Reference Books:

1. Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.
2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd.
3. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.
4. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Lt.

** Students should get a passing grade if they will clear at least two online aptitude tests and achieve minimum criteria of attendance.

Program:	B. Tech. (Computer Engineering)			Semester: V			
Course:	Emotional Intelligence (Audit Course - 2)			Code: BHM9963			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
01	-	-	01	-	-	-	-

Course Objectives:

1. To develop an awareness of Emotional Intelligence models.
2. To understand intelligence and develop emotional competence.
3. To understand how you use emotion to facilitate thought and behavior.
4. To know and utilize the difference between reaction and considered response.

Course Outcomes:

After learning the course, students will be able to:

1. Understand how to manage emotions, behaviour and self-control in any situation resulting in better productivity
2. Employ emotional intelligence competencies to effectively interact with people, colleagues and employees in building stronger relationships at work and at home
3. Articulate emotions using the right verbal and non-verbal language
4. Use tools to regulate their emotions and recognize and respond appropriately to emotions in self and others.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Emotional Intelligence (EI)** What is Emotional Intelligence, Emotional Intelligence and various EI models, The EQ competencies of self-regulation, motivation, empathy and interpersonal skills, Understand EQ and its importance in life.	03
II	**Self-awareness (SA):** Seeing the other side, giving in without giving up. **Tools:** Think, Feel, Act Cards, Plutchik's Wheel of Emotions& Emotional intelligence test **Self-Regulation/Managing Emotions:** The science of Emotions, Self-emotional quotient	03
III	**Gaining Control:** Use of Coping Thoughts and Relaxation Techniques to manage emotions, **Activities:** Be the Fog, Temperament Analysis. **Emotion recognition in others:** The universality of emotional expression, perceiving emotions accurately in others to build empathy **Activities:** Mindful Listening, Perceptual Positions	03
IV	**Emotional Intelligence at Work place** Importance of Emotional Intelligence at Work place, role of empathy and trust in relationships, building effective work relationships, conflict resolution strategy, Cohesive team building, **Tests:** My Colored Hat, ―I Am‖ Circle, Empathy Cards.	03
	Total	12

Text Books:

1. Daniel Goleman, ―Emotional Intelligence – Why It Matters More Than IQ,‖, Bantam, 10th Anniversary edition, 2005, ISBN: 978-0553383713
2. Steven C. Hayes, Spencer Smith, ―Get Out Of Your Mind And Into Your Life: The New Acceptance and Commitment Therapy‖, Read How You Want, [Large Print] edition, 2009, ISBN-13 : 978-1458717108

Reference Books:

1. Steven Stein, ―The EQ Edge‖, Jossey-Bass, 3rd edition, 2011, ISBN-13: 978-0470681619
2. Drew Bird , ―The Leader‘s Guide to Emotional Intelligence, Createspace Independent Pub, Kindle Edition, 2016, ISBN-13 : 978-1535176002.

Program:	B. Tech. (Computer Engineering)			Semester: V			
Course:	Entrepreneurship Development (Audit Course - 2)			Code: BHM9964			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
01	-		01	-	-	-	-

Course Objectives:

1. To inspire students and help them imbibe an entrepreneurial and start-up mind-set
2. To develop and strengthen entrepreneurial quality among students.
3. To understand the abilities to become an entrepreneur.
4. To acquaint with legalities in product development, IPR, Trademarks, Copyright and patenting
5. To know the facets of Business plans, Entrepreneurial Finance

Course Outcomes:

After learning the course, the students will be able to:

1. Develop an entrepreneurial mind-set by learning key skills such as product design, salesmanship, marketing and interpersonal skills.
2. Interpret their own business plan and analyse factors that contributed to the failure of a start-up
3. understand how to determine the best source of capital for a company and how to find revenue and expense assumptions
4. Understand the legalities in product development, IPR, Trademarks, Copyright and patenting

Detailed Syllabus

Unit	Description	Duration (H)
I	**Concept and Scope** Entrepreneurship as a career, Traits of Successful Intrapreneur/ Entrepreneur, why to become entrepreneur, Entrepreneurship Development Phases, Problem Solving and Ideation Process, Design Validation, Types of Start-ups	03
II	**Creating Entrepreneurial Venture** Sources of Innovation, methods of generating ideas, Prototype preparation and validation, Legal Issue, Private/Public Limited Company formation requirements, Intellectual Property Protection: Patents Trademarks and Copyrights, **Entrepreneurial Failure:** Case study of patterns, Early failures: good idea bad planning, False start, False positive, Late-stage failures: Speed trap, Cascading miracle, False confidence	03
III	**Business Plan Preparation** Sources of product for business: Feasible study, Ownership, capital, budgeting, Marketing plan for the new venture, steps in preparing marketing plan, Business Model Canvas (BMC), Financial plan- proforma income statements, Ratio Analysis.	03
IV	**Financial Modeling and Metrics** Spreadsheets, Benchmarks, Revenue assumptions, expense assumptions, Metrics customer Acquisition cost and life time model, Metrics viral coefficient, Funnel Analysis, **Entrepreneurial Finance:** venture capital, financial institutions supporting entrepreneurs, Lease Financing; Funding opportunities for Start-ups in India, Crowdfunding, Angel investing	03
	Total	12

