।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील अभियांत्रीकीच्या पदवी स्तरावरील अंतीम वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, मा. विद्याशाखेने **दिनांक ३१ मे २०२१ रोजीच्या बैठकीतील केलेल्या शिफारशीप्रमाणे व दिनांक १२ जून २०२१ रोजी संपन्न झालेल्या ५१ व्या मा. विद्या परिषद बैठकीतील विषय क्र. २६/५१–२०२१**च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील अभियांत्रीकीच्या पदवी स्तरावरील अंतीम वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्यात येत आहेत.

B. E. final year - Electrical Engineering

B. E. final year - Computer Engineeing

B. E. final year - Mechanical Engineering

B. E. final year - Civil Engineering

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.

जा.क्र.: शैक्षणिक–१/परिपत्रक/पदवी–सीबीसीएस अभ्यासक्रम/२०२१–२२/८९

दिनांक : २४.०७.२०२१.

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
७) अधीक्षक, परिक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

Swami RamanandThirthMarathwada University Nanded

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY "DNYANTEERTH", VISHNUPURI,

PROPOSED CURRICULUM FOR B.E. (COMPUTER ENGINEERING) (CGPA Revised) w.e.f 2021-22

Teaching Scheme - Final Year Computer Engineering

SEMESTER – VII

SI. No.	Category	Code	Course Title	Hours per Week				Marking Scheme					Theory Total
				L	T	P	CR	PR	OR	TW	MSE	ESE	
1.	Professional Elective Courses	PEC 701 (A)	Elective-IV	4	0	2	5	0	0	25	30	70	125
2.	Professional Elective Courses	PEC 702 (A)	Elective –V	3	0	2	4	0	0	25	30	70	125
3.	Open Elective Courses	OEC 703 (A)	Open Elective –II	3	0	2	4	0	0	25	15	35	75
4.	Basic Science Courses	BSC 704	Biology	2	0	2	3	0	0	25	15	35	75
5.	Project	PROJCS705	Project-II(Project work, Seminar)	0	0	8	4	0	150@	50	0	0	200
6.	Mandatory Courses(Non-Credit)	MC 706	Internship in industry or at appropriate work place	0	0	0	0	0	25 #	25	0	0	50
7.	Humanities and Social Sciences including Management Courses	HSMC 707	Interview Techniques and Mock Exercise	0	0	2	1	0	25 @	25	0	0	50
Total				**12**	**0**	**18**	**21**	**0**	**200**	**200**	**90**	**210**	**700**

Symbols to remember: -@ - Internal Assessment, # - External Assessment, * - Online Examinations***(Note:-Assessment of Industrial Internship at the start of 7th Semester)***

Dr. U.V. Kulkarni
Shri Guru GobindSinghji Institute of Engineering and Technology
Vishnupuri, Nanded.
(Chairman) Nanded

Dr. G.V. Chaudhari
Director
School of Computational Sciences
S. R.T. M.U.

Dr. J.V. Megha
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Mr. Wahi G.S.
Gramin College of Engineering
Vishnupuri, Nanded.

Mr. Maske P.S.
Gramin College of Engineering
Vishnupuri, Nanded.

Dean Engineering (S. R. T. M. U.)

List of Professional and Open Electives:-

Professional Elective IV:-

1. Digital Signal Programming
2. Cloud Computing

Professional Elective V:-

1. Distributed Systems
2. Embedded Systems

Open Elective –II:

1. Cyber Law and Ethics
2. Data Analytics
3. Java Programming

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Dean Engineering

S. R. T. M. U.Nanded

Teaching Scheme - Final Year Computer Engineering

SEMESTER – VIII

SI. No.	Category	Code	Course Title	Hours per Week				Marking Scheme					Theory Total
				L	T	P	CR	PR	OR	TW	MSE	ESE	
1.	Professional Elective Courses	PEC 801 (A)	Elective-VI	3	0	2	4	50 @	0	50	30	70	200
2.	Open Elective Courses	OEC 802 (A)	Open Elective-III	3	0	2	4	50 @	0	50	15	35	150
3.	Open Elective Courses	OEC 803 (A)	Open Elective-IV	4	0	0	4	0	0	0	15	35	50
4.	Project	PROJCS 804	Project-III(Continued from VII Semester, Project work, Seminar and Internship in industry or at appropriate work place)	0	0	8	4	0	200 #	50	0	0	250
5.	Humanities and Social Sciences including Management Courses	HSMC 805	Entrepreneurship Development	0	0	2	1	0	25 @	25	0	0	50
Total				**10**	**0**	**14**	**17**	**100**	**225**	**175**	**60**	**140**	**700**

Symbols to remember: -@ - Internal Assessment, # - External Assessment

T – Theory , P– Practical, T – Tutorial , CR – Credit , OR – Oral , TW – Term work, MSE – Minor Semester Examination, ESE – End Semester Examination.

List of Professional and Open Electives:-

Professional Elective VI:-

1. Image Processing
2. VLSI System Design

Open Elective –III:-

1. Cryptography and Network Security
2. Mobile App Development
3. Python Programming

Open Elective –IV:

1. Information Retrieval
2. Internet of Things

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Elective-IV

PEC 701 (A)	Digital Signal Processing	4L:0T:2P	5 Credits

Course Objective:

At the end of this course, students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
2. Analyse discrete-time systems using z-transform.

Course Contents:-

Module 1: Discrete-time signals and systems Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate. **(08Hrs.)**

Module 2: Z-transform z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms. **(10Hrs.)**

Module 3: Discrete Fourier Transform Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems. **(08Hrs.)**

Module 4: Design of Digital filters Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band stop and High-pass filters.

Effect of finite register length in FIR filter design.Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing. **(12Hrs.)**

Module 5: Applications of Digital Signal Processing Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter. **(08Hrs.)**

List of Practical's:

1. To generate discrete sequence using software tool
2. To Perform Operation on Sequence using software tool.

3. To represent basic signals (Module step, Module impulse, ramp, exponential, sine and cosine).
4. To develop program for discrete convolution
5. To develop program for discrete correlation.
6. To understand stability test.
7. To Perform Z Transform and Inverse Z-Transform and to find Poles, Zeros and gain from a given Z-Transform using software tool.
8. To understand sampling theorem
9. To design analog filter (low pass, band pass, band stop, high pass filter).
10. To design digital IIR filter (low pass, band pass, band stop, high pass filter).
11. To design FIR filter using windows technique.
12. To write a program to compare direct realization values of IIR filter
13. To study fixed point and floating point digital signal processors.
14. To study architecture of TMS320C2000 series Digital Signal Processors.

Course Outcomes:

1. Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
2. Design digital filters for various applications.
3. Apply digital signal processing for the analysis of real-life signals.

Text/Reference Books:

1. S. K. Mitra, “Digital Signal Processing: A computer based approach”, McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, “Digital Signal Processing: Principles, Algorithms And Applications”, Prentice Hall, 1997.
4. L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, Prentice Hall, 1992.
5. J. R. Johnson, “Introduction to Digital Signal Processing”, Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, “Digital Signal Processing”, John Wiley & Sons, 1988.

