G.H. Raisoni College of Engineering & Management, Wagholi, Pune – 412 207

(An Autonomous Institute Affiliated to SPPU, Pune)

Faculty of Engineering

Second Year B. Tech Computer Engineering

(Course 2017)

Course Book

(With effect from June 2017)

Autonomy Coordinator
(Mrs.B.Padmavathi)

Head of the Department
(Mrs. Poonam Gupta)

Department Information

The department of Computer Engineering was started in the year 2006 with Under graduate programme B. E. (computer Engineering) with intake 60 and increased to 120 in the year 2010. Postgraduate Programme M. E. Computer Engineering was started in the year 2010. In Academic Year 2016-17 we have got autonomy, and currently we have 120 intake for UG programme B. Tech (Computer Engineering) and 24 intake for M. Tech. (Computer Engineering). In the year 2013-14, our department has got permanent affiliation from SPPU for UG intake 60.

Department has all required infrastructure and resources such as well equipped, state of art laboratories, spacious classrooms, Seminar hall, well qualified and experienced faculty members most of them are perusing their PhD from various renowned universities. Our faculty members' expertise domains are Internet of Things, Vehicular Adhoc Networks, Network Security, Database, Wireless Sensor Networks, Image Processing and so on. Various activities such as Workshops, guest lectures, and seminars are conducted for students to make them aware about current trends of IT industry. Recently we have organized International conference SPCN-2017, last academic year National conference ACCNET was also organized. By now we have received Grant of Rs. 8, 71, 00 /- from SPPU. We ensure that our students should possess required skill set for better employability.

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VISION

To achieve excellent standards of quality education byKeeping pace with rapidly changing technologies. To create technical manpower of global standards withCapabilities of accepting new challenges.

MISSION

Our efforts will be dedicated to impart quality and Value based education to raise satisfaction level of all stake-holders. Our strength will be directed to create competent engineers. Our endeavor will be to provide all support to promote research & development activities

VISION

To produce global standard ethical professionals, innovators, and entrepreneurs having strong knowledge and urge to learn latest technologies in the field of computer engineering.

MISSION

The department continuously strives

- To pursue excellence in the area of Computer Engineering and develop students with strong foundations, able to adapt with rapidly changing technologies through effective Teaching- Learning Process.
- To develop competent professionals for global market with the spirit of self-study, team work, innovation and ethics among them.
- To promote continuous learning, entrepreneurial skills and research abilities amongst the students.

Program Educational Objectives

Our Graduates in Computer Engineering will be able to demonstrate:

- Ability to analyze, design and develop cost effective solutions to the real life problems by applying the acquired knowledge.
- Adoptability to learn latest technological advancement and interdisciplinary approaches by getting engaging in lifelong learning process.
- As a responsible team member with good Communication, presentation, inter personal, and leadership skills.
- Willingness to pursue higher studies, entrepreneurship and research in the field of computer engineering.
- Responsibility and awareness towards society, environment, being an ethical computer professional.

Program Specific Outcomes (PSOs)

At the end of the programme students will be able to demonstrate:

- The knowledge acquired in computer core courses such as operating system, database, computer network, computer organization and architecture, software engineering.
- The skills assimilated in latest programming languages , free open source software, web technologies, software designing and testing tools, advanced database systems and related technologies such as data mining, data warehousing
- The ability to analyze, design and develop software systems and prove oneself as responsible team member to groom as a competent professional with good Communication, presentation and interpersonal skills.
- Oneself as a global standard computer professional with good morals, ethics and sensitivity towards mankind.

Program Outcomes

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet t h e specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with t h e 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.
11. **Project management and finance**: Demonstrate knowledge and understanding of t h e 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.
12. **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.

Course Code

B. TECH. COMPUTER ENGINEERINGSECOND YEAR –SEMESTER-III

SR.NO	COURSE CODE	COURSE NAME	SEM	SCHEME	SUBJECT	ELECTIVE	OFFER
1	BEML204	Engineering Mathematics III	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
2	BCOL201	Data Structures	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
3	BCOP201	Data Structures	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes
4	BCOL202	Microprocessor Based Systems	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
5	BCOP202	Microprocessor Based Systems	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes
6	BCOL203	Computer Architecture& Organization	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
7	BITL201	Digital Electronics & Logic Design	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes

8	BITP201	Digital Electronics & Logic Design	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes
9	BCOP204	Hardware Maintenance and Trouble Shooting	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes
10	BCOGP205	GENERAL PROFICIENCY:- II : Foreign Language	III	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes

B. TECH. COMPUTER ENGINEERINGSECOND YEAR –SEMESTER-IV

SR.NO	COURSE CODE	COURSE NAME	SEM	SCHEME	SUBJECT	ELECTIVE	OFFER
1	BITL205	Graph Theory &Combinatorics	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
2	BCOL206	Operating system	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
3	BCOP206	Operating System	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes
4	BITL202	Object Oriented Programming	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
5	BITP202	Object Oriented Programming	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes
6	BITL206	Data Communication	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
7	BHUL201	Principles of Management	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Theory	No	Yes
8	BCOGP207	GENERAL PROFICIENCY-III : Hobby classes	IV	UG COMPUTER ENGINEERING 2017-18 [AUTONOMOUS]	Practical	No	Yes

Course Structure
SY B.Tech. (Sem III & IV)

DEPARTMENT OF COMPUTER ENGINEERING

Scheme of B.Tech (COMPUTER ENGINEERING)

*TAE will be based on Home Assignment, Seminar, Quiz, Surprise Test, Group Discussion, Debate, General Behavior, Attentiveness and Attendance

SEMESTER-III

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper (Hrs.)
							Theory			Practical		Total	
		Th.	Tu.	Pr.	Total		(TAE) (20)	(CAE) (20)	ESE (60)	Cont. Ass.	Ext.		
BEML204	Engineering Mathematics III	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BCOL201	Data Structures	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BCOP201	Data Structures	-	-	4	4	2	-	-	-	25	25	**50**	3
BCOL202	Microprocessor Based Systems	4	-	-	4	4	20	20	60	-	-	**100**	**3**
BCOP202	Microprocessor Based Systems	-	-	2	2	1	-	-	-	25	25	**50**	3
BCOL203	Computer Architecture & Organization	3	-	-	3	3	20	20	60	-	-	**100**	**3**
BITL201	Digital Electronics & Logic Design	3	-	-	3	3	20	20	60	-	-	**100**	**3**
BITP201	Digital Electronics & Logic Design	-	-	2	2	1	-	-	-	25	-	**25**	**-**
BCOP204	Hardware Maintenance and Trouble Shooting	-	-	2	2	1	**-**	**-**	**-**	25	-	**25**	**-**
BCOGP205	GENERAL PROFICIENCY-II : Foreign Language	1	**-**	**2**	3	Audit Course	**-**	**-**	**-**	**-**	**-**	**-**	-
	Total	**17**	**2**	**12**	**31**	**23**	**100**	**100**	**300**	**100**	**50**	**650**	

TAE – Teachers Assessment Evaluation
CAE – Class Assessment Examination
ESE – End Semester Examination
Cont. Ass – Continuous Assessment

Th - Theory
Tu – Tutorial
Pr – Practical
Ext – External

DEPARTMENT OF COMPUTER ENGINEERING

Scheme of B.Tech. (COMPUTER ENGINEERING)

*TAE will be based on Home Assignment, Seminar, Quiz, Surprise Test, Group Discussion, Debate, General Behaviour, Attentiveness and Attendance

