MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute, Affiliated to RGPV, Bhopal (M.P.) India)

NAAC Accredited with A++ Grade

B.Tech. VI Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140619/ 200619	DC	Mobile Communication & 5G Networks	50	10	20	20				100	4	-	-	4

Mobile Communication & 5G Networks (200619/140619)

Course Objective: The objective of the course is to provide an understanding of wireless communication system, its evolution, standards, and comparison of recent technologies and overview of 5G technology.

Unit I: Introduction to cellular mobile systems: Basic Cellular System, Cellular communication infrastructure: Cells, Clusters, Cell Splitting, Frequency reuse concept, Cellular system components, Operations of cellular systems, Handoff/Handover, Channel assignment , Fixed and dynamic, Cellular interferences: Co-Channel and adjacent channel and sectorization.

Unit II: Channel Models: Properties of mobile radio channels – Intersymbol interference – Multipath and fading effects – Interleaving and diversity – Multiple access schemes (TDMA, FDMA, CDMA, SDMA) – Interuser interference – Traffic issues and cell capacity.

Unit III: Modulations techniques for mobile communication: Pulse shaping, Linear and non-linear Modulation techniques, constant envelop modulation, QPSK, MSK, GMSK. Spread spectrum modulation techniques - Direct sequence and Frequency Hopping Spread Spectrum and their applications.

Unit IV: Introduction to modern cellular standards: 2G Architecture such as GSM and CDMA based – 2.5G – GPRS: GPRS and its features –3G standard details such as UMTS – Introduction to LTE, Basic concept of massive MIMO.

Unit V: Overview of 5G Broadband Wireless Communications: 5G potential and applications; Usage scenarios: enhanced mobile broadband (eMBB), ultra reliable low latency communications (URLLC), massive machine type communications (MMTC), D2D communications, V2X communications; Spectrum for 5G and sharing.

Text Books:

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, John Wiley & Sons.
2. 4G, LTE-Advanced Pro and The Road to 5G Third Edition, Elsevier publication

Reference Books:

1. V.K.Garg, J.E.Wilkes, “Principle and Application of GSM”, Pearson Education, 5th edition, 2008.

2. T.S. Rappaport ,“Wireless Communications: Principles and Practice”, second edition, Prentice Hall publication, 2002.

Course Outcomes:

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

- **CO1. Describe** mobile communication system.
- **CO2. Compare** multiple access techniques for signal transmission.
- **CO3. Explain** modulation techniques for mobile communication system.
- **CO4. Analyze** modern cellular standards.
- **CO5. Discuss** 5G technology in mobile communication.

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140616/200616	DC	VLSI Design	50	10	20	20	60	20	20	200	3	-	2	4

VLSI Design (140616/200616)

Course objectives: To understand the fundamental properties of digital CMOS logic circuits using basic MOSFET equations and to develop skills for various logic circuits using CMOS design.

Unit I: MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitances.

Unit II: MOS Inverters Static Characteristics: Introduction, Voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, Inverters with n-Type MOSFET Load and CMOS Inverter, DC Characteristics of CMOS Inverter, Calculation of VIL, VIH, VOL, VOH and Vth, Design of CMOS Inverters, Supply Voltage Scaling in CMOS Inverters, Power and Area considerations.

Unit III: MOS Inverters Dynamic Characteristics: Switching Characteristics and Interconnect Effects, Switching Characteristics of CMOS Inverter- Delay-Time Definitions, CMOS Propagation Delay, Calculation of Delay times, Power Dissipation-Switching, Short-Circuit and Leakage Components of Energy and Power, Power-Delay Product.

Unit IV: CMOS Logic Structures and Layout Design: Combinational MOS logic circuits- CMOS Logic circuits (NAND, NOR and Complex Logic Gates, Multiplexers etc.), CMOS Transmission Gates (Pass Gates). CMOS n-Well Process, layout design rules, layout design of CMOS Inverter, designing of stick diagram.

Unit V: Semiconductor Memories and Low-Power CMOS Logic Circuits: Semiconductor memories: non- volatile and volatile memory devices, flash memories, SRAM cell design, 1T DRAM cell design, dynamic CMOS logic circuits, domino logic CMOS circuits.