Text Books:

1. Kumar Arya, ―Entrepreneurship: Creating and Leading an Entrepreneurial Organization‖, Pearson Education India, First edition, 2012, ISBN-10: 8131765784; ISBN-13: 978-8131765784
2. S.S.Khanka, ―Entrepreneurial Development‖, S Chand and Company Limited, Revised 2012th edition, 2012, ISBN : 81-219-1801-4

Reference Books:

1. Taneja, Gupta, Entrepreneur Development New Venture Creation‖, Galgotia Publishing Company, 2nd edition. 2017, ISBN: 9788185989594
2. Charantimath, Poornima, ―Entrepreneurship Development and Small Business Enterprises‖ Pearson Education, 3rd edition, 2018, ISBN: 8177582607, 9788177582604
3. Blake Masters and Peter Thiel, ―Zero to One‖, Plata Publishing, 2nd edition, 2014, ISBN-10: 9780804139298 - ISBN-13: 978-0804139298

Program:	B. Tech. (Computer Engineering)			Semester: V			
Course:	Research Article Writing (Audit Course - 2)			Code: BHM9965			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
01	-	-	01	-	-	-	-

Course Objectives:

1. To understand about how to write effective research article
2. To create awareness about grammar, lexical choices, citations in the text
3. To develop a full-length article, proposal or conference presentation
4. To familiarize the basic methods and techniques of research writing

Course Outcomes:

After learning the course, students will be able to:

1. Understand necessary traits to write effective research article with appropriate grammatical and lexical choices in text
2. Comprehend the importance of citations, indexing, indexed articles and plagiarism.
3. Develop an ability of critical thinking necessary to analyse a research report.
4. Write a research article, review article, thesis chapter and other related academic research text effectively and demonstrate importance of revising and proofreading for writing research article.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Research Writing** What is a research article? Understanding what is 'Research Writing', Qualities and skills required in a Research writer, Types of Research writing, choosing a suitable journal/conference/book chapter, how to conduct an effective Research, Abstract Writing, Selection of keywords, defining problem statement.	03
II	**Sources of citations**: Understanding of giving citation to other works, identifying relevant citations, understanding impact factor, Importance of Indexing and Indexed articles, learning to scan research articles quickly and effortlessly, Using Your Sources Wisely**:** what to cite, where to find good sources and how to use them, avoiding plagiarism **Plagiarism tools**: iThenticate, Grammarly **Citation Tools:** Mendeley, BibMe, Citefast, APA, MLA	03
III	**Drafting**: Structure of a basic research paper, stages of writing and research, learn to write the first draft, Understanding the components of an article: Abstract, Introduction, Preliminary concepts, proposed system, Experimental section, result analysis and discussion, Conclusion, Reference.	03

IV	**Revising and Editing:** Importance of revision, Understanding the comments of reviewer, Point-to-Point address of reviewer comments, What/Whatnot to revise, Emphasis on Journal formats, Proper usage of Grammar and sentence formatting, Steps for submitting the revised manuscript/article	**03**
	Total	**12**

Text Books:

1. Charles A. MacArthur, ―Handbook of Writing Research‖, The Guilford Press; 2nd edition, 2016, ISBN 10: 1462529313, ISBN-13: 978-1462529315
2. 2. Margaret Cargill, Patrick O'Connor, ―Writing Scientific Research Articles‖, Wiley-Blackwell, 2nd Edition, 2013, ISBN: 978-1-118-57070-8

Reference Books:

4. Booth W., Colomb G. and Williams J., ―The Craft of Research‖, University of Chicago Press,4th edition, 2016, ISBN-13: 978-0226239736
5. Jennifer Peat, Elizabeth Elliott, Louise Baur, Victoria Keena ,―Scientific Writing Easy when you know how‖, Wiley & Sons, Inc, 2nd edition, 2013, ISBN:9780727916259

Course Syllabus

TY B Tech Semester - VI

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Operating Systems					Code: BCE6414	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior knowledge of
Computer Organization, Data Structures and Algorithms
Is essential

Course Objectives:

1. To provide a grand tour of the major components of operating systems.
2. To introduce the notion of a process, threads and CPU scheduling
3. To explore inter process communication mechanisms, to introduce the critical-section problem and solutions which can be used to ensure the consistency of shared data.
4. To develop a description of deadlocks and a number of different methods for handling deadlocks in a computer system.
5. To explore various techniques of allocating memory to processes and explain the concepts of demand paging, page-replacement algorithms.
6. To describe the details of implementing local file systems and directory structures

Course Outcomes:

After learning the course, the students should be able to:

1. Comprehend the components and services of operating systems
2. Compare various process scheduling algorithms for a given snapshot of the system.
3. Analyze IPC mechanisms and solutions of process synchronization for critical section problems.
4. Identify a deadlock for a given system snapshot.
5. Analyze the performance of memory management algorithms for a given problem.
6. Apply disk scheduling policies for a given I/O request sequence with file management concepts.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Operating Systems** Introduction to Operating systems, Evolution of OS, Types of OS, Operating system components, O.S. Services, system calls. **System programs:** compiler, linker, loader.	08
II	**Process Management:** Process Concept- Process states, Process control block, Threads- Introduction, Multithreading Models, POSIX / pthreads **Process Scheduling:** Basic Concepts ,Scheduling Criteria, Scheduling Algorithms.	08

