	BSL(CS/IT) 206	Chemistry Laboratory	0	0	3	1.5
02	Engineering Science Course	ESL(CS/IT) 206	Programming for Problem solving Laboratory	0	0	3	1.5
03	Engineering Science Course	ESL(CS/IT) 207	Workshop /Manufacturing Practices	1	0	2	2
04	Engineering Science Course	ESL(CS/IT) 208	Electronics Lab.	0	0	3	1.5
05	Humanities & Social Sciences including Management	HSL(CS/IT) 204	Design -Thinking Lab.	0	0	2	1
06	Community Service	ECA(CS/IT) 201	NSS				1
TOTAL				**15**	**0**	**13**	**22.5**

2 to 4 weeks training/internship in summer to be evaluated in 3rd Semester

3rd SEMESTER							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRs./WEEK	CREDIT
THEORY							
01	BS(IT)307	Mathematics- III	3	0	0	3	3
02	ES(IT) 309	Communication Engineering	3	0	0	3	3
03	PC(IT)301	Computer Organization	3	1	0	4	4
04	PC(IT)302	Data structure & Algorithms	3	1	0	4	4
05	HS(IT)305	Economics for Engineers	3	0	0	3	3
06	BS(IT)308	Environmental Sciences	2	0	0	2	2
SESSIONAL/PRACTICAL							
01	PCL(IT)303	Computer Organization Lab	0	0	3	3	1.5
02	PCL(IT)304	Data structure & Algorithms Lab	0	0	3	3	1.5
03	PCL(IT)305	IT Workshop	0	0	3	3	1.5
04	ESL(IT)310	Communication Engineering Lab.					
05	TRN(IT)301	Summer Internship 1	0	0	0	0	1
TOTAL			**17**	**2**	**12**	**31**	**24.5**

4th SEMESTER							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRs./WEEK	CREDIT
THEORY							
01	BS(IT)409	Discrete Mathematics	3	0	0	3	3
02	PC(IT)406	Design & Analysis of Algorithm	3	1	0	4	4
03	PC(IT)407	Formal Language and Automata Theory	3	1	0	4	4
04	PC(IT)408	Computer Architecture	3	1	0	4	4
05	ES(IT)411	Biology for Engineers	3	0	0	3	3
06	HS (IT)406	Constitution of India	2	0	0	2	2
SESSIONAL/PRACTICAL							
01	PCL(IT)409	Algorithm Lab	0	0	3	3	1.5
02	PCL(IT)410	Programming Lab using C++	0	0	3	3	1.5
04	PROJ(IT)401	Project 1 (part1)	0	0	2	2	1
TOTAL			**17**	**3**	**11**	**31**	**25.5**

2 to 4 weeks training/internship in summer to be evaluated in 5th Semester)

5th SEMESTER							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRs./WEEK	CREDIT
THEORY							
01	PC(IT)511	Operating Systems	3	1	0	4	4
02	PC(IT)512	Database Management System	3	1	0	4	4
03	PC(IT)513	Object Oriented Programming	3	1	0	4	4
04	PC(IT)514	Artificial Intelligence	3	0	0	3	3
05	OEC(IT)501	Open Elective-1	3	0	0	3	3
SESSIONAL/PRACTICAL							
01	PCL(IT)515	Operating System Lab	0	0	3	3	1.5
02	PCL(IT)516	Database Management System Lab	0	0	3	3	1.5
03	PCL(IT)517	Programming Lab using Java	0	0	3	3	1.5
04	OECL(IT)502 (A/B/C/D)	Open Elective-I Lab.	0	0	2	2	1
05	PROJ(IT)502	Project 1 (part 2)	0	0	2	2	1
06	TRN(IT)502	Summer Internship 2	0	0	0	0	1
TOTAL			**18**	**3**	**11**	**32**	**25.5**

6th SEMESTER							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRs./WEEK	CREDIT
THEORY							
01	PC(IT)618	Computer Networks	3	1	0	4	4
02	PC(IT)619	Compiler Design	3	0	0	3	3
03	PC(IT)620	Software Engineering	3	0	0	3	3
04	PC(IT)621	Introduction to Cyber Security	3	0	0	3	3
05	PEC(IT)601	Elective-I	3	0	0	3	3
06	OEC(IT)603	Open Elective-II	3	0	0	3	3
SESSIONAL/PRACTICAL							
01	PCL(IT)622	Computer Network lab	0	0	3	3	1.5
02	PCL(IT)623	Software Engineering Lab.	0	0	3	3	1.5
03	PECL(IT)602 (A/B/C/D)	Elective-I Lab.	0	0	2	2	1
04	PROJ(IT)603	Project 1 (part 3)	0	0	4	4	2
TOTAL			**20**	**1**	**10**	**31**	**25**

