Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

SY. (Department of Multidisciplinary Engineering)

Effective from Academic Year 2023-24

Prepared by: - SY (Department of Multidisciplinary Engineering)

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Dean Academics **Chairman – Academic Board**

Institute Vision:

To be a globally acclaimed Institute in Technical Education and Research for holistic Socio-economic development

Institute Mission:

- To ensure that 100% students are employable and employed in Industry, Higher Studies, become Entrepreneurs, Civil / Defense Services / Govt. Jobs and other areas like Sports and Theatre.
- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.
- Promote Research Culture among Students and Faculty through Projects and Consultancy.
- To make students Socially Responsible Citizen.

Department Vision:

- To inculcate multidisciplinary culture amongst students with knowledge from diverse areas of engineering

Department Mission:

- To provide a scholarly environment for the development of computing skills and competencies
- To cultivate research culture resulting in knowledge-base and innovative technologies
- To impart technical knowledge related to emerging multidisciplinary areas of Engineering
- To prepare students for solving problems of societal benefits and make them responsible citizens.

Title: Course Structure **FF No.: 653**
Branch: SY-DOME **Academic Year: 2023-24**
Semester: I/II **Year: S.Y Module: III**

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Total	Credits
			Theory	Lab	Tut	CA			MSA	ESA				
						Lab	Seminar	GD		CP	ESE	CVV		
S1	MD2201	Data Science	2	2	1	10	20			20	30	20	100	4
S2	CS2221	Internet of Things	2	2	1	10		20		20	30	20	100	4
S3	CS2218	Object Oriented Programming	2	2	1	10				20	50	20	100	4
S4	CS2227	Database Management Systems	2	2	1	10	20			20	30	20	100	4
	ME 2205	3-D Printing	2	2	1	10	20			20	30	20	100	
S5	Dept	Engineering Design & Innovation – I	-	2	-	-	-	-	30		70	-	100	6
S6	Dept	Design Thinking- III	-	-	1	-	-	-	-		-	-		1
Total														23

Table of Contents

FF No.: 654

COURSE CODE: MD2201 COURSE NAME: DATA SCIENCE

Course Prerequisites:

1. Linear Algebra Basics
2. Central Tendency & Measures of Dispersion – Mean, Mode, Median
3. Probability
4. Some exposure to programming environment – C programming; Python

Course Objectives:

1. Understand data processing pipeline
2. Perform dimensionality reduction operations
3. Optimize the performance of functions
4. Apply descriptive statistics tools
5. Deduce meaningful statistical inferences
6. Use unsupervised classification algorithms
7. Use supervised classification algorithms
8. Utilize the data science principles for an entire project life cycle as a case study

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: **2** Hours/Week

Course Relevance:

The course is offered in S.Y. B.Tech. to all branches of Engineering

Data Science is a multidisciplinary field. It uses scientific approaches, procedures, algorithms and frameworks to extract knowledge and insight from a huge amount of data.

Data Science uses concepts and methods which belong to fields like information technology, Mathematics, Statistics, Computer Science etc.

Data Science influences the growth and improvements of the product by providing a lot of intelligence about customers and operations, by using methods such as data mining and data analysis.

The course is relevant to all branches of Engineering and beyond, since data is generated as an obvious outcome of many processes.

Data science definition, raw data, processed data and their attributes, meta data, data cleaning, data science pipeline. **(3 Hours)**

Normal distribution, evaluating normal distribution, Binomial distribution, confidence Intervals, central limit Theorem, hypothesis testing **(6 Hours)**

Vector norms, Unconstrained Optimization **(4 Hours)**

Simple and multiple linear regression; Logistic regression, non-linear regression, polynomial regression **(4 Hours)**

Nearest Neighbor Classification – Knn approach, branch and bound algorithm, projection algorithm; Naïve Bayes Classification; Classification using decision trees, divisive and agglomerative clustering, K-means clustering **(6 Hours)**

Evaluation of model performance – Confusion matrices, sensitivity, specificity, precision, recall, F-measure, Classifier performance measurement metrics – Training & Testing strategies – Resubstitution, Hold-out, Cross validation, Bootstrap **(3 Hours)**

List of Tutorials:

1. Data Visualization
2. Distances and Projections
3. Singular Value Decomposition
4. Principal Component Analysis
5. Optimization
6. Normal & Binomial Distribution
7. Hypothesis Testing
8. ANOVA test
9. Linear Regression
10. Logistic Regression
11. Nearest Neighbor Classification
12. Decision Trees based classification
13. Naive Bayes classification
14. Clustering
15. Evaluation of model performance
16. Bagging & Boosting approaches

List of Practical's: (Any Six)

1. Data visualization
2. Unconstrained Optimization
3. Hypothesis Testing
4. Linear regression
5. Logistic Regression
6. Nearest Neighbor classification
7. Naive Bayes classification
8. Clustering
9. Classifier performance using Confusion matrix and other attributes
10. Cross Validation methods

List of Course Projects:

1. Movie recommendation system
2. Customer Segmentation using Machine Learning
3. Sentiment analysis
4. Uber Data analysis
5. Loan prediction
6. HVAC needs forecasting
7. Customer relationship management
8. Clinical decision support systems
9. Development of machine learning solutions using available data sets (multiple projects)
10. Fraud detection