III	**IPC and Process Synchronization:** Inter process Communication mechanisms: Pipes, Shared memory, Message passing **Process Synchronization :** Introduction, Critical-Section Problem, Hardware Support for Synchronization, Mutex Locks, Semaphores, Synchronization problem: Reader-writer, producer- consumer problem, Dining Philosophers problem.	**08**
IV	**Deadlocks:** Introduction, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	**08**
V	**Memory Management** Memory management: Introduction, Contiguous and non-contiguous, Swapping, Memory Allocation Strategies, Paging, Segmentation, Virtual Memory: Background, Demand paging, Page Replacement Policies, Thrashing.	**07**
VI	**I/O Management** File Management: Concept of Files and Directories, File-System Structure, File-System Implementation, Directory Implementation, File Allocation Methods, Free-Space Management. Disk Scheduling-Disk Scheduling policies like FIFO, SSTF, SCAN, C-SCAN. Case study: xv6 Operating System	**06**
	Total	**45**

Text Books:

1. Silberschatz, Galvin, Gagne, "Operating System Principles", 10th Edition - 2018, Wiley, ISBN 978-1-118- 063330
2. Stallings W., "Operating Systems- internals and design principles", 9th Edition-2018, pearson, ISBN-13: 978- 013-467-0959.

Reference Books:

1. Dhamdhere D., "Systems Programming and Operating Systems", Revised 2nd Edition- 2009, McGraw Hill, ISBN-13: 9780074635797
2. Andrew S. Tanenbaum; Modern Operating Systems; Prentice Hall of India Publication; 4th Edition-2015. ISBN-13: 978-0133-591620
3. H.M. Deitel, P. J. Deitel, D. R. Choffnes, “Operating Systems “, Pearson, 3rd Edition, ISBN 0131828274, 97801318282

Web references:

1. https://pdos.csail.mit.edu/6.828/2018/xv6/book-rev11.pdf

Program:	**B. Tech. (Computer Engineering)**					**Semester: VI**	
Course:	**Operating Systems Laboratory**					**Code: BCE6415**	
Teaching Scheme				**Evaluation Scheme**			
Practical	**Tutorial**	**Credit**	**Hours**	**TW**	**OR**	**PR**	**Total**
04	-	02	04	25	-	25	50

Prior knowledge of

Theory of Computation, Data Structures and Algorithms
Is essential

Course Objectives:

1. To learn and understand data structures used in design of operating systems.
2. To understand functions of operating system.
3. To learn and understand process, resource and memory management.

Course Outcomes:

After learning the course, the students will be able to:

1. Use the system calls related to process management for Linux commands
2. Implement process scheduling algorithms
3. Develop the solutions for synchronization problems
4. Implement memory management algorithms.
5. Simulate the deadlock management technique for deadlock avoidance.
6. Implement Disk scheduling algorithms for I/O management

Guidelines for Students:

1. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, Index, and handwritten write-up of each assignment. Each assignment write-up should have Title, Objectives, Theory- Concept in brief, Algorithm/Flowchart, Test cases, Conclusion.
2. Program codes with sample output of all assignments are to be submitted in softcopy.

Guidelines for Laboratory /Term Work Assessment:

1. Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student.
2. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality ect.

Guidelines for Practical Examination:

1. Problem statements must be decided jointly by the internal examiner and external examiner.
2. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students.

Guidelines for Laboratory Conduction

1. Set of suggested assignments are provided for reference. Lab instructors may design the assignments with variations or suitable updations if required.
2. Operating System recommended: 64-bit Open-source Linux or its derivative.
3. Programming tools recommended: Open-Source/C/C++/JAVA.

Suggested List of Assignments	
Assignment No.	**Assignment Title**
1	Write a program to simulate use of Linux commands like cp, grep with the usage of fork() and exec() system calls. Also show the usage of wait(), getpid() and exit() system calls.
2	Write a program to implement scheduling algorithms – FCFS, SJF, Round Robin and Priority
3	Write a program to simulate inter process communication mechanism using pipes and redirection.
4	Write a program using pthreads to demonstrate the reader writer synchronization problem. Implement appropriate synchronization. Show the different results with and without synchronization
5	Write a program to implement Banker's Algorithm for deadlock avoidance.
6	Write a program to simulate memory allocation techniques: First Fit, Best Fit, Next Fit and Worst Fit.
7	Write a to implement paging replacement algorithms : a) FCFS b) Least Recently Used (LRU) c) Optimal algorithm
8	Write a program to implement disk scheduling algorithms FIFO, SSTF, SCAN, C-SCAN

Text Books:

1. Silberschatz, Galvin, Gagne, "Operating System Principles", 10th Edition- 2018, Wiley, ISBN 978-1-118- 063330
2. Stallings W., "Operating Systems", 9th Edition-2018, pearson, ISBN-13: 978-013-467-0959.