Elective-IV

PEC 701 (B)	Cloud Computing	4L:0T:2P	5 Credits

Objectives:

1. To provide an in-depth and comprehensive knowledge of the Cloud Computing Fundamental issues, technologies, applications and implementations

2. To expose the students to the frontier areas of Cloud Computing

3. To motivate students to do programming and experiment with the various cloud Computing environments

Course Contents:

Module 1: Introduction (06 Hrs.)

Cloud computing at a glance, Historical developments, Building cloud computing environments, Computing platforms and technologies, Principles of parallel and distributed computing- eras of Computing, parallel vs. Distributed computing, Elements of parallel computing, Technologies for distributed computing.

Module 2: Virtualization (06 Hrs.)

Introduction, Characteristics of virtualized environments, Taxonomy of virtualization Techniques- execution virtualization, other types of virtualization, Virtualization and cloud Computing, Pros and cons of virtualization, Technology examples- Xen: para virtualization, VMware: full virtualization, Microsoft hyper-V.

Module 3: Cloud computing architecture (08 Hrs.)

Introduction, cloud reference model-architecture, Infrastructure / hardware as a service, Platform as a service, Software as a service, Types of clouds-public clouds, Private clouds, Hybrid clouds, CommModuley clouds, Economics of the cloud, Open challenges-cloud definition, Cloud Interoperability and standards, Scalability and fault tolerance, Security, Trust and privacy

Organizational aspects

Module 4: Cloud application platform (08 Hrs.)

Framework overview, Anatomy of the aneka container-from the ground up: platform abstraction layer, Fabric services, Foundation services, Application services, Building aneka clouds - Infrastructure organization, Logical organization, Private cloud deployment mode, Public cloud deployment mode, Hybrid cloud deployment mode, Cloud programming and management-aneka SDK, Management tools

Module 5: Cloud platforms in industry (06 Hrs.)

Data-intensive Computing-characterizing Data-intensive computations, Challenges ahead, Historical perspective, Technologies for data-intensive Computing-storage systems, Programming platforms, Amazon web services, Compute services, Storage services, Communication services, Additional services, Google app engine, Architecture and core concepts, Application life-cycle, Cost model observations, Microsoft azure, Azure core concepts, SQL azure, Windows azure Platform appliance

Module 6: Cloud security (06 Hrs.)

Cloud computing software security fundamentals, Cloud information security objectives, Cloud security services, Relevant cloud security design principles. Cloud computing security architecture-architectural considerations, General issues, Identity management and access Control, Autonomic security

List of Practical's:

1. Working of Google Drive to make spread sheet and notes.
2. Installation and configuration of Just cloud.
3. Working in Cloud9 to demonstrate different language.
4. Working in Codenvy to demonstrate provisioning and scaling of a website.

5. Installation and configuration of Hadoop/ Eucalyptus

6. Working and installation of Google App Engine

7. Working and installation of Microsoft Azure

8. Working with Mangrasoft Aneka Software

9. Installation and working with virtual machine

10. Implementation of SOAP web services in C#/JAVA applications

11. Demonstrate the use of map and reduce tasks

Course Outcomes:

At the end of the course the student will be able to

1. Compare various cloud computing providers / Software.

2. Understand and familiarize with the basic concepts of cloud computing.

3. Understand how to build large scale distributed systems and cloud applications.

4. Comprehend the importance of cloud security.

Text Books:

1. "Mastering Cloud Computing", RajkumarBuyya, Christian Vecchiola& S. ThamaraiSelvi, McGraw Hill Education (India). ISBN: 1-25-902995-6.

2. "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Ronald Krutz and Russell Dean Vines, 1st Edition, Wiley, 2010 ISBN-10**:** 8126528095

Reference Books:

1. "Cloud Computing, Implementation, Management and Strategy", John Rittinghouse& James Ransome CRC Press, 2010 ISBN-10: 1439806802

2. " Cloud Computing Bible", Barrie Sosinsky , Wiley ISBN-10: 8126529806

3. "Cloud Computing: A Practical Approach", Anthony T Velte, Toby J Velte, Robert Elsenpeter Tata McGraw-Hill 2010ISBN-10: 0070683514

4. “Cloud Computing Principles and Paradigms”, RajkumarBuyya, J.Broberg, A. Goscinski

Wiley-Blackwell publications ISBN-10: 0470887990

Elective-V

PEC 702 (A)	Distributed Systems	3L:0T:2P	4 Credits

Course Objectives:

1. This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

2. To learn the principles, architectures, algorithms and programming models used in distributed systems.

3. The structure of distributed systems using multiple levels of software is emphasized. Specific topics include: distributed algorithms, distributed file systems, distributed databases, security and protection distributed services such as the world-wide web.

Course Contents:

Module 2: Introduction (08 Hrs.)

Definition, Goals, Hardware and software concepts, Client server models.Communications:Layered protocols, Remote procedure call, Remote object invocation, Message oriented communications, Stream oriented communications.

Module 2: Processes (08 Hrs.)

Threads, Clients, Servers, Code Migrations, Software Agents.Naming:Naming entities, Locating mobile entities, removing unreferenced entities.

Module 3: Synchronization (04Hrs.)

Clock synchronizations, Logical clocks, Global states, Election algorithms, Mutual exclusion, Distributed transactions.

Module4: Consistency and replications (08Hrs.)

Introductions, Data centric consistency models, Client centric consistency model, Distribution protocols, Consistency protocols. Fault tolerance: Introduction, Process resilience, Reliable Client-server communication, Distributed commit, Recovery.

Module5: Distributed object based systems (08 Hrs.)

CORBA, Distributed COM, GLOBE and their comparisons. Distributed file systems: Sun network file system, the coda file systems, other file systems and their comparisons.

Module6: Distributed document based systems: (04Hrs.)

The World Wide Web: Communications, Processes, Synchronization, Caching and replications Fault tolerance. Lotus notes and its comparison.

List of Practical's:

1. Implement the concept of RPC.
2. Implement the concept of RMI.
3. Design a Distributed Application using Message passing Interface for remote computation.
4. Implementation of Clock Synchronization (logical/physical).
5. To write Program multi-threaded client/server processes.
6. Implement concurrent echo client-server application
7. Implement concurrent day-time client-server application.
8. Configure following options on server socket and tests them: SO_KEEPALIVE, SO_LINGER, SO_SNDBUF, SO_RCVBUF, TCP_NODELAY.
9. Incrementing a counter in shared memory.
10. To Study Implementation of Election algorithm.
11. To study Implementation of Mutual Exclusion algorithms.
12. Implement Network File System (NFS).

13. Write a program using CORBA to demonstrate object brokering

Course Outcomes:

At the end of the course students will be able to

1. Understand key features of the Distributed Systems such as Communications,

Processes, Synchronization, Fault Tolerance, Consistency and Replications.

2. Use and apply important methods in distributed systems to support scalability and fault

Tolerance.

