

**Open Electives offered by ECE Department**

<b>Open Elective I (VI Semester)</b>	<b>Open Elective II (VII Semester)</b>	<b>Open Elective III (VIII Semester)</b>
Principles of Electronic Communications (20EC611OE)	Electronic Sensors (20EC721OE)	Measuring Instruments (20EC831OE)
Fundamentals of Internet of Things (20EC612OE)	Embedded Systems Design (20EC722OE)	Microprocessors and Microcontrollers (20EC832OE)

**20EC611OE: Principles of Electronic Communications  
(Open Elective - I)**

**B.Tech. VI Sem.**

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**Prerequisite: Nil**

**Course Objectives:** The objective of this subject is to:

1. Introduce the students to modulation and various analog and digital modulation schemes.
2. They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

**Course Outcomes:** Upon completing this course, the student will be able to:

1. **Understand** modulation need and techniques in communications and overview of electromagnetic spectrum.
2. **Analyze** Analog, pulse modulation, and digital modulation techniques.
3. **Ddistinguish** Various Local Area Networks and their structure.
4. **Conceptualize** principles and applications of satellite and optical communications.
5. **Understand** various cellular telephone systems and wireless technologies.

**UNIT – I:**

**Introduction:** Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

**UNIT – II:**

**Simple description on Modulation:** Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

**UNIT – III:**

**Telecommunication Systems:** Telephones Telephone system, Paging systems, Internet Telephony.

**Networking and Local Area Networks:** Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

**UNIT – IV:**

**Satellite Communication:** Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

**Optical Communication:** Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

**UNIT – V:**

**Cellular and Mobile Communications:** Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

**Wireless Technologies:** Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

**TEXT BOOKS:**

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Electronic Communications systems, Kennedy, Davis 4e, MC Graw Hill Education, 1999.

**REFERENCE BOOKS:**

1. Theodore Rapp port, Wireless Communications - Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Introduction to data communications and networking, Wayne Tomasi, Pearson Education,2005.

## 20EC612OE: Fundamentals of Internet of Things (Open Elective–I)

**B.Tech. VI Sem.**

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**3 0 0 3**

**Course Objectives:** The objectives of the course are to:

1. Understand the concepts of Internet of Things and able to build IoT applications
2. Learn the programming and use of Arduino and Raspberry Pi boards.
3. Known about data handling and analytics in SDN.

**Course Outcomes:** Upon completing this course, the student will be able to:

1. Explained the basic protocols in sensor networks.
2. Analyze the Program and configure Arduino boards for various designs.
3. Illustrate and Apply Python programming and interfacing for Raspberry Pi.
4. Design IoT applications in different domains.
5. Analyze the various applications of IoT.

### **UNIT–I:**

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

### **UNIT-II:**

Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

### **UNIT - III:**

Introduction to Python programming, Introduction to RaspberryPi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with RaspberryPi.

### **UNIT-IV:**

Implementation of IoT with RaspberryPi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics.

### **UNIT-V:**

Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT. Case Study: Agriculture, Healthcare, Activity Monitoring.

### **TEXTBOOKS:**

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C.Raman (CRCPress).
2. "Make sensors":Terokarvinen, kemo, karvinen and villeyval tokari, 1<sup>st</sup> edition, maker media,2014.
3. "Internet of Things: A Hands-on Approach",by Arshdeep Bahgaand Vijay Madiseti.

**REFERENCEBOOKS:**

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach".
2. Walteneus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
3. Beginning Sensor networks with Arduino and Raspberry Pi—Charles Bell, Apress, 2013.

## 20EC721OE: Electronic Sensors (Open Elective - II)

B.Tech. VII Sem.

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**Prerequisite:** NIL

**Course Objectives:**

1. Learn the characterization of sensors.
2. Known the working of Electromechanical, Thermal, Magnetic and radiation sensors. Understand the concepts of Electro analytic and smart sensors.
3. Able to use sensors in different applications.

**Course Outcomes:** Upon completing this course, the student will be able to

1. Understand sensor Principle, Classification and Characterization.
2. Explore the working of Electromechanical, Thermal, Magnetic, Radiation.
3. Understand Electro analytical sensors.
4. Explained with the basic concepts of Smart Sensors.
5. Design a system with sensors.

### UNIT-I:

**Sensors/Transducers:** Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

**Electro mechanical Sensors:** Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor –Types, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors ,Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

### UNIT-III:

**Magnetic sensors:** Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchronos.

### UNIT-IV:

**Radiation Sensors:** Introduction, Basic Characteristics, Types of Photo resistors /Photo detectors, X-ray and Nuclear Radiation Sensors, Fibre Optic Sensors.

**Electro analytical Sensors:** The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramic sin Gas Media.

**UNIT-V:**

**Smart Sensors:** Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation

**Sensors –Applications:** Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

**TEXT BOOKS:**

1. “Sensors and Transducers” - D.Patranabis, PHI Learning Private Limited.,2003.
2. “Introduction to sensors” – John veteline, Aravind Raghu, CRC press, 2011.

**REFERENCE BOOKS:**

1. “Sensors and Actuators”, D. Patranabis, 2<sup>nd</sup> edition, PHI, 2013.
2. “Make sensors”, Tero karvinen, kemo,karvinen and villey valtokari,1<sup>st</sup> edition, maker media, 2014.
3. “Sensors handbook” Sabrie soloman, 2<sup>nd</sup> edition, TMH, 2009.

## 20EC722OE: Embedded System Design (Open Elective -II)

B.Tech. VII Sem.

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3 0 0 3

**Prerequisite:** NIL

### **Course Objectives:**

1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware.
3. To understand the necessity of operating systems in correlation with hardware systems.
4. To learn the methods of interfacing and synchronization for tasking.

**Course Outcomes:** Upon completing this course, the student will be able to

1. Understand the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. Visualize the role of Real time Operating Systems in Embedded Systems.
4. Evaluate the Correlation between task synchronization and latency issues.
5. Understand Task Communication/Synchronization Issues.

### **UNIT - I:**

**Introduction to Embedded Systems:** Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

### **UNIT - II:**

**Typical Embedded System:** Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

### **UNIT - III:**

**Embedded Firmware:** Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

### **UNIT - IV:**

**RTOS Based Embedded System Design:** Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

### **UNIT - V:**

**Task Communication:** Shared Memory, Message Passing, Remote Procedure Call and Sockets, **Task Synchronization:** Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

**TEXT BOOK:**

1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill.

**REFERENCE BOOKS:**

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013.
4. An Embedded Software Primer - David E. Simon, Pearson Education

## 20EC831OE: Measuring Instruments (Open Elective - III)

**B.Tech. VIII Sem.**

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**Prerequisite: Nil**

### **Course Objectives:**

1. To provide basic knowledge in transduction principles, sensors and transducer technology and Measurement systems.
2. To provide better familiarity with the concepts of Sensors and Measurements.
3. To provide the knowledge of various measurement methods of physical parameters like Velocity, acceleration, force, pressure and viscosity.

