

Date: 22nd June, 2021

**Minutes of 7<sup>th</sup> Board of Studies (BoS) - Online Meeting  
Department of Computer Science & Technology  
Manav Rachna University, Faridabad**

**Members Present:**

1. Prof. Anjana Gosain, Professor, GGSIP University Expert Member
2. Mr. Amitava Chakraborty, Sr. Architect IBM Infrastructure Services
3. Ms. Hanu Bhardwaj, HoD CST Chairperson
4. Dr. Hardeo Kr Thakur, Associate Professor Member
5. Ms. Manpreet Kaur, Associate Professor Member
6. Dr. Mrinal Pandey, Associate Professor Member
7. Ms. Gaganjot Kaur, Assistant Professor Special Invitee
8. Mr. Ankur Kr Aggarwal, Assistant Professor Special Invitee
9. Dr. Sanjay Singh, Associate Professor Special Invitee

**Agenda Items & Discussion:**

**Agenda 1:** In M.Tech CE 3rd SEM

- Syllabus for "Data Science" Course framed and needs to be approved. (From 2021 Batch onwards)

Designed Syllabus was presented in BoS and feedback was received to incorporate the following changes:

1. Data Science should come in 2nd SEM and Machine Learning should come in 3rd SEM.
  - Section A should focus on Big Data
  - Section B topics are overlapping with Machine Learning so we can include either Statistical tools or Business Analysis component in the same
  - Data Science tools are missing, we need to add tools for different phases (data pipeline) of data processing.
  - Include Business analytics, intelligence and modeling of data and also as per analysis this syllabus is diverting from Data Science.
  - Section D of Deep Learning should be merged with Section B of Machine Learning and Section C focus should not be completely on Time Analysis
  - Certain topics were suggested to be covered: **Probability, Conditional Probability, Bayes' Rule, Distributions, Confidence Intervals, One and two parameter regression, Linear regression, General least squares**

**Agenda 2:** As per our Knowledge Partner Xebia, changes in curriculum were suggested for both the specializations Artificial Intelligence & Machine Learning and Cloud Devops & Automation:

- The course **DevOps & Test Automation** has been renamed as **Version Control & Automation** for CDA Specialization for Semester 5, with revision in syllabus.
- The course **Internet of Things** is replaced with **Continuous Integration and Continuous Delivery** for CDA Specialization for Semester 7, and the syllabus has been framed by Xebia. IoT is already being offered as an Elective Workshop in Sem 6.
- **Computer Vision & Data Visualization** already covers almost every topic of **Image Processing**, therefore **Image Processing is being replaced with the course Computer Graphics & Multimedia** for Specialization AIML for semester 7.

**Agenda 3:** As per Faculty Members Feedback, existing Curriculum of following courses for 2019 Batch onwards have been updated:

- **Data Structures & Algorithms**

**Deleted Topics:** Euler graph, Hamiltonian graphs

**Reason:** The above topics are already covered in **Discrete Mathematics**.

- **Green Computing**

**Online Content:**

- ❖ [www.footprintcalculator.com](http://www.footprintcalculator.com)
- ❖ Living in Balance with Nature, SachinLakra, Kindle Desktop Publishing (online e-book only available at [www.amazon.com](http://www.amazon.com)).

**Reasons for additions:**

**Section A: Carbon Footprint Calculator (online)**

**Reason:** Carbon footprint calculations have become an essential part of impact analysis of a product on the environment. Such a calculator is available at [www.footprintcalculator.com](http://www.footprintcalculator.com) as mentioned in the Online content section above.

**Section C: Ethics of Green Computing in Daily Life**

**Reason:** To understand the ethical and moral reason of why green computing is essential in today's life.

**Section D: Green Computing in Ancient India: Balance of life in Indian villages with nature: Use of biomass as fuel, no electricity; devices made of natural materials, absence of e-waste.**

**Reason:** To understand how ancient India and the people of India maintained a balance with nature inspite of using devices of various types.

These additions are discussed to some extent in the book named "Living in Balance with Nature" as mentioned in the online content section above.

**Applications of Green Computing: Energy Efficiency of algorithms, Green Networks, Green Cloud Computing, Green Internet of Things, Green Artificial Intelligence, Relevance to Industry 4.0.**

**Reason:** To understand where and how green computing can be applied in real life and its relevance to current and future industries.

**Data Visualization using Tableau** course has been proposed in **workshop mode in Semester 6**. Outline topics have been decided and shared in BOS, detailed syllabus to be drafted after AICTE Training in Tableau

**Agenda 4:** As per **Alumni feedback**, following courses **have been introduced in elective basket**:

- Image Editing & Animation in workshop mode in Semester 6.
- Introduction to Blockchain Technology as a hard elective in Semester 8 for 2K18 batch and in Semester 7 for 2K19 batch onwards.
- Core Java and Advance Java course syllabi have been updated.

**Agenda 5: As per the feedback of Other Departments,**

- Curriculum of following courses have been revised:
  - (i) Wireless Sensor Network- ECE Department
  - (ii) Discrete Mathematics - Maths Department
- New Courses have been introduced for 2019 Batch and onwards, in Semester 7 Electives Basket:
  - (i) Digital Marketing
  - (ii) E-Commerce
  - (iii) Entrepreneurial Finance for Engineers

**Agenda 6:** MOOC Proposals to be offered as an elective to 5<sup>th</sup>& 7<sup>th</sup> SEM students.

Syllabus and MOOC courses list is mentioned in the trailing Appendix.

**Agenda 1: In M.Tech CE 3rd SEM - Syllabus for "Data Science" Course, if comes after Machine Learning**

<b>Course Title/ Code</b>	<b>Data Science (CSH604B-T&amp;P)</b>
<b>Course Type:</b>	<b>Domain Elective</b>
<b>Course Nature:</b>	Hard
<b>L-T-P-O Structure</b>	(3-0-2-0)
<b>Prerequisite</b>	Machine Learning
<b>Objectives</b>	At the end of the course the students should be able to <ul style="list-style-type: none"><li>· Develop in depth understanding of the key technologies in data science.</li><li>· Demonstrate the understanding of a wide variety of machine learning algorithms to solve classification and regression problems.</li><li>· Learn how to apply Deep learning algorithms to solve real world problems</li></ul>

**Section A**

**Introduction to Data Science in Big Data world:** Benefits and uses of data science and big data, Types of data: Structured data, Unstructured data, Natural language, Machine-generated data, Graph-based or network data, Audio, image, and video, Streaming data, Introduction to Data Science tools.

**The Data Science Process:** Overview of the data science process: Defining research goals and creating a project charter, Retrieving data, Cleansing, integrating, and transforming data, Data visualization & Exploratory data analysis, Build the models, Presenting findings.

**Section B**

**The Big Data ecosystem and Data science:** Distributed File Systems, Distributed Programming Framework, Data Integration Framework, No SQL databases, Scheduling tools, Benchmarking tools, System deployment, Service Programming, Security. Techniques for handling large volumes of data: Choosing right algorithm, Choosing right data structure, selecting the right tools, Distributing data storage and processing with frameworks.

**Section C**

**Business Intelligence Components:** Business Intelligence Concepts, Effective and timely decisions, Data, information and knowledge, Role of mathematical models, Business intelligence architectures: Cycle of a business intelligence analysis, Enabling factors in business intelligence projects, Development of a business intelligence system, Ethics and business intelligence, Business intelligence applications.

**Section D**

**Overview of Machine Learning & Deep Learning:** Application of machine learning in data science, Artificial Neural Network, Introduction to Deep learning: Basics, Difference between machine learning and deep learning. Deep Learning process and techniques.

**Text Books:**

1. Introducing Data Science by Davy Cielen, Arno D.B Meysman and Mohammed Ali, Manning Publication, 2016
2. Data science: theories, models, algorithms, and analytics, SanjivRanjan Das, 2016
3. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Verzellis, Wiley, 2009.
4. Deep Learning, An MIT Press, Ian Goodfellow and Yoshua Bengio and Aaron Courville, 2018.