Reference Books:

1. Dhamdhere D., "Systems Programming and Operating Systems", Revised 2nd Edition- 2009, McGraw Hill, ISBN-13: 9780074635797
2. Andrew S. Tanenbaum; Modern Operating Systems; Prentice Hall of India Publication; 4th Edition- 2015. ISBN- 13: 978-0133-591620

Web references:

1. https://pdos.csail.mit.edu/6.828/2018/xv6/book-rev11.pdf

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Skill Development Lab - I			Code: BCE6416			
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
04	-	02	04	25	-	25	50

Prior knowledge of

Computer Networks, Database Management Systems

Is essential

Course Objectives:

1. To understand the methodologies of web applications development process.
2. To apply client and server-side technologies
3. To develop current client side and server-side frameworks.
4. To use current tools used for web application developments.

Course Outcomes:

After learning the course, the students will be able to:

1. Construct UI interface for web applications.
2. Apply client-side scripting for web applications.
3. Demonstrate dynamic web-based application using server-side programming.
4. Demonstrate web applications using web frameworks.

Guidelines for Students:

1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Journal consists of prologue, certificate, table of contents and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, Conclusion/Analysis).

Guidelines for Laboratory /TW Assessment

1. Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality, and neatness.

Guidelines for Laboratory Conduction

1. All assignments are compulsory.
2. Students are expected to work in groups of 3 to 4 for mini project.

Suggested List of Assignments	
Assignment No.	**Assignment Title**
1	Construct a suitable static web application using HTML and CSS and Bootstrap. Use and configuration of Web Server. (Apache Tomcat)
2	Perform the user data validations. (Name, Password, Phone, Email, Address etc.) using JAVAScript/JQuery.
3	Write a XML schema to describe and validate the XML data.
4	Demonstrate the use of arrays by creating a PHP web page e.g. Create an indexed array of 20 elements (e.g. employee_name) and search whether a given name exists in the array.
5	Create a webpage using PHP to demonstrate the Inheritance concept such as: to create a Class shape and its subclass triangle, square and circle and display area of the selected shape.(use the concept of Inheritance) Display menu(use radio button) a) Triangle b) Square c) Circle
6	Design Employee Registration form and store and retrieve the data using PHP and MySql.
7	Implement the login and logout web application to handle the session management using session and cookies. (PHP)
8	Install Ruby Environment Setup and Write a Ruby program which accept the user's first and last name and print them in reverse order with a space between them.
9	Write a Ruby Script to send an Email to a specific User.
10	Design and develop mini project based on real life problems which comprises any one stack from above.

Text Books:

1. Achyut Godbole & Atul Kahate, “Web Technologies: TCP/IP to Internet Application Architectures”, McGraw Hill Education publications, ISBN, 007047298X, 9780070472983
2. Ralph Moseley & M. T. Savaliya, “Developing Web Applications”, Wiley publications

Reference Books:

1.Web Technologies: Html, Javascript, Php, Java, Jsp, Xml And Ajax,Black Book: Kogent Learning Solutions

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Technical Seminar - 2					Code: BCE6417	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
02	-	01	02	25	-	-	25

Course Objectives:

1. To apply the knowledge and skills for understanding realistic problem.
2. To review of literature for project work from appropriate sources such as books, manuals, research journals and from other sources, and in turn increase analytical skills.
3. To emphasizes learning activities that are long-term, Collaborative learning, interdisciplinary.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes:

After learning the course, the students will be able to:

1. Identify and define the real life engineering problem from societal need point of view.
2. Develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problem from technical perspective.
3. Choose and compare alternative approaches with the help of literature survey to select most feasible one.
4. Demonstrate Collaborative learning, Interpersonal Skills, Meta cognitive skills through different seminar activities.
5. Prepare good quality technical reports based on the selected problem statement.
6. Test and evaluate the model results to develop a probable solution.

Guidelines for Students:

1. Seminar is one of the significant contributory team works that has to be completed based on the required number of credits as per academic regulations.
2. It is necessary to explore the domain of interest / research/ thrust area/ society needs.
3. **Seminar teams**: 3-4 students can form a team within the same or different discipline and their area of interest is to be registered with seminar Coordinator.
4. Finalization of Problem statement for implementation as project statement and base model implementation.
5. **Selection of Seminar Topic:**
    a. Student shall identify the area or topics in recent trends and developments in consultation with seminar guide or industry or any research organization.
6. **Guide Allotment:**
    a. Considering registered teams' area of interest/domain and expertise of guide, the Seminar coordinator in consultation with **panel of experts** allots Seminar guides.
    b. Guide should be allotted from the **same program**.
    c. **In case of interdisciplinary Seminar**, along with the guide from same program, co-guide should be allotted from the other program
7. Teams in consultation with guide will prepare Seminar **Synopsis.**

8. **Seminar Review:**
    a. The Seminar coordinator with the Head of the department shall constitute a review committee comprising of domain experts and senior faculty members.
    b. The review committee will approve the Seminar group and title. Discussion / presentation may be arranged covering topics listed in the synopsis.
    c. The seminar Review committee will evaluate the timely progress of the projects.
    d. Student with group members is expected to appear for minimum three reviews as per the seminar calendar.
    e. Attendance for all 3 reviews is mandatory.
9. Student will be evaluated thrice in the semester based on seminar evaluation guidelines/Rubrics as follows:

Sr. No.	Review	Rubrics (Each carry 5 Marks)
1	Review-1 (10 Marks)	1. Novelty, Innovation and Relevance of the topic - Societal relevance, possible topic leading to patenting / multidisciplinary 2. Scope, Feasibility, and objectives for the topic
2	Review-2 (20 Marks)	1. Design of System Architecture 2. Status of base model implementation (50% expected) followed by model testing and evaluation. 3. Presentation Skills 4. Regularity & Team work
3	Review-3 (20 Marks)	1. Status of base model implementation (100% expected) followed by model testing and evaluation. 2. Documentation and Originality of the content 3. Paper publication/I PR/Participation in various contests/ Awards / Consultancy/ sponsored project 4. Technical Knowledge
Total- (50 Marks)		**Scaled down to (25 marks)**

10. **Report:**
    a. Report should be prepared as per the template provided by the department.
    b. Seminar reports shall be submitted in softcopy form/ (Hard bound reports could be avoided).
    c. In case of Interdisciplinary Seminar, students must submit **Completion certificate with signature of Co-Guide from another department.**
11. **Technical Seminar 2 Outcomes:**
    a. Student seminar team shall divide topic into sub topic and individually work on sub topic and perform literature survey.

b. Finalization of Problem statement for implementation as project statement and base model implementation

Seminar Work syllabus guidelines:

- The student is expected to complete the Seminar2 work which will consist of selection of Domain Selection, Topic Identification, Finalization of sub topics for each student in group literature review, Problem Statement finalization, Base model implementation.

- The student shall prepare and submit the report of Seminar work in standard format for satisfactory completion of the work that is the duly certified by the concerned guide (Internal External (in case of sponsored project)/ Co-Guide (in case of interdisciplinary project)) and head of the Department/Institute.

Program:	**B. Tech. (Computer Engineering)**			**Semester: VI**			
Course:	**Machine Learning (PEC-3)**			**Code: BCE6508**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
02	-	02	02	20	30	50	100

Prior knowledge of

Database Management Systems, Data Mining, and Engineering Mathematic Is essential.

Course Objectives:

1. To introduce different machine learning primitives.
2. To introduce different feature selection techniques to prepare training and testing data set
3. To solve regression problems using regression techniques.
4. To develop skills to understand nature of the problem and apply machine learning algorithm
5. To develop classifier model using classification algorithms
6. To interpret the model results and analyze the accuracy of the model.

Course Outcomes:

After learning the course, Students will be able to:

1. Use different data preprocessing techniques to prepare training and testing data set.
2. Solve real world problems using regression algorithms and improve the model performance
3. Apply classification and clustering algorithms to solve real world problems.
4. Evaluate the performance of the model using different performance metrics.

Detailed Syllabus

Unit	**Description**	**Duration (H)**
I	**Introduction to Machine learning** Introduction to Machine learning, Machine Learning approaches- Supervised Learning, Unsupervised Learning and Reinforcement Learning, Important Elements of Machine Learning- Data formats, Underfitting and Overfitting, Creating training and testing datasets, Feature Selection and Filtering, Principal Component Analysis (PCA)	**06**
II	**Linear Regression** **Linear regression**- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Ridge, Lasso and ElasticNet, Robust regression with random sample consensus, Stochastic gradient descendent algorithms, Finding the optimal hyper- parameters through grid search, Basics of polynomial regression.	**08**
III	**Supervised and Un Supervised Learning** **Logistic regression**-Linear classification, Logistic regression, **Decision Trees**-Impurity measures, Decision Tree Classification, Random Forest, **Ensemble Learning**: Bagging, Boosting. **Clustering -** K-means, finding optimal number of clusters using Elbow method	**08**
IV	**Classification and Performance Metrics** **Naive BayesClassifiers:** Bernoulli Naïve Bayes, Multinomial Naïve Bayes, and Gaussian Naïve Bayes. **K Nearest Neighbor** Classifier, Distance-Weighted	**08**

	KNN. **Metrics** for Evaluating Classifier Performance, Confusion Matrix, Evaluating the Accuracy of a Classifier: Holdout Method and Cross-Validation, ROC Curve	
	Total	**30**

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Ltd. 2017, ISBN 978-1-78588-962- 2
2. Jiawei Han, MichelineKamber, “Data mining: concepts and techniques", Morgan Kaufmann Publisher 2012, third edition, ISBN 13: 978-1-55860-901-3.

Reference Books:

1. Ethem Alpaydin, “Introduction to Machine Learning”, PHI second edition-2013, ISBN: 978-0-262-01243-0
2. Tom Mitchell, “Machine Learning” McGraw Hill Publication 1997, ISBN: 0070428077
3. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, O'Reilly Media, Inc. publisher 2017, ISBN: 9781491962299

Web references:

1. https://balasahebtarle.files.wordpress.com/2020/01/machine-learning-algorithms_text-book.pdf
2. https://www.cin.ufpe.br/~cavmj/Machine%20-%20Learning%20-%20Tom%20Mitchell.pdf
3. http://scikit-learn.org/stable/datasets/
4. https://scikit-learn.org/stable/modules/model_evaluation.html
5. https://www.kaggle.com/datasets

Program:	**B. Tech. (Computer Engineering)**			**Semester: VI**			
Course:	**Fundamentals of Blockchain (PEC - 3)**			**Code: BCE6509**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
02	-	02	02	20	30	50	100

Prior knowledge of

Basics of Cryptography and Information Security

Is essential

Course Objectives:

1. To explain basic components of a Blockchain, its operations, underlying algorithms, and essentials of trust
2. To provide the fundamental cryptographic base for Blockchain.
3. To make students familiar with the working of Smart Contracts
4. To provide a detailed understanding of workings of a blockchain, its transactions, blocks and mining.