**Course Outcomes:** After Completion of the course the student is able to

1. Identify suitable sensors and transducers for real time applications.
2. Translate theoretical concepts into working models.
3. Understand the basic of measuring device and use them in relevant situation.
4. Understand the flow, density and viscosity measurements.
5. Understand how to use the measuring device3s in metrology.

### **UNIT – I:**

Introduction to measurements. Physical measurement. Forms and methods of measurements. Measurement errors. Statistical analysis of measurement data. Probability of errors. Limiting errors. Standards. Definition of standard units. International standards. Primary standards. Secondary standards. Working standards. Voltage standard. Resistance standard. Current standard. Capacitance standard. Time and frequency standards.

### **UNIT – II:**

#### **Passive Sensors**

**Resistive Sensors:** Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers.

**Capacitive Sensors:** Variable capacitor, Differential capacitor.

**Inductive Sensors:** Reluctance variation sensors, Eddy current sensors.

### **UNIT – III:**

**Metrology:** Measurement of length – Plainness – Area – Diameter – Roughness – Angle – Comparators – Gauge Blocks. Optical Methods for length and distance measurements.

**Velocity and Acceleration Measurement:** Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods. Accelerometers- different types, Gyroscopes-applications.

### **UNIT – IV:**

**Force and Pressure Measurement:** Gyroscopic Force Measurement – Vibrating wire Force transducer. Basics of Pressure measurement –Manometer types – Force-Balance and Vibrating ,Cylinder Transducers – High- and Low-Pressure measurement

### **UNIT – V:**

**Flow, Density and Viscosity Measurements:** Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, Density measurements – Strain

Gauge load cell method – Buoyancy method. Units of Viscosity, Two float viscorator – Industrial consistency meter.

**TEXT BOOKS:**

1. “Measurement Systems – Applications and Design” – by Doeblin E.O., 4/e, McGraw Hill International, 1990.
2. “Principles of Industrial Instrumentation” – Patranabis D. TMH. End edition 1997

## 20EC832OE: Microprocessors and Microcontrollers (Open Elective - III)

**B.Tech. VIII Sem.**

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**Prerequisite: Nil**

### **Course Objectives:**

1. To familiarize the architecture of microprocessors and micro controllers
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors

**Course Outcomes:** Upon completing this course, the student will be able to

1. Understand the internal architecture, organization and assembly language programming of 8086 processors.
2. Understand the internal architecture, organization and assembly language programming of 8051/controllers.
3. Apply different interfacing techniques to 8086 and 8051 based systems.
4. Understand the internal architecture of ARM processors.
5. Understand the basic concepts of advanced ARM processors.

### **UNIT -I:**

**8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

### **UNIT -II:**

**Introduction to Microcontrollers:** Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

### **UNIT –III:**

**I/O And Memory Interface:** LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

**Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

### **UNIT –IV:**

**ARM Architecture:** ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

### **UNIT – V:**

**Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

**TEXT BOOKS:**

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006.
2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012.

**REFERENCE BOOKS:**

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3<sup>rd</sup> Ed, 2004.

### **Open Electives offered by CSE & IT Departments**

<b>Open Elective-I</b>	<b>Open Elective-II</b>	<b>Open Elective-III</b>
<b>(OE – I)</b>	<b>(OE – II)</b>	<b>(OE – III)</b>
1. Data Structures (20CS611OE)	1. Software Engineering (20CS721OE)	1. Mobile Application Development (20CS831OE)
2. Database Management Systems (20CS612OE)	2. Python Programming (20CS722OE)	2. Scripting Languages (20CS832OE)

## 20CS611OE: Data Structures (Open Elective – I)

B.Tech. VI Sem

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### Prerequisite:

1. A course on “Programming for Problem Solving “

### Course Objectives:

- Exploring basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs.
- Introduces sorting and pattern matching algorithms

### Course Outcomes:

- Ability to select the data structures that efficiently model the information in a problem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and pattern matching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees.

### UNIT - I

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

### UNIT - II

**Dictionaries:** linear list representation, skip list representation, operations - insertion, deletion and searching.

**Hash table representation:** hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

### UNIT - III

**Search Trees:** Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Red –Black, Splay Trees.

### UNIT - IV

**Graphs:** Graph Implementation Methods. Graph Traversal Methods.

**Sortings:** Heap Sort, External Sorting- Model for external sorting, Merge Sort.

### UNIT - V

**Pattern matching and Tries:** Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

### TEXT BOOKS:

1. Fundamentals of data structures in C, 2 nd edition, E.Horowitz, S.Sahni and Susan Anderson Freed, Universities Press.
2. Data structures using c – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/pearson education.

**REFERENCE BOOKS:**

1. Data structures: A Pseudocode Approach with C, 2<sup>nd</sup> edition, R.F.Gilberg And B.A.Forouzan,Cengage Learning.
2. Introduction to data structures in c, 1/e Ashok Kamthane.

## 20CS612OE: DATABASE MANAGEMENT SYSTEMS (Open Elective – I)

B.Tech. VI SEM

L T P C

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### Prerequisites

- A course on “Data Structures”.

### Course Objectives:

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

### Course Outcomes:

- Gain knowledge of fundamentals of DBMS, database design and normal forms
- Master the basics of SQL for retrieval and management of data.
- Be acquainted with the basics of transaction processing and concurrency control.
- Familiarity with database storage structures and access techniques

### UNIT - I

**Database System Applications:** A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

**Introduction to Database Design:** Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model

### UNIT - II

**Introduction to the Relational Model:** Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views.

Relational Algebra, Tuple relational Calculus, Domain relational calculus.

### UNIT - III

**SQL: Queries, Constraints, Triggers:** form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases.

**Schema refinement:** Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

### UNIT - IV

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

## **UNIT - V**

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning, Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure. TEXT BOOKS:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill 3rd Edition
2. Database System Concepts, Silberschatz, Korth, Mc Graw hill, V edition.

## **REFERENCE BOOKS:**

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J.Date Pearson Education
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

## 20CS721OE: SOFTWARE ENGINEERING (Open Elective – II)

B.Tech. VII SEM

L T P C

3 0 0 3

### Course Objectives

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

### Course Outcomes

1. Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).
2. Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
3. Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

### UNIT - I

**Introduction to Software Engineering:** The evolving role of software, changing nature of software, software myths.

**A Generic view of process:** Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models.

**Process models:** The waterfall model, incremental process models, evolutionary process models, the unified process.

### UNIT - II

**Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

**Requirements engineering process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

**System models:** Context models, behavioral models, data models, object models, structured methods.

### UNIT - III

**Design Engineering:** Design process and design quality, design concepts, the design model.

**Creating an architectural design:** software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

## **UNIT - IV**

**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

**Product metrics:** Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

## **UNIT - V**

**Metrics for Process and Products:** Software measurement, metrics for software quality.

**Risk management:** Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

**Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

## **TEXT BOOKS:**

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6<sup>th</sup> edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7<sup>th</sup> edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

## **REFERENCES:**

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

## 20CS722OE: PYTHON PROGRAMMING (Open Elective - II)

**B.Tech. VII SEM.**

**L T P C**

**3 0 0 3**

**Course Objectives:** This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python.
- Build Web Services and introduction to Network and Database Programming in Python.