SEMESTER-IV

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper (Hrs.)
							Theory			Practical		Total	
		Th.	Tu.	Pr.	Total		(TAE) (20)	(CAE) (20)	ESE (60)	Cont. Ass.	Ext.		
BITL205	Graph Theory &Combinatorics	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BCOL206	Operating system	4	-	-	4	4	20	20	60	-	-	**100**	**3**
BCOP206	Operating System	-	-	4	4	2	-	-	-	25	25	**50**	**3**
BITL202	Object Oriented Programming	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BITP202	Object Oriented Programming	-	-	4	4	2	-	-	-	25	25	**50**	**3**
BITL206	Data Communication	4	-	-	4	4	20	20	60	-	-	**100**	**3**
BHUL201	Principles of Management	3	-	-	3	3	20	20	60	-	-	**100**	**3**
BCOGP207	GENERAL PROFICIENCY-III: Hobby classes	1	-	2	3	Audit Course	-	-	-	-	-	-	-
	Total	**18**	**2**	**10**	**30**	**23**	**100**	**100**	**300**	**50**	**50**	**600**	

TAE – Teachers Assessment Examination

CAE – Class Assessment Examination

ESE – End Semester Examination

Cont. Ass – Continuous Assessment

Th - Theory

Tu – Tutorial

Pr – Practical

Ext - External

GROUP A				GROUP B		
S.No	**Subject Code**	**Subject Name**	**Credits**	**Subject Code**	**Subject Name**	**Credits**
1	BAML204	Applied Mathematics III	4	BAML204	Applied Mathematics III	4
2	BCOL203	Computer Architecture& Organization	3	BCOL203	Computer Architecture& Organization	3
3	BITL201 BITP201	Digital Electronics & Logic Design	4	BITL201 BITP201	Digital Electronics & Logic Design	4
4	BCOP204	Hardware Maintenance and Trouble Shooting	1	BCOP204	Hardware Maintenance and Trouble Shooting	1
5	BCOL201 BCOP201	Data Structures	6	BITL202 BITP202	Object Oriented Programming	6
6	BCOL202 BCOP202	Microprocessor Based Systems	5	BCOL206 BCOP206	Operating System	6
7	BCOGP205/ BCOGP207	GENERAL PROFICIENCY:II / III : Foreign Language/ Hobby classes	Audit Course	BCOGP205/ BCOGP207	GENERAL PROFICIENCY:II / III : Foreign Language/ Hobby classes	Audit Course
Total Credits			**23**	Total Credits		**24**

Course Syllabus

SY B.Tech. : SEM-III

DEPARTMENT OF COMPUTER ENGINEERING

Scheme of B.Tech (COMPUTER ENGINEERING)

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SEMESTER-III

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper (Hrs.)
							Theory			Practical		Total	
		Th.	Tu.	Pr.	Total		(TAE) (20)	(CAE) (20)	ESE (60)	Cont. Ass.	Ext.		
BEML204	Engineering Mathematics III	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BCOL201	Data Structures	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BCOP201	Data Structures	-	-	4	4	2	-	-	-	25	25	**50**	3
BCOL202	Microprocessor Based Systems	4	-	-	4	4	20	20	60	-	-	**100**	**3**
BCOP202	Microprocessor Based Systems	-	-	2	2	1	-	-	-	25	25	**50**	3
BCOL203	Computer Architecture& Organization	3	-	-	3	3	20	20	60	-	-	**100**	**3**
BITL201	Digital Electronics & Logic Design	3	-	-	3	3	20	20	60	-	-	**100**	**3**
BITP201	Digital Electronics & Logic Design	-	-	2	2	1	-	-	-	25	-	**25**	**3**
BCOP204	Hardware Maintenance and Trouble Shooting	-	-	2	2	1	**-**	**-**	**-**	25	-	**25**	**3**
BCOGP205	GENERAL PROFICIENCY-II : Foreign Language	1	**-**	2	3	Audit Course	**-**	**-**	**-**	**-**	**-**	**-**	-
	Total	**17**	**2**	**12**	**31**	**23**	**100**	**100**	**300**	**100**	**50**	**650**	

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G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BEML204: ENGINEERING MATHEMATICS III

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week TU:01 Hour/Week	04	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- --

Course Objectives:

After completing this course, student will have adequate mathematical background, conceptual Clarity,computational skills andalgorithm design for problem solving related to:

1. Linear differential equations of higher order applicable to Control systems, Computer vision and Robotics.
2. Transform techniques such as Fourier transform, Z-transform and applications to Image processing.
3. Statistical methods such as correlation, regression analysis and probability theory to analyze data and to make predictions applicable to machine intelligence.
4. Complex functions, conformal mappings and contour integration applicable to Image processing, Digital filters and Computer graphics

Course Outcomes:

On completion of the course, student will be able to–

1. Solve higher order linear differential equation using appropriate techniques for modelling and analyzing electrical circuits.
2. Solve problems related to Z-Transform and applications toSignal processing.
3. Solve problems on image processing using Fourier transform
4. Solve examples on statistical methods like correlation, regression analysis and probability theory for analysis.
5. Can use probability distribution effectively for solving problems.
6. Solve problems on analytic function and complex function within the given range of function.

Course Contents

Unit I	LinearDifferential Equations (LDE) andApplications	09 Hours
LDE of nth order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of Electrical circuits.		
Unit II	**Z-Transforms**	**08 Hours**
The Z transform- definition & properties, inverse & relation with Laplace Transform, Application to z transform to solve difference equations with constant coefficients.		
Unit III	**Fourier Series**	**07 Hours**
Periodic function & their Fourier expansion, even & odd function, change of interval, half range		

expansion, Fourier Transforms: Fourier Integral theorem, Fourier transforms and their simple properties.

Unit IV	**Statistics**	**06 Hours**

Measuresofcentraltendency,Standarddeviation,Coefficientofvariation,Moments,Skewnessand Kurtosis, Correlation and Regression, Reliabilityof Regression Estimates.

Unit V	**Probability andProbabilityDistributions**	**06 Hours**

Probability, Theorems on ProbabilityBays Theorem, Random variables, Mathematical Expectation, Probability Density function, Probability distributions: Binomial, Poisson, Normal & Hypergometric, Test of Hypothesis: Chi-Square test, t-distribution.

Unit VI	**Complex Variables**	**09 Hours**

Functions of Complex variables, Analytic functions, Cauchy-Riemann equations, Conformal mapping,Bilineartransformation,Cauchy'sintegraltheorem,Cauchy'sintegralformula,Laurent's series, andResidue theorem.

Books:

Text:

1. 1.Grewal B.S, 'Higher Engineering Mathematics', Khanna Publishers, 38th edition 2004.
2. Kreyszig E, 'Advanced EngineeingMathematics',ohn Wiley & Sons,8th edition, 2000.

Reference:

1. Chandrika Prasad, 'Mathematics for Engineer', S Chand Publication.
2. Peter O'Neil, 'Advanced Engineeing Mathematics',Cengage learning,2007.
3. 3 .Jain R.K. and Iyengar, S.R.K., 'Advanced Engineering Mathematics', Narosa Publishers, 2003.
4. 4 .H. K. Dass, 'Engineering Mathematics', S. Chand Publication, New Delhi.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOL201 DATA STRUCTURES

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week TU:01 Hour/Week	04	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- Programming in C

Course Objectives:

1. To gain knowledge about basic concepts of data structures.
2. To learn the representation, implementation and applications of linear data structures
3. To acquire knowledge ofstacks and queues with their applications.
4. To aware about the concepts of trees with their applications.
5. To learn and design the algorithm for graphs with their applications.
6. To get the knowledge of tables and multi-way trees.

Course Outcomes:

Graduates shall be able to:

1. Describe concepts of data structures.
2. Know the concepts of linked list.
3. Apply the knowledge to implement the algorithms for stacks and queues.
4. Describe the applications of trees.
5. Describe the concepts of graphs and its applications.
6. Use the knowledge of tables and multi way trees in different applications.