3. Design and implement distributed applications of Distributed Systems.

Text Books:

1. *"Distributed System",*Tanenbaum& Steen, PHI, 2002, ISBN: 0-13-148521-0.

Reference Books:

1. *"Distributed System: Concepts and Design",*Coulouris, Dollimore, Kindberg, Pearson

Education, 2011, ISBN: 978-81-317-1840-7.

2. "*Distributed Operating System",*P.K.Sinha, Addison Wesley, 2003, ISBN: 6321117891.

3. *"Advanced Concept in Operating Systems",*Singhal&Shivaratri, McGraw Hill Publication,

1996, ISBN: 0-7803-1119-1.

Elective-V

PEC 702 (B)	Embedded Systems	3L:0T:2P	4 Credits

General Objectives:

The course is design to meet the objectives of:

1. Define the class and its goals
2. Provide a general overview of Embedded Systems
3. Learn to design and development of an embedded system, including hardware and embedded software development.
4. Give examples of Embedded Systems
5. Show current statistics of Embedded Systems Design and development of small Embedded Systems.
6. Development of software.
7. Understand architecture of RTOS.

Course Contents:-

Module 1: (8Hrs.)

Introduction to Embedded systems.Embedded systems vs. general computing systems. Introduction to different embedded processors like 8051, ARM, PIC, DSP, and FPGA based processors etc. Hardware/software code sign, code sign for system specification and modelling. Single processor architectures and multiprocessor architectures.The co synthesis Problem.State transition graph.

Module 2: (8Hrs.)

Models of computation, requirements for embedded system specification, hardware/software partitioning problem, and hardware/software cost estimation. Generation of partitioning using different modelling technique, external peripherals types of memory and their management, case studies.

Module 3: (9Hrs.)

Introduction to RTOS: OS in embedded SoC. Introduction to tasks, process and threads. Multiprocessing and multitasking.Task scheduling. Inter process communication, message passing, interrupt driven input and output Non mask able interrupt, software interrupt. Threads single, multithread concept; multitasking sequential circuit, task synchronization techniques.Handling of interrupts in RTOS and timing analysis.Case studies.

Module 4: **(8Hrs.)**

Embedded system modeling, embedded C, role of infinite loop, instruction sequencing, compiling, state machine, pattern sequence detector, different types of embedded multitasking sequential switching circuit design and optimization. Case studies.

Module 5: **(10Hrs.)**

Embedded System: Introduction, block diagram, applications, advantages and disadvantages.Classification of Embedded System Small scale, medium scale, sophisticated, stand-alone, reactive/real time (soft and hard real time), Networked, Mobile, Single functioned, Tightly constrained, Design Metrics/Specifications/Characteristics of Embedded System: Processor power, memory, operating system, Reliability, performance, power consumption, NRE cost, Module cost, size, flexibility, time-to-prototype, time-to-market, maintainability, correctness and safety.

List of practicals:

1. Design an embedded controller for automatic room temperature control.
2. Design an FPGA based embedded SoC system.
3. Design an embedded system for industrial automation.
4. Design an embedded system for AUV.
5. Design an embedded system for Robot gripper.
6. Design an embedded system for wheel mechanism of mobile robot.
7. Design an embedded system for obstacle avoidance by an assembly line robot.
8. Any innovative embedded system design as mini project

Text Book:

- W. Wolf, "Computers as components: Principles of embedded computing system design", 2/e, Elsevier, 2008.
- R. Gaonkar, " Fundamentals of Microcontrollers and Application in Embedded Systems," Penram International Publishing, 2015
- A. N. Sloss, D. Symes, and C. Wright, "ARM system developer's guide: Designing and optimizing system software", Elsevier, 2008.

Reference Books:

- Product data sheet LPC 2141/42/44/46/48. NXP Semiconductors.
- ARM7TDMI Technical Reference Manual, ARM Limited
- Jack Ganssle, "The art of designing embedded systems", 2/e, Elsevier, 2008
- Michael Barr, “Programming Embedded Systems in C and C++”, Orally, 1999.
- Kirk Zurell, “C Programming for Embedded Systems”, CMP Books, 2000.
- Muhammad Ali Mazidi, Rolin D. Mckinlay& Danny Sansey, “PIC Microcontroller and Embedded System Using Assembly & C for PICI8,” Pearson International Edition, 2008.
- Muhammad Ali Mazidi, Janice GillispieMazidi&Rolin D. Mckinlay, “The 8051 Microcontroller and Embedded System Using Assembly & C,” Pearson India.

Open Elective-II

OEC 703 (A)	Cyber Law and Ethics	3L:0T:2P	4 Credits

Objectives:-

After learning the course the students should be able to:

1. Understand the core concepts of Defensive and Offensive Security.
2. Understanding of breaching the networks domains and systems.
3. Understanding the ethics of Hacking.
4. Limitations of Penetration Testing.
5. Cyber Crime Case s and IT act India and amendments.

Course Contents:-

Module 1: (12 Hrs.)

The Business Aspects of Penetration Testing, The Technical Foundations of Hacking, Foot printing and scanning Enumeration and Step - by-Step System Hacking, The Business Aspects of Penetration Testing, Automated Security Assessment Tools, Trojans and Backdoors, Sniffers Session Hijacking and Denial of Service Web Server Hacking Web application Vulnerabilities and Database Attacks

Module 2: (8 Hrs.)

Wireless Technologies, Security and Attacks IDS Honeypots and Firewalls Buffer Overflow Cryptographic Attacks and Defenses Social Engineering and Physical Security

Module 3: (11 Hrs.)

Understanding Copy Right in Information Technology, Understanding the technology of Software, software copyright vs Patent debate, Authorship Assignment issues, Commissioned work, Work for hire Idea/Expression dichotomy, Copy right in internet, Legal Issues in internet and Software Copyright Jurisdiction Issues, Copyright Infringe Remedies of Infringement Multimedia, Copyright issues, Software Piracy, Patents understanding.

Module 4: (12 Hrs.)

Cyber Crimes, Understanding Cyber Crimes in context of Internet, Indian Penal Law & Cyber Crimes Fraud Hacking Mischief, International law, Obscenity and Pornography Internet, Potential of Obscenity Indian Law On Obscenity & Pornography Technical, Legal solutions International efforts Changes in Indian Laws, Ecommerce & Taxation, UNCITRAL model law

of E,-Commerce, Indian Legal Position on E-Commerce IT Act 2000/Indian Evidence, Act/Draft law on E-Commerce.

List of Practical's:-

1. Download the tool samspade and carry out a who is on any of the domains.
2. Using Google hacks /dorks carry out any three information gathering exercises.
3. Usingbing, find the shared hosting details for a domain.
4. Using net craft identify the webserver / server associated with a domain of your choice.
5. Carry out an email header analysis on an email received (preferably from a non -Gmail email and document the identified information.
6. Carry out information gathering using FOCA.
7. Using Wire shark, create a Filter to capture only FTP traffic
8. Using wire shark, identify the version of SSL protocol used (SSLv1, SSLv2, SSLv3, TLSv1, TLSv2, etc.) in any HTTPS web portal of your choice. You may need to login to get this information.
9. Carry out a port scanning on an internal lab machine using nmap.
10. Carry out a Vulnerability Scanning using Nessus and assess the report.