**Course Outcomes:** The students should be able to:

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

### **UNIT - I**

Python Basics, Objects- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types

Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules

Sequences - Strings, Lists, and Tuples, Mapping and Set Types

### **UNIT - II**

FILES: File Objects, File Built-in Function [ open() ], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules, Related Modules

Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, \*Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, \*Creating Exceptions, Why Exceptions (Now)?, Why Exceptions at All?, Exceptions and the sys Module, Related Modules  
Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules

### **UNIT - III**

Regular Expressions: Introduction, Special Symbols and Characters, Res and Python

Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules

### **UNIT - IV**

GUI Programming: Introduction, Tkinter and Python Programming, Brief Tour of Other GUIs, Related Modules and Other GUIs

WEB Programming: Introduction, Web Surfing with Python, Creating Simple Web Clients, Advanced Web Clients, CGI-Helping Servers Process Client Data, Building CGI Application  
Advanced CGI, Web (HTTP) Servers

**UNIT – V**

Database Programming: Introduction, Python Database Application Programmer's Interface (DB-API), Object RelationalManagers (ORMs), Related Modules

**TEXT BOOK:**

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.

## 20CS831OE: MOBILE APPLICATION DEVELOPMENT

(Open Elective - III)

**B.Tech. VIII SEM.**

**L T P C**

**3 0 0 3**

### **Prerequisites:**

1. Acquaintance with JAVA programming
2. A Course on DBMS

### **Course Objectives:**

- To demonstrate their understanding of the fundamentals of Android operating systems
- To improve their skills of using Android software development tools
- To demonstrate their ability to develop software with reasonable complexity on mobile platform
- To demonstrate their ability to deploy software to mobile devices
- To demonstrate their ability to debug programs running on mobile devices

### **Course Outcomes:**

- Student understands the working of Android OS Practically.
- Student will be able to develop Android user interfaces
- Student will be able to develop, deploy and maintain the Android Applications.

### **UNIT - I**

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools

Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

### **UNIT - II**

Android User Interface: Measurements – Device and pixel density independent measuring UNIT - s Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components – Editable and non editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

### **UNIT - III**

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

#### **UNIT - IV**

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

#### **UNIT - V**

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

#### **TEXT BOOKS:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning,2013

#### **REFERENCE BOOK:**

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

## 20CS832OE: SCRIPTING LANGUAGES (Open Elective - III)

**B.Tech. VIII SEM.**

**L T P C**

**3 0 0 3**

### **Prerequisites:**

1. A course on “Computer Programming and Data Structures”
2. A course on “Object Oriented Programming Concepts”

### **Course Objectives:**

- This course introduces the script programming paradigm
- Introduces scripting languages such as Perl, Ruby and TCL.
- Learning TCL

### **Course Outcomes:**

- Comprehend the differences between typical scripting languages and typical system and application programming languages.
- Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem.
- Acquire programming skills in scripting language

### **UNIT - I**

Introduction: Ruby, Rails, The structure and Execution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, cookies, Choice of Webservers, SOAP and webservices.

RubyTk – Simple Tk Application, widgets, Binding events, Canvas, scrolling

### **UNIT - II**

Extending Ruby: Ruby Objects in C, the Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter

### **UNIT - III**

Introduction to PERL and Scripting

Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

### **UNIT - IV**

Advanced PERL

Finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

## **UNIT - V**

**TCL:** TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface.

**Tk:** Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl-Tk.

### **TEXT BOOKS:**

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly
3. "Programming Ruby" The Pragmatic Programmers guide by Dabve Thomas Second edition

### **REFERENCE BOOKS:**

1. Open Source Web Development with LAMP using Linux Apache, MySQL, Perl and PHP, J.Leeand B. Ware (Addison Wesley) Pearson Education.
2. Perl by Example, E. Quigley, Pearson Education.
3. Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.
4. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
5. Perl Power, J.P. Flynt, Cengage Learning.

**Open Electives offered by CSE [AI & ML] Department**

<b>Open Elective-I</b>	<b>Open Elective-II</b>	<b>Open Elective-III</b>
<b>(OE – I)</b>	<b>(OE – II)</b>	<b>(OE – III)</b>
1. Introduction to Artificial Intelligence <b>(20AM611OE)</b>	1. Cyber Security <b>(20AM721OE)</b>	1. Introduction to Machine Learning <b>(20AM831OE)</b>
2. Data Warehousing and Business Intelligence <b>(20AM612OE)</b>	2. Artificial Neural Networks <b>(20AM722OE)</b>	2. Data Visualization Techniques <b>(20AM832OE)</b>

## 20AM611OE: Introduction to Artificial Intelligence (Open Elective-I)

B. Tech VI SEM.

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### Course Objectives:

- To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- To provide a basic exposition to the goals and methods of Artificial Intelligence.
- To apply the techniques in applications which involve perception, reasoning and learning.

### Course Outcomes:

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

1. Enumerate the history and foundations of Artificial Intelligence
2. Apply the basic principles of AI in problem solving
3. Choose the appropriate representation of Knowledge
4. Solve the problems with uncertainty using probability
5. Examine the Scope of AI and its societal implications

### UNIT I

**Introduction:** What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

### UNIT II

**Problem Solving:** Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

### UNIT III

**Knowledge Representation:** Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

### UNIT IV

**Uncertain Knowledge and Reasoning:** Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks.

### UNIT V

**AI present and Future:** Weak AI: Can Machines Act Intelligently?, Strong AI: Can Machines Really Think?, The Ethics and Risks of Developing Artificial Intelligence, Agent Components, Agent Architectures, Are We Going in the Right Direction?, What If AI Does Succeed?.

### Text Books:

- 1) Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson.
- 2) Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

**Reference Books:**

- 1) Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011
- 2) David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010.
- 3) Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.

**Web Resources:**

- 1) <https://nptel.ac.in/courses/106105077>
- 2) <https://nptel.ac.in/courses/106106126>
- 3) <https://aima.cs.berkeley.edu>
- 4) [https://ai.berkeley.edu/project\\_overview.html](https://ai.berkeley.edu/project_overview.html)

## 20AM612OE: Data Warehousing and Business Intelligence

(Open Elective-I)

**B. Tech VI SEM.**

**L T P C**

**3 0 0 3**

### **Course Objectives:**

1. To extract data from the information systems that deal with the day-to-day operations and transforming it into data that can be used by businesses to drive high-level decision making.
2. To design and create a data warehouse, and how to utilize the process of extracting, transforming, and loading (ETL) data into data warehouses.