Course Contents

Unit I	Review of C	07 Hours

Functions: Parameter passing call by value and call by reference, scope rules, functions and pointers, function returning pointer and pointer to function, String manipulations using arrays, pointer to pointer. Structure and Union: Passing and returning structure as parameter for function, structure and pointer, Recursion: Definition, writing recursive functions & how recursion works.

Unit II	Sorting and searching techniques	07 Hours

Need of sorting and searching, sorting order & stability in sorting.

Sorting Techniques: Algorithms for Bubble sort, Selection sort, Insertion sort, Shell sort, Radix sort, Quick sort and Merge sort.

Analysis of Bubble, Insertion and Quick sorting technique for best, worst and average case, Concept of Internal & External sorting.

Searching Techniques: Algorithms for Sequential search, Binary search, Fibonacci search & concept of Index Sequential search, analysis of sequential and binary searching technique for best, worst and average case.

Unit III	Linear Data Structures using Link List Organization	08 Hours

Limitations of static memory allocation. Dynamic memory allocation in C. Concept of linked organization, Singly linked list, Doubly linked list, Circular linked list. Operations like insertion, deletion, traversal & other operations on these data structures.

Applications: Representation & manipulation of polynomials using circular linked lists, Application of doubly linked list in dynamic storage management.		
Unit IV	**Stacks and Queue**	**07 Hours**
Stacks: Concept of stack as ADT, Representation and implementation of stack using sequential & linked organization. **Applications of Stacks:**, Arithmetic expression conversion & evaluation, reversing a string, parsing : well-formed parenthesis checking. **Queues**: Concept of queue as ADT, Representation and implementation of linear queue & circular queue using sequential organization. **Applications of Queues:** Job scheduling, Queue simulation, Categorizing data, Types of Queue: Priority Queue, DEQUE.		
Unit V	**Trees**	**09 Hours**
Basic tree concepts, binary trees and their properties, representation using linked organization, full and complete binary trees, converting tree to a binary tree, binary tree traversals, Binary search trees & operations. BST as an ADT, Threaded binary trees, Insertion and deletion of nodes in in-order threaded binary tree, pre-order, in-order and post order traversals of in-order threaded binary tree, AVL tree, and applications of trees: Gaming and Expression trees.		
Unit VI	**Graphs**	**07 Hours**
Graph as an ADT, operations, graphs storage structures: Adjacency list, Adjacency Matrix, Traversals: DFS, BFS, Minimum spanning trees: Kruskal's and Prim's. Algorithm for shortest path and topological sorting.		
Books:		
Text: 1. Horowitz,Sahani, "Fundamentals of Data Structures in C" second edition, Universities Press.		
Reference: 1. Thomos H. Corman, Charls E. Leiserson, Ronald E. Rivest, Clifford Stein,"Introduction to Algorithms", Third Edition, Prentice Hall India Learning Pvt. Ltd. 2. Data Structures using c,Aron M. Tanenbaum, Pearson Education, 1 Edition(2003).		

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOP201 DATA STRUCTURES

Teaching Scheme:	Credit	Examination Scheme:
PR: 04 Hours/Week	02	Cont. Ass: 25 Marks Ext. : 25 Marks Total: 50 Marks

Guidelines for Instructor's Manual

The instructor‘s manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, conclusion/analysis).
As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab performance of student. Each lab assignment assessment should assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficiency, punctuality and neatness.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student‘s for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Course Objectives:---

1. To understand the Basic concepts of data structures.
2. To learn the representation, implementation and applications of linear data structures

3. To understand the concepts of stacks and queues with their applications.
4. To understand the concepts of trees with their applications.

Course Outcomes:-

Student shall be able to:

1. Implement the Basic concepts of data structures.
2. Implement the concepts of linked list.
3. Develop applications of stacks and queues.
4. Develop the applications of trees.
5. Implement graph and its applications.
6. Use the knowledge of tables and multi way trees in different applications.

Sr.No	List of Laboratory Assignments
1	Write a program to perform Set operations - Union, Intersection, Difference, and Symmetric Difference.
2	Write a program to perform various string operations such as Copy, Length, Reversing, Palindrome, and Concatenation and to find occurrence substring with and without using library functions.
3	Implement Sorting Methods using functions- Bubble Sort, Selection Sort and Quick Sort.
4	Implement Sorting Methods using Insertion Sort, and Shell Sort, and Merge Sort.
5	Implement Searching Methods-Sequential Search, Binary Search.
6	Write a menu driven program to perform following operations on SLL: Create, Insert – Start, end, between, Search & delete -- Start, end, between, Reverse without creating temporary list, Display.
7	Perform polynomial addition using a CLL.
8	Implement Stack using an array and use this stack to perform conversion of an expression from infix to postfix form.
9	Implement Stack using a linked list. Use this stack to perform evaluation of a postfix expression.
10	Implement binary tree using linked list and perform recursive and non-recursive traversals.
11	Implement in-order threaded binary tree using linked list and perform traversals.
12	Implement graph using adjacency list or matrix and perform DFS and BFS.
13	Implement graph using adjacency matrix and generate minimum spanning tree using Prim's algorithm.
14	Determine single source shortest paths for a graph represented using adjacency matrix.
15	Mini Project - Implement the Mini Project of Student Database using Linked list for following requirements: a. Creation of Student Database in memory containing student ID, Name, Name Initials, Address, Contact No and Date of Birth . b. Insertion, Deletion, Modification of student record for a given student ID. c. Sorting on name initials and searching a particular student record on name initials.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOL202: MICROPROCESSOR BASED SYSTEMS

Teaching Scheme:	Credit	Examination Scheme:
TH: 04 Hours/Week	04	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- NA

Course Objectives:

1. To get familiar with the basic of microprocessor.
2. To gain knowledge about programming of microprocessor.
3. To acquire knowledge of basic peripherals and their interfacing with 8086 microprocessor.
4. To ensure understanding of special purpose programmable peripheral devices and their interfacing.
5. To learn and describe the design of microprocessor based systems.
6. To identify and describe the recent advancements in microprocessor architectures.

Course Outcomes:

Graduate shall be able to:

1. Understand the taxonomy of microprocessors and knowledge of contemporary microprocessors.
2. Implement programs using the various addressing modes and instruction set of 8086 microprocessor.
3. Analyze the concept & types of interrupts.
4. Demonstrate interfacing of special purpose programmable peripheral devices with microprocessor.
5. Describe architecture, memory management & multitasking of 80386 microprocessor.
6. Apply the required knowledge to recognize the recent microprocessor architectures.

Course Contents

Unit I	**Introduction to 8086 Microprocessor**	**08 Hours**
Building Concepts of Microprocessor, Introduction to 16, 32, 64 bit Microprocessor, Comparison of 8086 / 8088 CPU Architecture, Microprocessor Evolution - INTEL 8086 to Pentium with focus on- Clock Speed, Concurrent operation of EU and BIU, Register organization, Memory Organization & Interfacing.		
Unit II	**8086 Programming**	**08 Hours**
Addressing modes, Instruction set, Programming examples, Pseudo Opcodes, Assembler Directives, Macro and procedure, Introduction to Software and Hardware tools. [Cross assemblers, Logic analyzers, Emulators, Simulators.		
Unit III	**Interrupt Structure**	**08 Hours**
Examples on Programming. Interrupt Structure , Interrupt service Routine, Interrupt Vector Table, Hardware and Software Interrupts, INTR ,NMI , Interrupt, Execution of an ISR, Priority of Interrupts.		
Unit IV	**8255 Interfacing**	**08 Hours**
Interfacing and programming of Peripheral 8255, Interfacing of ADC, DAC & applications. Interfacing and programming of Peripheral 8253.		
Unit V	**Advanced Microprocessor-I**	**08 Hours**

80386 Architecture, Real and Protected Mode, Register Model, Memory Management Unit, Address pipelined, Segmentation- support registers.