**Reference Books:**

1. Deep Learning with Python by François Chollet, 2017
2. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2009.

**Lab Experiments:**

1. Reading a Data
2. Data Visualization
3. Exploratory data Analysis
4. Handling Missing Data
5. Handling Large data volume
6. Implementation of Business Intelligence Applications
7. Implementation of Artificial Neural Network
8. Implementation of real time Data Science applications

**In M.Tech CE 1st SEM**

**- Syllabus for "Data Science" Course, if it comes before Machine Learning Course, for 2021 Batch onwards.**

<b>Course Title/ Code</b>	<b>Data Science (CSH511B-T&amp;P)</b>
<b>Course Type:</b>	<b>Domain Core</b>
<b>Course Nature:</b>	Hard

<b>L-T-P-O Structure</b>	(3-0-2-0)
<b>Prerequisite</b>	Basic Python programming
<b>Objectives</b>	<p>At the end of the course the students should be able to</p> <ul style="list-style-type: none"> <li>· Develop in depth understanding of the key technologies in data science.</li> <li>- Demonstrate the understanding of a wide variety of machine learning algorithms to solve classification and regression problems.</li> </ul>

### Section A

**Introduction to DS:** Introduction and history of DS, Benefits and uses of data science, Scale of Measurements (Nominal, Ordinal, Ratio and Interval), Measures of Location, Measures of Variability/Spread, and Measures of Shape. Types of data: Facets of data, Structured data, Unstructured data, Natural language, Machine-generated data, Graph-based or network data, Audio, image, and video, Streaming data.

### Section B

**Data Science Statistics:** Basic Statistical Concepts: mean, mode, median, Standard deviation, Normal Distribution Principle of counting, definitions of probability theory, independent events, mutually exclusive events, collectively exhaustive events, conditional probability, Bayes Theorem, covariance, correlation, normal distribution, P-Value, T-Value, Confidence Interval, t- distribution and chi square distribution.

### Section C

**The data science process:** Overview of the data science process: Defining research goals and creating a project charter, Retrieving data, Cleansing, integrating, and transforming data, Data visualization & Exploratory data analysis, Build the models, Presenting findings.

**Data Science & Machine Learning:** Introduction and history of ML, Overlap between DS, ML and AI, Applications of DS & ML in the modern context. Introduction to Machine Learning: Concept & Theory: Machine learning pipe line.

### Section D

**Regression & Classification:** Difference between Regression and classification, Linear Regression, Multiple liner regression single, Bias / Variance, Training and Testing, Evaluation measures  
**Classification:** Logistic Regression, Support Vector Machines, Decision Trees, naive-Bayes.

#### **Text Books:**

1. Introducing Data Science by Davy Cielen, Arno D.B Meysman and Mohammed Ali, Manning Publication, 2016

2. Data science: theories, models, algorithms, and analytics, SanjivRanjan Das, 2016
3. Deep Learning, An MIT Press, Ian Goodfellow and Yoshua Bengio and Aaron Courville, 2018.

**Reference Books:**

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2009.

**Lab Experiments:**

1. Reading a Data
2. Data Visualization
3. Exploratory data Analysis
4. Handling Missing Data
5. Implementations Linear Regression
6. Implementations Multiple Linear Regression
7. Implementations of Decision tree
8. Implementations of SVM
9. Implementations Naïve Bayes

**Agenda 2:**

- Syllabus for **Version Control & Automation** for CDA Specialization for Semester 5th

<b>Course Title/Code</b>	<b>VERSION CONTROL &amp; AUTOMATION (CSH321B-T&amp;P)</b>
<b>Course Type:</b>	Domain Core
<b>Course Nature:</b>	Hard
<b>L-T-P-O Structure</b>	3-1-2-0

	<b>Sections</b>	<b>Weightage</b>
<b>Syllabus</b>	A	25%
	B	25%
	C	25%

	D	25%
	<b>TOTAL</b>	<b>100%</b>

### **Unit 1 Introduction to DevOps**

Definition of DevOps: Challenges of traditional IT systems & processes, History and emergence of DevOps, DevOps definition and principles governing DevOps, DevOps and Agile, The need for building a business use case for DevOps, Purpose of DevOps, Minimum Viable Product (MVP), Benefits of MVP, Application Deployment, Automated Application Deployment, Application Release Automation (ARA), Components of Application Release Automation (ARA), DevOps Periodic Table.

### **Unit 2: Introduction to Automation**

The Software Delivery Pipeline, Overview of the Continuous Delivery Pipeline, Fully Automated Software Delivery Process, The Build Process, Automated build, Automated Test, Automated Deployment, Benefits of Automated Deployment, Automated Deployment and DevOps Adoption, Automated Deployment and DevOps Adoption, Overview of Rapid Application Development (RAD), Phases in RAD, Essential Aspects of RAD, Code generation, Categories of Code Generators, Common

### **Unit 3 Advantages of Automation**

Advantages of Automation, Automation Scenarios, Archiving Logs, Auto-Discard Old Archives, MySQL (RDBMS) Backups, Email Web Server Summary, Ensure Web Server is Running, User Command Validation, Disk Usage Alarm, Sending Files to Recycle Bin, Restoring Files from Recycle Bin, Logging Delete Actions, File Formatter, Decrypting Files, Bulk File Downloader, System Information, Install LAMP Stack, Get NIC's IP, Scenarios Where Automation Prevents Errors

### **Unit 4 Interacting with Linux Environment**

The Linux System, Linux File System, Partitions, Common System Directories, Shell, User Groups and Permissions, User Accounts, The passwd File, Creating User Accounts, File Ownership, File Permissions, Working with Bash, Shell Features Scripting Development Tasks, Writing Automation Scripts, Task Scheduling Using Cron, Basic Linux Commands, Best Practices for Scripting, Make use of Shell's Built-In Options, Naming Conventions, Annotations Make the Logic Clean, Command Substitution, Always Begin with a Shebang, Variable Substitution, Conditionals, Regular Expressions,

### **Unit 5: Test Automation**

Seven principles of Software Testing, SDLC vs STLC, Testing Life Cycle, Usability Testing, Why do we need Usability Testing, How to do Usability testing, Advantages & Disadvantages, Functional Testing, End to End Testing, Methods, Selenium components, Selenium Architecture, TestNG Installing TestNg in Eclipse, TestNG annotations – Understanding usage, Setting priority of execution for test cases, Hard Assertion, Soft Assertion, TestNG Reports, ANT- Downloading & Configuring, XSLT report generation generation using TestNg and Ant

### **Automation Lab**

1. Introduction to Bash & Shell Scripting
2. Conditional Statement & Loop
3. Working with Automation Scripts that save Time & Effort
4. Automatically delete archive files that are older than two days.
5. Take MySQL Backups every 12 hours and move them to the backup directory.
6. Email the summary of the web server requests every day
7. Continuously monitor and Restart the web server if it is not running
8. Block executing the forbidden commands.

9. Monitor the disk usage and alert if it is beyond the given threshold.
10. Moves the deleted files/folders to the recycle bin
11. Working with Cron
12. Working with Make and MakeFiles

- **Syllabus for "Continuous Integration & Continuous Delivery" Course in Semester 7th**

<b>Course Title/Code</b>	<b>Continuous Integration &amp; Continuous Delivery (CSH415B-T&amp;P)</b>
<b>Course Type:</b>	Domain Core
<b>Course Nature:</b>	Hard
<b>L-T-P-O Structure</b>	3-1-2-0

**UNIT 1: Overview**

Introduction to CI, Continuous Integration Workflow, Benefits of Continuous Integration, How CI Benefits Distributed Teams, Continuous Delivery, Steps Involved in CICD, Pipelines, Prerequisites, Checklist, Business Drivers for Continuous Deployment, Benefits of Continuous Deployment, CD – The HP Laserjet Case Study

**UNIT 2: Stages of Continuous Integration and Continuous Delivery**

Core CI Process, VCS, Merging Local Changes to Integration Branch, Fork & Pull, Code Review, Automated code builds – Key metrics, Static Code Analysis, Snapshot, Sample Bug Report, Automated Unit Testing- JUNIT, Test Frameworks, Automated Unit Testing Process