### **Course Outcomes:**

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

1. Compare and Contrast OLAP with OLTP.
2. Understand Fundamental concepts of BI and Analytics
3. Enumerate BI Key Performance indicators
4. Understand Utilization of Advanced BI Tools and their Implementation.
5. Implementation of BI Techniques and BI Ethics.

### **UNIT - I**

**DATA WAREHOUSE:** Data Warehouse-Data Warehouse Architecture- Multidimensional Data Model-Data cube and OLAP Technology-Data Warehouse Implementation -DBMS schemas for Decision support - Efficient methods for Data cube computation.

### **UNIT - II**

**Business Intelligence:** Introduction – Definition, Leveraging Data and Knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics. BI Life Cycle. Data for BI - Data Issues and Data Quality for BI.

### **UNIT - III**

**BI Implementation** - Key Drivers, Key Performance Indicators and Performance Metrics, BI Architecture/Framework, Best Practices, Business Decision Making, Styles of BI-Vent-Driven alerts - A cyclic process of Intelligence Creation. The value of Business Intelligence-Value driven & Information use.

### **UNIT - IV**

Advanced BI – Big Data and BI, Social Networks, Mobile BI, emerging trends, Description of different BI-Tools (Pentaho, KNIME)

### **UNIT - V**

Business intelligence implementation -Business Intelligence and integration implementation-connecting in BI systems- Issues of legality- Privacy and ethics- Social networking and BI.

### **TEXT BOOKS:**

1. Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER, Elsevier.
2. Rajiv Sabherwal “Business Intelligence” Wiley Publications, 2012.

**REFERENCE BOOKS:**

1. Efraim Turban, Ramesh Sharda, Jay Aronson, David King, Decision Support and Business Intelligence Systems, 9th Edition, Pearson Education, 2009.
2. David Loshin, Business Intelligence - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.
3. Philo Janus, Stacia Misner, Building Integrated Business Intelligence Solutions with SQL Server, 2008 R2 & Office 2010, TMH, 2011.
4. Carlo-Verellis , Business Intelligence Data Mining and Optimization for decision making Wiley Publishers.
5. Data Warehousing, Data Mining & OLAP- Alex Berson and Stephen J. Smith- Tata McGraw-Hill Edition, Tenth reprint 2007.
6. Building the Data Warehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.
7. Data Mining Introductory and Advanced topics –MARGARET H DUNHAM, PEA.

## 20AM721OE: Cyber Security (Open Elective-II)

**B. Tech VII SEM.**

**L T P C**  
**3 0 0 3**

### **Course objectives:**

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

### **Course Outcomes:**

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

1. Enumerate different cyber-attacks.
2. Understand different cyber laws.
3. Explore different types of attacks on mobile and wireless devices
4. Understand cyber security issues in an organization
5. Understand privacy policies

The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

### **UNIT - I**

**Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

### **UNIT - II**

**Cyberspace and the Law & Cyber Forensics:** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

### **UNIT - III**

**Cybercrime: Mobile and Wireless Devices:** Introduction, Proliferation of Mobile and Wireless

Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

### **UNIT- IV**

**Cyber Security: Organizational Implications:** Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

**Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

**UNIT - V**

**Privacy Issues:** Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

**Cybercrime: Examples and Mini-Cases**

**Examples:** Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of

Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

**Mini-Cases:** The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**TEXT BOOKS:**

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

**REFERENCES:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group

## 20AM722OE: Artificial Neural Networks (Open Elective-II)

**B. Tech VII SEM.**

**L T P C**  
**3 0 0 3**

### **Course Objectives:**

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithms
- To know the issues of various feed forward and feedback neural networks.
- To explore the Neuro dynamic models for various problems.

### **Course Outcomes:**

#### **Upon Successful completion of the course, the student will be able to**

1. Understand the similarity of Biological networks and Neural networks
2. Perform the training of neural networks using various learning rules.
3. Understanding the concepts of forward and backward propagations.
4. Understand the concept of self-organizing Maps
5. Understand and Construct the Hopfield models.

### **UNIT-I:**

**Introduction:** A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

**Learning Process:** Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

### **UNIT-II:**

**Single Layer Perceptrons:** Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

**Multilayer Perceptron:** Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

### **UNIT-III:**

**Back Propagation:** Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

### **UNIT - IV:**

**Self-Organization Maps (SOM):** Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

### **UNIT-V:**

**Neuro Dynamics:** Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

**Hopfield Models –** Hopfield Models, restricted boltzmen machine.

### **TEXT BOOKS:**

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.,.
2. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

**REFERENCE BOOKS:**

1. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
3. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005

## 20AM831OE: Introduction to Machine Learning (Open Elective-III)

**B. Tech VIII SEM.**

**L T P C**  
**3 0 0 3**

### **Course Objectives:**

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

### **Course Outcomes:**

**Upon Successful completion of the course, the student will be able to**

1. Understand the perspectives and issues in machine learning.
2. Enumerate the Issues in decision tree learning
3. Compare different learning algorithms.
4. Design classifiers based on Bayes Theorem
5. Differentiate lazy learning and eager learning.

### **UNIT - I**

**Introduction** - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning, Concept learning and the general to specific ordering, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, inductive bias.

### **UNIT-II**

**Decision Tree Learning** – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

### **UNIT-III**

**Evaluation Hypotheses** – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

### **UNIT - IV**

**Bayesian learning** – Introduction, Bayes theorem, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, Bayesian belief networks, EM algorithm.

### **UNIT-V**

**Instance-Based Learning**- Introduction, k-nearest neighbor learning, locally weighted regression, Radial basis functions, case-based reasoning, remarks on lazy and eager learning.

**TEXT BOOK:**

- 1) Tom M. Mitchell, *Machine Learning*, McGraw Hill Edition, 2013

**REFERENCE BOOK:**

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.
2. Christopher Bishop, Pattern Recognition and Machine Learning (PRML) , Springer, 2007.
3. ShaiShalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

## 20AM832OE: Data Visualization Techniques (Open Elective-III)

**B. Tech VIII SEM.**

**L T P C**

**3 0 0 3**

**Course Objective:** To understand various data visualization techniques.

**Course Outcomes:**

**Upon Successful completion of the course, the student will be able to**

1. Design and process the data for Visualization.
2. Understand the taxonomy of visualization
3. Apply the visualization techniques for spatial, geospatial and multivariate data
4. Enumerate different Interaction concepts and techniques.
5. Explore different research directions in visualization.