List of Course Seminar Topics:

1. Data wrangling
2. Predictive modeling
3. Data analytics in life science (multiple topics)
4. Ensemble modeling techniques
5. Text pre-processing
6. Feature scaling for machine learning
7. Multivariate normal distribution applications
8. Distance metrics and their applications
9. Visualization techniques such as Chernoff's faces
10. Tree based algorithms
11. Ridge regression
12. LASSO

Assessment Scheme:
Written ESE:30
Course Project:20
Laboratory Work:10

Seminar Presentation:20
CVV:20

Text Books: ***(As per IEEE format)***

1. 'A Beginner's Guide to R' – Zuur, Leno, Meesters; Springer, 2009
2. 'Introduction to Data Science' – Igual, Segui; Springer, 2017
3. 'Mathematics for Machine Learning' – Diesenroth, Faisal, Ong; Cambridge University Press, 2017
4. 'Machine Learning with R' – Lantz, Packt Publishing, 2018

Reference Books: ***(As per IEEE format)***

1. 'Elements of Statistical Learning' - Hastie, Tibshirani, Friedman; Springer; 2011
2. 'Data Science from Scratch' - Grus; Google Books; 2015
3. 'The art of Data Science' - Matsui, Peng; 2016
4. 'Machine Learning for absolute beginners' - Theobald; Google Books; 2017

Moocs Links and additional reading material: www.nptelvideos.in

1. https://www.edx.org/course/machine-learning-fundamentals-2
2. https://www.edx.org/course/foundations-of-data-analysis-part-1-statistics-usi
3. https://www.coursera.org/learn/statistical-inference/home/welcome
4. https://www.coursera.org/learn/data-scientists-tools/home/welcome

Course Outcomes:

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

1. Apply data processing and data visualization techniques
2. Perform descriptive and inferential statistical analysis
3. Utilize appropriate distance metrics and optimization techniques
4. Implement supervised algorithms for classification and prediction
5. Implement unsupervised classification algorithms
6. Evaluate the performance metrics of supervised and unsupervised algorithms

Future Courses Mapping:

1. Deep Learning
2. Reinforcement Learning
3. DBMS
4. Big Data
5. Data Mining
6. Information Retrieval
7. Recommendation Systems

8. Cloud Computing – AWS
9. IOT
10. Artificial Intelligence
11. Pattern Recognition
12. Natural Language Processing
13. Computer Vision
14. Machine Vision
15. Fault Diagnosis
16. Optimization
17. Bioinformatics
18. Computational Biology
19. Econometrics
20. Supply Chain
21. Ergonomics
22. Operations Research
23. Nano-informatics

Job Mapping:

Job opportunities that one can get after learning this course

1. Data Scientist
2. Data Analyst
3. AI Engineer
4. Data Architect.
5. Data Engineer.
6. Statistician.
7. Database Administrator.
8. Business Analyst
9. Business Intelligence Developer
10. Infrastructure Architect
11. Enterprise Architect
12. Machine Learning Engineering
13. Machine Learning Scientist

FF No. : 654

COURSE CODE: CS2221 COURSE NAME: INTERNET OF THINGS

Course Prerequisites:

Students should have a basic Understanding of the Internet, Cloud, Networking Concepts and Sensors

Course Objectives:

The student will be able to

1. Understand IoT Architecture and framework.
2. Design IoT use cases.
3. Explain sensors, actuators and development platform.
4. Learn fundamental concepts of wireless sensor networks.
5. Understand basic networking, IoT protocols and cloud.
6. Apply knowledge of IoT for practical cases.

Credits: 4 **Teaching Scheme Theory: 2** Hours/Week

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance:

The Internet of Things is transforming our physical world into a complex and dynamic system of connected devices on an unprecedented scale. Interne of Things is a system of interrelated computing and sensing devices and has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.

IoT is highly relevant in this growing ecosystem of internet-enabled devices. IoT offers increasing opportunities to collect, exchange, analyse and interpret data in real-time. This robust access to data will result in opportunities to further enhance and improve operations. In a world which is moving towards an increasingly connected future, Internet of Things (IoT) is the next big thing. Right from our homes to our cars to our cities, everything is being connected and the technology of IoT is right in the middle of it.

Introduction to IoT

Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels & Deployment Templates **(4 Hours)**

IOT Platform Design Methodology

IoT Design Methodology Steps, Home Automation Case Study, Smart Cities, Health Care, Agriculture **(4 Hours)**

IoT Devices

IoT System Design Cycle, Sensors - Terminologies, Calibration, Types, Specification, Use, Actuators - Types and Use, Prototype Development Platform – Arduino, Node MCU, Interface with Embedded System. **(6 Hours)**

Introduction to Wireless Sensor Network

Sensor Node, Smart Sensor Network, Wireless Sensor Network, RFID - Principles and Components, Node MCU **(4 Hours)**

Connectivity Technologies

Network Configuration in IoT, IoT Stack and Web Stack, IEEE 802.15.4 Standard, Zigbee, Bluetooth, MQTT, Cloud Architecture and Types, Cloud Service Providers **(8 Hours)**