Reference Books

1. Gray Hat Hacking: The Ethical Hackers Handbook by Allen Harper, Shon Harris, Cyber Laws by C.K punia, Sumit Enterprises
2. Cyber Crime and Law Enforcement t by V. D. Dudeja, Commonwealth Publishers

Open Elective-II

OEC 703 (B)	Data Analytics	3L:0T:2P	4 Credits

Objectives:

1. To optimize business decisions and create competitive advantage with Big Data analytics
2. To explore the fundamental concepts of big data analytics.
3. To learn to analyze the big data using intelligent techniques.
4. To understand the various search methods and visualization techniques.
5. To learn to use various techniques for mining data stream.
6. To understand the applications using Map Reduce Concepts.
7. To introduce programming tools PIG & HIVE in Hadoop echo system.

Course Contents:-

Module 1:- Introduction to big data (8Hrs.)

Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

Module 2:-Mining data streams (10Hrs.)

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

Moudule 3:-Hadoop (10Hrs.)

History of Hadoop- the Hadoop Distributed File System – Components ofHadoopAnalyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features- Hadoop environment.

Module 4:-Frameworks (8Hrs.)

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams.

Module 5:-Predictive Analytics (8Hrs.)

Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

List of Practical's:-

1. Perform setting up and Installing Hadoop in its two operating modes:

I) Pseudo distributed,

II) Fully distributed.

iii) Use web based tools to monitor your Hadoop setup.

2. Implement the following file management tasks in Hadoop:

I) Adding files and directories

II) Retrieving files

III) Deleting files

3. Benchmark and stress test an Apache Hadoop cluster

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

Find the number of occurrence of each word appearing in the input file(s)

Performing a Map Reduce Job for word search count (look for specific keywords in a file)

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented. Data available at:

https://github.com/tomwhite/hadoop/book/tree/master/input/ncdc/all.

Find average, max and min temperature for each year in NCDC data set?

Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

6. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

7. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

8. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.

References:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.

3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hill Publishing, 2012.

4. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.

5. Bill Franks, "Taming the Big Data Tidal Wave: Finding OpportModuleies in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.

6. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.

7. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

8. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, Reprinted 2008.

9. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007.

10.Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.

11. ArshdeepBahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands- On Approach ", VPT, 2016

12. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014.

Open Elective-II

OEC 703 (C)	Java Programming	3L:0T:2P	4 Credits

Objectives:

1. To learn the fundamentals of Java programming.
2. To write programs using object-oriented paradigm in Java.
3. To apply object-oriented programming paradigm for solving the specified problem.

Course Contents:

Module I: **(08 Hrs.)**

Java Evolution: Java history, Java features, How Java differs from C and C++.

Java Platform and Program Structure: Java, Java Runtime Environment, Architecture of JVM, Characteristics of Java, Java Program Structure, Commands for running Java Program, Code Conventions, Constants, Variables and Data Types, Operators and Expressions, Decision Making and Branching, Decision Making and Looping, Classes, Objects and Methods, Arrays, Strings and Vectors.

Module 2: **(08 Hrs.)**

Interfaces: Multiple Inheritances: Introduction, Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables.

Packages: Putting Classes Together: Java API Packages, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a class to a Package, Hiding Classes.

Module 3: **(10 Hrs.)**

Managing Input/ Output Files in Java: Concept of Streams, Stream classes, using Streams. **Multithreaded Programming**: Creating Threads, Extending the Thread class, Stopping and Blocking a thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface, Inter-thread Communication. **Managing Errors and Exceptions**: Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using Finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging.

Module 4: **(06 Hrs.)**

Applet Programming: How Applets differ from Applications, Preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable Applet, Designing a web page, Applet Tag, Adding Applet to HTML File, Running the Applet, Passing Parameters to Applets, Event Handling.

Module 5: **(07 Hrs.)**

Graphics Programming: The Graphics class, Lines, Rectangles, Circle, Ellipse, and Drawing Arcs, Drawing Polygons.

Swing: Applets, Applications and Pluggable Look and Feel, Text Fields, Buttons, Toggle Buttons, Checkboxes, and Radio Buttons.

Module 6: **(06 Hrs.)**

Swing: Viewports, Scrolling, Sliders, Lists, Table and Trees, Combo Boxes, Progress Bars, Tooltips, Separators, Layered Panes, Tabbed Panes, Split Panes, Menus, Toolbars.

List of Practical's:

1. Write a program to implement Vector class and its methods.
2. Class and Method Implementation by-
    - Method overloading
    - Constructor overloading
    - Static members in methods
    - Inner Classes (Use any application)
3. Implementation of multiple inheritances using Interface.
4. To write a java program to handle the situation of exception multi inheritance.
5. Implementation of Packages.
6. Exception handling for-
    - Divide by Zero error
    - Null values
    - Data entry
7. Implementation of multithreading.
8. Write a java program which shows the use of yield (), stop (), and sleep () methods.
9. Program to scroll the banner using Applet.
10. Write a program to draw bar chart using Applet.

11. Program using Applet to illustrate event handling with interactive radio buttons to control font style of text field. Also provide a textbox wherein the user may enter font size.

12. Write a program to draw line, rectangle, circle, ellipse, polygon by using Graphics Class methods.

13. Design 8-digit calculator using AWT package and layout manager.

14. W rite a program to create and display Frame.

15. Write a program to demonstrate mouse events.

16. Write a program to demonstrate keyboard events.

17. GUI Design using Swing package- Login and Password verification

18. Write a program to draw table using swing package.

19. Write a program to draw tree using swing package.

20. To write a java program to implement the concept of the Dining Philosopher problem.

21. To write a java program to implement the concept of the producer consumer problem.

Text Books:

1. "Programming with Java" by E Balgurusamy, Fourth Edition, Tata McGraw Hill Education, ISBN-13:978-0-07-014169-8.

2. "Object-Oriented Programming with JAVA" by Raj Kumarbuyya, S. ThamaraiSelvi, Xingchen, Tata McGraw Hill Education Private Limited, ISBN13:978-0-07-066908- 6.

Reference Books:

1. "Java 2 Programming Black Book" by Steven Holzner, Fifth Edition, Paraglyph Press, Dremtech Press, ISBN-978-81-7722-655-3.

2. "The Complete Reference Java2" by Herbert Scheldt, 5th Edition, Tata McGraw Hill. ISBN-13:978-0-07-049543-2.