Unit VI	**Advanced Microprocessor-II**	**08 Hours**

logical to linear/physical address translation in real and protection mode, Privileged instructions , Introduction of Dual Core Processor.

Books:

Text:

1. A.K. Ray & K.M. Bhurchandi, Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing, Third Edition, McGraw-Hill Education India Pvt.Ltd., 2007.
2. Yu-cheng Liu, Glenn A.Gibson, Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design, Second Edition, Prentice-Hall, 2007.

Reference:

1. Kenneth Ayala, The 8086 Microprocessor: Programming & Interfacing the PC, Second Edition, Cengage Delmar Learning, 1992.
2. Barry B. Brey, The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4 and Core2 with 64 - bit Extensions, Eighth Edition,Pearson Education, 2009.
3. Walter A. Triebel, Avtar Singh, The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications, Fourth Edition, Pearson, 2002.
4. Roy W. Goody, Programming and Interfacing the 8086/8088 Microprocessor : A Product-Development Laboratory Process, Second Edition, Prentice Hall, 1992.
5. Thomas P. Skinner, An Introduction to 8086/8088 Assembly Language Programming, Second Edition.
6. Wiley, John & Sons, Incorporated, 1987.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOP202:MICROPROCESSOR BASED SYSTEMS

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 Hours/Week	01	Cont. Ass: 25 Marks Ext. : 25 Marks Total: 50 Marks

Guidelines for Instructor's Manual

The instructor‘s manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, conclusion/analysis).

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab performance of student. Each lab assignment assessment should assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficiency, punctuality and neatness.

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The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student‘s for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Course Objectives:---

1. To introduce a general idea and basic digital circuits used for designing a microprocessor.
2. To develop assembly language programs for various algorithms.

3. To acquire knowledge of basic peripherals and their interfacing with 8086 microprocessor.
4. To learn and describe the design of microprocessor based systems.
5. To identify and describe recent advancements in the microprocessor architecture.

Course Outcomes:-

Upon successful completion of the course, graduate shall be able to

1. Demonstrate programming using the various addressing modes and instruction set of 8086 microprocessor.
2. Evaluate component requirements to solve a computing solution.
3. Analyze and implement hardware and software aspects of microprocessor based systems.
4. Write and execute assembly language program to perform array addition, code conversion, block transfer, sorting and string operations.
5. Demonstrate interfacing between peripherals and 8086 microprocessor.
6. Learn & apply interfacing of real world input & output devices to 8086 Microprocessor.

Sr.No	List of Laboratory Assignments
1	To study the architecture of microprocessor 8086 & perform following programs a) Addition of two 8-bit numbers b) Multiplication of two 16-bit numbers .
2	Write an ALP to add array of N hexadecimal numbers stored in the memory. Accept input from the user.
3	Write an ALP to accept a string and to display its length.
4	Write a program to convert 4-digit hex number into its equivalent BCD number. Make your program user friendly to accept the choice from user for: (A) HEX to BCD (B) EXIT.
5	Write a program to convert 5-digit BCD number into its equivalent HEX number.Make your program user friendly to accept the choice from user for: (A) BCD to HEX(B) EXIT.
6	Write 8086 Assembly language program (ALP) toConcatenate two strings entered by the user.
7	Write 8086 Assembly language program (ALP) to compare two strings entered by the user.
8	Write 8086 ALP to interface DAC and generate following waveforms on oscilloscope. Any two a)Square wave b) Ramp wave c) Trapezoidal wave d) Stair case wave
9	8253: Write 8086 ALP to program 8253 in various modes.
10	Write ALP to interface 8086 with: Stepper motor to rotate motor with different step angles and speeds.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOL203COMPUTER ARCHITECTURE & ORGANIZATION

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- Basics of Electronics Engineering

Course Objectives:

1. To introduce basic fundamental units of a computer system.
2. To perform arithmetic operations using various algorithms.
3. To develop skills to understand control unit design.
4. To build concepts of memory system.
5. To study communication of I/O devices.
6. To enhance knowledge of parallel system.

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Describe fundamental units of computer system.
2. Apply concept of fixed and floating point arithmetic.
3. Identify different types of control unit.
4. Analyze organization and design of memory system.
5. Identify different ways of communicating with I/O devices and interfaces.
6. Describe working of parallel systems.

Course Contents

Unit I	Basic Structure of Computers	07 Hours

The Evolution of Computers, Functional Units, Basic operational concepts , Bus Structure, Performance Measures , System Architecture, VLSI Era, Von Neumann Architecture. Addressing modes, Execution of a Complete Instruction.

Unit II	Data Path Unit	08 Hours

Data Representation, Fixed and Floating point numbers, Signed numbers,Fixed-Point Arithmetic, Booths Algorithm, Division: Restoring and Non Restoring algorithms, Arithmetic Logic unit, Floating point representations, IEEE standards, Floating point arithmetic.

Unit III	Processing Unit	06 Hours

Basic Concept, Hardwired control, Micro programmed Control, Coprocessor, Pipeline Control, Pipeline Performance

Unit IV	Memory Organization	08 Hours
Characteristics of memory, Internal and External Memory, Types of memory: RAM: SRAM, DRAM, SDRAM,RDRAM ROM: PROM, EPROM, EEPROM, Cache Memory, Virtual Memory, Associative Memory, Secondary Memory, Performance.		
Unit V	**Input /Output Organization**	**07 Hours**
I/O mapped I/O and memory mapped I/O, interrupts and interrupts Handling Mechanisms, Direct Access Memory, Buses: synchronous vs. asynchronous, Interface Circuits, Standard I/O Interface: PCI,SCSI,USB. Computer Peripheral: I/O devices such as magnetic disk, magnetic tape, CDROM, USB systems.		
Unit VI	**Parallel Organizations**	**07 Hours**
Superscalar Processors, Multiple Processor Organizations, Symmetric Multiprocessors, Clusters, Non - uniform Memory Access, Vector Computations, Bus allocation Schemes. **RISC**: Instruction execution characteristics, use of large register file, compiler based register optimization, RISC architecture and pipelining. RISC Vs CISC.		
Books:		
Text: 1. John Hayes**, '**Computer Architecture and Organization", McGraw Hill, 3rd Edition. 2. V.C.Hamacher, Z.G.Vranesic and S.G.Zaky, 'Computer Organization', McGraw Hill, 5th edition, 2002.		
Reference: 1. A. S. Tanenbaum, "Structured Computer Organization" 4th Edition, Pearson Education. 2. M Mano, "Computer System and Architecture", Pearson Education. 3. W. Stallings, "Computer Organization & Architecture", Pearson Education.		

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Information Technology (2017 Course)
BITL201 DIGITAL ELECTRONICS & LOGIC DESIGN

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisites: Basic Electronics Engineering

Course Objective:

1. To possess knowledge and skills in designing of different code convertors.
2. To develop, design and implement skills of combinational and sequential circuits.
3. To learn and understand basics of Programmable Logic Devices.
4. Use the knowledge of digital electronics concept to design a digital system.
5. Understand basic digital design techniques.
6. To introduce digital logic design software such as VHDL.

Course Outcome:

Upon completion of the course, graduates will be able to -

1. Minimize logical equations and design code convertors.
2. Construct Combinational and Sequential circuits.
3. Validate design outputs using standard test equipments.
4. Describe Programmable Logic Devices.
5. Design of sequential circuits using ASM.
6. Design & develop an application using VHDL.