Industrial training (4 to 6 weeks training in summer to be evaluated in 7th Semester)

7th SEMESTER							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRs./WEEK	CREDIT
THEORY							
01	PEC(IT)703	Elective-II	3	0	0	3	3
02	PEC(IT)704	Elective-III	3	0	0	3	3
03	OEC(IT)704	Elective-IV	3	0	0	3	3
04	OEC(IT)705	Open Elective-III	3	0	0	3	3
05	HS(IT)707	Industrial Management	3	0	0	3	3
SESSIONAL/PRACTICAL							
01	PROJ(IT)704	Project 2/ Internship / Industrial Project	0	0	6	6	3
02	TRN(IT)703	Industrial Training	0	0	0	0	2
TOTAL			**15**	**0**	**10**	**25**	**20**

8th SEMESTER							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRs./WEEK	CREDIT
THEORY							
SESSIONAL/PRACTICAL							
01	PROJ(IT)805	Project 3/ Internship / Industrial Project	0	0	10	10	5
02	CVV(IT)801	Comprehensive Viva Voce	0	0	0	0	2
TOTAL			**0**	**0**	**10**	**10**	**7**

Name of the course		**MATHEMATICS-III**	
Course Code: BS(IT) 307		**Semester: 3rd**	
Duration: 6 month		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3hrs/week		Mid Term 1 Exam: 15 Marks	
Tutorial: 0hrs/week		Mid Term 2 Exam: 15 Marks	
Practical: 0 hrs/week		Other Assessment tools (Assignment, Quiz etc.): 20 Marks	
Credit Points: 3		End Semester Exam: 100 Marks (50% weightage for final reckoning i.e., 50 mark)	
Objective:			
1.	To understand the use of periodic signals and Fourier series to analyze circuits.		
2.	To understand gradient,divergence and curl using the calculus and multiple variable.		
3.	To understand Green,Gauss and stokes theorem using integral of a function.		
4.	To learn analytical technique for finding solution of higher order differential equation.		
5.	To create mathematical models using first order differential equation.		
6.	To understand basic concept of graph theory.		
Pre-Requisite			
1.	Mathematics –I (BS(CS/IT)101		
2.	Engineering Mathematics (UG level)		
Module	**Content**	**Hrs.**	**Marks**
1	**Module 1: Fourier series & Fourier transforms** Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2 and arbitrary period. Half range Fourier series. Fourier transforms properties, Sine & Co-Sine Fourier transforms, convolution, inverses and Parseval's Identity.	8	
2	**Module 2:Multivariable Calculus (Differentiation)** Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems.	7	
3	**Module 3: Multivariable Calculus (Integration)** Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar).Theorems of Green, Gauss and Stokes (Statement only) and related problems.	8	
4	**Module 4: Ordinary Differential Equation** Review of first Order Differential Equation, Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation.	7	
5	**Module 5: Graph Theory** Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, Kruskal and Prim's algorithm for finding the minimal spanning tree.	6	
Course outcomes			
After completion of the course, a student would be able to:			

CO 1	Understand the concept of limits, continuity and differentiability of functions of several variables. Analytical definition of partial derivative. Maxima and minima of functions of several variables Define gradient, divergence and curl of scalar and vector functions.
CO 2	evaluate multiple integrals and apply the techniques to different physical problems.
CO 3	solve first and second order ordinary differential equations by applying different techniques and also will be able to formulate differential equations for model systems and problems of engineering sciences.
CO 4	apply the basic concepts of graph theory to network analysis, data analytics and many other branches of computer science.
CO 5	analyze circuits using periodic signals and Fourier series.
Learning Resources:	
1.	S.K Mapa, Real Analysis,Sarat
2.	Charles H.C. Little, Kee L. Teo, Bruce van Brunt,Real analysis via sequence and series,Springer
3.	Douglas Brent West, Introduction to Graph Theory, Prentice Hall.
4.	Robert wrede,Murray Spiegel,Schaum's Outline of Advanced Calculus, Third Edition,Schaum's outline
5.	S.L. Ross, Differential equation,Willey.
6.	Clark John, Holton Derek Allan, A First Look at Graph Theory, World Scientific.