**UNIT 3: Stages Extended**

Code Coverage analysis, Code Coverage Methods, Condition Coverage, Line Coverage, Publishing Code Coverage reports to Jenkins, Uploading build artifact to a repository, Advanced CI process, Automated Functional Testing, Publish Report to the Development Team, Google Canary release Case study

**UNIT 4: Anatomy of a Continuous Delivery Pipeline**

Simple Delivery Pipeline, Continuous Deployment Pipeline, Releasing an application to Production, Zero-Downtime Releases, Rolling back deployments, Blue-Green Deployments, Canary Releasing, Emergency Fixes, Continuous Delivery engineering practices, Continuous Development/Integration

**UNIT 5: Continuous Testing**

Deploying and Promoting your Application, Modeling Your Release Process and Promoting Builds, Continuous Deployment to successive environments until before Production, Continuous monitoring for the delivery pipeline, Nagios sampler report, Continuous Feedback rules

**Continuous Integration and Continuous Delivery Lab**

1. Introduction to Jenkins and setup/configuration
2. Installation and Configuration of git/Java/maven on Build server (Windows)
3. Jenkins job, parameters, build, post-build actions and Pipeline
4. Jenkins Agent/Slave configuration with Windows/Ubuntu master hosts
5. Configuring Jenkins with git plugin
6. Create a new Jenkins pipeline
7. Merging local changes to the version control system (Git)
8. Installing/Configuring Nexus
9. Use Jenkins as a Continuous Integration server
10. Deploying the application to staging/prod environment



11. Merging feature branch code (V 2.0) to existing application created in step 1.6
12. Uploading plugins manually in Jenkins
13. Backup Management in Jenkins Server

**Agenda 3:** As per Faculty Feedback:

- Existing Curriculum of following courses for 2019 Batch onwards have been updated:

- o Data Structures & Algorithms –

**Deleted Topics:** Euler graph, Hamiltonian graphs

The above topics are already covered in Discrete Mathematics.

- o Green Computing

**Online Content:**

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2. Living in Balance with Nature, SachinLakra, Kindle Desktop Publishing (online e-book only available at [www.amazon.com](http://www.amazon.com)).

**Reasons for additions:**

1. Section A: **Carbon Footprint Calculator (online)**

**Reason:** Carbon footprint calculations have become an essential part of impact analysis of a product on the environment. Such a calculator is available at [www.footprintcalculator.com](http://www.footprintcalculator.com) as mentioned in the Online content section above.

2. Section C: **Ethics of Green Computing in Daily Life**

**Reason:** To understand the ethical and moral reason of why green computing is essential in today's life.

3. Section D:

**Green Computing in Ancient India: Balance of life in Indian villages with nature: Use of biomass as fuel, no electricity; devices made of natural materials, absence of e-waste.**

**Reason:** To understand how ancient India and the people of India maintained a balance with nature inspite of using devices of various types.

These additions are discussed to some extent in the book named "Living in Balance with Nature" as mentioned in the Online content section above.

**Applications of Green Computing: Energy Efficiency of algorithms, Green Networks, Green Cloud Computing, Green Internet of Things, Green Artificial Intelligence, Relevance to Industry 4.0.**

**Reason:** To understand where and how green computing can be applied in real life and its relevance to current and future industries.

**Syllabus for "Data structures and Algorithms" Course**

Course Title/ Code	Data Structures (CSH103B) T & P
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)

**Objectives**

**The course should assess how the choice of data structures and algorithm design methods impacts the performance of programs and choose the appropriate data structure and algorithm design method for a specified application.**

**Section-A**

Data structures and Algorithms: Introduction to Data structure: Concept of data structure, choice of right data structures, types of data structures, Abstract Data types, Introduction to algorithms, how to design and develop an algorithm: stepwise refinement, algorithm analysis, complexity of algorithms

Arrays: Introduction, One Dimensional Arrays, two dimensional array, Multidimensional arrays, address calculation of a location in arrays operations defined: traversal, selection, searching, insertion, deletion, and sorting.

Searching: linear search, binary search, Sorting: selection sort, bubble sort, insertion sort, merge sort, quick sort.

**Section-B**

Pointers: Introduction to pointers, Pointer variables, Pointer and arrays, array of pointers, pointers and structures, Dynamic allocation. Linked Lists: Concept of a linked list, circular linked list, doubly linked list, operations on linked lists: traversal, selection, searching, insertion, deletion, and sorting, concepts of header linked lists. Applications of linkedlists.

**Section-C**

Stacks: Introduction to Stacks, array representation of stack, operations on stack: PUSH, POP, Evaluation of Expression: Concept of precedence and associativity in expressions, difficulties in dealing with infix expressions, Resolving precedence of operators and association of operands, postfix & prefix expressions, conversion of expression from one form to other form using stack (with & without parenthesis), Evaluation of expression in infix, postfix & prefix forms using stack. Recursion, Linked list representation of stack, Applications of stacks.

Queues: Queues, Circular queues, array representation of Queues, priority queues, dequeue, circular queue, operations on queue: insertion and deletion, Applications of Queues.

**Section-D**

Non-Linear Structures: Trees definition, characteristics concept of child, sibling, parent child relationship etc, binary tree: different types of binary trees based on distribution of nodes: complete binary tree, binary tree (threaded and unthreaded), operation on binary tree: insertion, deletion, searching and traversal of binary trees, traversing: Preorder, Postorder and Inorder, Introduction to binary search tree, operations and Time complexity on BST: insertion, deletion, searching, Introduction to AVL tree: Concept of balanced trees, balance factor in AVL trees, insertion into and deletion from AVL tree, balancing AVL tree after insertion and deletion, in B trees, Application of trees.

Graphs: Definition, Relation between tree & graph, directed and undirected graph, connected and disconnected graph, Representation of graphs using adjacency matrix and list, Depth first and breadth first traversal of graphs, Applications of Graph.

### **List of Experiments:**

1. Programs on C language
2. Write a program on Linear search and Binary search Using C
3. Write a program to implement bubble sort, insertion sort, selection sort
4. Write a program to implement Merge sort, Quick sort
5. Programs on Link list
6. Programs on stack
7. Programs on queues
8. Programs on binary trees
  - Traversal
  - Insertion
  - Deletion
9. Programs on binary search tree:
  - Calculate the height of BST
  - Calculate the number of leaf nodes
  - Insertion
  - Deletion
10. Programs on Graphs
  - BFS
  - DFS
11. Case studies on Trees and Graphs.

### **Text Books:**

1. Data Structures with C by Seymour Lipschutz ,McGraw Hill Education(India) Private Limited.
2. Data Structures using C by A. K. Sharma, Pearson Publication.
3. Data Structures using C-YashwantKanetkar Publication.

### **Reference Books:**

1. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub.

2. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman Publisher.

### Syllabus for "Green Computing" Course

<b>Course Title/ Code</b>	<b>Green Computing (CSS325B-T&amp;P)</b>
<b>Course Type:</b>	<b>Elective (Department)</b>
<b>Course Nature:</b>	<b>Soft</b>
<b>L-T-P-O Structure</b>	<b>(1-0-2)</b>

#### Section A

Overview and Issues: Problems: Toxins, Power Consumption, Equipment Disposal; Company's Carbon Footprint: Measuring, Carbon Footprint Calculator (online); Plan for the Future; Cost Savings: Hardware, Power.

Initiatives and Standards: Global Initiatives: United Nations, Basel Action Network, Basel Convention; WEEE Directive, Restriction on Hazardous Substances Directive, the Paris Climate Agreement.

#### Section B

Minimizing Power Usage: Power Problems, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Virtualization, Management, Low Power Computers, PCs, Linux, Components, Servers, Computer Settings, Storage, Monitors, Power Supplies, Wireless Devices, Software.

Green Data Centers: The benefits of a green data center, developing a strategy, Energy optimization with IT equipment.

#### Section C

Changing the Way of Work: Old Behaviours, starting at the Top, Process Reengineering with Green in Mind, Analysing the Global Impact of Local Actions, Recycling, Energy, Pollutants, Teleworkers, Telecommuting, Outsourcing, how to Outsource, Ethics of Green Computing in Daily Life.