BSC 704	Biology (Biology for Engineers)	2L:0T:2P	3 Credits

[3 credit course; 2 (one hour) lectures and one (one hour) tutorial per week. Only lecture hours are shown]

Module 1. - *Introduction* **(2 Hrs.)**

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18^{th} Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2.- *Classification* **(2 Hrs.)**

Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, ureotelic, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3.-*Genetics* **(2 Hrs.)**

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele.Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring.Concepts of recessiveness and dominance.Concept of mapping of

phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4.-*Biomolecules* **(2 Hrs.)**

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric Modules and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins.Nucleotides and DNA/RNA.Two carbon Modules and lipids.

Module 5.*Enzymes* **(2 Hrs.)**

Purpose: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyzereactions. Enzyme classification.Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6.- *Information Transfer* **(2 Hrs.)**

*Purpose***:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code.Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7.- *Macromolecular analysis* **(2 Hrs.)**

*Purpose***:** How to analyses biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure.Primary secondary, tertiary and quaternary structure.Proteins as enzymes, transporters, receptors and structural elements.

Module 8.- *Metabolism* **(2 Hrs.)**

*Purpose***:** The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoincreactions.Concept of K_{eq} and its relation to standard free energy.Spontaneity.ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis).Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9.*Microbiology* **(2 Hrs.)**

Concept of single celled organisms.Concept of species and strains.Identification and classification of microorganisms.Microscopy.Ecological aspects of single celled organisms.Sterilization and media compositions.Growth kinetics.

Course Outcomes

After studying the course, the student will be able to:

- Describe how biological observations of 18th Century that lead to major discoveries.
- Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
- Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
- Classify enzymes and distinguish between different mechanisms of enzyme action.
- Identify DNA as a genetic material in the molecular basis of information transfer. Analyse biological processes at the reductionistic level
- Apply thermodynamic principles to biological systems.
- Identify and classify microorganisms.

Text/References:

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

PROJ-CS 705	Project-II (Project work, Seminar)	0L:0T:8P	4 credits

Students have to make extensive literature survey and identify the problem in view to complete Final Project of Eighth semester. Problem identification and pre work of the project should be carried out and presented in the department.

Survey for Project Selection		**05**
Selection of Problem/ Project		**05**
Presentation for selection of project		**05**
Weekly Report for continued assessment	**1**	**05**
	2	**05**
	3	**05**
	4	**05**
	5	**05**
Final Presentation for Project	**6**	**30 HOD**
		30 Guide
Weightage		**Oral 100 Marks by HOD/Professor of institute**
		TW of 50 Marks by Internal Guide

MC 706	Internship in industry or at appropriate work place	0L:0T:0P	0 credits

Every Student has to undergo 4 weeks industrial training after completion of Sixth Semester Examination, Performance of training will be assessed in the 7 th semester. He has to submit continuous assessment and report of training to the Department and work should be represented in presentation before the Head of Department and faculties and students.

HSMC 707	Interview Techniques and Mock Exercise	0L:0T:2P	1 credits

Module1: Pre interview preparation

Know yourself Interview as selection process Types of interview Competency based interview technique

Module 2: Interview Process

Interview Process Candidate philosophy, reason for selecting and rejecting candidate, most common Mistakes during interview, Questions not to be asked in interview, Dress code for interview, Preparing FAQ s in the interview Aptitude Test Psychometric Test

Module 3: Group Discussion

Meaning of GD - Why group discussion? - Characters tested in a GD - Tips on GD - Types of GD - Skills required in a GD - Consequences of GD - Behaviour in a GD - Essential elements of GD - Different characters in GD - Traits tested in a GD - GD etiquette - Areas to be concentrated while preparing for a GD - Initiating a GD - Techniques to initiate a GD - Non-verbal communication in GD - Movement and gestures to be avoided in a GD - Topics for GD.

Module4: Etiquettes and Manners

Etiquette Introduction - Modern etiquette - Benefits of etiquette - Classification of etiquette - Accompanying women - Taboo topics - Proposing the toast. Manners Introduction - Poor manners noticed in youth - Why should you practice good manners? - Practicing good manners - Manners at the wheel: Driving - Manners in the flight - Respecting the sacred : Visiting holy places - Dealing with the challenged - Attending funeral - Professional manners - Social skills (manners) - Getting along with people - Manners to get respect from others , Corporate grooming tips - Mind your mobile manners - Annoying office habits. Exercise 1: Test your etiquette Exercise 2: Test your manners

Module5: Preparing Resume

Difference among Bio-data, CV and Resume - The terms - The purpose of CV writing - Types of resumes - Interesting facts about resume, CV / Resume Perpetration tips, Entry level Resume,

Module6: Exercise

Finding Pattern of aptitude test of different MNC's and Preparation of the same**.**3 Question papers solving each on aptitude and Technical Competency**,** Video shooting of Mock interview of individual student and identification of common mistakes committed by him.

Text/Reference Books:

1. How to Win interview – TusharKokane – Education Publications New Delhi
2. Soft Skills – Know yourself and Know your world by Dr.K.Alex – Chand and Publications, New Delhi

Elective-VI

PEC 801 (A)	Image Processing	3L:0T:2P	4 Credits

OBJECTIVES:

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

- Discuss digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Use image compression and segmentation Techniques.
- Represent features of images.

Course Contents:-

Module 1: DIGITAL IMAGE FUNDAMENTALS (8 Hrs.)

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color models.

Module 2: IMAGE ENHANCEMENT (10Hrs.)

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

Module 3: IMAGE RESTORATION AND SEGMENTATION (10Hrs.)

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

Module 4: WAVELETS AND IMAGE COMPRESSION (8 Hrs.)

Wavelets – Sub band coding – Multiresolution expansions – Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

Module 5: IMAGE REPRESENTATION AND RECOGNITION (8 Hrs.)

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors –Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.

List of practical's:-

1. Write a program to display an image as a gray scale image.
2. Write a program to display an image as a histogram.
3. Write a program to find the negative of an image using the complement function and the script code.
4. WAP to display an image in RED, Gray scale, GREEN and blue.
5. WAP to apply linear and power log transformation functions on an image.
6. WAP to enhance an image properties using combination of spatial filters.
7. WAP to illustrate the effect of square averaging of different masks on an image.
8. WAP to observe the effect of median filtered on an image corrupted by salt and pepper method.
9. WAP to show: Image Enhancement using various filter"SOBEL" "PREVIT" and "LAPLACIAN".

Course Outcomes:

1. Understand the need for **image** transforms different types of **image** transforms and their properties.
2. develop any **image processing** application
3. Understand the need for **image** compression and to learn the spatial and frequency domain techniques of **image** compression.

TEXT BOOK:

- Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.

REFERENCES:

- Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011.

- Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
- William K Pratt, “Digital Image Processing”, John Willey, 2002.
- Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
- http://eeweb.poly.edu/~onur/lectures/lectures.html.
- http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html.

Elective-VI

PEC 801 (B)	VLSI System Design	3L:0T:2P	4 Credits

Objective:-

Student will be in a position that he/she can design VLSI circuits starting from pmosnmos, cmos, and bicmos technology based design

1. Gains thorough knowledge on design tools to draw layouts for the transistor structures
2. The student will understand the design of logic gates
3. The student will understand the design of sequential system

Course Contents:

Module 1: REVIEW OF MICROELECTRONIC S AND INTRODUCTION TO MOS TECHNOLOGIES: **(4Hrs.)**

(MOS, CMOS, Bi - CMOS) Technology Trends and Projections.