Name of the course:	**Communication Engineering**		
Course Code: ES(IT)309	Semester: 3rd		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme	Examination Scheme		
Theory Contact Hrs.: 3 hrs./week	Mid Semester-1 Exam: 15 Marks		
Tutorial Contact Hrs.:	Mid Semester-2 Exam: 15 Marks		
Credit Point: 3	Assignment, Quiz & class attendance: 20 Marks		
	End Semester Exam: 100 Marks (to be mapped into 50 marks)		
Objective:			
1.	To study Amplitude Modulation and Frequency modulation techniques		
2.	To study pulse modulation techniques and line codes.		
3.	To study different shift keying techniques		
4.	To study different aspects of satellite communication		
Pre-Requisite			
1.			
Module	**Content**	**Hrs.**	**Marks**
1.	Introduction to Communication Engineering, need of Modulation ,Amplitude Modulation(AM): Concept of AM, Calculation of Modulation Index, Total transmitted power of AM, DSB-SC modulation & SSB-SC modulation techniques, calculation of Bandwidth and Savings of power ,Demodulation of AM, Superheterodyne receiver	10	
2.	Frequency Modulation(FM): Concept of FM, Direct & Indirect Method, Bandwidth calculation of FM, Demodulation of FM. Phase Modulation(PM) : Concept of PM ,	05	

	generation of PM from FM		
3.	Pulse & Digital Communication: Sampling Theorem, aliasing effect, natural and flat top sampling, PAM, PWM,PPM, basic concept of Pulse Code Modulation (PCM) , concept of quantization and quantization error, Companding, DPCM, Delta Modulation and Adaptive Delta Modulation, signal to quantisation noise ratio in PCM system. ASK, FSK, PSK, QPSK	1	
4.	Data Formatting: NRZ-Unipolar, NRZ-polar, NRZ-Bipolar, RZ-Bipolar, Manchester Coding Synchronous and Asynchronous Data Transmission .	03	
5.	Fundamental concepts of wireless communication, networks, types, advantages, challenges and spectrum used. Introduction to cellular concept Understand frequency reuse, handoff strategies, and capacity improvement techniques in cellular networks & its architecture.	08	
Course Outcome: After completion of this course the students will be able to -			
CO1	Explain the necessity of modulation and how to transfer information from one place to another place using Amplitude Modulation, Frequency modulation and Phase modulation.		
CO2	Apply the concept of sampling for analog to digital signal conversion.		
CO3	Compare various techniques for digital communication techniques.		
CO4	Compare different line coding techniques.		
CO5	Understand fundamental Concepts about wireless & cellular communications.		
CO6	Evaluate cellular System design.		
Learning Resources:			
1.	Modern Digital and Analog Communication Systems by B.P. Lathi, Published by Oxford University Press.		
2.	An Introduction to Analog and Digital Communications by Simon Haykin (Wiley India)		
3.	Principles of Communication Engineering by Taub H. & Shilling D.L.- TMH		
4.	Introduction to Digital and Data Communication – Michael A. Miller, Jaico Publishing House		
5.	Communication Systems by A. B. Carlson, Published by McGraw-Hil		
6.	Principles and Analog and Digital Communication by Jerry D Gibson, Published by MacMillan.		
7.	Communication Systems (Analog and Digital) by Sanjay Sharma, Published by S.K.Kataria & Sons		

Name of the course	**COMPUTER ORGANIZATION**
Course Code:	PC(IT)301
Semester	3rd
Duration:	6 months
Maximum Marks	100

Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester 1 Exam: 15 Marks
Tutorial: 1 hrs/week	Mid Semester 2 Exam: 15 Marks
Practical: 0 hrs/week	Assignment, Quiz, flip teaching, Term paper: 20 Marks
Credit Points: 4	End Semester Exam: 50 Marks (100 marks converted to 50)

Objective:

1. To identify different processor architectures and their performance measurement parameters.
2. To develop the concept of instruction set of a processor.
3. To develop the concept of memory hierarchy
4. To develop the concept of I/O architecture like bus configuration, DMA, RAID
5. To design simple pipeline architecture