### **UNIT - I**

**Introduction and Data Foundation:** Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

### **UNIT - II**

**Foundations for Visualization:** Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson's Affordance theory – A Model of Perceptual Processing.

### **UNIT - III**

**Visualization Techniques: Spatial Data:** One-Dimensional Data - Two-Dimensional Data – Three-Dimensional Data - Dynamic Data - Combining Techniques. **Geospatial Data:** Visualizing Spatial Data- Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization  
**Multivariate Data:** Point-Based Techniques - Line- Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

### **UNIT - IV**

**Interaction Concepts and Techniques: Text and Document Visualization:** Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations – Document Collection Visualizations - Extended Text Visualizations **Interaction Concepts:** Interaction Operators - Interaction Operands and Spaces - A Unified Framework.  
**Interaction Techniques:** Screen Space -Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure – Animating Transformations -Interaction Control

### **UNIT - V**

**Research Directions in Visualizations:** Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications.

**TEXT BOOKS:**

1. Matthew Ward, Georges Grinstein and Daniel Keim, “Interactive Data Visualization Foundations, Techniques, Applications”, 2010.
2. Colin Ware, “Information Visualization Perception for Design”, 2nd edition, Morgan Kaufmann Publishers, 2004.

**REFERENCE BOOKS:**

1. Robert Spence “Information visualization – Design for interaction”, Pearson Education, 2<sup>nd</sup> Edition, 2007.
2. Alexandru C. Telea, “Data Visualization: Principles and Practice,” A. K. Peters Ltd, 2008.

**Open Electives offered by CSE[DS] Department**

<b>Open Elective-I</b>	<b>Open Elective-II</b>	<b>Open Elective-III</b>
<b>(OE – I)</b>	<b>(OE – II)</b>	<b>(OE – III)</b>
1. Introduction to Data Science <b>(20DS611OE)</b>	1. Information Retrieval Systems <b>(20DS721OE)</b>	1. Software Engineering <b>(20DS831OE)</b>
2. Text Analytics <b>(20DS612OE)</b>	2. DevOps <b>(20DS722OE)</b>	2. Data Mining <b>(20DS832OE)</b>

## 20DS611OE: Introduction to Data Science (Open Elective – I)

**B. Tech VI SEM.**

**L T P C**

**3 0 0 3**

### **Pre-Requisites:**

1. A course on “Programming with Python”

### **Course Objectives:**

1. To provide a comprehensive knowledge of data science using Python.
2. To learn the essential concepts of data analytics and data visualization.

### **Course Outcomes:**

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

1. Apply principles of NumPy and Pandas to the analysis of data.
2. Make use of various file formats in loading and storage of data.
3. Identify and apply the need and importance of pre-processing techniques.
4. Show the results and present them in a pictorial format.

### **UNIT I**

Data science: definition, Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process.

NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, Creating ndarrays, Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays, Sorting, Unique.

### **UNIT II**

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, DataFrame, Index Objects, Essential Functionality (Reindexing, Dropping entries from an axis, Indexing, selection, and filtering), Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

### **UNIT III**

Data Loading, Storage, and File Formats: Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files.

### **UNIT IV**

Data Wrangling: Combining and Merging Data Sets, Database style DataFrame Merges, merging on Index, Concatenating Along an Axis, Combining Data with Overlap, Reshaping and Pivoting, reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.

### **UNIT V**

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

**TEXT BOOKS:**

1. Wes McKinney, “Python for Data Analysis”, O’REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O’neil, “Doing Data Science”, O’REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

**REFERENCE BOOKS:**

1. Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 2015
2. Matt Harrison, “Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O’Reilly, 2016.

## 20DS612OE: Text Analytics (Open Elective – I)

**B. Tech VI SEM.**

**L T P C**

**3 0 0 3**

### **Pre-Requisites:**

2. A course on “Programming with Python”
3. Knowledge of Natural Language Processing.

### **Course Objectives:**

1. To provide an overview of common natural language processing and text analytic activities.
2. To understand the complexities of processing text, classification and clustering.
3. To enable students to solve complex real-world problems for sentiment analysis.

### **Course Outcomes:**

1. Ability to understand the natural language processing concepts and text processing concepts.
2. Apply a wide range of classification algorithms on Textual data.
3. Design new solutions to data summarization problems.
4. Apply a wide range of clustering techniques on Textual data.
5. Design new solutions to opinion extraction and sentiment classification.

### **UNIT - I**

**Natural Language Basics:** Natural Language, Language Syntax and Structure, Language Semantics, Text Corpora, Natural Language Processing.

**Processing and Understanding Text:** Text Tokenization, Text Normalization, Understanding Text Syntax and Structure.

### **UNIT - II**

**Text Classification:** What Is Text Classification? Automated Text Classification, Text Classification Blueprint, Text Normalization, Feature Extraction, Classification Algorithms, Evaluating Classification Models, Building a Multi-Class Classification System, Applications and Uses.

### **UNIT - III**

**Text Summarization:** Text Summarization and Information Extraction, Key-phrase Extraction, Topic Modeling, Automated Document Summarization,

### **UNIT - IV**

**Text Similarity and Clustering:** Information Retrieval, Feature Engineering, Similarity Measures, Text Similarity, Analyzing Term Similarity, Analyzing Document Similarity, Document Clustering.

### **UNIT - V**

**Semantic and Sentiment Analysis:** Semantic Analysis, Exploring WordNet, Word Sense Disambiguation, Named Entity Recognition, Analyzing Semantic Representations, Sentiment Analysis.

### **TEXT BOOKS:**

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from Your Data”, Apress, 2016.
2. Bing Liu, “Sentiment Analysis and Opinion Mining”, Morgan & Claypool Publishers, 2012.

### **REFERENCE BOOK:**

1. Nitin Indurkha, Fred J Damerau, “Handbook of Natural Language Process”, 2nd Edition, CRC Press, 2010.
2. Julia Silge and David Robinson, “Text Mining for R: A Tidy Approach.”, O’Reilly.

## 20DS721OE: Information Retrieval Systems (Open Elective – II)

**B. Tech VII SEM.**

**L T P C**

**3 0 0 3**

**Prerequisites:** Data Structures

### **Course Objectives:**

1. To learn the important concepts and algorithms in IRS
2. To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

### **Course Outcomes:**

1. Ability to apply IR principles to locate relevant information large collections of data
2. Ability to design different document clustering algorithms
3. Implement retrieval systems for web search tasks.
4. Design an Information Retrieval System for web search tasks.

### **UNIT - I**

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities.

### **UNIT - II**

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction.

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

### **UNIT - III**

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages.

Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.

### **UNIT - IV**

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.

### **UNIT - V**

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems.

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval.

### **TEXT BOOK:**

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer

**REFERENCE BOOKS:**

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.
3. Modern Information Retrieval By Yates and Neto Pearson Education.