Case Studies (Any Two from following List to be covered💻

Smart lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Weather Report Bot, Air Pollution Monitoring, Forest fire Detection, Smart Irrigation, IoT Printer, IoT in Manufacturing Industry, IoT in Process Industry, IoT in Quality, Control Applications in Industry, IoT in Material Handling System in Industry, IoT in Automobile Industry, Navigation System, Connected Vehicles, Industry 4.0 **(4 Hours)**

List of Practical's: (Minimum Six)

1. Setting up Arduino / Node MCU ESP8266 : Basic handling, programming
2. LED Interfacing
3. Sensor interface to Node MCU / Arduino Temperature measurement using LM35
4. Actuator interface to Node MCU /Arduino Traffic Signal Control
5. Node MCU /Arduino wireless communication Raspberry Pi as a web server
6. Node MCU / Arduino Cloud interfacing and programming like Thingspeak. Email alert using SMTP protocol
7. Sensor data acquisition on Mobile (Mobile APP) / Developing Application (WEB APP) with Django Text transfer using MQTT protocol
8. Home Automation using Cisco Packet Tracer

List of Course Projects:

1. Smart Agriculture System
2. Weather Reporting System
3. Home Automation System
4. Face Recognition Bot
5. Smart Garage Door
6. Smart Alarm Clock
7. Air Pollution Monitoring System
8. Smart Parking System
9. Smart Traffic Management System
10. Smart Cradle System
11. Smart Gas Leakage Detector Bot
12. Streetlight Monitoring System
13. Smart Anti-Theft System
14. Liquid Level Monitoring System
15. Night Patrol Robot
16. Health Monitoring System
17. Smart Irrigation System
18. Flood Detection System
19. Mining Worker Safety Helmet
20. Smart Energy Grid

List of Group Discussion Topics:

1. Role of Internet of Things in development of India.
2. Manufacturing industries should make efforts to limit contribution to IoT.
3. Should countries put a ban on IoT for children?
4. Should IoT pay more attention to security rather than just expanding its horizon to the extremes?
5. IoT is the next big thing in technology.
6. IoT poses a huge risk to privacy, if they your system is hacked.
7. IoT is the next big thing for hackers trying to have access to your intimate data.
8. Pros and cons of over-usage of IoT at homes and offices.
9. IoT at battlefields will make life of soldiers safer and easier.
10. IoT will make way for robots to rule over humans one day.
11. IoT devices are making people lazier and obese.
12. IoT needs to be regulated before it goes out of limits and poses serious threat.

Assessment Scheme:

Written ESE:30
Course Project:20
Laboratory Work:10
Group Discussion:20
CVV:20

Text Books: ***(As per IEEE format)***

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-on Approach", (Universities Press)
2. PethuruRajandAnupamaC.Raman,"TheInternetofThings:EnablingTechnologies,Platforms,and Use Cases", (CRC Press)

Reference Books:

1. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", Wiley
2. OvidiuVermesan&PeterFriess"InternetofThingsApplications-FromResearchandInnovationtoMarket Deployment", ISBN:987-87-93102-94-1,RiverPublishers
3. Joe Biron and Jonathan Follett, "Foundational Elements of an IoT Solution," by Joe Biron

MOOCs Links and additional reading material:

1. https://proed.stanford.edu/course/view.php?id=191
2. https://nptel.ac.in/courses/106/105/106105166/
3. https://create.arduino.cc/projecthub/electropeak/getting-started-w-nodemcu-esp8266-on-arduino-ide-28184f

Course Outcomes

1. Demonstrate fundamental concepts of Internet of Things (CO Attainmentlevel:2)
2. Recognize IoT Design Methodology Steps (COAttainmentlevel:3)
3. Select sensors for different IoT applications (COAttainmentlevel:3)
4. Analyze fundamentals of networking (COAttainmentlevel:4)
5. Apply basic Protocols in IoT (CO Attainment level:4)
6. Provide IoT solutions practically with the help of case study(COAttainmentlevel:5)

Future Courses Mapping:

Other courses that can be taken after completion of this course

1. Ad-Hoc Networks
2. Cyber Security
3. Wireless Networks
4. Industry 4.0
5. Big Data

Job Mapping:

The Internet of Things (IoT) is the most emerging field in today's world. It is revolutionizing every industry, from home appliances to agriculture to space exploration. Since the advent of cloud computing, there has been an exponential growth in the number of sensor-enabled devices connected to the internet and expecting further growth accelerating in the coming years. There are diversified career opportunities in this field. The various career positions available as IoT Research Developer, IoT Design Engineer, IoT Product Manager, IoT Software Developer, IoT Solution Architect, IoT Service Manager and many more.

FF No.: 654

COURSE CODE: CS2218 COURSE NAME: OBJECT ORIENTED PROGRAMMING

Course Prerequisites:
Basic course on programming

Course Objectives:

1. Understand Object Oriented programming concepts
2. Demonstrate Object Oriented programming concepts by writing suitable Java programs
3. Model a given computational problem in Object Oriented fashion
4. To develop problem solving ability using Object Oriented programming constructs like multithreading
5. Develop effective solutions using for real world problems using the concepts such as file handling and GUI
6. Implement applications using Java I/O and event-based GUI handling principles
7.