Prerequisite: Digital Electronics

Module	**Content**	**Lecture Hours**
1	Introduction: History of computing, von Neumann machine, Instruction and data, fixed-point and floating point numbers, errors, IEEE standards	3
2	Processor design: Instruction Set Architecture-Instruction format, opcode optimization; operand addressing; Instruction implementation-data movement, branch control, logical, Input/output and debugging instructions; arithmetic instruction implementation–addition and subtraction, multiplication-division, 2’s complement multiplication; Booth’s algorithm–theory and examples; bitpair algorithm; high performance arithmetic	9
3	Control unit design: Hardwired control, micro-programmed control design – micro-instruction formats, problem solving on control optimization	3
4	Memory subsystem: Registers, Memory hierarchy, memory interfacing, virtual memory, cache memory, memory replacement techniques, address mapping, content addressable memory (CAM), memory interleaving, real life problem solution	9
5	Peripherals: Basic properties, bus architectures, control and arbitration, interfacing of I/O devices, data transfer schemes –programmed I/O, memory mapped I/O, I/0 mapped I/O, DMA, mass storage, RAID	7
6	Pipelining: Pipelining, data path and instructions, speed up, CPI, latency; linear / non-linear pipeline–reservation table, MAL; super-pipelined and super-scalar processors,	6

	concept of memory parallelism	
Course Outcomes: After completion of the course the learners will be able to		
CO1	Analyse fixed-point and floating-point systems number representation	
CO2	Apply machine's instruction set architecture (ISA) including basic instruction fetch and execute cycles, instruction formats, control flow, and operand addressing modes	
CO3	Analyze the design and functioning of a machine's central processing unit (CPU), the data path components (ALU, register file) and the control unit.	
CO4	Design memory organization systems and compare in terms of efficiency	
CO5	Analyse basic input/output functioning including program controlled I/O and interrupt I/O	
CO6	Compare and contrast performance improvement of system using instruction and memory level parallelism	
Learning Resources:		
1	Mano, M.M., "Computer System Architecture", PHI.	
2	Hayes J. P., Computer Architecture & Organisation, McGraw Hill	
3	Hamacher, Computer Organisation, McGraw Hill,	
4	Behrooz Parhami" Computer Architecture", Oxford University Press	
5	Tanenbaum, "Computer System Architecture", PHI.	
6	Stalling "Computer Organization & Architecture, 11e", Pearson	
7	Wang "Computer Architecture and Organization: Fundamentals and Architecture Security", PHI	
8	Computer architecture and parallel processing; Kai Hwang &Faye A. Briggs, McGraw Hill	

Name of the course	**DATA STRUCTURE AND ALGORITHM**
Course Code: PC(IT)302	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Term Exam I: 15 Marks
Tutorial: 1 hr./week	Mid Term Exam II: 15 Marks
Practical: NIl	Assignment.: 20 Marks
Credit Points: 4	Semester End Exam: 100 Marks (50% s weightage for final reckoning i.e., 50 marks)

Objective:			
1.	To Understand basic data structures such as arrays, linked lists and trees.		
2.	To Calculate the time complexities of accessing various data structures.		
3.	The ability to decide based on a given problem which data structure is appropriate.		
Pre-Requisite:			
1.	Programming for problem solving (ES(CS/IT) 204)		
Module	**Content**	**Lecture Hours**	
1	Introduction :Elementary Data Organizations, Data Structure Operations - insertion, deletion and traversal in arrays, asymptotic Notations, Time-Space trade off, recursion, tail recursion, Tower of Hanoi, recursion tree and master theorem method of complexity analysis, Linear Search and Binary Search Techniques and their complexity analysis, finding min max in O(3n/2) time.	10	
2	Stacks and Queues: ADT Stack and its operations; Algorithms and their complexity analysis, Applications of Stacks - Expression Conversion and evaluation – corresponding algorithms and complexity analysis; ADT queue and types of Queue- Simple Queue, Circular Queue, Operations on each type of Queue- Algorithms and their analysis.	8	
3	Linked List: Singly linked lists, Representation in memory, Algorithms of several operations -Traversing, Searching, Insertion into, Deletion from linked list; Linked List representation of Stack and Queue; Doubly linked list - operations, space and time analysis; Circular Linked Lists - all operations and complexity analysis; Floyd-Cycle finding algorithm.	8	
4	Trees: Basic Tree Terminologies, Different types of Trees - Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, binary heap, B-tree; operations on each of the trees and their algorithms with complexity analysis; Tree traversal algorithms - recursive and iterative. Catalan Number and its connection to binary trees and stack sortable permutations ;Comparison of performance of Heap, array and insertion priority queues.	10	
5	Hashing: Chaining, probing, Universal hashing function and analysis of various hashing methods.	4	
Course Outcomes: After completion of this course, the learners will be able to-			
CO1	Analyze computation complexity of various algorithms.		
CO 2	Apply stacks and queues to various problems.		
CO 3	Implement linked list data structure		
CO 4	Analyze complexities of non linear data structures.		
CO 5	Compare performances of various hashing techniques		
Learning Resources:			
1	**Horowitz, Sahni, Anderson-Freed:** *Fundamentals of Data Structures in C* **(Second Edition), Universities Press, 2008.**		
2	**T.H. Cormen, C.E. Leiserson, R. Rivest and C. Stein:** *Introduction to Algorithms*,**(Second/Third Edition), PHI**, **2009.**		