## 20DS722OE: Devops (Open Elective – II)

**B. Tech VII SEM.**

**L T P C**

**3 1 0 4**

**Prerequisites:** Software Engineering

**Course Objectives:** The main objectives of this course are to:

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. Implement automated system update and DevOps lifecycle.

**Course Outcomes:** On successful completion of this course, students will be able to:

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tool.
4. Investigate different DevOps Software development models.
5. Assess various Devops practices.
6. Collaborate and adopt Devops in real-time projects.

### **UNIT - I**

**Introduction:** Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

### **UNIT - II**

**Software development models and DevOps:** DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. **DevOps influence on Architecture:** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

### **UNIT - III**

**Introduction to project management:** The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

### **UNIT - IV**

**Integrating the system:** Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

### **UNIT - V**

**Testing Tools and automation:** Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development

**Deployment of the system:** Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

**TEXT BOOKS:**

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

**REFERENCE BOOK:**

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.

## 20DS831OE: Software Engineering (Open Elective – III)

**B. Tech VIII SEM.**

**L T P C**

**3 0 0 3**

**Prerequisites:** None

### **Course Objective:**

1. Understand the basic Business types, the impact of the Economy Businesses and Firms specifically.
2. Learn the market demand and supply.
3. Analyze the Business from the Financial Perspective.
4. Preparing account statements and balance sheets.
5. Analyze the fund flow and cash flows.

### **Course Outcome:**

1. Understand the various Forms of Business and the impact of economic variables on the Business.
2. Comprehend the demand and supply analysis.
3. Explore the usage of marketing and pricing of a product.
4. Maintaining the financial accounts of a firm or company.
5. Monitoring the accounts through ratios.

### **UNIT - I**

**Introduction to Software Engineering:** The evolving role of software, changing nature of software, software myths.

**A Generic view of process:** Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models.

**Process models:** The waterfall model, incremental process models, evolutionary processmodels, the unified process.

### **UNIT - II**

**Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

**Requirements engineering process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

**System models:** Context models, behavioral models, data models, object models, structuredmethods.

### **UNIT - III**

**Design Engineering:** Design process and design quality, design concepts, the design model. **Creating an architectural design:** software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

### **UNIT - IV**

**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. **Product metrics:** Software quality, metrics for analysis model, metrics for design model, metricsfor source code, metrics for testing, metrics for maintenance.

## **UNIT - V**

**Metrics for Process and Products:** Software measurement, metrics for software quality.

**Risk management:** Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

**Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

### **TEXT BOOKS:**

1. Software Engineering, A practitioner's Approach-Roger S. Pressman, 6<sup>th</sup> edition, McGrawHill International Edition.
2. Software Engineering- Sommerville, 7<sup>th</sup> edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

### **REFERENCES:**

1. Software Engineering, an Engineering approach-JamesF. Peters, Witold Pedrycz, JohnWiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-HillCompanies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: PearsonEducation.

## 20DS832OE: Data Mining (Open Elective – III)

**B. Tech VIII SEM.**

**L T P C**

**3 0 0 3**

### **Pre-Requisites:**

1. A course on “Database Management Systems”
2. Knowledge of probability and statistics

### **Course Objectives:**

1. It presents methods for mining frequent patterns, associations, and correlations.
2. It then describes methods for data classification and prediction, and data–clustering approaches.
3. It covers mining various types of data stores such as spatial, textual, multimedia, streams.

### **Course Outcomes:**

1. Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. Apply preprocessing methods for any given raw data.
3. Extract interesting patterns from large amounts of data.
4. Discover the role played by data mining in various fields.
5. Choose and employ suitable data mining algorithms to build analytical applications
6. Evaluate the accuracy of supervised and unsupervised models and algorithms.

### **UNIT - I**

**Data Mining:** Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with a Data warehouse–Major issues in Data Mining–Data Preprocessing.

### **UNIT - II**

**Association Rule Mining:** Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining. Graph Pattern Mining, SPM.

### **UNIT - III**

**Classification:** Classification and Prediction – Basic concepts–Decision tree induction– Bayesian classification, Rule–based classification, Lazy learner.

### **UNIT - IV**

**Clustering and Applications:** Cluster analysis–Types of Data in Cluster Analysis– Categorization of Major Clustering Methods– Partitioning Methods, Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

### **UNIT - V**

**Advanced Concepts:** Basic concepts in Mining data streams–Mining Time–series data— Mining sequence patterns in Transactional databases– Mining Object– Spatial– Multimedia– Text and Web data – Spatial Data mining– Multimedia Data mining–Text Mining– Mining the World Wide Web.

**TEXT BOOKS:**

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3<sup>rd</sup> Edition Elsevier.
2. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.

**REFERENCE BOOK:**

1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques(Second Edition), Morgan Kaufmann, 2005.

**Open Electives offered by MBA Department**

<b>Open Elective-I</b>	<b>Open Elective-II</b>	<b>Open Elective-III</b>
<b>(OE – I)</b>	<b>(OE – II)</b>	<b>(OE – III)</b>
1. Basics of Entrepreneurship <b>(20MB611OE)</b>	1. Product and Services <b>(20MB721OE)</b>	1. Financial Institutions, Markets and Services <b>(20MB831OE)</b>
2. Fundamentals of Management for Engineers <b>(20MB612OE)</b>	2. Entrepreneurship, Project Management & Structured Finance <b>(20MB722OE)</b>	2. Entrepreneurship and Business Design <b>(20MB832OE)</b>

## 20MB611OE: Basics of Entrepreneurship (Open Elective-I)

**B.Tech. VI Sem**

**L T P C**

**3 0 0 3**

### **UNIT I: INTRODUCTION TO ENTREPRENEURSHIP**

Entrepreneurship - meaning , elements , determinants and importance of entrepreneurship and creative behaviour- Dimensions of entrepreneurship-Qualities of an Entrepreneur, factors influencing entrepreneurship, Role of entrepreneurship in economic development, Women as entrepreneur

### **UNIT II: INSTITUTIONAL SUPPORT TO ENTREPRENEURSHIP**

Agencies - commercial banks –district industries center- national small industries corporation –Small industries development organization –small industries service institutions –All India institutions – IDBI-IFCI-ICIIC-IRCBI,EDI,NIESBUB

### **UNIT III: NEW VENTURE EXPANSION STRATEGIES**

Funding new venture - requirement –availability and access to finance –marketing – technology and industrial accommodation-Role of industries/entrepreneur’s associations and self-help groups concept-business incubators-angel investors- venture capital and private equity fund

### **UNIT IV: THE BUSINESS PLAN OF AN ENTREPRENEURSHIP**

Significance of writing the business plan/ project proposal - Contents of business plan/ project proposal - Designing business processes — location - layout — operation - planning & control