Recycling: Problems: China, Africa; Materials, Means of Disposal, Recycling, Refurbishing, Recycling Life Cycle, Life of a Product, Cost, Green Design, Recycling Companies, Certifications, Hard Drive Recycling, Consequences, cleaning a Hard Drive, Pros and cons of each method, CDs and DVDs, good and bad about CDs and DVDs disposal, Change the mind-set.

#### Section D

Greening Your Information Systems: Initial Improvement Calculations, Change Business Processes, Customer Interaction, Paper Reduction, Green Supply Chain, Improve Technology Infrastructure, Reduce PCs and Servers, Shared Services, Hardware Costs, Cooling.

Green Computing in Ancient India: Balance of life in Indian villages with nature: Use of biomass as fuel, no electricity; devices made of natural materials, absence of e-waste.

Applications of Green Computing: Energy Efficiency of algorithms, Green Networks, Green Cloud Computing, Green Internet of Things, Green Artificial Intelligence, Relevance to Industry 4.0.

**Text books:**

1. Green IT, Toby Velte, Anthony Velte, Robert Elsenpeter, McGraw Hill, 2008.
2. Green Data Center: Steps for the Journey Alvin Galea, Michael Schaefer, Mike Ebbers, Shroff Publishers and Distributors, 2011.

**Reference Books:**

1. Green Computing and Green IT Best Practice, Jason Harris, Emereo.

- **Outline for Data Visualization using Tableau**

This course is designed for the beginner Tableau user who works with data – regardless of technical or analytical background. This course is designed to understand and use the important concepts and techniques in Tableau to move from simple to complex visualizations and learn how to combine them in interactive dashboards.

Prerequisites: None.

At the end of this course, you will be able to:

- Connect to your data.
- Edit and save a data source.
- Understand Tableau terminology.
- Use the Tableau interface / paradigm to effectively create powerful visualizations.
- Create basic calculations including basic arithmetic calculations, custom aggregations and ratios, date math, and quick table calculations.
- Represent your data using the following visualization types:
  - Cross tabs
  - Geographic maps
  - Heat maps
  - Tree maps
  - Pie charts and bar charts
  - Dual axis and combined charts with different mark types
  - Highlight Tables
  - Scatter Plots
- Build dashboards to share visualizations.
  - Introduction
  - Connecting to data
  - Simplifying and sorting your data
  - Organizing your data
  - Slicing your data by date
  - Using multiple measures in a view
  - Showing the relationship between numerical values
  - Mapping data geographically
  - Viewing specific values

- Customizing your data
- Analyzing data with quick table calculations
- Showing breakdowns of the whole
- Highlighting data with reference lines
- Making your views available

#### Agenda 4: Syllabus for "Image Editing & Animation" Course

<b>Course Title/ Code</b>	<b>Image Editing &amp; Animation (CSW207) P</b>
<b>Course Type:</b>	<b>Elective</b>
<b>Course Nature:</b>	Workshop
<b>L-T-P-O Structure</b>	(0-0-3-0)
<b>Objectives</b>	The students will learn the skills to edit an image & create animation.

#### Section-A

**Understanding Photoshop:** Images & Types of Images, Image Size and Resolution, Creating a Digital Collage, Working with Files, Rulers and Guides, Changing Print Size of an Image. Working with Colors, Selections, Shapes and Painting, Adjusting Monitor Display, Converting between Color Modes, Softening and Refining Selections, Saving, Loading, Deleting, Moving, Copying Pasting and Extracting Selections, Drawing with Pen Tool, Creating Brush, Filling and Stroking Selection and Layers. Transforming and Typing: Rotating, Cropping, and Flipping Images, Transforming Objects, Retouching and Liquefying, Leading and Kerning, Type Selection, Pasteurization, Text Wrapping.

#### Section-B

**Working with Layers:** Creating and Deleting Layers, Selecting, Grouping and Linking Layers, Moving Copying and Locking Layers, Merging Layers: Layer Effects and Styles, Adjustment and Fill Layers, Masking Layers. Designing Web Pages: Creating Slices, Image Maps, Rollover and Animation, Creating Slices for Rollovers, Applying and Creating Rollover Styles, Animation Twining, Working with Layers, and Optimizing Images.

#### Section-C

**Flash:** Introduction, Overview of tool, symbols, Simple Animation using Shape, Motion, Guided Twining and Frame by Frame Animation, Layers, Text Effect, Fade in- Fade out, Zooming Effect, Alpha Ripple Effect, Photo Effects: Simple photo effect, motion photo masking, Special Effect: outline effect, shape effect, onion peel effect, shading effect, masking. Flash Animation Using Text and Voice.

#### Section-D

**Basics of Flash:** Assigning Actions: Working with Actions Toolbox, Working with the Script Navigator, working with the Script Pane, Working with Formatting, Using Code Hinting, Help Panel. Coding, Working with Strings, Numbers and Booleans, Casting Data, Declaring and Naming Variables, Working with Operators, Using Comments: Working with Statements, Control statements, Array, Functions Introduction to Action Script Coding- Variables and its scope in flash, working with data type variables, Arithmetic operations with numbers and string data type, Conditional Logic: If Else, Switch Cases, Loops, Arrays and Functions. Event Handler.

#### List of Experiments:

- Controlling your image and workflow using Photoshop.
  - Implementation of 2-D transformation using Photoshop.
  - Design a project using Masking, Image Manipulation and Layer Effects.

- Create a Frame by frame animation.
- Implementing the concept of layers.
- Motion & Shape Tweening.
- Guided Motion Tweening Concept.
- Working with the Flash effects.
- Create a simple animation in Flash with Action script.
- Create a Form using Action Script.
- Design the web page using Action Script.
- Animated Project.

**Text Books:**

- ❖ “Photoshop CS2-In Simple steps” by Shalini Gupta
- ❖ “Micromedia Flash 8 Bible” by Robert

**Reference Book:**

- ❖ VikasGubta&Kogent Solutions Inc.: Multimedia and Web Design.
- ❖ Paul Marino: 3D Animation and Film making Using Game engines.
- ❖ Antony Bolante: Adobe After effects 5 for windows After Indian edition 2002 Published by G.C. Jain for Techmedia.
- ❖ Arena Animation: Image Editing using Photoshop.
- ❖ Arena Animation: Animation using Flash.

- **Syllabus for "Blockchain Technology" Course**

<b>Course Title/ Code</b>	<b>Blockchain Technology</b>
<b>Course Type:</b>	<b>Domain Elective</b>
<b>Course Nature:</b>	Workshop
<b>L-T-P-O Structure</b>	(3-0-2-0)
<b>Objectives</b>	Students will be familiar with blockchain and cryptocurrency concepts. Also, they can build their application using the learned concepts.

**Section-A**

**Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance.

**Cryptography:** Hash function, Digital Signature, Zero Knowledge Proof.

**Blockchain:** Introduction, Advantage over a conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

**Section-B**

**Distributed Consensus:** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, difficulty Level, Sybil Attack, Energy utilization, and alternate.

**Cryptocurrency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards

**Section-C**

**Ethereum** - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

**Cryptocurrency Regulation:** Stakeholders, Roots of Bitcoin, Legal Aspects - Cryptocurrency Exchange, Black Market, and Global Economy.

**Section-D**

**Blockchain Applications:** Internet of Things, Medical Record Management System, Banking, Finance, copyrights, digital resources etc. and future of Blockchain.

**Lab:** Naive Blockchain construction, Solidity Programming, Working with Remix (Ethereum), Metamask Smart Contract Construction, Applications using Blockchain.

**TEXT BOOKS:** Nil

**REFERENCE BOOKS:**

- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
- Wattenhofer, The Science of the Blockchain
- Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
- Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
- DR. Gavin Wood, ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
- Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

● **Syllabus for "Object Oriented Programming Using Java" Course**

<b>Course Title/ Code</b>	<b>Object Oriented Programming Using Java(CSH201B) T &amp; P</b>
<b>Course Type</b>	Core (Departmental)
<b>Course Nature</b>	Hard
<b>L-T-P-O Structure</b>	(3-1-2-0)
<b>Objectives</b>	Student will be able to apply the object-oriented programming principles and techniques for solving the real life problems.