3	**R. Sedgewick:** *Algorithms in C***, Pearson, 2004.**
4	Steven S Skiena, Algorithm design manual, 2nd Edition, Springer.
5	Steven S Skiena, Miguel A. Revilla, Programming Challenges: The Programming Contest Training Manual (Texts in Computer Science) Springer.

Name of the course	**ECONOMICS FOR ENGINEERS**
Course Code: HS(IT)305	**Semester: 3RD**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Term Exam I: 15 Marks
Tutorial: Nil	Mid Term Exam II: 15 Marks
Practical: Nil	Assignment.: 20 Marks
Credit Points: 3	Semester End Exam: 100 Marks (50% weightage for final reckoning i.e., 50 marks)

Objective:

1.	To familiarize with the analysis of different economic alternatives using appropriate concepts and methods of Economics for Engineers.

Pre-Requisite

1.	Class 12th standard knowledge of Mathematics.

Module	Content	Hours	Marks
1	• Introduction to Economics for Engineers – Basic Introduction to Economics, Productive resources, Scarcity and the Economic problem, Circular flow in an Economy, Production Possibility Frontier, Types of business organisation, Demand and Supply, Efficiency and sustainability, Engineering & Economics, Scope of Economics for Engineers, Fundamental principles of Engineering Economics, Role of Engineers in Economic Decision making, Problems in Economic Decision-Making, Decision-Making Process. • Engineering Cost Concepts and Cost Estimation Techniques – Fixed, Variable, Marginal & Average costs, Semi-variable and Step cost, Product and Period cost, Direct and Indirect cost, Sunk cost, Shutdown cost, Opportunity cost, Explicit and Implicit cost, Out of pocket cost and Imputed cost, Recurring and Nonrecurring costs, Anticipated and Unanticipated costs, Differential or Incremental costs, Cash cost vs. Book costs, Life-Cycle Costing. Approaches to cost estimation, Types of Estimate, Cost Estimation Models - Per Unit Model, Segmenting Model, Cost Index Model, Power-Sizing Model, Learning Curve Model, Benefits and difficulties in estimation. • Break-even analysis- Basic concept, terminology and assumptions, Derivation of break-even point, Profit Volume (P/V) ratio, Margin of Safety, Uses and limitations of break-even analysis.	9	
2	• Cash Flow, Interest and Equivalence: Cash Flow – Diagrams and Cash Flow Statement, Time Value of Money, Real, Nominal & Effective Interest rate. Different Interest Formulae and their application.	4	

3	• Capital budgeting and Project selection – Basic concept of capital budgeting, Types of projects and cash flow patterns, features of a good capital budgeting criteria; Net Present Value (NPV) Analysis, NPV criteria for revenue dominated and cost dominated models, Internal Rate of Return (IRR) Analysis, Incremental Analysis, Comparison between NPV and IRR, Future Worth Analysis, Annual Worth Analysis, Payback period, Evaluation of Public Projects and Benefit-Cost Ratio Analysis, Sensitivity Analysis.	9	
4	• Uncertainty in Future Events - Uncertainty and Risk, Types of risk, Risk vs. Return, Application of Probability to analyse risk, Using Expected Value, Variance, and Coefficient of Variation to measure return and risk; Economic Decision Trees, Simulation, Real options analysis. • Inflation and Price Change – Definition, Effects, Causes and Stages of inflation, Price Change with Indexes, Types of Index, Tests of index numbers, Composite vs Commodity Indexes, Use of Price Indexes in Engineering Economic Analysis, Effect of inflation on project cash flows.	6	
5	• Depreciation and Replacement Analysis - Basic aspects of depreciation, Depreciation, depletion and amortization, Various methods of calculating depreciation; Replacement analysis – Basic aspects, Types of maintenance, Replacement Analysis Decision Map, Minimum Cost Life of a New Asset. • Introduction to Accounting – Basic concepts, scope, functions and limitations of Accounting, Financing business needs, Capital transactions, Cost accounting, Financial Statements, Financial Ratios, Uses and limitations of ratio analysis.	8	