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.
2. David A. Johns and Ken Martin, "Analog Integrated Circuit Design" John Wiley and Sons Inc., 1997.
3. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010
4. John P.Uyemura, "CMOS Logic Circuit Design", Springer International Edition.2005.Logic Circuit Design", Springer International Edition.2005.

Course Outcomes:

After completion of the course the students will be able to:

CO1. Analyze operating modes of CMOS transistors

CO2. Compute static characteristic parameters of CMOS inverters.

CO3. Evaluate the propagation delay and power dissipation of CMOS inverter.

CO4. Design CMOS logic circuit and layout.

CO5. Compare semiconductor memories.

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B.Tech. VI Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini proj		L	T	P	
140617	DC	Artificial Intelligence & Machine Learnin	50	10	20	20				100	4	-	-	4

Artificial Intelligence & Machine Learning (140617/200617)

Course Objectives: To provide the fundamental knowledge of Artificial Intelligence, Neural Network and Machine Learning, to present the basic representation and reasoning paradigms used in AI & ML, to understand the working of techniques used in AI & ML.

Unit – I Introducing Artificial Intelligence: Definition, Goals of AI, Task of AI, Computation, Psychology and Cognitive Science. Perception, Understanding, and Action. Artificial intelligence vs machine learning vs deep learning and other related fields. Applications of Artificial intelligence and Machine Learning in the real world.

Unit – II Problem, Problem Space and Search: Production System, Blind Search: BFS & DFS, Heuristic Search, Hill Climbing, Best First Search

Introduction to Neural Networks: History, Biological Neuron, Artificial Neural Network, Neural Network Architectures, Classification, & Clustering

Unit – III Introduction to Machine Learning: Traditional Programming vs Machine learning. Key Elements of Machine Learning: Representation, process (Data Collection, Data Preparation, Model selection, Model Training, Model Evaluation and Prediction), Evaluation and Optimization. Types of Learning: Supervised, Unsupervised and reinforcement learning. Regression vs classification problems.

Unit – IV: Supervised Machine Learning: Linear regression:implementation, applications & performance parameters. Decision tree classifier, terminology, classification vs regression trees, tree creation with Gini index and information gain, IDE3 algorithms, applications and performance parameters. Random forest classifier. Case study on regression and classification for solving real world problems.

Unit – V: Unsupervised Machine Learning: Introduction, types: Partitioning, density based, DBSCAN, distribution model-based, hierarchical, Agglomerative and Divisive, Common Distance measures, K-means clustering algorithm. Case study on clustering for solving real world problems.

Text Books/Reference Books:

1. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
2. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop
5. Introduction to Machine Learning using Python: Sarah Guido
6. Machine Learning in Action: Peter Harrington

Course Outcomes:

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

CO1. Explain basic concepts of Artificial Intelligence & Machine Learning.

CO2. **Describe** the techniques for search and processing.

CO3. Compare AI, ANN & Machine Learning techniques.

CO4. Apply AI and ML techniques to solve real world problems

Annexure VII

Item 8

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batches admitted in 2021-22) **in online mode under Departmental Elective (DE-1) Course** with credit transfer, in the VI Semester.

S. No	Category Code	Course Code	Name of The course	Duration of the Course in weeks	Course Registration		Name of the Mentor Faculty
					Start Date	End Date	
Electronics Engineering							
1	DE-1	140665	Electromagnetic Waves in Guided and Wireless Media	8	22/01/24	15/03/24	Dr. Laxmi Shrivastava
2		140662	Digital IC Design	12	22/01/24	12/04/24	Dr. Vikas Mahor
3		140663	Fuzzy sets, logic and System & Applications	12	22/01/24	12/04/24	Dr. Hemant Choubey
Electronics & Telecommunication Engineering							
1	DE-1	200665	An Introduction to Information Theory	8	22/01/24	15/03/24	Prof. Pooja Sahoo
2		200663	Fuzzy sets, logic and System & Applications	12	22/01/24	12/04/24	Dr. Hemant Choubey
3		200662	Digital IC Design	12	22/01/24	12/04/24	Dr. Vikas Mahor

Annexure VIII

Item 9

To review and finalize the courses & syllabi to be offered (for batch admitted in 2021-22) under the Open Category (OC) Courses (in traditional mode) for VI semester students of other departments along with their COs.