Course Outcomes:

After learning the course, Students will be able to:

1. Comprehend the fundamental characteristics of Blockchain.
2. Apply the basic cryptographic primitives essential for Blockchain.
3. Compare the private and public Blockchain.
4. Analyze the working of Smart Contracts for verification or execution of agreement.
5. Apply appropriate distributed consensus algorithms for the real life problem.

Detailed Syllabus

Unit	**Description**	**Duration (H)**
I	**Introduction to Blockchain** Introduction to decentralized system, History, Conceptualization, Architectural principles behind Blockchain, Characteristics of Blockchain. Mining strategy.	**06**
II	**Basic Crypto Primitives** Hashing, public key cryptosystems, **Types of Blockchains:** private vs public Blockchain, Blockchain protocol and use cases, Hash puzzles.	**08**
III	**Distributed Consensus** Consensus approach, Consensus elements **Consensus Algorithms:** Proof of Work, Byzantine General problem, Proof of Stake, Proof of Elapsed Time, Proof of Activity, Proof of Burn.	**08**
IV	**Smart Contracts and Ethereum** History, Purpose and types of smart contracts, Introduction to Ethereum, bitcoin vs Ethereum stack. P2P network in Ethereum, consensus in Ethereum, scripts in Ethereum. Developing and executing smart contracts in Ethereum. State and data structure in Ethereum.	**08**
	Total	**30**

Text Books:

1. Artemis Caro, “Blockchain: The Beginners Guide to Understanding the Technology Behind Bitcoin & Cryptocurrency”, Kevin Wolhuter, 2021, ISBN: 1922590061, 9781922590060
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O'Reilly Media, Inc.2017, ISBN: 9781491954386

Reference Books:

1. Mark Watney, Blockchain for Beginners: The Complete Step by Step Guide to Understanding Blockchain Technology”, CreateSpace Independent Publishing Platform, 2017, ISBN: 1548766887, 9781548766887
2. Alwyn Bishop, “Blockchain Technology Explained”, CreateSpace Independent Publishing Platform, 2018, ISBN: 9781986273800

Web references:

1. NPTEL Course “Introduction to Block Chain Technology & Applications” https://nptel.ac.in/courses/106/104/106104220/
2. NPTEL Course on “Blockchain Architecture & Use Cases” https://nptel.ac.in/courses/106/105/106105184/

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Full Stack Development (PEC - 3)					Code: BCE6510	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	02	02	20	30	50	100

Prior knowledge of

SQL, Basics of Web Technologies

Is essential

Course Objectives:

1. To familiarize with the core concepts of frontend and backend programming.
2. To explore the latest web development technologies.
3. To get acquainted with NOSQL databases.

Course Outcomes:

After learning the course, Students will be able to:

1. Articulate the latest technological stack for web application development.
2. Apply concepts of Angular JS for web applications development.
3. Explore the concepts of Node.js and Express for web applications development.
4. Explore the features of NOSQL databases for designing data models.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to ANGULAR JS** Introduction, Features, Angular JS, Model-View-Controller, Expression, Directives and Controllers, AngularJS Modules, Arrays, Working with ng-model, Working with Forms, Form Validation, Error Handling with Forms, Nested Forms with ng-Form, Other Form Controls.	**06**
II	**Directives & Building Databases** Filters, Using Filters in Controllers and Services, AngularJS Services, Internal AngularJS Services, Custom AngularJS Services, Directives, Alternatives to Custom Directives, Understanding the Basic Options, Interacting with Server, HTTP Services, Building Database **Case Study:** App Development Using AngularJS	**08**
III	**Node JS and Express Framework** Introduction, Terminals, Editors, Building a Web server with Node, HTTP Module, Views and Layouts, Middleware, Routing, Form Handling with Express, Request and Response Objects, Handle Bars, Comments and Blocks. **Case Study:** App Development Using Node and ExpressJS	**08**
IV	**MongoDB** JSON and MongoDB, adopting a Non-relational Approach, Opting for Performance vs. Features, Running the Database Anywhere, Generating or Creating a Key, Using Keys and Values, Implementing Collections.	**08**
	Total	**30**

Text Books:

1. Adam Freeman “ProAngular JS, Apress”, First Edition, 2014.
2. ShyamSeshadri, Brad Green “Angular JS: Up and Running: Enhanced Productivity with Structured Web Apps”, Apress, O'Reilly Media, Inc.
3. AgusKurniawan “AngularJS Programming by Example”, First Edition, PE Press, 2014.
4. David Hows, Peter Membrey, EelcoPlugge “MongoDB Basics”, Apress, 2014.
5. Ethan Brown, “Web Development with Node and Express”, Oreilly Publishers, First Edition, 2014.