Course outcomes	
After completion of the course, a student would be able to:	
CO 1	Analyse short term alternatives using basic principles of Economics, Cost estimation and Break even analysis.
CO 2	Examine the concept of Interest and Equivalence.
CO 3	Inspect the feasibility of projects using various methods like Net Present Worth, Future Worth, Internal rate of Return, Annual worth, Payback period, Benefit Cost Analysis and Sensitivity analysis.
CO 4	Identify the effects of risk, uncertainty and price change.
CO 5	Apply Depreciation, Replacement Analysis, Financial statements and Financial ratio analysis using appropriate methods in relevant problems.

Learning Resources:	
1.	R. Panneerselvam: Engineering Economics, PHI.
2.	H.L. Bhatia & S.N. Maheswari: Economics for Engineers, Second edition, Vikas Publishing House Pvt. Ltd.
3.	Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
4.	Sullivan and Wicks: Engineering Economy, Pearson
5.	Chan S. Park, Contemporary Engineering Economics, Pearson
6.	Partha Chatterjee: Economics for Engineers, Vrinda Publications.

7.	James L. Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill .
8.	Dr. Shantanu Chakraborty, Nilanjan Singha Roy: : Economics for Engineers, Lawpoint Publications.
9.	N.G. Das, Statistical Methods, Tata Mcgraw Hill.

Name of the course		**ENVIRONMENTAL SCIENCES**	
Course Code: BS(IT)308		Semester: 3rd	
Duration: 6 month		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 2hrs/week		Mid Semester-1 Exam: 15 Marks	
Tutorial: NIL		Mid Semester-2 Exam: 15 Marks	
Practical: NIL		Assignment, Quiz & class attendance: 20 Marks	
Credit Points: 2		End Semester Exam: 100 Marks (Fifty % weightage for final reckoning i.e., 50 marks)	
Objective:			
1.	To provide knowledge about Green computing and Green strategies		
2.	To learn about the various types of E waste and their composition ,their harmful effects on the environment .		
3.	To know about carbon footprint , quantification and measurement		
4	To get the idea about urban problems related to energy and to know about sustainable transportation.		
5	To learn various green technologies and their implimentations.		
Pre-Requisite			
Class 12 standard knowledge of physics, chemistry, biology, mathematics			
Module	Content	Hrs	Marks
1	. Green computing : Green IT Fundamentals, business ,IT and the environment ,Green IT strategies ; Drivers, Dimensions and Goals	6	
2	Green Assets and Modelling ; Buildings, Data Centres ,Networks and Devices , green enterprise architecture ,Environmental intelligence –green supply chains	6	
3	Carbon footprint : definition ,quantification, measurement .direct and indirect emissions, types , difference from Ecological Footprint .	5	
4	E waste : definition, global scenario ,growth of Electrical and Electronics industry in India E waste generation in India, environmental and health impact of E waste	6	
5	Social issues and the Environment (a) Urban problems related to energy (b) Water conservation, rain water harvesting, water shed management (c) Resettlement and rehabilitation of people; its problems and concerns, (d) Climate change, global warming, acid rain, ozone layer depletion, nuclear	7	

6	Green technologies ; a) renewable energy(solar, wind etc.), energy efficiency b)waste management (recycling, composting) c) sustainable transportation(electric vehicles, biofuels) d) green building design and pollution control e) green chemistry (carbon capture and storage) f) sustainable agriculture	6	

Course Outcome:	
After completion of the course the students will be able to-	
CO 1	Understand the environmental consequences of information technology and the importance of green computing
CO 2	Understand the components environmental and health impact of e waste
CO 3	Apply the strategies of ewaste management in real world scenarios .
CO 4	Analyse the environmental consequences of various technologies and industrial processes.
CO 5	Apply their knowledge in implementing policies that incentivize sustainable practices , regulate emissions and promote carbon offsetting initiatives.
Co6	apply their knowledge of various environment protection acts, "Environment Impact Assessment" (EIA) as and when required in setting up of new industries as well as expansion of industries in which they will be employed
Learning Resources:	
1	AnubhaKaushik, C.P. Kaushik, Perspectives in environmental studies, New Age International (P) Ltd, Publishers
2	ErachBharucha, Textbook for Environmental Studies, University Grants Commission
3	D. D. Mishra, Fundamental concepts in Environmental Studies, S Chand & Co Ltd
4	Anil Kumar De, Arnab Kumar De, Environment and Ecololgy, New age international (P) Limited, Publishers
5	Environmental Chemistry by Anil Kumar De, Wiley Eastern Limited
6	Linda D. Williams, Environmental Science demystified, McGRAW-HILL
7	ShashiChawla, A Textbook of Environmental Studies, Tata McGraw Hill Education Private Limited.