Credits: 4 **Teaching Scheme Theory: 2 Hours/Week**
Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance:
This is an important course for engineering students. It develops computational problem solving and logic building capability of students. Acquiring programming skills has a high relevance in all branches of Engineering. Once the student gains expertise in coding, this course proves to be beneficial to them to excel in industry demanding coding in specific software.

Introduction:

What is Object Oriented Programming (OOP)? The need of OOP, Characteristics of OOP.

Java overview: Classes and Objects, Java object storage, Access Modifiers, this reference, main method, Static vs. Instance block, Static methods vs. Instance methods in Java.

Constructors: Constructors in Java, Default constructor, Parameterized constructor.

Input and Output: Byte Stream vs. Character Stream, use of Scanner Class.

Arrays in Java: Arrays in Java, initialization, Default Array values, multi-dimensional array, java.util .Arrays class, string class, string buffer, string builder.

Methods in Java: Methods, Parameters passing, Returning Multiple values.

Inheritance: Inheritance in Java, Types, Constructor in Inheritance, Using final with Inheritance, Accessing superclass member, Parent and Child classes having same data member, Base vs derived class reference. Polymorphism: Method Overloading, Overloading main(), Static vs Dynamic Binding, Method Hiding. Private and final methods, Passing and Returning Objects in Java

Exception Handling: Exceptions, types, types of handling exception, Checked vs Unchecked Exceptions, Throw and Throws, User-defined Exception.

Interfaces and Abstract Classes: Interface and its usage, Abstract Class and its usage, Difference between Abstract Class and Interface, Nested Interface, Nested Class, Inner class, Anonymous

Collection in Java: Collections Class, Using Iterators, Iterator vs. Foreach, Array List, Vector, Map, Set.

Multithreading: Thread life Cycle, Thread Priority, Thread Methods.

File Handling: File Processing, Primitive Data Processing, Object Data Processing, Connecting Java with database (JDBC/ODBC).

Java GUI: Swing, Components. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key).

List of Practical's:

1. Implement Student class using following Concepts
   - All types of Constructors
   - Static variables and instance variables
   - Static blocks and instance blocks
   - Static methods and instance methods

2. There is a class Adder which has two data members of type 1D int array and int variable. It has two functions: getdata and numsum. Function getdata accepts non-empty array of distinct integers from user in 1D int array data member and a targetsum in another data member. The function numsum adds any two elements from an input array which is equal to targetsum and return an array of resulting two elements, in any order. If no two numbers sum up to the target sum, the function should return an empty array. Note that the target sum is to be obtained by summing two different integers in the array; you can't add a single integer to itself in order to obtain the target sum. You can assume that there will be at most one pair of numbers summing up to the target sum. Use constructor. Use extra variables if needed

   Input:
   Array=[3,5,-4,8,11,1,-1,7] targetsum=15
   Output: [8,7]
   Input:
   Array=[3,5,-4,8,11,1,-1,6] targetsum=15

Output: []

3. Write Java program to calculate area of triangle, square & circle using method overloading. Method parameters accept from user (Use Method Overloading concepts and Inheritance).
4. Write a program for following exception, develop a suitable scenario in which the following exceptions occur:
    a. divide by zero
    b. Array index out of bounds exception
    c. Null pointer Exception
5. Write a java program to solve producer-consumer problem where there are two producer threads and one consumer thread OR Write a java program using collection classes.
6. Implement various operations using JDBC Connectivity.
7. Display bank account information (Use interface and inheritance using java)
8. Develop a GUI in java which reads, update the file.

List of Course Projects:

1. Airline reservation system
2. Course management system
3. Data visualization software
4. Electricity billing system
5. e-Healthcare management system
6. Email client software
7. Library management system
8. Network packet sniffer
9. Online bank management system
10. Online medical management system
11. Online quiz management system
12. Online Survey System
13. RSS feed reader
14. Smart city project
15. Stock management system
16. Supply chain management system
17. Virtual private network
18. Pocket Tanks Game Java Project
19. Internet Banking
20. Hospital Management Java Project
21. Teachers Feedback Form Java Project
22. Online Job Portal Java Project
23. Online Examination Java Project
24. Alumini Database Java Project
25. Virtual Classroom Java Project
26. Lan Chat and File Sharing Java Project
27. Payroll System Java Project
28. Online Exam Java Project
29. Java Game mini Project
30. Online Shopping Java Project
31. Online Library Management System