S. No	Category	Subject Code	Subject Name
1	OC-1	900116	Embedded Systems
2	OC-1	900117	Intelligent Control

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
900104	OC	Intelligent Control	50	10	20	20	-	-		100	3	-	-	3

Intelligent Control (900117)

Course Objectives: The main objective of this course is to develop the basic understanding of an Intelligent control i.e. control system with optimization and prediction using Artificial Neural Network to the students.

Unit I Adaptive Control: Introduction, Close loop and open loop adaptive control. Self-tuning controller, Parameter estimation using least square and recursive least square techniques, Gain Scheduling, Model Reference Adaptive Control, Self Tuning Regulators, Adaptive Smith predictor control, Auto tuning and self tuning smith predictor.

Unit II Artificial Neural Network (ANN) Based Control: Introduction to ANN, Different activation functions, Different architectures and different learning methods, Back Propagation and Radial Basis Function networks.

Unit III Modeling of Control System: Representation and identification, Modeling the plant, Control structures – supervised control, Model reference control, Internal model control, Predictive control,Indirect and direct adaptive controller design using neural network.

Unit IV Fuzzy Logic Based Control: Fuzzy Controllers: Preliminaries – Mamdani and Sugeno inference methods, Fuzzy sets in commercial products – basic construction of fuzzy controller – fuzzy PI, PD and PID control, Analysis of static properties of fuzzy controller, Analysis of dynamic properties of fuzzy controller , Simulation studies and case studies , Stability issues in fuzzy control.

Unit V Hybrid Control: Introduction to Genetic Algorithm (GA), Neuro-Fuzzy and Fuzzy-GA based hybrid system design.

Text Books:

1. Astrom **.**K, Adaptive Control, Second Edition, Pearson Education Asia Pvt. Ltd, 2002.
2. Shivanandan**,** Introduction to Artificial Neural Network with MATLAB 6.0.1, Third Edition, Mcgraw Hill India Ltd, 2015.

Reference Books:

1. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, New Delhi 1994.
2. Bose and Liang, Artificial Neural Networks, Tata Mcgraw Hill, 1996.
3. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence, Prentice Hall of India, New Delhi, 1992.
4. Chang C. Hong, Tong H. Lee and Weng K. Ho, Adaptive Control, ISA press, Research Triangle Park, 1993.

Course Outcomes:

After successful completion of this course students will be able to:

CO1. Explain adaptive control systems.

CO2. Describe neural network architecture and learning algorithms.

CO3. Apply the concept of artificial neural network to model the control system.

CO4. Design fuzzy logic based control system**.**

CO5. Optimize control system using Genetic algorithm.

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
900116	OC	Embedded System	50	10	20	20	-	-		100	3	-	-	3

Embedded System (900116)

Course objectives: To introduce the basic concepts of microcontroller and to develop assembly languageprogramming skills along with the introduction of microcontroller applications.

Unit I Introduction: Embedded system architecture, classification, challenges and design issues, fundamentals of embedded processor and microcontrollers, Von Neumann/Harvard architectures, CISC vs. RISC, microcontrollers types and their selection, Overview of the 8051 family, architecture, pin description, Flags, Register Banks, Internal Memory Organization, I/O configuration, Special Function Registers, addressing modes.

Unit II Assembly programming and instruction of 8051: An Overview of 8051 instruction set, Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.

Unit III 8051 Timer, Serial port, interrupt Programming: Basics of Timers/Counters, Programming 8051 timers/Counter, basics of serial communication, 8051 connection to RS232, 8051 serial port programming, basics of 8051 Interrupts, 8051 interrupts programming: Timer interrupts, external hardware interrupts and serial communication interrupt, 8051 Interrupt priority.

Unit IV Interfacing real world devices with 8051 microcontroller: Memory address decoding, 8051 interfacing with memory, 8051 interface with 8255 PPI and various interfacings like: LCD and Matrix Keyboard interfacing with 8051 microcontroller, ADC, DAC and Temperature Sensor interfacing with 8051 microcontroller, Stepper motor interfacing.

Unit V Interfacing real world devices with Arduino : Overview of Arduino, Configuration, Interfacing, Board layout, Atmega328 specifications, Interfacing of Arduino with LED, Switches, Light dependent resistor (LDR), PWM, 16*2 LCD, Serial, L293D for motor interfacing, ADC.