Name of the course	**Computer Organization Lab**
Course Code: PCL(IT)303	**Semester: 3rd**
Duration: 6 months	**Maximum marks:100**

Teaching Scheme	**Examination scheme:**
Theory: Nil	Attendance: 10 marks
Tutorial: Nil	Preparation of Lab Report: 30 marks
Practical: 3 hrs/week	Experimental data/ Precision of work done: 30 marks
Credit Points:1.5	Presentation / analysis of the result: 30 marks
	Viva voce: 20 marks

Module	**Content**
1.	Familiarization with IC chips: Multiplexer, Decoder, Priority Encoder, ROM, Comparator, Flip flop (Truth table verification and application)
2.	Design Adder, Subtractor using basic gates, Multiplexer and decoder
3.	Design Adder Subtractor composite unit
4.	Design BCD adder
5.	Design Carry look ahead adder circuit
6.	Design ALU(Arithmetic Logic Unit)
7.	Design of counter using Flip Flop
8.	Synthesize sequential circuits
9.	Execute Read and Write operation using RAM chip
10.	Cascading of RAM IC for vertical and horizontal expansion

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

CO1	Asses different Integrated circuits
CO2	Design combinational circuits
CO3	Design sequential circuits
CO4	Implement different real life applications of combinational and sequential circuits required for basic computer architecture.
CO5	Evaluate different applications for higher order design

Learning Resources:

1	Mano, M.M., "Computer System Architecture", PHI.
2	M. Lotia, Modern IC data and substitution Manual, PHI

Name of the course:	**Data Structure & Algorithm Lab**
Course Code: PCL(IT)304	**Semester: 3rd**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory:NIL	Attendance 10
Tutorial:NIL	Preparation of Lab Report: 30
Practical:3 hrs/week	Experimental data/Precision of work done: 30

Credit Point:1.5	Presentation/ analysis of the result: 10
	Viva Voce:20

Objective:

1.	To understand the working of basic data structures..
2.	To analyse the performance of various data structures
3.	To implement various data structures
4.	To understand the difference between linear and non-linear data structure

Pre-Requisite:

1.	

Module	Content	Hours	Marks
1	Application of array insertion, deletion and traversal operations in solving problems.	03	
2	Linear Search, Binary Search Techniques and time complexity comparison.	03	
3	Application of binary search like divide and conquer technique in various array related O (log n) problems.	03	
4	Implementation and applications of Stacks and queues using arrays.	03	
5	Implementation of Singly linked lists, Linked representation of Stack and Queue.	03	
6	Implementation of Binary Search Tree.	03	
7	Application of binary trees in solving various problems.	03	
8	Array implementation of binary heap.	03	
9	Comparison of performance of binary Heap and array as priority queues.	03	
10	Implementation of B-Tree.	03	
11	Implementation of Chaining and probing techniques of collision resolution in hashing.	03	

Course Outcomes:

After completion of this course, the learners will be able to -

CO1	**Implement** linear data structures.
CO2	**Analyze** data sets and problems.
CO3	**Implement** non-linear data structures.
CO4	**Compare** various searching techniques.
CO5	**decide** which data structure to implement based on the problem.

Learning Resources:

1.	**Horowitz, Sahni, Anderson-Freed:** ***Fundamentals of Data Structures in C*** **(Second Edition), Universities Press, 2008.**
2.	**T.H. Cormen, C.E. Leiserson, R. Rivest and C. Stein:** ***Introduction to Algorithms*****,(Second/Third Edition), PHI, 2009.**
3.	**R. Sedgewick:** ***Algorithms in C*****, Pearson, 2004.**
4.	Steven S Skiena, Algorithm design manual, 2nd Edition, Springer.