32. Feedback Collection System java project
33. Text Editor in Java Project
34. Moving Balls using Java Applet
35. Online Reservation System Project
36. Web skeletonizer service
37. Web Enabled Manufacturing Process Project
38. Album Manager Project
39. Global Communication Network
40. Library System project
41. Link Handler System Project
42. Crypto system Project
43. Scheduling and Dispatching project
44. Intranet Mailing System
45. Online Examination System Project
46. Business to Customer System Project
47. University Admission & Maintenance System
48. Campaign Management System Project
49. Content Management System Project
50. Digital Library System Project
51. Contract Labour Management System Project
52. Pay Roll System Project using Java
53. Revenue Recovery System Project
54. Online medical Booking Store Project
55. Client Management System Project
56. Tele Dormitory System Project
57. Reusable CAPTCHA security engine Project
58. Mobile Service Provider System
59. Forestry Management System
60. Distributed Channel management System
61. Online Tenders Management System
62. Noble Job Portal System
63. Energy Audit Processing System
64. Collector Monthly Review System
65. Grievance Handling System
66. Student Project Allocation and Management Project
67. Web Based Reporting System
68. Vehicle Identification System
69. Diamond Shipping System
70. Visa Processing System
71. Enterprise Fleet Management System
72. Global Communication Media
73. HR Help Desk System
74. SQL Workbench Project
75. Remarketing System project
76. Cargo Express Courier project
77. Automated Sports Club Project
78. Multi Banking System Project
79. Java Application World

80. Cricket Game Java Project
81. Email Program System
82. Employee Information and Payroll System
83. Complete Mailing System
84. Complete Banking System
85. College Library Application System
86. Colleges Enrollment System
87. Car Sales System
88. Bus Booking System
89. Bug Tracking System
90. University Admission Management System Java Project
91. Beat It Game in Java
92. Civilization Game Project
93. Airways Reservation System
94. Airstrike System Game
95. Pong Game Java Project
96. Faculty Book System
97. Bank Application System
98. ATM Database System
99. Advanced Payroll System
100. Virtual Private Network Java Project
101. ISP Automation System
102. Life Insurance Management System
103. Help Desk Management System
104. Datamart Management System
105. Automated Sports Club System
106. University Search Engine Project
107. Online Exam Suite Project
108. Forensic Management System
109. Student Registration System
110. E Mail Scanning Project
111. Criminal Face Detection System
112. Web Server Management System Java Project
113. Stores Management System
114. Bug Tracking System Java Project
115. Career Information Management System Java Project
116. Course Management System Java Project
117. Data Visualization Software Java Project
118. Digital Steganography Java Project
119. E Health Care Management System Java Project
120. Electricity Billing System Java Project
121. Email Client Software Java Project
122. Event Management System Java Project
123. Farmers Buddy Java Project Java Project
124. File Transfer and Chat Java Project
125. Knowledge Evaluator Software Java Project
126. Library Management System Java Project
127. Mail Server Java Project

128. Network Packet Sniffer Java Project
129. Number Guessing Game Java Project
130. Online Attendance Management System Java Project
131. Online Bank Management System Java Project
132. Online Book Store
133. Online Customer Care and Service Center Java Project
134. Online Document Management System Java Project
135. Online Examination Management System Java Project
136. Online Medical Management System Java Project
137. Online Quiz System Java Project
138. Online Survey System Java Project
139. Photo Lab Management System Java Project
140. RSS Feed Reader Java Project
141. Smart City Project Java Project
142. Stock Management System Java Project
143. Student Result Processing System Java Project
144. Supply Chain Management System Java Project
145. Telephone Billing System Java Project
146. Travel Management System Java Project
147. Currency Converter
148. Career Information Management System
149. Digital Steganography
150. Event Management System
151. Farmers Buddy
152. File Transfer and Chat
153. Knowledge Evaluator Software
154. Mail Server
155. Number Guessing Game
156. Online Attendance Management System
157. Online Customer Care and Service Center
158. Online Document Management System
159. Online Examination Management System
160. Online Quiz System
161. Photo Lab Management System
162. Student Result Processing System
163. Travel Management System
164. University Admission Management System
165. Web Server Management System
166. Address Book Management System
167. Affiliate Manager
168. Ajax Browser
169. Application Installer Software
170. Application Re-installer Software
171. ATM Simulator System
172. Automatic File Update
173. Bookmark Sync
174. Bus Ticket Reservation System
175. Calendar Icon Maker Application

176. CSS Color and Image Annotator
177. Cybercafe Management System
178. Data Encryption
179. Database Explorer
180. Directory and File Explorer
181. Domain Search Engine
182. E-Acquisition
183. E-Advertisement
184. E-Learning
185. Enterprise Scheme Planner
186. Face Identification
187. File and Folder Explorer
188. Font Detector/Finder
189. HTML Color Code Finder
190. HTML Spell Checker
191. Image Compressor Application
192. Image to Text Converter
193. Internet Credit Card System
194. Internet Usage Monitoring System
195. Intrusion Detection in Wireless Sensor Network
196. Keyword Finder and Number Calculator
197. Language Emulator
198. Mac Ethernet Address
199. Malware Scanner
200. MP4 Video Converter
201. Online Auction
202. Online Magazine
203. Password Protector and Reminder
204. PDF Converter
205. Pharmacy Management System
206. Port Scanner
207. Process Analysis in Asynchronous System
208. Remote Desktop Administrator
209. Resource Planner and Organizer
210. Search Engine
211. Security System for DNS using Cryptography
212. SmartFTP Uploads
213. Synchronous Conferencing System
214. Text to HTML Converter
215. Unicode Font
216. Voice Chatting and Video Conferencing
217. Voice Compressor Software
218. Windows Fixer
219. XML Compactor