**Section-A**

**Introduction to OOPS:** Paradigms of Programming Languages - Basic concepts of Object Oriented Programming, Differences between Procedure Oriented Programming and Object Oriented Programming, Objects and Classes, Data abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic binding, Message communication, Benefits of OOP, Application of OOPs.

**Introduction to Java:** History of Java, Java features, Java Environment: JDK API. Types of java program, Creating and Executing a Java program, Java Tokens: Keywords, Character set, Identifiers, Literals, Separator, Java Virtual Machine (JVM), Comments in Java program, Command line input and Arguments, Data Types, Variables, Operators, Control Statements, Arrays, String handling, Scanner Class.

**Class and objects:** Defining a class, Methods, Creating objects, Accessing class members. Constructors, Method overloading, constructor overloading, this keyword.

**Section-B**

**Inheritance:** Defining a subclass, Deriving a subclass, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Overriding methods, super keyword, Final variables and methods, Final classes, Final methods, Abstract methods and classes, Visibility Control, Public access, Private access, protected. **Interfaces:** Defining interface, Extending interface, Implementing Interface, Accessing interface variables, Static members, Nesting of Methods

**Packages:** Java API Packages: System Packages, Naming Conventions, Creating & Accessing a Package, Adding Class to a Package, Hiding Classes



### Section-C

**Code Design:** Basic concepts of design patterns and preliminaries of its categories. SOLID Design Principles.

**Exception Handling:** Exception Handling Mechanism, using try and catch blocks, nesting try Statements, Multiple catch Block, Throwing Exceptions, using finally clause, creating a Custom Exception.

### Section-D

**Multithreading:** Getting the main thread, naming a Thread, Pausing a thread, Creating a Thread with the Runnable Interface, Creating a Thread with Thread Class, Creating Multiple Threads, Waiting for (joining) Threads, Checking whether thread is alive, Setting Thread Priority and Stopping Threads, Thread Synchronization, Suspending and Resuming Threads.

**I/O Streams:** I/O Basics Reading Console Input Writing Console Output, Using the File Class, InputStream, OutputStream, FileInputStream, FileOutputStream, Buffered Input Stream, Buffered Output Stream, Random Access File, File Reader, File Writer, Buffered Reader, Buffered Writer, Serialization.

#### List of Experiments

1. Basic programs in java, use of if else construct and switch construct.
2. Programs on Loops and Arrays.
3. Programs on Strings and classes creation in java.
4. Programs on constructors and use of keyword this keyword, static keyword, final keyword, finalize method.
5. Programs on single inheritance,
6. Programs on multilevel inheritance, Hierarchical inheritance.
7. Programs on method overriding, super keyword and final method.
8. Programs on interfaces
9. Programs on SOLID design principles.
10. Programs on Packages
11. Programs Exception Handling
12. Programs on threads
13. Programs on File Handling
14. Mini-Project

#### Text Books:

1. Programming with Java Primer by E BalagurusamyTmh Publication
2. Java; the complete reference, 7th editon, Herbert schildt, TMH.
3. H. M. Deitel and P. J. Deitel, Java How to Program, Prentice Hall, 7<sup>th</sup> Edition, 2007
4. Head First Design Patterns: A Brain-Friendly Guide 1st Edition, by Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson

#### Reference Book:

1. Java2 Programming Black Book, Steven Holzner (no. of copies: 23)
2. C. S. Horstmann and G. Cornell, Core Java 2 (Volume I-Fundamentals), Prentice Hall, 7th Edition, 2004. (no. of copies: 10)
3. Head First Java By Kathy Sierra

#### ● Syllabus for "Advanced Java" Course

<b>Course Title/ Code</b>	<b>Advanced Java(CSW308B)</b>
<b>Course Type</b>	<b>Core (Department)</b>

<b>Course Nature</b>	Workshop
<b>L-T-P-O Structure</b>	(0-0-3-0)
<b>Objectives</b>	Students will be able to design/Create GUI desktop applications and web applications with database connectivity along with client server architecture and frameworks for solving real life problems.

#### Section-A

**GUI Application:** Review of Java Basic Features (OOPS concepts, data types), Event Handling: Delegation event model, event interfaces & classes, Swing: Swing containers, LayoutManager, Swing Components (JLabel, JFrame, JPanel, Swign buttons, JList, JComboBox, JRadiobuttons, JTextField, JTable ,JTree), Swing Menu. JAR files

**Java Database Connectivity:** Connectivity model, java.sql package, JDBC Exception classes, Database connectivity steps, Data manipulation and navigation, creating database applications.

#### Section-B

**Java Generic:** type parameters, methods and classes, **Lambda expression** with single or multiple parameters, **Collection framework:** Collection interface and methods, List, Queue, Set & Map - interfaces and classes, Iterator, ListIterator& Enumeration interface.

**Networking:** Networking basics, Client/server model, Socket programming using Socket and ServerSocket class, Inet Address class, URL &URLConnection class, create networking applications.

#### Section-C

**Java Servlets:** Lifecycle& Architecture, ServletConfig, Servlet Context, Sharing information among servlet, GenericServlet, ServletRequest, and ServletResponse , HttpServletRequest, HttpServletResponse and HttpServlet ,Request-response, headers, GET, POST.

**Session Management:** Hidden form fields, Cookies, session tracking, Http Session, Exception handling and error pages.

#### Section-D

Java Server Pages: Introduction, Architecture, Lifecycle , JSP mplicit object , JSP syntax: directives, scripting element, standard action elements, Model View Controller (MVC) , Data Sharing among JSP pages.

Frameworks in Java Struts: Introduction to the Apache Struts, MVC Architecture, Struts Architecture, How Struts Works? , Introduction to the Struts Controller, Introduction to the Struts Action Class, Using Struts ActionFrom Class, Using Struts HTML Tags, Introduction to Struts Validator Framework, Client Side Address Validation in Struts, Custom Validators Example, Developing Application with Struts Tiles.

#### LIST OF EXPERIMENTS:

1. GUI using Swings
2. Event Handling in GUI application
3. Java Database Connectivity (JDBC)
4. Java Generic program
5. Java Collection program
6. Networking and Socket Programming
7. Servlet application
8. JSP application
9. Struts framework

#### Text Books:

1. Core Java, Volume II: Advanced Features 9th Edition by Cay Horstmann

2. Java: The Complete Reference, Ninth Edition
3. Advanced Java Programming by Uttam K. Roy (Oxford university)

**Reference Book:**

1. O'Reilly Series for JSP and Servlets
2. O'Reilly Series for Swings and AWT

**Agenda 5:**

- **Syllabus for "Wireless Sensor Network" Course**

<b>Course Title/ Code</b>	<b>WIRELESS SENSOR NETWORK (ECH403B)</b>
<b>Course Type:</b>	<b>Elective (Departmental)</b>
<b>Course Nature:</b>	<b>Hard</b>
<b>L-T-P-O Structure</b>	<b>(3-1-2-0)</b>
<b>Objectives</b>	<b>Students will be able to implement communication network using wireless sensors.</b>

Course Outcomes:

At the end of this course, students will be able to

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensor for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor network based systems and application.
- Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
- Handle special issues related to sensors like energy conservation and security challenges.

**SECTION-A**

Introduction and Overview of WSN: Definitions and Background Sensing and Sensors - Challenges and Constraints- Energy, Self-Management, Wireless Networking, Decentralized Management, Design Constraints, Security, Other Challenges Applications: Structural Health Monitoring, Traffic Control

**SECTION-B**

Architecture: Basic sensor network architectural elements, Single node architecture, Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Network architecture, Sensor network scenarios, Optimization goals and figures of merit, Gateway concepts.

**SECTION-C**

NODE AND NETWORK MANAGEMENT: Power Management, Local Power Management Aspects, Dynamic Power Management Time Synchronization, Time Synchronization Protocols, Localization, Security

**SECTION-D**

ADHOC NETWORKS AND ROUTING PROTOCOLS: Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance

Vector (DSDV), On-Demand Routing protocols –Ad hoc On-Demand Distance Vector Routing (AODV).