Module 2:BASIC ELECTRICAL PROPERTIES OF MOS, CMOS & BICOMS CIRCUITS **(6Hrs.)**

Ids -Vds Relationships, Threshold Voltage Vt, Gm, Gds and Wo, Pass Transistor, MOS,CMOS & Bi - CMOS Inverters, Zpu/Zpd, MOS Transistor Circuit Model, Latch - Up in CMOS Circuits.

Module 3: LAYOUT DESIGN AND TOOLS: **(6Hrs.)**

Transistor Structures, Wires and Vias, Scalable Design Rules, Layout Design Tools.

Module 4: LOGIC GATES & LAYOUTS: **(8Hrs.)**

Static Complementary Gates, Switch Logic, Alternative Gate Circuits, Low Power Gates, Resistive and Inductive Interconnect Delays.

Module 5: COMBINATIONAL LOGIC NETWORKS: **(6Hrs.)**

Layouts, Simulation, Network delay, Interconnect Design, Power Optimization, Switch Logic Networks, Gate and Network Testing.

Module 6: SEQUENTIAL SYSTEMS: **(4Hrs.)**

Memory Cells and Arrays, Clocking Disciplines, Design, Power Optimization, Design Validation and Testing.

Module 7: FLOOR PLANNING & ARCHITECTURE DESIGN:**(6Hrs.)**

Floor Planning Methods, Off Chip Connections, High Level Synthesis, Architecture for Low Power, SOCs and Embedded CPUs, Architecture Testing.

Module 8: INTRODUCTION TO CAD SYSTEMS (ALGORITHMS) AND CHIP DESIGN: **(6Hrs.)**

Layout Synthesis and Analysis, Scheduling and Printing; Hardware - Software Co - design, Chip Design n Methodologies - A simple Design Example.

List ofPractical's:

1. Introduction to programmable devices (FPGA, CPLD), Hardware Description Language (VHDL), and the use programming tool.
2. Implementation of basic logic gates and its testing.
3. Implementation of adder circuits and its testing.
4. Implementation 4 to 1 multiplexer and its testing.
5. Implementation of 3 to 8 decoder and its testing.
6. Implementation of 8 to 3 priority encoder and its testing.
7. Implementation of J-K and D Flip Flops and its testing.
8. Implementation of sequential adder and its testing.
9. Implementation of BCD counter and its testing.
10. Implementation of two 8-bit multiplier circuits and its testing.
11. Simulation of CMOS Inverter using SPICE for transfer characteristic.
12. Simulation and verification of two input CMOS NOR gate using SPICE.
13. Implementation and simulation of given logic function using dynamic logic.
14. To generate layout for CMOS Inverter circuit and simulate it for verification.
15. To prepare layout for given logic function and verify it with simulations.
16. To measure IDS – VGS and IDS – VDS characteristics of given n-channel and p-channel MOSFETs.
17. To measure propagation delay of a given CMOS Inverter circuit.

Course Outcomes:

1. Identify the various IC fabrication methods.
2. Express the Layout of simple MOS circuit using Lambda based design rules.
3. Apply the Lambda based design rules for subsystem design.

4. Differentiate various FPGA architectures.

5. Design an application using Verilog HDL

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems, K. Eshraghianet .al (3 authors) PHI of India Ltd., 2005

2. Modern VLSI Design, 3rd Edition, Wayne Wolf, Pearson Education, fifth Indian Reprint, 2005.

REFERENCES:

1. Principals of CMOS Design – N.H.E Weste, K.Eshraghian, Adison Wesley, 2nd Edition.

2. Introduction to VLSI Design –Fabricius, MGH International Edition, 1990.

3. CMOS Circuit Design, Layout and Simulation –Baker, Li Boyce, PHI, 2004.

Open Elective-III

OEC 802 (A)	Cryptography and Network Security	3L:0T:2P	4 Credits

OBJECTIVES:

The student should be made to:

1. Understand OSI security architecture and classical encryption techniques.
2. Acquire fundamental knowledge on the concepts of finite fields and number theory.
3. Understand various block cipher and stream cipher models.
4. Describe the principles of public key cryptosystems, hash functions and digital signature.

Course Contents:-

Module 1:INTRODUCTION&NUMBERTHEORY (10Hrs.)

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

Module 2:BLOCKCIPHERS&PUBLICKEYCRYPTOGRAPHY (10Hrs.)

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

Module3:HASHFUNCTIONSANDDIGITALSIGNATURES (6Hrs.)

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

Module 4:SECURITYPRACTICE&SYSTEMSECURITY (8Hrs.)

Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and

related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

Module 5:E-MAIL,IP&WEBSECURITY (10Hrs.)

E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPsec – IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

List of Practical's:-

1. W.A.P. to implement Ceaser Cipher
2. W.A.P. to implement Affine Cipher with equation c=3x+12
3. W.A.P. to implement Play fair Cipher with key ldrp
4. W.A.P. to implement polyalphabetic Cipher
5. W.A.P. to implement Auto Key Cipher
6. W.A.P. to implement Hill Cipher. (Use any matrix but find the inverse yourself)
7. W.A.P. to implement Rail fence technique
8. W.A.P. to implement Simple Columnar Transposition technique
9. W.A.P. to implement Advanced Columnar Transposition technique
10. W.A.P. to implement Euclidean Algorithm
11. W.A.P. to implement Advanced Euclidean Algorithm
12. W.A.P. to implement Simple RSA Algorithm with small numbers

Course Outcomes:

At the end of the course students will be able to:

1. Implement various concepts of cryptography and network security.
2. Analyze the security requirements of communication systems & networks.
3. Design cryptographic protocols to secure a system, networks or application.

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (MODULE I, II, III, IV).
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002. (MODULE V).

REFERENCES:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication in Public World", PHI 2002.
6. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
7. Douglas R Simson "Cryptography – Theory and practice", First Edition, CRC Press, 1995.

Open Elective-III

OEC 802 (B)	Mobile App Development	3L:0T:2P	4 Credits

Objectives:-

1. Be exposed to technology and business trends impacting mobile applications
2. Be competent with the characterization and architecture of mobile applications.
3. Be competent with understanding enterprise scale requirements of mobile applications.
4. Be competent with designing and developing mobile applications using one application development framework.

Course Contents:

Module 1:- **(12Hrs.)**

Introduction-About Android, Smartphones future, preparing the Environment, Installing the SDK, Creating Android Emulator, Installing Eclipse, Installing Android Development Tools, Choosing which Android version to use. Hello Sheep- Creating a project, working with the AndroidManifest.xml, Using the log system, Activities

Module 2:- **(10Hrs.)**

UI Architecture-Application context, Intents, Activity life cycle, Supporting multiple screen sizes, User Interface Widgets- Text controls, Button controls, Toggle buttons, Images Notification and Toast- Parameters on Intents, Pending intents, Status bar notifications, Toast notifications.