Assessment Scheme:

Practical ESE:50

Course Project:20

Laboratory Work:10
CVV:20

Reference Books:

1. *Bruce Eckel, "Thinking In Java – The Definitive Introduction to Object-Oriented Programming in the Language of the World-Wide Web", Fourth Edition, Pearson Education, Inc.*

2. R. Morelli and R. Walde, "Java, java, Java – Object-Oriented Problem Solving", 3rd edition, Pearson Education, Inc.

3. "JAVA- The Complete Reference", Herbert Schildt, 11th Edition, McGraw Hill Education

Moocs Links and additional reading material:

Programming using Java| Java Tutorial | By Infosys Technology
https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01304972186110361645_shared/overview

An Introduction to Programming through C++ – Prof A.G. Ranade- NPTEL- computer science and engineering – NOC https://nptel.ac.in/courses/106/101/106101208/#

Course Outcomes:

The student will be able to –
1. Understand object-oriented programming features.
2. Apply the knowledge of Java IO and arrays to design real world problem.
3. Analyze and implement the complex real world problem using OOP concepts such as classes, inheritance and polymorphism.
4. Solve computing problems by applying the knowledge of Exception handling and Multithreading
5. Design solutions by choosing suitable data structures such as Array, Vector, Map etc
6. Implement applications using Java I/O and event-based GUI handling principles

Future Courses Mapping:

Advanced Data Structures, Advanced Java, Spring Frame Work, Grails Frame Work

Job Mapping:

Java Programmer, Application Developer, Design Engineer, Senior Software Developer

COURSE CODE: CS2227 COURSE NAME: DATABASE MANAGEMENT SYSTEMS

Course Prerequisites:
Data structures, Discrete Mathematics

Course Objectives:
1. Learn the fundamentals of different data modeling techniques.
2. Design and development of relational database management systems.
3. Study the theory behind database systems, the issues that affect their functionality and performance
4. Design of query languages and the use of semantics for query optimization.
5. Understand the latest trends of data management systems.

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: **2** Hours/Week

Course Relevance:
The course emphasizes on the fundamentals of database modelling and design, the languages and models provided by the database management systems, and database system implementation techniques. The goal is to provide an in-depth and up-to-date presentation of the most important aspects of database systems and applications, and related technologies.

SECTION-I
Topics and Contents
Introduction: Need of Database Management Systems, Evolution, Database System Concepts and Architecture, Database Design Process
Data Modeling: Entity Relationship (ER) Model, keys, Extended ER Model, , Relational Model, Codd's Rules;
Database Design: Need of Normalization, Functional Dependencies, Inference Rules, Functional Dependency Closure, Minimal Cover, Decomposition Properties, Normal Forms: 1NF, 2NF, 3NF and BCNF, Multi-valued Dependency, 4NF
Query Languages: Relational Algebra, SQL: DDL, DML, Select Queries, Set, String, Date and Numerical Functions, Aggregate Functions ,Group by and Having Clause, Join Queries, Nested queries, DCL, TCL, PL/SQL: Procedure, Function, Trigger, Mapping of Relational Algebra to SQL

SECTION-II

Topics and Contents
Storage and Querying: Storage and File structures, Indexed Files, Single Level and Multi Level Indexes; Query Processing, Query Optimization

Transaction Management: Basic concept of a Transaction, ACID Properties, State diagram, Concept of Schedule, Serializability – Conflict and View, Concurrency Control Protocols, Recovery techniques

Parallel and Distributed Databases: Architecture, I/O Parallelism, Interquery, Intraquery, Intraoperation and Interoperation Parallelism, Types of **Distributed** Database Systems, Distributed Data Storage, Distributed Query Processing

NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Databases, Types of NOSQL Databases, BASE properties, CAP theorem, Introduction to Big Data

Data Warehousing: Architecture and Components of Data Warehouse, OLAP and OLTP

List of Practical: (Any Six)

1) Choose a database application; you propose to work on throughout the course. Perform requirement analysis in detail for the same. Draw an entity-relationship diagram for the proposed database.
2) Create a database with appropriate constraints using DDL and populate/modify it with the help of DML.
3) Design and Execute "SELECT" queries using conditional, logical, like/not like, in/not in, between...and, is null/is not null operators in where clause, order by, group by, aggregate functions, having clause, and set operators. Use SQL single row functions for date, time, string etc.
4) Write equijoin, non equijoin, self join and outer join queries. Write queries containing single row / multiple row / correlated sub queries using operators like =, in, any, all, exists etc. Write DML queries containing sub queries. Study a set of query processing strategies.
5) Write PL/SQL blocks to implement all types of cursor.
6) Write useful stored procedures and functions in PL/SQL to perform complex computation.
7) Write and execute all types of database triggers in PL/SQL.
8)Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
9) Create a database with suitable example using MongoDB and implement Inserting and saving document, Removing document, Updating document
10) Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques:find and findOne, Query criteria, Type-specific queries
11) Implement Map Reduce operation with suitable example using MongoDB.