Course Contents

UNIT – I :	NUMBER SYSTEM AND CODES	8 Hours

Introduction, Binary number System, Sign-Magnitude representation, One's and Two's complement representation, Binary arithmetic, 2's complement arithmetic, Octal number System, Hexadecimal number System, BCD code, Excess-3 code, Gray code. Code conversion, Boolean algebra: Basic theorems and properties, K-Map: Representation of truth-table, SOP form, POS form, Simplification of logical functions, Minimization of SOP forms using K- Map. Code converters

UNIT – II :	COMBINATIONAL & SEQUENTIAL LOGIC CIRCUITS	8 Hours

Part A: Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary adder (IC 7483),look ahead carry generator Introduction to MSI functions & chips - Multiplexers (IC 74153), Decoder / Demultiplexer(IC 74138), Encoder

Part B: Introduction of flip-flop (F.F), 1 bit memory cell, clocked S-R F.F., J-K F.F. race around condition, M/S J-K F.F, flip-flop truth table, excitation table, flip-flop conversion, flip flop characteristics. T and D F.F, Design of 4 – bit UP-Down ripple counter using J-K flip-flop, Design of Synchronous 3 bit up/down counter, mod-n counters (IC -7490)

UNIT – III :	DESIGN OF SEQUENTIAL CIRCUITS	7 Hours

Shift register (SISO, SIPO, PISO& PIPO), 4 bit bi-directional universal shift register, application of shift

registers (Ring counter, Sequence generator, Johnson's counter.) Introduction to PLD's:- ROM, PAL,PLA, Applications of PLAs to implement combinational and sequential logic circuits Introduction to :FPGA, CPLD.		
UNIT – IV :	**LOGIC FAMILIES**	**6 Hours**
Characteristics of Digital ICs: Speed, Power dissipation, fan-out, current and voltage parameters, noise margin, operating temperature etc., TTL: Operation of TTL NAND gate, Standard TTL, TTL Characteristics, Active pull-up, Wired-AND, totem pole, open collector, Unconnected Inputs. CMOS Logic: CMOS Inverter, CMOS characteristics.		
UNIT – V :	**ALGORITHMIC STATE MACHINES**	**6 Hours**
Algorithmic State Machines: Finite State Machines (FSM) and ASM, ASM charts, notations, construction of ASM chart and realization for sequential circuits, Sequence Generator, Types of Counters.		
UNIT – VI :	**INTRODUCTION TO VHDL AND PROGRAMMING**	**6 Hours**
Introduction to VHDL - Library, Package, Entity, Architecture, Data Objects (Variable, signal & constant), Data Types (scalar, composite array type & predefined data types, Attributes (necessity and use. event attribute) VHDL Modeling styles – Dataflow, behavioral & structural VHDL statements - Concurrent Statements (With Select, When Else), Sequential Statements (if else, case)VHDL design Examples - Multiplexer, binary adder, counter, shift register.		
Books:		
Text: 1. R. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, 2003, ISBN 0 – 07 – 049492 – 4. 2. "A VHDL Primer", J. Bhaskar, Englewood Cliffs, Prentice Hall, 1994, ISBN-13: 978-0131814479, 2nd Edition.		
Reference: 1. Digital Design", M. Mano, Pearson Education, 2002, ISBN - 81 - 7808 - 555 – 0, 3rd Edition. 2. Malvino, D.Leach" Digital Principles and Applications", 5th edition, Tata McGraw Hill.		

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Information Technology (2017 Course)
BITP201 DIGITAL ELECTRONICS &LOGIC DESIGN

Teaching Scheme:	Credit	Examination Scheme:
TH: 02 Hours/Week	01	Cont. Ass: 25 Marks Ext. : -- Total: 25 Marks

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The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, conclusion/analysis).

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.

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Guidelines for Laboratory Conduction

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Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student‘s for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Pre-requisite: NA

Course Objectives:

1. To Possess knowledge and skills in designing of different code convertors
2. To develop, design and implement skill of combinational and sequential circuits

3. To learn and understand basics of Programmable Logic Devices
4. Use the knowledge of digital electronics concept to design a digital system
5. Understand basic digital design techniques.
6. To introduce digital logic design software such as VHDL Programming.

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Minimize logical equations and design code convertors
2. Construct Combinational and Sequential circuits
3. Validate design outputs using standards test equipment
4. Describe Programmable Logic Devices
5. Design of sequential circuits by using ASM
6. Design & develop an application using VHDL

Sr.No	List of Laboratory Assignments
1	Design (truth table, K-map) and implementation of 4 bit Code converters. i. Binary to gray and vice versa ii. BCD to Excess-3 and vice versa
2	Multiplexer - e.g. 16:1 Mux using 4:1 Mux (IC 74153) &. Decoder – (IC 74138)HA/FA.
3	Verify the truth table of one bit and two bit comparators using logic gates and IC(7485).
4	BCD adder –using IC 7483.
5	Synchronous 2 bit up down Counter.
6	Ripple (asynchronous) mod –N counter using IC 7490.
7	Design (State diagram, state table, K map, Bush table & Bush diagram) and implementation of Sequence Generator (with & without bushing) shift register IC 74194.
8	Full adder using behavioral &structure modeling in VHDL.
9	4:1 multiplexer using dataflow &structure modeling in VHDL.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOP204 HARDWARE MAINTENANCE AND TROUBLESHOOTING

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 Hours/Week	01	Cont. Ass: 25 Marks Ext. : -- Total: 25 Marks

Pre-requisite: NA

Course Objectives:

1. Introduction of different hardware Units of system and its assembly.
2. Skills the students about the installation of system and application software.
3. Develop student's skills to identify problems occurring in the system and its Trouble Shooting.
4. Develop student's skills to identify methods to protect System from Virus, Spyware and Malware.

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Know the Motherboard, BIOS, and Storage devices features and functions.
2. Assemble Personal Computer.
3. Create Partitioning of Hard disk.
4. Install Operating System and Application software.
5. Establish small network between two or more PC's.
6. Configure Operating System to protect it from Virus, Spyware and Malware.

Sr.No	List of Laboratory Assignments
1	Study of Motherboard of Pentium-4.
2	Study of Storage devices.
3	Study and Configuration of BIOS.
4	To demonstrate Assembling of Personal Computer.
5	To demonstrate Partitioning of Hard disk
6	To demonstrate Windows 2007.
7	To demonstrate installation of Linux
8	To demonstrate Protecting PC from Virus, Spyware and Malware.
9	To Configure Structured Cabling.
10	To Configure a LAN .
11	To Build Small Home Network
12	To demonstrate File and Printer Sharing in Network.
13	To demonstrate mounting xp files in Linux using NFS
14	Configuration of Wi-Fi Basics.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOGP205 GENERAL PROFICIENCY-II : Foreign Language

Teaching Scheme:	Credit	Examination Scheme: --
TH: 01 Hour/Week PR: 02 Hours/Week	Audit Course	

Prerequisite:- Nil

Course Objectives:

1. To learn foreign languages to improve inter personal skills.
2. To enable improving business communications and having access to literature in globally recognized languages.
3. To help communicate at international forums and explore opportunities for employment

Course Outcomes: Upon successful completion of the course, students will be able to

1. Communicate effectively in more than one globally recognized language like French, Spanish, German, Japanese, etc.
2. Interact with technical and business communities at international forums.