Text Book:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. Mckinlay, ―The 8051 Microcontroller and Embedded Systems using Assembly and C‖ Pearson Education India, 2nd Edition

Reference Books:

1. Kenneth Ayal, –The 8051 Microcontroller‖, Architecture, Programming and Applications.
2. SubrataGhoshal, ―Embedded Systems and Robots, Projects using the 8051Microcontroller.

Course Outcomes:

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

CO1. Explain the architecture of embedded system and 8051.
CO2. Write assembly language programs for 8051.
CO3. Describe the interfacing of 8051 microcontroller with Timers/Counters, Serial communication and interrupt.
CO4. Design memory and I/O interfacing circuits with 8051.
CO5. Explain the interfacing of Arduino with I/O devices.

Annexure IX

Item 10

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.VI semester ***(*for batch admitted in 2021-22).**

S. No	Category	Subject Code	Subject Name
1	DC	140616/200616	VLSI Design
2	DC	140617/200617	Artificial Intelligence & Machine Learning
3	DLC	140518/200618	Minor Project-II

Subject Name: VLSI Design
Subject Code: 140616/200616

Course Objectives

This course gives the ability to students to learn the design and simulation of SPICE simulation of basic CMOS logic circuits.

List of Experiments

Following experiments are to be designed and simulated on Symica EDA tool:

1. Design and simulation of inverter at 180 nm CMOS technology.
2. Design and simulation of NOR Gate at 180 nm CMOS technology.
3. Design of NOR Gate Symbol at 180 nm CMOS technology and simulate to verify the functionality.
4. Design and simulation of NAND Gate at 180 nm CMOS technology.
5. Design of NAND Gate Symbol at 180 nm CMOS technology and simulate to verify the functionality.
6. Design and simulation of AND Gate with its symbol at 180 nm CMOS technology.
7. Design and simulation of OR Gate with its symbol at 180 nm CMOS technology.
8. Design and simulation of Exclusive OR Gates with its symbol at 180 nm CMOS technology.
9. Design and simulation of Half Adder using symbols designed in experiment 7 and 8.
10. Design and simulation of Full Adder using symbols designed in experiment 7 and 8.

Course Outcomes:

After the completion of this course students will be able to:
CO1. **Demonstrate** a clear Understanding in hardware design language (SPICE).
CO2. Model a Combinational circuit using SPICE Netlist.
CO3. Simulate and validate the functionality of the CMOS VLSI circuits using CAD tools

Subject Name: Artificial Intelligence & Machine Learning (AIML)
Subject Code: 140617 /200617

Course Objectives:

This course provides the fundamentals programming skills, import, manipulate, and analyze data using NumPy and Pandas DataFrames and implement machine learning models using the scikit-learn package in Python.

List of Experiments

1. Perform creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: strings, list, tuples, dictionary and set.
2. Solve problems using decision and looping statements.
3. Apply Python built-in data types: strings, list, tuples, dictionary, set and their methods to solve any given problem.
4. Manipulation of NumPy arrays- indexing, slicing, reshaping, joining and splitting.
5. Computation on NumPy arrays using universal functions and mathematical methods.
6. Import a CSV file and perform various statistical and comparison operations on rows/columns.
7. Create Pandas series and Data Frame from various inputs.
8. Import any CSV file to Pandas Data Frame and perform the following:
    1. Visualize the first and last 10 records.
    2. Get the shape, index and column details.
    3. Select/Delete the records (rows/columns) based on conditions.
    4. Perform ranking and sorting operations.
    5. Do required statistical operations on the given columns.
    6. Find the count and uniqueness of the given categorical values.
9. Import any CSV file to Pandas Data Frame and perform the following:
    1. Handle missing data by detecting and dropping/ filling missing values.
    2. Transform data using different methods.
    3. Detect and filter outliers.
    4. Perform Vectorized String operations on Pandas Series.
    5. Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
10. Use scikit-learn package in python to implement following machine learning models to solve real world problems using open source datasets:
    1. Linear Regression model.
    2. Multi-linear regression model.
    3. Decision tree classification model.
    4. Random forest model.
    5. SVM model.
    6. K-means clustering model.

Course Outcomes:

After the completion of this course students will be able to:

CO1. Perform the fundamental operations on Python built-in data types.
CO2. Develop problem-solving skills using decision and looping statements in Python.
CO3. Perform Data Handling with Python built-in functions..
CO4. Analyze data using Pandas Data Frames.

Annexure X

Item 11

To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B.Tech. VI Semester **(for the batch admitted in 2021-22)**.