Module 3:- **(10Hrs.)**

Menus-Localization, Options menu, Context menu, Dialogs- Alert dialog, Custom dialog, Dialog as Activity, Lists-Using string arrays , Creating lists, Custom lists, Location and Maps-Google maps, Using GPS to find current location.

Module 4:- **(12Hrs.)**

Working with data Storage-Shared preferences, Preferences activity, Files access, SQLite database, Animation-View animation, Draw able animation, Content Providers- Content provider introduction, Query providers, Network Communication- Web Services, HTTP Client, XML and JSON, Services-Service lifecycle, Foreground service, Publishing Your App- Preparing for publishing, Signing and preparing the graphics, Publishing to the Android Market.

List of practical's:-

1. Design an application representing a simple calculator.
2. Develop an application for working with Menus and Screen Navigation XML Code: [Create a menu-Android Resource Directory and create a main_menu.xml–Android Resource File in it.]
3. Develop an application for working with Notifications.
4. Develop an application demonstrating Internal Storage to store private data on the device memory.
5. Design a simple to do list application using SQLite.
6. Develop an application for connecting to the internet and sending email.
7. Develop an application for working with graphics and animation.
8. Develop an application for working with device camera.
9. Develop an application for working with location based services.
10. Using Worker thread write Android code for a click listener that downloads an image from a separate thread and displays it in an Image View.

Text/Reference Books:-

1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano.
2. Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 2nd edition, 2015.
3. Christian Keur and Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 5th edition, 2015.
4. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004.
5. Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with xJava, O'Reilly Media, 2016.
6. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, Java8inAction: Lambdas, Streams, and Functional-Style Programming, Manning Publications, 2015.
7. Benjamin J. Evans and MartijnVerburg, the Well-Grounded Java Developer: Vital Techniques of Java 7 and Polyglot Programming, Manning Publications, 2013.
8. Brian Fling, Mobile Design and Development, O'Reilly Media, Inc., 2009.

9. MaximilianoFirtman, Programming the Mobile Web, O'Reilly Media, Inc., 2nd ed., 2013.
10. CristianCrumlish and Erin Malone, Designing Social Interfaces, 2nd ed., O'Reilly Media, Inc., 2014.
11. Suzanne Ginsburg, Designing the iPhone User Experience: A User-Centered Approach to Sketching and Prototyping iPhone Apps, Addison-Wesley Professional, 2010.
12. Benjamin Muschko, Gradle in Action, Manning Publications, 2014.
13. Craig Larman, Applying UML and Patterns: A Guide to Object- Oriented Analysis and Design and Iterative Development, 3rd ed., Prentice Hall, 2004.

Open Elective-III

OEC 802 (C)	Python Programming	3L:0T:2P	4 Credits

Objectives:

1. Learning a Python language for expressing computations.
2. Learning about the process of writing and debugging a program in Python
3. Understand the principles of object-oriented programming using the logical constructs of the Python language.

Course Contents:

Module1: (10 Hrs.)

Introduction to Python: Introduction to Python interpreter, Byte code compilation, Python Virtual Machine, Python implementation alternatives- Cpython, Jpython, Ironpython, How to run Python programs, Running file with command line, Executable scripts. Types and Operators: Build in types, Python core data types, Strings- Sequence operations, Immutability, Type specific methods, other ways to code string, Pattern matching. Lists-type specific operations, Bound checking, Nesting, Comprehensions, Dictionaries mapping operation, Iteration and optimization

Module 2: (08 Hrs.)

Numeric Types: Numeric type basics, Numeric literals, Built in numeric literals, Python expression operators Mixes operators follow operator precedence, parenthesis group sub expression, Numbers in action, Statement and syntax- If test and syntax rules, while and for loops, Iterations. List: Creating lists, Accessing elements of list, Negative list indices, List slicing [Start: end], List slicing with step size, Python built-in functions for lists, The list operator, List comprehensions, List methods, List and strings, Splitting a string in list.

Module 3: (10 Hrs.)

String :Introduction, The index operator, Access characters via negative index, Traversal with for loop, Traversal with a while loop, The string slicing operator [start: end], string slicing with step size, various methods of str (String) class, Testing string, Searching substring in a string, Methods to convert a string to another string, Stripping unwanted characters from a string, Formatting string. Functions: Introduction, Arguments and parameters, Positional arguments,

Keyword arguments, Precautions while using keyword arguments, Parameter with default values, The local scope of variable, The return statement, Returning multiple values.

Module4: (08 Hrs.)

Classes and methods: An introduction to object-oriented programming in Python. How to create new objects, overload operators, and utilize Python special methods. Basic principles of object oriented programming: Operator overloading, Polymorphism, and Inheritance.

Module 5: (08 Hrs.)

Python- Database Access: MYSQL dB, Installing MYSQL dB, Database connection, Creating database table, Database operation- Insert, Update, Delete, Commit, Rollback. Graphical User Interface in Python: GUI Basics, Tkinter widgets- Button, CheckButton, Frame, Label, Labelframe, RadioButton, Scrollbar, Progress bar.

List of Practical's:

1. Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old.
2. Write a program to check whether the number is even or odd, print out an appropriate message to the user.
3. Write a program which will find all such numbers which are divisible by 7.
4. Write a program which can compute the factorial of a given numbers.
5. Write a program that prints out all the elements of the list that are less than 10.
6. Write a program that returns a list that contains only the elements that are common between the lists (without duplicates). Make sure your program works on two lists of different sizes.
7. Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number.

Given the input: 34, 67, 55,33,12,98

Then, the output should be:

['34', '67', '55', '33', '12', '98']

('34', '67', '55', '33', '12', '98')

8. To determine whether the number is prime or not.
9. To check whether a number is palindrome or not. (Using recursion and without recursion).
10. Write a program (function!) that takes a list and returns a new list that contains all the

elements of the first list minus all the duplicates. Write two different functions to do this - one using a loop and constructing a list, and another using set.

11. Write a program that asks the user how many Fibonacci numbers to generate and then generates them.

12. Write a program (using functions!) that asks the user for a long string containing multiple words. Print back to the user the same string, except with the words in backwards order. E.g."I am tybca student" is:" studenttybca am I"

13. Write a password generator in Python. Be creative with how you generate passwords - strong passwords have a mix of lowercase letters, uppercase letters, numbers, and symbols. The passwords should be random, generating a new password every time the user asks for a new password.

14. Write a program to implement binary search to search the given element using function.

15. Given a .txt file that has a list of a bunch of names, count how many of each name there are in the file, and print out the results to the screen.

Course Outcomes:

1. To understand why Python is a useful scripting language for developers.
2. To learn how to design and program Python applications.
3. To learn how to use lists, tuples, and dictionaries in Python programs.
4. To learn how to identify Python object types.