**Text Books**

KazemSohraby,DanielMinoli,TaiebZnati, “Wireless Sensor Networks: Technology, Protocols, and Applications”, John wiley& Sons.

Holger Karl, Andreas Willig, “Protocols and architectures for wireless sensor networks”, John wiley& Sons.

**Reference Books**

Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks; An Information Processing Approach”, Elsevier.

C. S. Raghavendra, Krishna M. Shivalingam, TaiebZnati, “Wireless sensor networks”, Springer Verlag.

H. Edgar, Jr. Callaway, “Wireless Sensor networks, Architectures and Protocols”, CRC Press

List of Experiments

- Applications and its simulation.
- Network Simulator installation of wireless sensor network.
- Write TCL script for transmission between mobile nodes.
- Write TCL script for sensor nodes with different parameters.
- Generate TCL script for udp and CBR traffic in WSN nodes.
- Generate tcl script for TCP and CBR traffic in WSN nodes.
- Implementation of routing protocol in NS2 for AODV protocol.
- Implementation of routing protocol in NS2 for DSDV protocol.

Study other wireless sensor network simulators (Mannasim. Contiki.)

● **Syllabus for "Discrete Mathematics" Course**

<b>Course Title</b>	<b>DISCRETE MATHEMATICS</b>
<b>Course Code</b>	<b>MAH104 T&amp;P</b>
<b>Course Type</b>	<b>Core (Allied)</b>
<b>Course Nature</b>	<b>Hard</b>
<b>L-T-P-O Structure</b>	<b>(3-1-2-0)</b>
<b>Objective</b>	<b>To equip the students with the concepts of counting, permutation and combination, Recurrence relations and graph theory required for solving the mathematical problems and their applications.</b>

<b>Course Outcome</b>	<p><b>The student will be able to:</b></p> <p><b>CO1. Specify and manipulate basic mathematical objects such as sets, relations, POSET and Lattices and will also be able to verify simple mathematical properties that these objects possess, explain partial ordering and solve related problems.</b></p> <p><b>CO2. Apply basic counting techniques to solve combinatorial problems.</b></p> <p><b>CO3. Express mathematical properties formally via the formal language of propositional logic and predicate logic explain Algebraic structures and solve related problems.</b></p> <p><b>CO4. Simplify simple Boolean functions by using the basic Boolean algebraic properties and K-map.</b></p> <p><b>CO5. Analyze Graphs and trees and solve related problems.</b></p>
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#### SECTION – A

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation.

POSET and Lattices; Partial orderings, POSETS, Totally Ordered Set, Dual Order, Hasse Diagram, Lexicographic Ordering, Well-Ordering Theorem, Lattices and their properties, Bounded Lattices, Sub Lattices, Direct Products.

#### SECTION – B

Counting Techniques: Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. Basic counting techniques-inclusion and exclusion ,pigeon-hole principle.

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers.

#### SECTION – C

Boolean algebra: Introduction to Boolean algebra and Boolean functions, Different representations of Boolean functions, Application of Boolean functions to synthesis of circuits. Karnaugh maps.

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields (Definition and examples only

#### SECTION – D

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

### **DISCRETE MATHEMATICS LAB (MAH104-P)**

#### **LAB EXERCISE:**

1. Introduction to programming.
2. Programming with control flow, i.e., for-loop, if-else-end etc.

3. Creation of user defined functions.
4. To use the set operation, i.e. union, intersection, Cartesian product etc.
5. Use of Boolean logics

### **Mini Project**

Objective: Mini Project encourage students to explore and strengthen the understanding of subject through practical application of theoretical concepts. It also helps students to boost their skills and widen their horizon of thinking.

Students are required to identify an application of the given topics in the real-life problems by using discrete mathematics concepts theory. Students can work individually or in a group of 2 & 3. Some suggested topic for mini project are

1. Application of Graph theory in Physics
2. Application of Graph theory in Chemistry
3. Application of Graph theory in Signal Processing
4. Application of Graphs in Networking
5. Applications of Boolean algebra in switching circuit
6. Application of Kruskal's and prim's algorithm in real life problems.
7. Application of Boolean algebra in computer science.
8. Routing problems (e.g. Hamiltonian paths, travelling salesman problem)
9. Graph colorings applications (Chromatic Number, chromatic polynomial)
10. Traffic management using graph algorithm
11. Job Assignment problem. ... etc

### **RECOMMENDED BOOKS:**

#### **Text books:**

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.
4. M.K. Sen (Author), D.S. Malik (Author), Discrete Mathematics: Theory and Applications, Cengage.

#### **Reference books:**

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and Its Application to Computer Science”, TMG Edition, Tata McGraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schum's Outlines Series, Seymour Lipchitz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

### **ELECTIVES FOR CST TO BE OFFERED BY FACULTY OF MANAGEMENT**

- **Syllabus for "Entrepreneurial Finance For Engineers" Course**

Course Title/Code	<b>ENTREPRENEURIAL FINANCE FOR ENGINEERS</b>
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Course Type:	Elective (Departmental)
Course Nature:	Soft
L-T-P-O Structure	2-0-0-0
Course Objectives	Students will be able to determine the sources of funds required at various stages of business, analyze the various sources of investment and also know the support provided by the state and central government for entrepreneurship. and be able to comprehend the various financial support schemes provided by different institutions to the entrepreneurs.

#### SECTION – A

**Introduction to Finance for Entrepreneurs:** · Understanding the financing needs of the start-up · Stages and Types of Financing · Sources and types of capital · Introduction to Bootstrapping and Incubation.

#### SECTION B

**Long Term Sources of Funding:** · Long term sources of funding such as equity capital, preference share capital, debentures and bonds, term loans · Raising entrepreneurial finance through angel investors, venture capital, crowdfunding, private equity etc. (Only basic understanding of these options.

#### SECTION C

**Short Term Sources of Funding:** · Short term sources of funding for Working capital requirement such as trade finance, working capital loan, commercial paper · Government Schemes for Financing the start-ups

#### SECTION D

**Institutional Financial Support Schemes and functions of rate of Industries** - District Industries Centres (DICs) - Industrial Development Corporation (IDC) - State Financial Corporation (SFCs) - Small Scale Industries Development Corporations (SSIDCs) -Khadi and Village Industries Commission (KVIC) - Technical Consultancy Organisation (TCO) - Small Industries Development Bank of India (SIDBI).

#### Reference Book:

- Entrepreneurial Finance (5th Edition) by Philip J. Adelman (Author), Alan M. Marks (Author), PHI
- Entrepreneurial Finance: Finance and Business Strategies for the Serious Entrepreneur 2nd Edition by Steven Rogers
- Entrepreneurial Finance: Fundamentals of Financial Planning and Management for Small Business, M. J. Alhabeeb, Wiley
- Entrepreneurial Finance: Venture Capital, Deal Structure & Valuation, Janet Kiholm Smith, Richard L. Smith, Jr.

#### ● Syllabus for "Digital Marketing" Course

Course Title/Code	<b>DIGITAL MARKETING</b>
Course Type:	Elective
Course Nature:	Soft

L-T-P-O Structure	2-0-0-0
Course Objectives	<p>By the end of the course, a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the scope of digital marketing and how it integrates with overall business and marketing strategy globally;</li> <li>2. Assess various digital channels and understand which are most suitable to an idea or solution;</li> <li>3. Understand the fundamentals of a digital marketing campaign, and be able to apply it to achieve your business objectives.</li> </ol>

#### **PART – A**

Introduction , Digital Marketing meaning, scope and Importance, Web marketing strategy , Web marketing environment, Web Content, Web marketing tools

#### **PART B**

Online Buyer Behavior, Website Design, Online user experience, Online site design, Integrated Internet Marketing Communications, Interactive Marketing Communication, Search Engine Optimization, Creating and Managing Campaigns.