- preparation of project report - Project submission/ presentation and appraisal by external agencies - financial/non-financial institutions

### **UNIT V: CREATING FOR START UP VENTURE**

Mobilizing resources to start –up Accommodation and utilities – preliminary contracts with the vendors-suppliers-bankers-principal customers-contract management

### **REFERENCES:**

1. Prasanna Chandra : Project Preparation, Appraisal, Implementation, Tata McGraw Hill, New Delhi
2. Sangram Keshari Mohanty (2005)Fundamentals Of Entrepreneurship, Princeton publication
3. V Desai (2014)Dynamics of Entrepreneurial Development and Management”Himalaya publication
4. Anna Kennedy (2015)Business Development for Dummies
5. Steven Rogers and Roza E Makonnen Entrepreneurial Finance, Third Edition:Harvard business school
6. B. Janakiram , M. Rizwana(2011) Entrepreneurship Development: Text & Case
7. Khanka S.S(2007) Entrepreneurial Development, s. chand
8. Essentials of Entrepreneurship by Robert A. Baron; Keith M. Hmieleski
9. Handbookof Research on Corporate Entrepreneurship by Shaker A. Zahra (Editor); Donald O.Neubaum (Editor); James C. Hayton
10. Entrepreneurship As Organizing by William B. Gartner
11. Entrepreneurial Neighborhoods by Maarten van Ham

**20MB612OE: Fundamentals of Management for Engineers  
(Open Elective – I)**

**B. Tech. VI Sem.**

**L T P C**

**3 0 0 3**

**Course Objective:** To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.

**Course Outcome:** The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

**UNIT - I**

**Introduction to Management:** Evolution of Management, Nature & Scope-Functions of Management- Role of Manager-levels of Management-Managerial Skills - Challenges-Planning-Planning Process-Types of Plans-MBO

**UNIT - II**

**Organization Structure & HRM:** Organization Design - Organizational Structure-Departmentation – Delegation - Centralization – Decentralization – Recentralization - Organizational Culture- Organizational climate- Organizational change Human Resource Management-HR Planning - Recruitment & Selection - Training & Development- Performance appraisal - Job Satisfaction-Stress Management Practices

**UNIT - III**

**Operation Management:** Introduction to Operations Management-Principles and Types of Plant Layout-Methods of production (Job Batch and Mass production) - Method study and Work Measurement-Quality Management - TQM-Six sigma - Deming's Contribution to Quality – Inventory Management – EOQ - ABC Analysis - JIT System-Business Process Re-engineering (BPR)

**UNIT - IV**

**Marketing Management:** Introduction to Marketing-Functions of Marketing-Marketing vs. Selling- Marketing Mix - Marketing Strategies - Product Life Cycle - Market Segmentation - Types of Marketing - Direct Marketing-Network Marketing - Digital Marketing-Channels of Distribution - Supply Chain Management (SCM)

**UNIT - V**

**Project Management:** Introduction to Project Management-steps in Project Management – Project Planning - Project Life Cycle-Network Analysis-Program Evaluation & Review Technique (PERT)- Critical Path Method (CPM) - Project Cost Analysis - Project Crashing - Project Information Systems

**TEXT BOOKS:**

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Fundamentals of Management, Stephen P.Robbins, Pearson Education, 2009.
3. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
4. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
5. Industrial Engineering and Management: Including Production Management, T.R.Banga, S.C Sharma , Khanna Publishers.

## **20MB721OE: Product and Services (Open Elective – II)**

**B. Tech. VII Sem.**

**L T P C**

**3 0 0 3**

### **UNIT- I: Interpretations on Product**

Meaning of Product - Product Market Fit Analysis - Product Levels - Product Mix - Product Pruning and Product Cannibalization - Types of Product Classification.

### **UNIT- II: Product Innovation and Validation**

New Products - What is a new product - New Product Development Process - Idea Generation Systems - Concept test - Product testing - Pre-launch - Market test - Final evaluation using “Stage / Gate Process - Product Validity - Break Even Analysis - Financial and Market Analysis.

### **UNIT- III: Launching Product**

Cost Analysis - Steps to fix the final price - Promotion planning - Digital Marketing and Methods - Retailing - Types of Retailing Online Retailing - Post Market Analysis of the Launch

### **UNIT - IV: Introduction to Service, Service Process Design and Service Distribution**

Meaning and Definition of Service - Characteristics of Services - Classification of Service - Service Verses Physical Goods - 7 P’s for Marketing of Services – Servicescape - Service Design Meaning - Tools for Service Design - Role of Intermediaries - Methods of Distribution of Services

### **UNIT – V: Quality of Service**

Definition of Service Quality - Elements of Service Quality - Service Quality Measuring Tools; SERVQUAL Scale - Service Quality Gap Analysis - Objective Service Metrics - Cost of Quality in Service - Challenges and Problems of Service Quality in India.

### **REFERENCES:**

1. Prof. S. L. Gupta, Product Management, Wisdom Publications
2. C. Merle Crawford, New Product Management
3. Valarie A. Zeithaml & Mary Jo-Bitner: Services Marketing—Integrating Customer Focus Across the Firm, 3/e, Tata McGraw Hill, 2007.
4. Thomas J. DeLong & Asish Nanda: Managing Professional Services—Text and Cases, McGraw-Hill International, 2006.
5. Christopher Lovelock: Services Marketing People, Technology, Strategy, Fourth Edition, Pearson Education, 2006.

**20MB722OE: Entrepreneurship, Project Management and Structured Finance  
(Open Elective – II)**

**B. Tech. VII Sem.**

**L T P C**

**3 0 0 3**

**UNIT I: CONCEPTS OF ENTREPRENEURSHIP**

Definition of Entrepreneurship - Evolution of Entrepreneurship - Classification of Entrepreneurs - Characteristics of Entrepreneur - Selection of Product and the means required for starting an enterprise - Financing and Financial incentives available - Success rate of entrepreneurs.

**UNIT-II: PROJECT MANAGEMENT, FORMULATION AND IMPLEMENTATION**

Concept and characteristics of a project - types of projects - Project Organizational structure - Project life cycle - Challenges and problems of project management - Qualities & functions of a project manager. Generation of Project Ideas - Monitoring the environment - Preliminary Screening of Projects - Feasibility study - Project Selection - Detailed Project Report - Prerequisites for Successful Project Implementation - Project Risk Management Process - Post-audit - Abandonment Analysis.

**UNIT-III: INTRODUCTION TO STRUCTURED FINANCE**

Term Loans - Bonds/Debentures - Types of debentures - Issue of debt instruments - Structured Finance - Evolution - Securitization process – characteristics - structured finance products (ABS, CDO, MBS, CDS).