List of indicative project areas: (Any 1)

Following is the indicative list of projects but is not limited to. Student and teacher can also jointly decide project area other than specified in the list.

1. University/Educational institute database
2. Railway reservation/Show booking system
3. Finance management system
4. Travel/Tours management system
5. Blood bank management system
7. Sales management
8. Online retailer/payment systems
9. Hospital management system
10. Human resource management
11. Manufacturing/production management

12. Matrimonial databases for finding matches.
13. Online appointment booking

List of Course Seminar Topics:
1. Object and Object-Relational Databases
2. XML data model, XML documents and associated languages
3. Database Security
4. Modern Storage Architectures
5. Google Cloud- SQL Databases
6. Google Cloud- NOSQL Databases
7. Amazon Databases
8. Oracle NoSQL Database
9. Cassandra DB
10. Data Center Engineering
11. Google File System (GFS)

Assessment Scheme:
Written ESE:30
Course Project:20
Laboratory Work:10
Seminar Presentation:20
CVV:20

Text Books:
1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan; "Database System Concepts"; 6th Edition, McGraw-Hill Education
2. Ramez Elmasri, Shamkant B. Navathe; "Fundamentals of Database Systems"; 7th Edition, Pearson

Reference Books:
1. Thomas M. Connolly, Carolyn E. Begg," Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition ;Pearson
2. Raghu Ramakrishnan, Johannes Gehrke; "Database Management Systems", 3rd Edition; McGraw Hill Education
3. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN: 978-93-5110-269-4, 2nd Edition.
4. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
5. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication. 6. Reese G., Yarger R., King T., Williums H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.
7. Dalton Patrik, SQL Server – Black Book, DreamTech Press.
8. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.
9. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

Moocs Links and additional reading material:
https://nptel.ac.in/courses/106/105/106105175/
https://onlinecourses.nptel.ac.in/noc21_cs04/preview
https://www.datacamp.com/courses/introduction-to-sql

Oracle MOOC: PL/SQL Fundamentals - Oracle APEX
Course Outcomes: The student will be able to – 1. Design data models as per data requirements of an organization 2. Synthesize a relational data model up to a suitable normal form 3. Develop a database system using relational queries and PL/SQL objects 4. Apply indexing techniques and query optimization strategies 5. Understand importance of concurrency control and recovery techniques 6. Adapt to emerging trends considering societal requirements
Future Courses Mapping: Advanced databases Big Data Management Cloud Databases Database Administrator
Job Mapping: Database Engineer SQL developer PL/SQL developer

COURSE CODE: ME2205 **COURSE NAME: 3D PRINTING**

Course Prerequisites:
Basic manufacturing, Materials

Course Objectives:
Additive Manufacturing (AM) is a technology supporting the sustainable rapid development of personalized complex design in various disruptive applications, especially in manufacturing and medical.

Credits: 4 **Teaching Scheme Theory: 2** Hours/Week
Tut: 1 Hours/Week
Lab: **2** Hours/Week

Course Relevance:
This course aims to build student competence in AM and related technology. The students will learn fundamental knowledge of Additive Manufacturing and Reverse Engineering (RE) and their applications in manufacturing, medical and other sectors. Besides, the students will be proficient in practice design for additive manufacturing.

SECTION-1

Design Thinking (4Hrs)

- Engineering Design, Product Development Process
- Types of Design, Phases of Engineering design
- Ergonomic and Aesthetic Aspects in Design, Design for Manufacturing,
- Limits, fits and tolerancing and Concept of Geometric dimensioning and tolerancing.

3D Printing Materials (5Hrs)

- Types of Materials, Properties of materials,
- Application of materials in mechanical, chemical, electronics and software industry,
- Selection of Materials,
- Smart materials
- Materials for 3D Printing

Introduction to Manufacturing and 3D Printing (5Hrs)

- Introduction to conventional manufacturing processes like casting, forming, machining etc.
- Introduction Overview, Basic principle need and advantages of Additive Manufacturing (AM),

- Classification of additive manufacturing processes,
- Applications and Future of AM.

Pre-Processing in 3D Printing (3D Modeling and Design) (4Hrs)

- Creation of 2D geometry using Auto CAD, 2D drawing space
- 3D solid Modeling
- Design for Additive Manufacturing
- Topology optimization
- Slicing of 3D models for 3D printing

Advance Thermal Manufacturing Processes (5Hrs)

- Laser principles, Properties of Lasers, Types of Lasers,
- Laser parameters
- Use of Laser Beam for Additive Manufacturing,
- Electron Beam Melting (EBM).
- Principle and Process of EBM, Models and Specifications, Applications, Advantages and Limitations, Case Study

Additive Manufacturing Processes (5Hrs)

- Liquid based rapid prototyping Process Stereo lithography (SLA),
- Solid based rapid Prototyping processes Fused deposition modeling (FDM), Laminated Object Manufacturing (LOM),

Powder Based AM Processes: Selective laser sintering (SLS), Direct Metal deposition (DMD)

List of Tutorials: (Any Three)

In the tutorial students are expected to present a technical seminar (PPT) relevant to 3D Printing and Design. Also, students (in a group of 4/5 students) are expected to discuss any technical novel topic related to 3D Printing and Design.