#### **PART C**

Digital Promotion Techniques: EMail marketing, Social Media Marketing, Content Marketing, PPC Advertising, Display Advertising, Mobile Advertising, Video Advertising; YouTube Advertising

#### **PART D**

Google Analytics, Tracking Performance, Tracking Mobile marketing Performance, Web Analytics, Traffic Reports, Behaviour reports, KPIs in analytics, Tracking SMM performance

#### **References:**

1. Ryan Damian, Understanding Digital Marketing, Kogan Page.
2. ParkinGodfrey, **Digital Marketing: Strategies for Online Success**,New Holland Publishers.
3. Hanson, W. and Kalyanam, E-Commerce and Web Marketing, Cengage.

#### ● **Syllabus for "E-Commerce" Course**

Course Title/Code	<b>ECOMMERCE/MCH-370</b>
Course Type:	Elective (Departmental)
Course Nature:	Soft
L-T-P-O Structure	2-0-0-0



Course Objectives	<p>By the end of the course, a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the scope of ecommerce and how it integrates with overall business and marketing strategy globally;</li> <li>2. Understand various categories of ecommerce business</li> <li>3. Understand the fundamentals of ecommerce and be able to apply it to achieve your business objectives.</li> <li>4. To enable the student to become competent to understand the mechanism for excelling in e commerce based employments and self-employment opportunities.</li> </ol>
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### **Section A**

History of ecommerce. Introduction to E Commerce and Definition, E-Commerce based activities, Technical Components of E-Commerce, Functions, Advantages and Disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Framework of E-Commerce, Supply Chain Management.

### **Section B**

Enabling technologies of the internet. and dynamics of the internet. Electronic business models: B2B, B2C, C2C, C2B. Website Design: Websites as marketplace. E –commerce, pure online vs. brick and click business; assessing requirements for an online business designing, developing and deploying the system. Technology for Online-Business Internet and its Evolution, IT Infrastructure, Middleware, Domain names, Contents: Text and Integrating E-business applications. Components of Internet Information technology structure, Development of Intranet, Extranet and their Difference.

### **Section C**

Operations of E Commerce ,Online-payment mechanism; Electronic Payment systems; payment Gateways; Tools for promoting websites; Risk management options for e - payment systems. e-marketing, e-security, e-payment systems

### **Section D**

e-crm, e-strategy and knowledge management, Security and Legal Aspects of E-Commerce Threats in E-Commerce, Cyber Laws – Relevant, provisions of Information Technology Act 2000, offences, secure electronic records and digital signatures penalties and adjudication. M-commerce.

#### **Suggested Readings:**

1. Agarwala, Kamlesh N., Amit Lal and Deeksha Agarwala, Business on the Net: An Introduction to the Whats and Hows of E -Commerce, Macmillan India Ltd.
2. Bajaj, Deobyani Nag, E-Commerce, Tata McGraw Hill Company, New Delhi.
3. Turban, E., et. al., Electronic commerce: A Managerial Perspective, Pearson Education Asia.
4. Diwan, Prag and Sunil Sharma, Electronic Commerce -A Manager's Guide to E-Business, Vanity Books International, Delhi.
5. Dietel, Harvey M., Dietel, Paul J., and Kate Steinbuhler., E-business and E-commerce for managers, Pearson Education.
6. Greenstein, M. and T.M. Feinman, Electronic Commerce: Security, Risk Management and Control, Tata McGraw hill.
7. Kosiur, David, Understanding Electronic Commerce, Prentice Hall of India Private Ltd., New Delhi.
8. Whiteley, David, E-commerce, McGraw Hill, New York.
9. E-commerce by PT Joseph.

**Agenda 6:** MOOC Proposals to be offered as an elective to 5th & 7th SEM students

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**SWAYAM-NPTEL Courses for Semester July-Oct, 2021**  
**B.Tech CSE VII Semester**

SN o	Course Type (Domain \ Allied Elective )	NPTEL Course	Insti- tute	Durati- on (Weeks)	Course Start Date	Course End Date	Exam date	Cre- dits at M RU	Mapp- ing Statu- s Full/ Parti- al
1	<b>Domain Elective</b>	Introduction to Machine Learning	IIT M	12 weeks	7/26/21	15-Oct-21	10/24/21	5	Full
2		Reinforcement Learning	IIT M	12 Weeks	7/26/21	15-Oct-21	10/24/21	5	Full
3		Artificial Intelligence Search Methods For Problem Solving	IIT M	12 Weeks	7/26/21	15-Oct-21	10/23/21	5	Full
4		Deep Learning	IIT Rop- ar	12 Weeks	7/26/21	15-Oct-21	10/23/21	5	Full
5		Introduction to Internet of Things	IIT KG P	12 Weeks	7/26/21	15-Oct-21	10/24/21	5	Full
6		Social Networks	IIT Rop- ar	12 weeks	7/26/21	15-Oct-21	10/23/21	5	Full
7		Natural Language Processing	IIT KG P	12 Weeks	7/26/21	15-Oct-21	10/23/21	5	Full
8		Deep Learning for Computer Vision	IIT H	12 Weeks	7/26/21	15-Oct-21	10/23/21	5	Full
9		Computer Vision	IIT KG P	12 Weeks	7/26/21	15-Oct-21	10/23/21	5	Full

10		Digital Image Processing	IIT KG P	12 Weeks	7/26/21	15-Oct-21	10/23/21	5	Full
11		The Joy of Computing using Python	IIT Ropar	12 Weeks	7/26/21	15-Oct-21	10/23/21	5	Full
		Introduction to Industry 4.0 and Industrial Internet of Things	IIT KG P	12 Weeks	July 26, 2021	October 15, 2021	October 23, 2021	5	Full
12	<b>Allied Soft Elective I</b>	Innovation, Business Models and Entrepreneurship	IIT R	8 Weeks	8/23/21	15-Oct-21	10/24/21	2	Full
13		Entrepreneurship	IIT M	12 Weeks	7/26/21	15-Oct-21	10/24/21	2	Full
14		Entrepreneurship and IP strategy	IIT KG P	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full
15		Design Technology and innovation		8 Weeks	8/23/21	15-Oct-21	10/23/21	2	Full
16		Principles of Management	IIT KG P	12 Weeks	July 26, 2021	October 15, 2021	October 24, 2021	2	Full
17		Organization Development and Change in 21st Century	IIT B	8 Weeks	July 26, 2021	September 17, 2021	September 26, 2021	2	Full
18		Design Thinking - A Primer	IIT M	4 Weeks	July 26, 2021	August 20, 2021	September 26, 2021	2	Full

19		The Future of Manufacturing Business: Role of Digital Technologies	IIT K	8 Weeks	23-Aug-21	10/15/21	October 23, 2021	2	Full
20	<b>Allied Soft Elective II</b>	Managerial Economics	IIT B	12 Weeks	7/26/21	15-Oct-21	10/23/21	2	Full
21		Corporate Finance	IIT KG P	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full
22	<b>Allied Hard Elective</b>	Introduction to Wireless and Cellular Communications	IIT M	12 Weeks	7/26/21	15-Oct-21	10/24/21	2	Full
23	<b>Elective Workshop</b>	Introduction to R Software	IIT K	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full
24		Business Analytics & Text Mining Modeling Using Python	IIT R	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full
25		Data Science for Engineers	IIT M	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full
26		Cloud computing	IIT KG P	8 Weeks	8/23/21	15-Oct-21	10/23/21	2	Full

27	Scalable Data Science	IIT KGP	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full
28	Big Data Computing	IIT P	8 Weeks	8/23/21	15-Oct-21	10/23/21	2	Full
29	Introduction To Haskell Programming	CM I	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full
30	Programming, Data Structures And Algorithms Using Python	CM I	8 Weeks	7/26/21	17-Sep-21	9/26/21	2	Full