**UNIT-IV: COMMERCIAL MORTGAGAGE LOAN BASICS**

Definition and characteristics of CMBS - CMBS Vs Other Mortgage - Backed Securities - CMBS three level perspective - property level - loan level - bond level - Life cycle of commercial real estate loans – Loan cycle - Key players in loan cycle - Property types and characteristics - property performance.

**UNIT-V: BASICS OF CRE SERVICING**

Introduction to servicing - Role of the Servicer - Servicing approaches - Influence of technology - Ethics in commercial servicing - Servicing – sources of income - Overview of servicing agreements - Pooling & Servicing agreement - Sub servicing agreement.

**REFERENCES:**

1. H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.
2. Jeffrey K. Pinto “Project Management”, 2nd edition, Pearson
3. Dhandapani Alagiri “Structured Finance – Concepts & Perspectives”, ICFAI University press.
4. Projects by Prasanna Chandra, McGraw-Hill Publishing Co. Ltd
5. Project Management: Systems approach to Planning Scheduling and Controlling, H. Kerzner.
6. The Complete Real Estate Documents by Mazyar M. Hedayat, John J. Oleary
7. The Fundamentals of Listing and Selling Commercial Real Estate - By Keim K. Loren (Author)

**20MB831OE: Financial Institutions, Markets and Services**  
(Open Elective –III)

**B. Tech. VIII Sem.**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVES:** The objective of the course is to provide to students an understanding of Financial Markets, the major Institutions involved and the Services offered within this framework.

**COURSE OUTCOMES:** At the end of this course, the students will be able to

1. Understand the financial structure and the financial sector reforms after 1991.
2. Identify the role of RBI and the Regulating and credit policies adopted by the RBI.
3. Analyze the role of Non-Banking financial institutions and the role of financial institutions in India.
4. Understand the role of regulatory bodies like SEBI and also to know the capital and money market instruments.
5. Understand about the asset fund based financial services
6. Expose to investment banking and merchant banking.

**UNIT I: Introduction:** The structure of financial system, Equilibrium in financial markets, Indicators of Financial Development, Financial system and Economic Development, Financial Sector Reforms after 1991.

**UNIT II: Banking Institutions:** Structure and Comparative performance, Functions and Role of RBI, Competition, Interest rates, Spread; Bank Capital Adequacy norms; Banking Innovations – BPLR to Base rate, Core Banking System, Financial Inclusion, Current rates: Policy rates, Reserve Ratios, Exchange rates, Lending/ Deposit rates.

**UNIT III: Non Banking Financial Institutions:** Structure and functioning of Unit Trust of India and Mutual Funds, Growth of Indian Mutual funds and their Regulation, Role of AMFI. Performance of Non-Statutory Financial Organizations: IFCI, IRBI, NABARD, SIDBI and SFCs.

**UNIT IV: Financial And Securities Markets:** -, Role and functions of SEBI, Structure and functions of Call Money Market, Government Securities Market – T-bills Market, Commercial Bills Market, Commercial paper and Certificate of Deposits; Securities Market – Organization and Structure, Listing, Trading and Settlement, SEBI and Regulation of Primary and Secondary Markets.

**UNIT V: Asset/Fund Based Financial Services And Merchant Banking:** Lease Finance, Consumer Credit and Hire Purchase Finance, Factoring - Definition, Functions, Advantages, Evaluation, Forfeiting, Bills Discounting, Housing Finance, and Venture Capital Financing. Merchant Banking: Definition, Merchant Banks Vs Commercial Banks, Services of Merchant Banks.

**REFERENCES:**

1. L.M. Bhole: Financial Institutions and Markets, TMH, 2009.
2. E. Gordon, K. Natarajan: Financial Markets and Services, Himalaya Publishing House, 2013.
3. Vasant Desai: Financial Markets and Financial Services, Himalaya,2009
4. Pathak: Indian Financial Systems, Pearson, 2009
5. M.Y. Khan: Financial Services, TMH, 2009.
6. S. Gurusamy: Financial Services and System, Cengage,2009
7. Justin Paul and Padmalatha Suresh: Management of Banking and Financial Services, Pearson, 2009.
8. Gomez, Financial Markets, Institutions and Financial Services, PHI, 2012. 9. R M Srivatsava: Dynamics of Financial Markets and Institutions in India, Excel, 2013.

## 20MB832OE: Entrepreneurship and Business Design (Open Elective –III)

**B. Tech. VIII Sem.**

**L T P C**  
**3 0 0 3**

**Course Objective:** The objective of the course is to make students understand the essentials of building their startups and to familiarize with business design process develop business models, and market their product.

**Course Outcomes:** At the end of this course, the students will be able to

1. Understand the essentials of entrepreneurship and the key role played by the entrepreneurs.
2. Differentiate the different phases of UI /UX.
3. Outline the attentiveness on designing a business strategy.
4. Explore on designing and delivery of services.
5. Understand reverse engineering methods in product development. 6. Indicate information on IPR, and patent application.

**UNIT – I: Introduction to Entrepreneurship:** Meaning of Entrepreneurship. Reasons feeding the Entrepreneurial fire. Understanding Entrepreneurship as a Process. Multiple roles of Entrepreneur: Intrapreneur, Inventor, Coordinator, Manager and Controller. Psychological and behavioral aspects of First-Generation Entrepreneur.

**UNIT – II: Introduction to UI/UX:** Human centered design and benefits, the distinction between UX and UI, UX process – user research, prototyping strategies, UI principles, UI analysis, UI design, UI components and Responsive design.

**UNIT – III: Designing a Business Strategy:** Define a problem and frame a strategic question, map the lives of users, journey mapping and ideation, color theory, killing the ideas through Stage Gate Models, pitching of full-fledged, idea, choosing the Start-Up Team.

**UNIT – IV: Designing Services and Services Delivery:** Services as solutions, Service delivery pathways, rapid branding and marketing strategies, key metrics for Design thinking. Types of New services, Mix of core services and secondary and enhancing services, service flower and service design matrix.

**UNIT – V: Business Model & Entrepreneurial funding:** Meaning of business model, Difference between business model and business planning, the business model canvas, Risks and Assumptions, Validation of business models. Funding: Bootstrapping, Angel Investors, Venture capitalists, Private equity funding, customer acquisition, return on equity and Break even analysis.

### REFERENCES:

1. J. Chris Leach & Ronald W. Melicher “Entrepreneurial Finance, Fourth Edition”, South Western, Cengage Learning, 2012.
2. Robert D. Hisrich & Veland Ramadani – “ Effective Entrepreneurial Management, Strategy, Planning, Risk Management, and Organization” , Springer, 2017.
3. Mæhlum, A. R. (2017). Extending the TILES Toolkit-from Ideation to Prototyping (Master's thesis, NTNU).
4. Norman, D. (2013). The design of everyday things: Revised and expanded edition. Basic books.