List of Practical: (Any Six)

1) Design & develop a CAD model of a product
2) Tension test on Mild Steel and Aluminum
3) Brinell hardness test on different materials
4) Study of different 3D Printing Machines
5) Demonstration of CNC Lathe Machine Operation
6) Laser Beam Machining
7) 3D Printing Machine
8) Design and 3D print a master part
9) Design and 3D print a non-demountable assembly
10) Reverse engineering of a mechanical part
11) Design and 3D print a complex part
12) Optimize the 3D printing parameters for the function of the product

List of Projects:

Students can do course projects on

1. Reverse Engineering
2. 3D Printing Machine
3. Dynamics of Machinery
4. Smart Materials
5. Smart Manufacturing
6. Industrial Automation
7. 3D Printing for Electronics
8. Prototyping
9. Ergonomics
10. Design for Additive Manufacturing
11. Quality in Additive Manufacturing
12. Precision Engineering
13. Process Planning and Cost Estimation
14. Tool Design
15. Green Manufacturing

List of Course Seminar Topics:

1. Additive Manufacturing Aiming Towards Zero Waste & Efficient Production of High-Tech Metal Products
2. High-Precision 3D Printing of complex 3D parts
3. Additive Manufacturing for Wear and Corrosion Applications
4. Flexible and on-demand manufacturing of customized Products
5. Manufacturing decision and supply chain management system for additive manufacturing
6. Toolless Manufacturing of Complex Structures
7. Computer Aided Technologies for Additive Manufacturing
8. Hybrid Additive Manufacturing
9. Laser-based Additive Manufacturing
10. Sensor package fabrication via additive manufacturing for automotive sector
11. Additive Manufacture of High Temperature Components
12. Dynamic Properties of Additive Manufacturing
13. Material characterization of additively manufactured part
14. Biomaterials and Additive Manufacturing
15. Materials for 3D Printing
16. Rapid Manufacturing of lightweight metal components
17. Additive Manufacturing and Nature-based solutions
18. Functionally Graded Materials to Extra-Large Structures
19. Additive Manufacturing technologies in the Aerospace sector
20. Additive Manufacturing technologies in the medical sector
21. Metal Additive Manufacturing (AM)
22. Topology optimization in Additive Manufacturing

23. Design against Distortion of metallic aerospace parts based on combination of numerical modelling activities and topology optimization.
24. Comparison AM with a conventional manufacturing process
25. Assessment of additive manufacturing parts
26. New EDM electrodes manufactured with electrically conductive materials by Additive manufacturing.
27. Nano 3D printing
28. Bio 3D printing
29. 3D printing in industrial scale
30. Limitations of additive manufacturing
31. Challenges for additive manufacturing
32. Design for 3D printing
33. Case study on material selection for electronic industry, chemical industry, aerospace and automobile industry etc.
34. Case study on selection of manufacturing process for given component
35. Difficult to cut materials and effective strategies to manufacture for the same
36. Design of simple components for manufacturability
37. Selection of additive manufacturing process
38. Materials for industry 4.0
39. Material characterization of additively manufactured part

Assessment Scheme:
Written ESE:30
Course Project:20
Laboratory Work:10
Seminar Presentation:20
CVV:20

Text Books: (As per IEEE format)

A Treatise on Additive Manufacturing, R. B. Chaoudary, Khanna Publishers, First Edition, 2022

Reference Books: (As per IEEE format)

1. ISO/ ASTM DIS 52900:2018 (E), (2018), Additive manufacturing – General principles – Terminology, ISO/ ASTM International 2018.
2. Wohlers T., (2018), Wohlers Report 2018, 3D Printing and Additive Manufacturing State of the Industry: Annual Worldwide Progress Report, Wohlers Associates, ISBN ISBN 978-0-9913332-4-0.
3. Redwood B., Schöffer F., Garret B., (2017), The 3D Printing Handbook: Technologies, design and applications, Editura 3D Hubs, ISBN 978-90-827485-0-5.
4. Zhang J., Jung Y.G., (2018), Additive Manufacturing: Materials, Processes, Quantifications and Applications, Elsevier, ISBN 978-0-12-812155-9
5. Gibson I., Rosen D., Stucker B., (2015), Additive Manufacturing Technologies - 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Editura Springer, ISBN 978-1-4939-2112-6.

MOOCs Links and additional reading material:

Course Outcomes:

1. Apply design for additive manufacturing (DfAM) in practice for the development of new products (apply).
2. Select an appropriate material for AM technology based on mechanical, physical and thermal properties (Select);
3. Apply knowledge on manufacturing, additive manufacturing, and reverse engineering in a variety of domains (apply);
4. To develop an ability to design a system, component, or process to meet desired needs within realistic constraints (Develop)
5. Investigate process parameters for effective additive manufacturing (create);
1. Select an appropriate AM technology based on preset optimisation criteria (eg. cost, quality, time/ available resources) (evaluate)

Future Courses Mapping:
Mention other courses that can be taken after completion of this cours

Job Mapping: What are the Job opportunities that one can get after learning this course