Course Contents:

Topics	Learning Goals	Activities
The Alphabets and accents	Pronunciations techniques	Worksheet and charts
Number 1 to 20		
Greetings & Salutations,	Articles , Personal Pronoun Day timing	Daily routines forms of respects , Vocabulary
Family and relations	Shapes and colors , Possessive Pronouns , Gender , Negative Sentence	Relations, Day of week
Weather and Seasons	Climate , Fabrics & Clothes , sizes , interrogatives , Basic verbs	Group Activities , Paragraph writing including , Names of months , Seasons, Sky , Stars
House & Household things.	Describing neighborhood Present Tense	Furniture , Household articles, Colors
Visit to supermarket	Learning the shopping etiquettes , vocabulary of food items , conversing with shopkeepers etc , Plurals	Project on vocabulary of vegetables and fruits , Bakery products , Group Activity / Role play

Timing , Telephonic Conversions	How to Ask time , converse on telephone	Timing and clock (Hours & Minutes)
Visit to city , Prominent places and park	Nature, Directions, Means of transportations, Tenses	Self introductions , Role-play , preparing charts
In Restaurant / Hotel	Ordering eatables , Table manner .Verbs	Enhancing vocabulary of food Dishes , cutlery
Visit to Doctor.	Health matters, illness. Commonly used verbs contd.	Worksheets , projects
French / German /Spanish culture – monuments , delicacies , wines visa vis Indian culture Diwali festival	Vocabulary of clothes , Accessories , Cuisines , Beverages , Adjectives	Presentations by students , situation based conversations
Receiving Guests/ Entertaining people / Good Bye's	Customs , Traditions , Manners , welcome & Audieu's	Activities , Role play , Assignments

Note: Based on above content, faculty can perform 8-10 practicals / activities

Course Syllabus

SY B. Tech. : SEM-III

DEPARTMENT OF COMPUTER ENGINEERING

Scheme of B.Tech (COMPUTER ENGINEERING)

*TAE will be based on Home Assignment, Seminar, Quiz, Surprise Test, Group Discussion, Debate, General Behaviour, Attentiveness and Attendance

SEMESTER-IV

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper (Hrs.)
							Theory			Practical		Total	
		Th.	Tu.	Pr.	Total		(TAE) (20)	(CAE) (20)	ESE (60)	Cont. Ass.	Ext.		
BITL205	Graph Theory &Combinatorics	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BCOL206	Operating system	4	-	-	4	4	20	20	60	-	-	**100**	**3**
BCOP206	Operating System	-	-	4	4	2	-	-	-	25	25	**50**	**3**
BITL202	Object Oriented Programming	3	1	-	4	4	20	20	60	-	-	**100**	**3**
BITP202	Object Oriented Programming	-	-	4	4	2	-	-	-	25	25	**50**	**3**
BITL206	Data Communication	4	-	-	4	4	20	20	60	-	-	**100**	**3**
BHUL201	Principles of Management	3	-	-	3	3	20	20	60	-	-	**100**	**3**
BCOGP207	GENERAL PROFICIENCY-III : Hobby classes	**1**	-	**2**	3	Audit Course	-	-	-	-	-	-	-
	Total	**18**	**2**	**10**	30	**23**	**100**	**100**	**300**	**50**	**50**	**600**	

TAE – Teachers Assessment Examination

CAE – Class Assessment Examination

ESE – End Semester Examination

Cont. Ass – Continuous Assessment

Th - Theory

Tu – Tutorial

Pr – Practical

Ext - External

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BITL205 GRAPH THEORY AND COMBINATORICS

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week TU: 01 Hour/Week	04	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- Engineering MathematicsIII

Course Objectives:

1. To use appropriate set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context.
2. Learn graphs and trees to use different data structure.
3. Formulate problems precisely, solve the problems and applygroups and rings.
4. Introduce combinatorial structures and apply algebraic techniques to combinatorial problems.

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Solve real world problems logically using appropriate set theory concepts.
2. Analyze concepts of number theory.
3. Analyze concepts of relation.
4. Understand concepts of groups and rings.
5. Analyze data structure used to represent different kinds of objects viz Graph, Trees.
6. Understand the basics of combinatorial structure and develop algebraic technique to solve combinatorial problems.

Course Contents

Unit I	Logic and Set theory	09 Hours

Propositional logic, application of propositional logic, propositional equivalences, predicates and quantifiers, normal forms, mathematical induction, sets, finite and infinite sets, un-countable infinite set, set operation, function, cardinality of sets.

Unit II	Number Theory	07 Hours

Divisibility and modular arithmetic, integer representations and algorithms, primes and greatest common divisors, solving congruence, applications of congruence.

Unit III	Relation	08 Hours

Relation, closure of relation, warshall algorithm, equivalence relation, matrix of relation, transitive closure of relation, partial ordering relation, hasse diagram, recurrence relation, linear recurrence relation with constant coefficient.

Unit IV	Groups and Rings	07 Hours

Algebraic systems, groups, semi group, monoid, subgroup, homomorphism, permutations groups, properties of cyclic groups, generator of group, quotient group,rings, fields, integral domain, group codes, : hamming distance.

Unit V	Graphs Theory and Trees	08 Hours

Graphs and its types, subgraph, euler path, hamilton path, in-degree, out-degree, cycle, adjacency matrix, graph isomorphism, shortest-path problems, planar graphs, graph coloring, trees, tree traversal,

minimum spanning trees: kruskal'sand prims algorithm.		
Unit VI	**Combinatorics**	**06 Hours**
Definition of generating functions and examples, proof of simple combinatorial identities, Probability, G.F. $p(t) = \sum p_n t^n$, $E(x) = p'(t)$, examples. Permutation, Combination,binomial coefficient & identifier, generation of permutation and combination.		
Books:		
Text: 1. Kenneth Rosen. Discrete Mathematics and Its Applications, 7th Edition , McGraw Hill Publishing Co., 2012. 2. Discrete Mathematical structure with application to computer science by Trembley&Manohar (Mc. Graw Hill). 3. Discrete Mathematical Structure byKolmann , Busby & Ross (PHI).		
Reference: 1. C.L. Liu, 'Element of Discrete Mathematics' 2nd second edition TMH 2000. 2. John Truss , 'Discrete Mathematics' Addison Wesley, 2000 . 3. K. D. Joshi, 'Foundations of Discrete Mathematical' Willey Eastern. 4. M. L. Khanna , 'Modern Algebra' , Jai PrakashNath& Company Meeru.		

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOL206 OPERATING SYSTEM

Teaching Scheme:	Credit	Examination Scheme:
TH: 04 Hours/Week	04	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- NA

Course Objectives:

1. To introduce general idea, structure and functions of operating system.
2. To make aware of basic mechanisms used to handle processes, manages memory, and manages storage devices and files.
3.To provide the details of designing operating systems.

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Analyze Basics of operating system.
2. Identify mechanism to handle processes, memory, I/O devices, and files and develop an appropriate algorithm for it.
3. Describe Memory management in operating System.
4. Understand concept of management of process and their synchronization.
5. Apply the concept of deadlocks on advanced applications.
6. Identify and understand advanced operating systems, its advantages and features.

Course Contents

Unit I	Introduction	06 Hours

Evolution of OS, Types of OS, Basic hardware support necessary for modern operating systems, services provided by OS, system programs and system calls, system design and implementation.

Unit II	Process Scheduling and Synchronization	08 Hours

Process concept, process control block, Types of scheduler, context switch, threads, multi threading model, IPC concept, types of IPC, Goals of scheduling and different scheduling algorithms, Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems.

Unit III	Deadlocks detection & avoidance	08 Hours

Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation, Recent trends in Operating System, Introduction to Advanced OS & its Application.

Unit IV	**Memory Management**	**07 Hours**

Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging , Virtual Memory Concepts, page faults and instruction restart , page replacement algorithms , working sets , Locality of reference, Thrashing, Garbage Collection.

Unit V	**File Systems**	**08 Hours**

File systems: File concept, Access methods, Disk space management and space allocation strategies, directory structures, Recovery, Log-structured File System, disk arm scheduling strategies, File system of windows ,Linux, android.

Unit VI	**Device Management**	**08 Hours**

Secondary-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.

I/0 Systems : Overview, I/0 Hardware, Application I/0 Interface, Kernel I/0 Subsystem, Transforming I/0 Requests to Hardware Operations, STREAMS.