Reference Books:

1. Brad Dayley “Learning Angular JS”, Addison-Wesley Professional, First Edition, 2014.
2. Steve Hoberman “Data Modeling for MongoDB”, Technics Publication, First Edition, 2014.
3. Kyle Banker, Peter Bakkum, Shaun Verch, Dough Garrett, Tim Hawkins “MongoDB in Action”, Manning Publications, Second Edition, 2016.
4. Evan M. Hahn, “Express in Action”, Manning Publications, First Edition, 2014.

Web references:

1. https://www.w3schools.com/whatis/whatis_fullstack.asp
2. https://www.geeksforgeeks.org/what-is-full-stack-development/
3. https://github.com/bmorelli25/Become-A-Full-Stack-Web-Developer

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Image and Video processing (PEC - 4)					Code: BCE6511	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	02	02	20	30	50	100

Prior knowledge of

Matrix Operations and Binarization

Is essential

Course Objectives:

The course is aiming to impart conceptual clarity among students about.

1. Application of point processing methods on digital image.
2. Application of spatial domain methods on digital image.
3. Application of image compression methods like RLE/Huffman coding and orthogonal transforms on digital image
4. Comprehension of the video processing basics.

Course Outcomes:

After learning the course, Students will be able to:

1. Apply point processing methods on digital image.
2. Apply spatial domain methods on digital image.
3. Apply the image compression methods like RLE/Huffman coding and orthogonal transforms on digital image
4. Comprehend the video processing basics.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Fundamentals of Image Processing** Basic steps of Image Processing System, Applications of Image Processing, Digital Image Acquisition: Sampling and Quantization, Basic relationship between pixels, Spatial domain image processing methods: point processing techniques: Image negation, Thresholding, gray level slicing,bit plane slicing, darkening and lightning of image.	**08**
II	**Spatial Domain Image Enhancement Techniques** Histogram processing: Image Histogram and Histogram Equalization, Mask processing methods, smoothing spatial filters (Low pass filter), Sharpening spatial filters (High pass filters), High boost filter, Gradient filters: Prewit, Sobel and Robert.	**07**

III	**Fundamentals of Image Compression** Types of redundancies: coding, spatial, temporal, Compression models: Lossy & Lossless, Lossless compression: Run length encoding (RLE) and Huffman coding, Lossy compression: Introduction to JPEG., Introduction to orthogonal transforms: Haar transform, cosine transform, significance of transforms,applying transform on image, inverse of transformed image.	**08**
IV	**Basic Steps of Video Processing** Introduction to Digital Video, Video frames: normal-key frames, concept of shots and scenes Time-Varying Image, Extraction of visual and audio parts from digital video, applying point and mask processing methods on video frames: Introduction to MPEG	**07**
	Total	**30**

Text Books:

1. Rafael.C,Gonzalez, Richard E Woods, "Digital Image Processing",4th Edition, Pearson India, ISBN:9353062985, 2018.
2. Jain A.K, "Fundamentals of Digital Image Processing", 4 Edition, Prentice Hall of India.

Reference Books:

1. B.Chanda, D. DuttaMajumder, "Digital Image Processing and Analysis", 2 nd Edition, Phi learning, *ISBN*- 978-81-203-4325-2, 2011.
2. William K Pratt, "Digital Image Processing", 4 Edition, Wiley, ISBN:9780471767770, 2006.

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Internet of Things (PEC - 4)					Code: BCE6512	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	02	02	20	30	50	100

Prior knowledge of

Basic concepts of Computer Networks, Protocols stack in Computer Network, limitations of Computer Network

Is essential

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematic all principles related to:

1. To understand fundamentals of IoT including its reference architecture
2. To comprehend sensors, types of sensors and development boards
3. To provide detailed understanding of workings of various IoT protocols
4. To design and develop IoT systems for real time applications

Course Outcomes:

After learning the course, the students will be able to:

1. Comprehend fundamentals IoT building blocks and its enabling technologies
2. Analyze the challenges in IoT systems
3. Comprehend various development boards like Arduino and Raspberry-pi
4. Select appropriate sensors and development board for stated IoT problem
5. Implement interfacing of various sensors and actuators to the development boards
6. Use various IoT protocols for designing real time applications

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to IoT** Definition and characteristics of IoT, Technical building blocks of IoT, Physical design of IoT, Communication technologies, IoT enabling technologies (WSN, Cloud Computing, Big Data Analytics, RFID, NFC), IoT communication models, IoT communication APIs (Representational State Transfer (REST) API, Web Socket Based Communication APIs), IoT issues and challenges, IoT reference architecture, IoT applications.	06
II	**IoT Hardware** **Sensors:** Roles of sensors & actuators, Types of sensors, Active and passive, analog and digital, Contact and no-contact, Absolute and relative Working of Sensors: position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera. **Development Boards:** Types of boards - Arduino, Raspberry-pi, Interfacing of sensors with development boards.	08
III	**IoT Protocols** **PHY/MAC Layer:** Wireless HART, ZWave, Bluetooth Low Energy (BLE) Network Layer:6LoWPAN, RPL, COAP **Transport Layer and Application Layer:** CARP, XMPP, AMQP, MQTT	08

IV	**IoT Applications** Industrial IoT, IoT for smart cities, IoT in agriculture, IoT in Home automation, IoT in healthcare, IoT in remote monitoring.	**08**
	Total	**30**

Text Books:

1. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0.