Name of the course:	**IT WORKSHOP**
Course Code: PCL(IT)305	**Semester: 3rd**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory Contact Hrs.:	Attendance : 10
Tutorial Contact Hrs.:	Preparation of Lab Report : 20
Practical: 3 hrs./week	Experimental data/ Precision of work done : 30
Credit Point: 1.5	Presentation/ analysis of the result : 20
	Viva Voce: 20

Objective:

1.	To implement Python programs using core Python programming concepts and functions
2.	To understand Object Oriented Python Programming techniques

Pre-Requisite:

1.	Basic Programming concept

Module	Content	Hours	Marks
1.	**Python Fundamentals** Python Character Set, Python Tokens, Basic structure of Python Program, Variables and assignments, Multiple Assignments, Dynamic Typing, Input and Output in Python, Data Types and Operators, Control Structure, Sequence Statements, Selection Statements, range() function , Iterative Statements, Jump Statements	6	10
2.	**Strings** Accessing Values in Strings, Traversing a String, String Operators, Built-In String Methods	3	10
3.	**Lists** Creating a List, Accessing Lists, Difference between String and List, Traversing a List, List Operations	3	10
4.	**Tuples** Tuple vs List, Creating a Tuple, Accessing Tuples, Traversing a Tuple, Comparing Tuples, Common Tuple Operators, Packing and Unpacking Tuples, Tuples Built-In Functions, Deleting a Tuple	3	10
5.	**Dictionary** Creating a Dictionary, Properties of Dictionary Keys, Traversing a Dictionary, Accessing Keys or Values Separately, Nested Dictionary, Adding Elements to Dictionary, Updating Elements in a Dictionary, Deleting Element from a Dictionary, Dictionary Built-In Methods	3	10
6.	**Introduction to Python Modules** Math Module, Random Module, Statistics Module	3	10
7.	**Functions** Scope, Parameter passing, Passing strings, Default parameters, Return values, Positional parameters	3	10

8.	**Object Oriented Programming(OOP) With Python** Basics of OOP, Class and Objects, Inheritance, Types of Inheritance	6	10
9.	**File Handling** Need for data file, Types of file :Text, Binary and Comma separated value files	3	10
10.	**Data Structures** Stacks : Push, Pop using a list, Queues : Insert, Delete using a list	3	10

Course Outcomes: After completion of this course the students will be able to -	
CO1	**Interpret** the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements
CO2	**Express** proficiency in the handling of strings and functions
CO3	**Identify** the commonly used operations involving file systems
CO4	**Apply** object oriented programming concepts
CO5	**Determine** the methods to create and manipulate Python programs by utilizing lists, tuples and dictionaries
Learning Resources:	
1.	https://www.anaconda.com
2.	Rakesh K. Yadav, Srinivas Arukonda, Monu Singh, Tapasya Dinkar, Dileep Kumar Yadav, Zero to Mastery in Python Programming, Vayu Education of India, ISBN: 9789389769364
3.	Pooja Sharma, Programming in Python, BPB Publications, ISBN: 9789386551276
4.	Reema Thareja, Python Programming- Using Problem Solving Approach, OUP India, ISBN: 9780199480173

Name of the course	**Communication Engineering Lab.**
Course Code: ESL(IT)310	**Semester: 3rd**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme, Total Marks: 100**
Theory: Nil	Attendance : 10
Tutorial: Nil	Preparation of Lab Report : 20
Practical: 3 hrs./week	Experimental data/ Precision of work done : 30
Credit Points: 1.5	Presentation/ analysis of the result : 20
	Viva Voce: 20

Module	**Content**	**Hours**	**Marks**
1.	Amplitude Modulation and Demodulation	03	
2.	Frequency modulation and Demodulation.	03	
3.	Generation and Detection of PAM	03	

4.	Generation and detection of PWM & PPM	06	
5.	Generation and detection of ASK	03	
6.	Generation and detection of FSK	03	
7.	Time Division Multiplexing & Demultiplexing	03	

Course Outcomes: After completion of this course the students will be able to -	
CO1	Compare the Amplitude modulated(AM) and Frequency modulated (FM) signals.
CO2	Measure the modulation index of amplitude modulated and frequency modulated signals.
CO3	Compare PAM, PWM and PPM signal.
CO4	Compare ASK and FSK signals with AM and FM signals.
CO5	Identify the multiplexed signals at the output of TDM system and the corresponding demultiplexed signals at the receiver end.
Learning Resources:	
1	Octave online https://octave-online.net/ the open-source alternative for simulation of the above experiments