Books:

Text:

1. Operating System concepts – Silberchatz& Galvin, Addison Wesley, 6th Edn.
2. Modern Operating Systems – Tanenbaum, Pearson Edn. 2ndedn.

Reference:

1. Operating Systems – S R Sathe, Macmillan Publishers, India, 2008
2. Operating System –Milan Milenkovik, McGraw-Hill, 1987
3. Operating Systems - 3rd Edition by Gary Nutt, Pearson Education.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOP206 OPERATING SYSTEM

Teaching Scheme:	Credit	Examination Scheme:
PR: 04 Hours/Week	02	Cont. Ass: 25 Marks Ext. : 25 Marks Total: 50Marks

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Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, conclusion/analysis).

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.

Guidelines for Lab /TW Assessment

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Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weight age to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student‘s for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Course Objectives:---

1. To introduce basics of shell programming concepts.
2. To develop skills to write shell scripts in Linux environment.

3. To design Shell scripts applications from simple to massive.

Course Outcomes:-

1. Understand and execute basic commands of shell script.
2. Apply basic operations in shell scripts which are required for different applications.
3. Identify and understand concept of file systems in shell script
4. Apply concept of creating new process from parent process.
5. Apply concept of virtual file and execute basic commands on it

Sr.No	List of Laboratory Assignments
1	Study of Unix/Linux general purpose utility command list obtained from (man, who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod,chown, finger, pwd, cal, logout, shutdown) commands.
2	Write a shell script to write your user name as a banner and send to the printer.
3	Write a shell script to print the first five arguments in reverse order.
4	Write a shell script that gives how many times that person is logged on.
5	Write a shell script program to check whether given file is a directory or not.
6	Write a shell script that takes a “uid” as an argument and prints that person’s name, home directory, shell and group number, and other groups that person may belongs to.
7	Write a shell script program to develop a scientific calculator
8	Write a program for creating child process by fork () command.
9	Write a shell script program to check variable attributes of file and processes.
10	Write an IPC program using pipe. Process A accepts a character string and Process B inverses the string. Pipe is used to establish communication between A and B processes using Python or C++.
11	Use Python for Socket Programming to connect two or more PCs to share a text file.
12	Write a program in C++ to read display the i-node information for a given text file, image file.
13	Write a program in Python/C++ to test that computer is booted with Legacy Boot ROM BIOS or UEFI.
14	Write program in python for Reader writer problem.
15	Create an iso boot image using open source tools.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Information Technology (2017 Course)
BITL202: OBJECT ORIENTED PROGRAMMING

Teaching Scheme:	Credit	Examination Scheme:
TH: 03Hours/Week Tu: 01 Hours/Week	04	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- Programming in C

Course Objectives:

1. To learn and understand the difference between object oriented programming and procedural programming.
2. To understand the concepts of dynamic memory allocation & functions.
3. To be aware about the concepts of constructor, destructor & operator overloading.
4. To learn and understand the concepts of inheritance and polymorphism.
5. To recognize the console I/O operations & templates.
6. To learn advanced techniques such as exception handling and file handling.

Course Outcomes:

After successful completion of the course, students should be able to:

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Implement dynamic memory allocation techniques & different types of functions.
3. Describe & implement the concept of constructor, destructor & operator overloading.
4. Classify & implement inheritance with the concept of virtual functions and polymorphism.
5. Implement the console I/O operations & templates.
6. Apply advanced techniques such as exception handling and file handling.

Course Contents

Unit I	Principles Of Object Oriented Programming	08 Hours

Introduction of Procedure oriented programming, object oriented programming paradigm.

Fundamental of object oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism, benefits of OOP, application of OOP.

Beginning with C++: Introduction of C++, Simple C++ Program, Structure of C++, Creating Source File, Compiling and Linking, cin, cout, iostream, and namespace.

Unit II	Function in C++	08 Hours

Tokens, identifiers and constant, keywords, data types, operators, variables, expression and control structure, static and dynamic memory allocation, default and constant argument.

Function in C++: Introduction, function prototype, call by reference, return by reference, inline function, defining member functions.

Unit III	Constructors and Operator overloading	08 Hours

Constructor: Introduction to constructor, types of constructors (default, parameterized and copy constructor), destructors.

Operator Overloading: Introduction to operator overloading, rules of operator overloading, unary and

binary operator overloading, operator overloading usingfriend function and using member function, type of conversion.

Unit IV	**Inheritance and polymorphism**	**06 Hours**

Inheritance: Introduction, Need of inheritance, types of inheritance , ambiguity in multiple inheritance, base and derived classes, member access control, virtual base class

Polymorphism: Introduction, pointer, pointers to object, this pointers, pointer to derived classes, virtual function and pure virtual function.

Console I/O operations: Introduction, C++ stream, C++ streams classes, I/O operations formatted and unformatted I/O operations.

Templates: Class templates, class templates with multiple parameters, function templates, function templates with multiple parameters.

Unit V	**Console I/O operations and Templates**	**06 Hours**

Console I/O operations: Introduction, C++ stream, C++ streams classes, I/O operations formatted and unformatted I/O operations.

Templates: Class templates, class templates with multiple parameters, function templates, function templates with multiple parameters.

Unit VI	**Exceptions and File handling**	**08 Hours**

Exception handling: introduction, basic of exception handling, mechanism of exception handling: try, catch, and throw.

File handling: Introduction, Classes for file stream operations, file operations: open, close, read, write,detect end of file, file modes, File pointers and their manipulations, error handling during fileoperations.

Books:

Text:

1. Object oriented programming with C++, E Balagurusamy, 4th edition, TMH.
2. Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications.
3. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH.

Reference:

1. Let's C++ by Y. Kanetkar, BPB publications.
2. Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications.
3. Object-Oriented Programming with C++, SouravSahay, Oxford University Press, 2006.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Information Technology (2017 Course)
BITP202: OBJECT ORIENTED PROGRAMMING

Teaching Scheme:	Credit	Examination Scheme:
TH: 04 Hours/Week	02	Cont. Ass: 25 Marks Ext. : 25 Marks Total: 50Marks

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Course Objectives:

1. To learn and understand the difference between object oriented programming and procedural programming.
2. To understand the concepts of dynamic memory allocation & functions.
3. To be aware of concepts of constructor, destructor & operator overloading.

4. To learn and understand the concept of inheritance and polymorphism.
5. To recognize the console I/O operations & templates.
6. Learn advanced techniques such as exception handling and file handling.

Course Outcomes:

After successful completion of the course, students should be able to:

1. Develop solutions for a range of problems using objects and classes.
2. Implement algorithms utilizing the principles of object oriented programming to solve simple problems.
3. Demonstrate the implementation of constructors, destructors and operator overloading.
4. Apply fundamental algorithmic problems including type casting, inheritance, and polymorphism.
5. Understand & implement console I/ O operations &templates.
6. Design & implement applications using file and Exception handling.

Sr.No	List of Laboratory Assignments
1	Write a C++ program to accept and display student details like student name, roll number, class, and phone number and address using member function and class name as student.
2	Write a C++ program for book details using structure variable.
3	Write a C++ program to calculate the area of triangle and rectangle using friend function.
4	Write a C++ program to generate the weather report using constructor.
5	Write a C++ program to add and subtract two complex number using operators overloading with constructor (default and parameterized).
6	Write a C++ program to find volume of cube, cylinder using virtual function.
7	Write a C++ program for employee salary details using inheritance.
8	Write a C++ program using multiple inheritance to create student bio-data using following classes i) Personal record ii)Academic record Assume appropriate data members and member function to accept required data & print bio-data.
9	Write a in C++ using function template to read two matrices of integer data type and perform addition operations on these matrices and display it.
10.	Implement various file handling operations using GUI application.