**SWAYAM-NPTEL Courses for Semester July-Oct, 2021**

**Course: B.Tech V Semester**

SN o	Cour se Type (Domain \ Allied Elective)	NPT EL Course	Inst itute	Du ration	Cour se Start Date	Course End Date	Exam date	Du ration/ Credits at MR U	Mappin g Status Full/Partial	NPTEL URL
1	<b>Domain Elective</b>	Intro ducti on to Mac hine Lear ning	IIT M	12 wee ks	26-Jul-21	15-Oct-21	24-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105152/">https://nptel.ac.in/courses/106/105/106105152/</a>
2		Rein force ment Lear ning	IIT M	12 We eks	26-Jul-21	15-Oct-21	24-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106143/">https://nptel.ac.in/courses/106/106/106106143/</a>

3	Artificial Intelligence Search Methods For Problem Solving	IIT M	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106126/">https://nptel.ac.in/courses/106/106/106106126/</a>
4	Deep Learning	IIT Ropar	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106184/">https://nptel.ac.in/courses/106/106/106106184/</a>
5	Introduction to Internet of Things	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	24-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105166/">https://nptel.ac.in/courses/106/105/106105166/</a>
6	Social Networks	IIT Ropar	12 weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106169/">https://nptel.ac.in/courses/106/106/106106169/</a>
7	Natural Language Processing	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105158/">https://nptel.ac.in/courses/106/105/106105158/</a>
8	Deep Learning for Computer Vision	IIT H	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106224/">https://nptel.ac.in/courses/106/106/106106224/</a>

9		Computer Vision	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105216/">https://nptel.ac.in/courses/106/105/106105216/</a>
10		Digital Image Processing	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/117/105/117105135/">https://nptel.ac.in/courses/117/105/117105135/</a>
11		The Joy of Computing using Python	IIT Ropar	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/117/105/117105135/">https://nptel.ac.in/courses/117/105/117105135/</a>
12		Introduction to Industry 4.0 and Industrial Internet of Things	IIT KGP	12 Weeks	July 26, 2021	October 15, 2021	October 23, 2021	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105195/">https://nptel.ac.in/courses/106/105/106105195/</a>
12	<b>Allied Soft Elective I</b>	Patent Drafting for Beginners	IIT M	4 Weeks	26-Jul-21	20-Aug-21	26-Sep-21	2	Full	<a href="https://nptel.ac.in/courses/109/106/109106128/">https://nptel.ac.in/courses/109/106/109106128/</a>

13		Patent Law for Engineers and Scientists	IIT M	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/109/105/109105176/">https://nptel.ac.in/courses/109/105/109105176/</a>
14		Patent Search for Engineers and Lawyers	IIT KGP	8 Weeks	23-Aug-21	15-Oct-21	23-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/110/105/110105140/">https://nptel.ac.in/courses/110/105/110105140/</a>
15	<b>Allied Soft Elective II</b>	Sustainability through Green Manufacturing Systems: An Applied Approach	IIT K	8 Weeks	23-Aug-21	15-Oct-21	23-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/112104225/">https://nptel.ac.in/courses/112104225/</a>
16		Ecology and environment	IIT M	8 Weeks	23-Aug-21	15-Oct-21	24-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/109/103/109103123/">https://nptel.ac.in/courses/109/103/109103123/</a>



17		Water, Society and Sustainability	IIT KGP	4 Weeks	23-Aug-21	17-Sep-21	24-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/109/105/109105136/">https://nptel.ac.in/courses/109/105/109105136/</a>
18		Ethics in Engineering Practice	IIT KGP	8 Weeks	23-Aug-21	15-Oct-21	23-Oct-21	two	FULL	<a href="https://nptel.ac.in/courses/110/105/110105097/">https://nptel.ac.in/courses/110/105/110105097/</a>

Annexure II

S No	Course Type (Domain \ Allied Elective)	NPTEL Course	Institute	Duration	Course Start Date	Course End Date	Exam date	Duration/ Credits at MRU	Mapping Status Full/ Partial	NPTEL URL
1	Domain Elective	Introduction to Machine Learning	IITM	12 weeks	26-Jul-21	15-Oct-21	24-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105152/">https://nptel.ac.in/courses/106/105/106105152/</a>
2		Reinforcement Learning	IITM	12 Weeks	26-Jul-21	15-Oct-21	24-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106143/">https://nptel.ac.in/courses/106/106/106106143/</a>

3	Artificial Intelligence Search Methods For Problem Solving	IIT M	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106126/">https://nptel.ac.in/courses/106/106/106106126/</a>
4	Deep Learning	IIT Ropar	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106184/">https://nptel.ac.in/courses/106/106/106106184/</a>
5	Introduction to Internet of Things	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	24-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105166/">https://nptel.ac.in/courses/106/105/106105166/</a>
6	Social Networks	IIT Ropar	12 weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106169/">https://nptel.ac.in/courses/106/106/106106169/</a>
7	Natural Language Processing	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105158/">https://nptel.ac.in/courses/106/105/106105158/</a>
8	Deep Learning for Computer Vision	IIT H	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/106/106106224/">https://nptel.ac.in/courses/106/106/106106224/</a>
9	Computer Vision	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105216/">https://nptel.ac.in/courses/106/105/106105216/</a>
10	Digital Image Processing	IIT KGP	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/117/105/117105135/">https://nptel.ac.in/courses/117/105/117105135/</a>

1	1	The Joy of Computing using Python	IIT Ropar	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	5	Full	<a href="https://nptel.ac.in/courses/117/105/117105135/">https://nptel.ac.in/courses/117/105/117105135/</a>	
1	2	Introduction to Industry 4.0 and Industrial Internet of Things	IIT KGP	12 Weeks	July 26, 2021	October 15, 2021	October 23, 2021	5	Full	<a href="https://nptel.ac.in/courses/106/105/106105195/">https://nptel.ac.in/courses/106/105/106105195/</a>	
1	2	<b>Allied Software E-I</b>	Patent Drafting for Beginners	IITM	4 Weeks	26-Jul-21	20-Aug-21	26-Sep-21	2	Full	<a href="https://nptel.ac.in/courses/109/106/109106128/">https://nptel.ac.in/courses/109/106/109106128/</a>
1	3		Patent Law for Engineers and Scientists	IITM	12 Weeks	26-Jul-21	15-Oct-21	23-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/109/105/109105176/">https://nptel.ac.in/courses/109/105/109105176/</a>
1	4		Patent Search for Engineers and Lawyers	IIT KGP	8 Weeks	23-Aug-21	15-Oct-21	23-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/110/105/110105140/">https://nptel.ac.in/courses/110/105/110105140/</a>

15	Allied Soft Elective II	Sustainability through Green Manufacturing Systems: An Applied Approach	IIT K	8 Weeks	23-Aug-21	15-Oct-21	23-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/112104225/">https://nptel.ac.in/courses/112104225/</a>
16		Ecology and environment	IIT M	8 Weeks	23-Aug-21	15-Oct-21	24-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/109/103/109103123/">https://nptel.ac.in/courses/109/103/109103123/</a>
17		Water, Society and Sustainability	IIT KGP	4 Weeks	23-Aug-21	17-Sep-21	24-Oct-21	2	Full	<a href="https://nptel.ac.in/courses/109/105/109105136/">https://nptel.ac.in/courses/109/105/109105136/</a>
18		Ethics in Engineering Practice	IIT KGP	8 Weeks	23-Aug-21	15-Oct-21	23-Oct-21	two	FULL	<a href="https://nptel.ac.in/courses/110/105/110105097/">https://nptel.ac.in/courses/110/105/110105097/</a>

Annexure III

SN o	Course Type (Domain \ Allied Elective)	NPTEL Course	Institute	Duration	Course Start Date	Course End Date	Exam date	Duration/ Credits at MRU	Mapping Status Full/Partial
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1	<b>Allied Soft Elective</b>	Gender justice and workplace security	IIT KGP	4 Weeks	23-Aug-2021	17-Sep-2021	23-Oct-2021	2	Full
2		Sociology of science	IITK	4 Weeks	26-Jul-2021	20-Aug-2021	26-Sep-2021	2	Full
3		Stress Management	IITKGP	4 Weeks	26-Jul-2021	20-Aug-2021	26-Sep-2021	2	Full
4		Psychology of Everyday	IITK	4 Weeks	23-Aug-2021	17-Sep-2021	24-Oct-2021	2	Full