S. No	Category	Subject Code	Subject Name
1	DC	140616/200616	VLSI Design
2	DC	140617/200617	Artificial Intelligence & Machine Learning

Subject Name: VLSI Design
Subject Code: 140616/200616

Skill Based Mini Project

1. Design and Verify the 180 nm CMOS based NAND gate on LTSpice.
2. Design and Verify the 180 nm CMOS based NOR gate on LTSpice.
3. Design and Verify the 180 nm CMOS based Half-adder on LTSpice.
4. Design and Verify the 180 nm CMOS based 1-bit Shift Register on LTSpice.
5. Design and Verify the 180 nm CMOS based XOR gate on LTSpice.
6. Design and Verify the 180 nm CMOS based EXNOR gate on LTSpice.
7. Design and Verify the 180 nm CMOS based Full-adder on LTSpice.
8. Design and Verify the 180 nm CMOS based 2-bit Shift Register on LTSpice.
9. Design and Verify the 180 nm CMOS based OR gate on LTSpice.
10. Design and Verify the 180 nm CMOS based AND gate on LTSpice.
11. Design and Verify the 180 nm CMOS based half-substractor on LTSpice.
12. Design and Verify the 180 nm CMOS based 1 bit comparator on LTSpice.
13. Design and Verify the 180 nm CMOS based Inverter on LTSpice and measure the delay at 100 MHz Frequency.
14. Design and Verify the 180 nm CMOS based Inverter on LTSpice and measure the total power dissipation at 100 MHz Frequency.
15. Design and Verify the 180 nm CMOS based full-substractor on LTSpice.
16. Design and Verify the 180 nm CMOS based 2 bit comparator on LTSpice.
17. Design and Verify the 180 nm CMOS based domino logic 2- input NAND gate on LTSpice.
18. Design and Verify the 180 nm CMOS based domino logic 2- input NOR gate on LTSpice.
19. Design and Verify the 180 nm CMOS based domino logic 4- input NAND gate on LTSpice.
20. Design and Verify the 180 nm CMOS based domino logic 2- input NOR gate on LTSpice.

Subject Name: Artificial Intelligence & Machine Learning (AIML)
Subject Code: 140617 /200617

Skill Based Mini Project

1. Write a program to Predicting Iris Flower Species [Dataset: Iris dataset (available in scikit-learn).]
2. Write a program for Handwritten Digits Recognition [Dataset: MNIST dataset of handwritten digits.]
3. Write a program for Sentiment Analysis on Movie Reviews [Dataset: IMDb movie reviews dataset.]
4. Write a program to Predict House Prices [Dataset: Housing price data from Kaggle.]
5. Write a program for Spam Email Detection [Dataset: Enron Email Dataset.]
6. Write a program for Image Classification on CIFAR-10 [Dataset: CIFAR-10 dataset.]
7. Write a program for Credit Card Fraud Detection [Dataset: Credit Card Fraud Detection dataset from Kaggle.]
8. Write a program for Predicting Stock Prices [Dataset: Yahoo Finance or Alpha Vantage API.]
9. Write a program for Customer Segmentation [Dataset: Online Retail Data from UCI Machine Learning Repository.]
10. Write a program to Digit Recognition in Sign Language [Dataset: ASL Alphabet dataset.]
11. Write a program for Predicting Diabetes Onset [Dataset: Diabetes dataset from UCI ML Repository.]
12. Write a program for Facial Recognition [Dataset: Labeled Faces in the Wild (LFW) dataset.]
13. Write a program for Movie Recommendation System [Dataset: MovieLens dataset.]
14. Write a program for Predicting Employee Churn [Dataset: Human Resources Analytics dataset from Kaggle.]
15. Write a program for Text Generation with LSTM [Dataset: Various books, articles, or Kaggle text datasets.]
16. Write a program for Fake News Detection [Dataset: Fake news dataset from Kaggle.]
17. Write a program for Predicting Wine Quality [Dataset: Wine Quality dataset from UCI ML Repository.]
18. Write a program for Object Detection with YOLO [Dataset: COCO (Common Objects in Context) dataset.]
19. Write a program for Customer Lifetime Value Prediction [Dataset: Online Retail Data from UCI ML Repository.]
20. Write a program for Predicting Cardiovascular Disease [Dataset: Framingham Heart Study dataset.]