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BITL206 DATA COMMUNICATION

Teaching Scheme:	Credit	Examination Scheme:
TH: 04 Hours/Week	04	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:-Basic Electronics Engineering

Course Objectives:

1. To introduce basics of data communication and techniques used to transfer data.
2. Identify various types of transmission media and interfaces in network.
3. Introduce various analog and digital services for data communication.
4. Understand various multiplexing techniques.
5. Understand advanced techniques such as Data encoding and Compression.

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand and explain Data Communications System and its components.
2. Summarize signal conversions techniques for digital communication.
3. Identify and categorize various types of transmission media.
4. Understand various analog and digital services for data communication.
5. Evaluate bandwidth utilization using multiplexing techniques.
6. Implement advanced technique such as Data encoding and Compression for Image processing Applications.

Course Contents

Unit I	Signals	08 Hours

ANALOG AND DIGITAL: Analog and digital data, Analog and digital signals; PERIODIC AND APERIODIC SIGNALS, TIME AND FREQUENCY DOMAINS; COMPOSITE SIGNALS: Frequency spectrum and Bandwidth; DIGITAL SIGNALS: Decomposition of digital signal; TRANSMISSION MODES: Serial and Parallel transmission, Asynchronous and Synchronous Transmission, Simplex, Half-Duplex and Full-Duplex communication.

Unit II	Digital Communication	08 Hours

Basic communication system, Bit rate/baud rate, Sampling Rate, How many Bits per Sample? , Shannon theorem, ANALOG-TO-DIGITAL CONVERSION: Pulse Code Modulation (PCM), DPCM,ADPCM, DM,ADM DIGITAL-TO-DIGITAL CONVERSION: Unipolar, Polar, Bipolar; Block encoding, Scrambling.

Unit III	Interfaces and Modems	08 Hours

DIGITAL DATA TRANSMISSION: Parallel transmission, Serial Transmission; DTE-DCE INTERFACE: Data Terminal Equipment (DTE), Data Circuit-Terminating Equipment (DEC), Standards, EIA-232 Interface; OTHER INTERFACE STANDARDS: EIA-449, EIA-530.

Unit IV	Communication Media	07 Hours

GUIDED MEDIA: Twisted pair cable, Coaxial cable, Optical Fiber cable; UNGUIDED MEDIA: Radio frequency allocation, Propagation of Radio waves, Terrestrial microwave, Satellite communication, Cellular Telephony; TRANSMISSION IMPAIRMENTS: Attenuation, Distortion, Noise; PERFORMANCE: Throughput, Propagation Speed, Propagation time.

Unit V	Multiplexing	07 Hours

FREQUENCY DIVISION MULTIPLEXING (FDM), TIME DIVISION MULTIPLEXING (TDM): Inverse Multiplexing, WAVE-DIVISION MULTIPLEXING,CDMA, HSPA. HSUPA, LTE MULTIPLEXING APPLICATIONS: THE TELEPHONE

SYSTEM: Common carrier services and hierarchies, Analog services, Digital Services, FTTC: FTTC in the Telephone Network, FTTC in the Cable TV Network.		
Unit VI	**Data Compression**	**07 Hours**
Huffman code, Run-Length Encoding, Relative Encoding, Lempel-Ziv Encoding, Image Compression, JPEG, MPEG, Recent trends and advanced topic on Data Communication.		
Books:		
Text: 1. Behrouz A. Forouzan , 'Data Communications and Networking', 4th edition, Tata McGraw Hill. 2. Kennedy, 'Electronic communication Systems'.		
Reference: 1. William A. Shay, 'Understanding Data Communications and Networks', 2nd Edition, Vikas Publishing House. 2. Fred Halsall, 'Data communication', Pearson Education. 3. http://www.tutorialspoint.com/lte/lte_quick_guide.html.		

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BHUL201 PRINCIPLES OF MANAGEMENT

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	TAE: 20 Marks CAE: 20 Marks ESE: 60 Marks

Prerequisite:- NA

Course Objectives:

1. Understand the basic structure and function of Management, planning of management issues
2. To introduce idea of management issues viz. Marketing, Financial, Human Resource and its planning.
3. To understand about the past structure of organization and its Behavior and future improvements.
4. To study information management systems related with policy, implementation, and other applications related to all areas of the organization/(s) enabling decision making smooth and faster.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Update today's trend in market.
2. Understand the structure and behaviour of organization.
3. Develop an information management systems related with policy, and applications related to all areas of the organization /(s).
4. Develop decision making processes.
5. Manage the Financial skills, decision making, Economics and Accounting.
6. Describe the role of Human resource management.

Course Contents

Unit I	Introduction	05 Hours

Nature and Functions of Management, Management yesterday and today, Planning and Decision making.

Unit II	Management Information System	06 Hours

Management Information System: Introduction, Conceptual Foundations,Information System Requirement.

Unit III	Marketing Management and Planning	07 Hours

Marketing Management: Marketing concept, Indian Marketing Environment, Market segmentation, Market Planning, International Marketing.

Unit IV	**Financial Management**	**08 Hours**
Evolution of financial Management, Financial decisions in a Firm, Goal of Financial Principle of Finance, Risk return trade off, Forms of Business organization, Relationship of Finance to Economics and Accounting, Emerging Role of the Financial Manager in India		
Unit V	**Human Resource Management**	**07 Hours**
Human Resource Management: Human Resource Planning, Recruitment, Selection, Training and development, Security, Safety and Health.		
Unit VI	**Organization Structure and Behavior**	**07 Hours**
Organization Behavior: Organization Structure and design, Designing Effective Organization, Managing Job Stress, Organization Development.		
Books:		
Text: 1.P C Tripathi and P N Reddy , 'Principles of management' 2.Davis and H. Olison, 'Management Information System,Gordan', McGraw Hill Pub. 3.WilliamWerther and Keith Davis, ' Human Resources and Personal Management' 4. Prasanna Chandra, "Financial Management", McGraw Hill- Seventh Edition. 5.V S Ramaswamy and S Namakumari, 'Marketing Management' 6.High Arnold and Daniel Feldman, 'Organization Behavior', McGraw Hill		

G.H.Raisoni College of Engineering & Management, Pune
Second Year of Computer Engineering (2017 Course)
BCOGP207 GENERAL PROFICIENCY-III : HOBBY CLASSES

Teaching Scheme: **TH: 01 Hour/ Week** **PR: 02 Hours/Week**	**Credit** **Audit Course**	**Examination Scheme: --**

Prerequisite:-NIL

Course Objectives:

To enhance the inherent qualities of oneself and provide a platform to show hidden talents.

1. To nurture one's special capability and interest in activities like sports, drama, singing etc.
2. To help express oneself and be more compatible with outer world in the hobby domain.
3. To enhance creativity & imagination to flow freely.

Course Outcomes:

Upon successful completion of the course students will be able to:

1. Explore and demonstrate the inherent talents within.
2. Engage themselves in creative activities during spare time.
3. Create balance between academic & work life.
4. Acts as a stress buster in the stressed life.
5. Develop self-expression and communication skills.
6. Learn a new skill and increase self-confidence and boosts self esteem.

Course Contents:

Topics	**Activities**
Stress management sessions	Yoga, pranayam, meditation, relaxation techniques
Outdoor activities	Nature walks, treks, cycling, horse riding
Painting	Canvas, fabric , Sketching, knife, glass
Music (vocals and instrument)	Singing, Guitar, Synthesizer, Harmonium, Piano, Flute
Dance	Bharatnatyam, Kathak
Indoor sports	Chess, carom, table tennis
Movie club	Motivational movies and documentaries to be shown
Other creative skills	Embroidery , knitting, use of making things from waste materials, photography, puzzle solving