Text Books:

1. "Python: The Complete Reference" by Martin C. Brown (McGraw Hill Education), ISBN - 978-0072127188

2. "Learning with Python: How to Think Like a Computer Scientist" by Allen Downey (Dreamtech Press), ISBN-978-9351198147

3. "Learning Python: Powerful Object-Oriented Programming" by Lutz M (Shroff publishing Fifth edition) ISBN- 978-935110201

4. "How to Solve It by Computer" by Droomy (Pearson Education; 1 edition), ISBN: 978-8131705629

Reference Books:

1. “Head First Python” by Barry Paul (Author) (Shroff publication First edition) ISBN978-9350231883

2. “Think Python” by Allen B. Downey (Shroff publisher, First edition) ISBN-13: 978-9350238639

Open Elective-IV

OEC 803 (A)	Information Retrieval	4L:0T:0P	4 Credits

Module 1: INTRODUCTION (8Hrs.)

Introduction -History of IR- Components of IR - Issues –Open source Search engine Frameworks - The impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Versus Web Search - Components of a Search engine- Characterizing the web.

Module 2: NFORMATION RETRIEVAL (10Hrs.)

Boolean and vector-space retrieval models- Term weighting - TF-IDF weighting- cosine similarity – Pre-processing - Inverted indices - efficient processing with sparse vectors – Language Model based IR - Probabilistic IR –Latent Semantic Indexing - Relevance feedback and query expansion.

Module 3: WEB SEARCH ENGINE (10Hrs.)

INTRODUCTION AND CRAWLING Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement - search engine optimization/spam – Web Search Architectures - crawling - Meta-crawlers- Focused Crawling - web indexes –- Near-duplicate detection - Index Compression - XML retrieval.

Module 4: WEB SEARCH (10Hrs.)

LINK ANALYSIS AND SPECIALIZED SEARCH

Link Analysis –hubs and authorities – Page Rank and HITS algorithms -Searching and Ranking – Relevance Scoring and ranking for Web – Similarity - Hadoop& Map Reduce - Evaluation - Personalized search - Collaborative filtering and content-based recommendation of documents and products – handling “invisible” Web - Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.

Module 5: DOCUMENT TEXT MINING (8Hrs.)

Information filtering; organization and relevance feedback – Text Mining -Text classification and clustering - Categorization algorithms: naive Bayes; decision trees; and nearest neighbour - Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Course Outcomes:

1. To gain an understanding of the basic concepts and techniques in **Information Retrieval.**
2. Understand the issues involved in providing an **IR** service on a web scale, including distributed index construction and user modeling for recommendation engines.

Text/Reference Books:-

1. "Introduction to Information Retrieval" by Manning and Schutz
2. "Modern Information Retrieval" by Baeza-Yates and Ribeiro-Neto
3. "Mining the Web" by SoumenCharabarti
4. "Information Retrieval Thesaurus 01 Edition" by RajendraKumbhar
5. "Conceptual Information Retrieval: A Case Study in Adaptive Partial Parsing" by Mauldin Michael

Open Elective-IV

OEC 803 (B)	Internet of Things	4L:0T:0P	4 Credits

OBJECTIVES

1. To Understand the Architectural Overview of IoT.
2. To Understand the IoT Reference Architecture and Real World Design Constraints
3. To Understand the various IoT Protocols (Data link, Network, Transport, Session, Service)

Course Contents:-

Module 1: OVERVIEW (10Hrs.)

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

Module 2: REFERENCE ARCHITECTURE (10Hrs.)

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Module 3: IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS(8Hrs.)

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zig bee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

Module 4: TRANSPORT & SESSION LAYER PROTOCOLS (8Hrs.)

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

Module 5: SERVICE LAYER PROTOCOLS & SECURITY (8Hrs.)

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer.

Course Outcomes:

1. Able to understand the application areas of IOT.
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
3. Able to understand building blocks of Internet of Things and characteristics.

Text/Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, **"**From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**",** 1st Edition, Academic Press, 2014.

2. Peter Waher**, "**Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

4. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

5. Vijay Madisetti and ArshdeepBahga, **"**Internet of Things (A Hands-on-Approach)**",** 1st Edition, VPT, 2014.

PROJCS 804	Project-III(Final Project)	0L:0T:8P	4 credits

It is intended to start the project work early in the seventh semester and carry out both design and fabrication of a mechanical device whose working can be demonstrated. The design is expected to be completed in the seventh semester and the fabrication and demonstration will be carried out in the eighth semester.

Survey for Project Selection	**05**
Selection of Problem/ Project	**05**
Presentation/Project	**05**
Presentation for selection of project	**05**
Weekly Report for continued assessment 1	**05**
2	**05**
3	**05**
4	**05**
5	**05**
Final Presentation for Project 6	**30 HOD**
	30 Guide
Weight	**Oral 100 Marks by HOD & Guide**
	TW 100 Marks by Internal Guide

HSMC 805	Entrepreneurship Development	0L:0T:2P	1 credits

Module 1: Entrepreneurship, Creativity &OpportModuleies

1.1) Concept, Classification & Characteristics and qualities of Entrepreneur

1.2) Creativity and Risk taking.

1.2.1) Concept of Creativity & Qualities of Creative person.

1.2.2) Risk Situation, Types of risk & risk takers.

1.3) Business Reforms.

1.3.1) Process of Liberalization.

1.3.2) Reform Policies.

1.3.3) Impact of Liberalization.

1.3.4) Emerging high growth areas.

1.4) Business Idea Methods and techniques to generate business idea.

1.5) Transforming Ideas in to opportModuleies transformation involves Assessment of idea &Feasibility of opportModuley

1.6) SWOT Analysis

Module 2: Information and Support Systems

2.1) Information Needed and Their Sources.

Information related to project, Information related to support system, Information related to procedures and formalities

2.2) Support Systems

1) Small Scale Business Planning, Requirements.

2) Govt. & Institutional Agencies, Formalities

3) Statutory Requirements and Agencies.

Module 3: Market Assessment

3.1) Marketing -Concept and Importance

3.2) Market Identification, Survey Key components

3.3) Market Assessment

Module 4: Business Finance & Accounts

Business Finance

4.1) Cost of Project

1) Sources of Finance

2) Assessment of working capital

3) Product costing

4) Profitability

5) Break Even Analysis

6) Financial Ratios and Significance

Business Account

4.2) Accounting Principles, Methodology

1) Book Keeping

2) Financial Statements

3) Concept of Audit,

Module 5: Business Plan & Project Report

5.1)Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost

5.2) **Project Report**

1) Meaning and Importance

2) Components of project report/profile **(Give list)**

5.3) **Project Appraisal**

1) Meaning and definition

2) Technical, Economic feasibility

3) Cost benefit Analysis

3) Cost benefit Analysis

Module 6: Enterprise Management and Modern Trends

6.1) **Enterprise Management**: -

1) Essential roles of Entrepreneur in managing enterprise

2) Product Cycle: Concept and Importance

3) Probable Causes of Sickness

4) Quality Assurance Importance of Quality, Importance of testing

6.2) E-Commerce Concept and process

6.3) Global Entrepreneur