Reference Books:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0:0996025510, 13: 978-0996025515.
2. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012. ISBN: 9781439892992
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, 2011. ISBN: 978-3-642-19156-5
4. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN: 978-1-118- 43063-7

Web references:

1. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
2. https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT
3. https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot- right-now/

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Software Project Management (PEC-4)			Code: BCE6513			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	02	02	20	30	50	100

Prior knowledge of

Software Engineering

Is essential

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Understand basics of software project management and its significance
2. Learn software project planning using CPM and PERT
3. Know resource scheduling in software project life cycle
4. Learn project cost estimation in software project life cycle
5. Learn project risk identification and mitigation in software project life cycle
6. Understand contemporary software project management concepts

Course Outcomes:

After learning the course, Students will be able to:

1. Comprehend software project management concepts, viewpoints and significance
2. Prepare and analyze software project plans using CPM and PERT
3. Prepare and analyze resource scheduling in software project lifecycle.
4. Estimate the project cost in software project life cycle
5. Identify and mitigate project risk in software project life cycle
6. Comprehend contemporary software project management concepts

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction** What is a project, Project Management: the need, Systems approach to management, Project goal and project management benefits, The Person, the team, the methodology functions and viewpoints of management, Project viewpoint versus traditional management, evolution of project management, where is project management appropriate? Management by Project: A common approach, Different forms of project management: industrial, service and government.	**06**
II	**Advanced Project Network Analyses and Scheduling** Work Breakdown Structure (WBS), Project activities, Predecessor and successor activities, Network diagrams: (Activity on Arrow) AOA &(Activity on Node) AON, Do's and don'ts of drawing network diagrams, Project plan, Project schedule, Critical Path Method (CPM) and Time–Cost tradeoff, Variability of activity duration, Program Evaluation and Review Technique (PERT), Theory of Constraints (TOC) and Critical chain method, Introduction to Graphical Evaluation and Review Technique(GERT).	**08**

III	**Resource Scheduling, Cost Estimation and Budgeting:** **Resource Scheduling:** Allocating resources and multiple project scheduling, TOC method for allocating resources to multiple projects, Resource loading and leveling using CPM, Resource rescheduling in CPM **Cost Estimating and Budgeting:** Cost estimating, Cost escalation, System life cycle costs, Cost estimating process, Elements of budgets and estimates, Project cost accounting systems, Budgeting using control accounts.	**08**
IV	**Risk, Contemporary and International Project Management:** **Project Risk Management:** Risk concepts, Risk identification, Risk assessment, Risk response planning, Risk tracking and response, Risk Mitigation, Monitoring and Management Plan(RMMM). **Contemporary Software Project Management:** Project Management Information Systems (PMIS), Web-enabled project management, Significance of informal communication, Project terminating and closeout. **International Project Management:** Problems managing international projects, Introduction to Capability Maturity Model (CMM) and People Capability Maturity Model (PCMM).	**08**
	Total	**30**

Text Books:

1. John M. Nicholas, ―Project Management for Business and Technology: Principles and Practice, 2nd Edition, Pearson Education,2001
2. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", Sixth Edition, Tata McGraw Hill, New Delhi, 2017.
3. Jalote Pankaj, "Software Project Management in Practice", Addison-Wesley Professional, 2002

Reference Books:

1. Roger S.Pressman, ―Software Engineering - A Practitioner's Approach‖, 7th Edition McGraw Hill
2. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.

Web references:

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview
2. Software Project Management By Prof. Rajib Mall & Prof. Durga Prasad Mohapatra | IIT Kharagpur

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Project Based Learning - IV					Code: BCE6514	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
04	-	02	04	25	50	-	75

Course Name		Group A		Group B
	Part I	Machine Learning	Part IV	Image & Video Processing
	Part II	Fundamental of Blockchain	Part V	Internet of Things
	Part III	Full Stack Development	Part VI	Software Project Management

Course Objectives:

1. To make the students aware about the fundamentals of the Programme /Professional Elective Course.
2. To develop skills for implementing various tools and technologies used for Professional Electives.
3. To make the students learn about the teamwork and to analyze the result of their teamwork in the form of project/application.

Course Outcomes:

After learning the course, the students will be able to:

1. Analyze the fundamentals of Professional Electives.
2. Assess various tools and techniques available for Professional Electives.
3. Design/develop an application using functionalities of Professional Electives in a team.

Group A

Part I: Machine Learning

Guidelines for Students:

1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Each assignment write-up should have Title, Objectives, Outcomes, Theory- Concept in brief, dataset used, data description, conclusion, and assessor's sign.
3. Program codes with sample output of all performed assignments should be submitted.

Guidelines for Laboratory/Term Work Assessment:

1. Continuous assessment of laboratory work is done based on the overall performance and laboratory performance of the students.
2. Each laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each laboratory assignment assessment include- timely completion and submission, performance, innovation, efficiency, punctuality, neatness and soundness of the contents.

Guidelines for Laboratory Conduction

1. Recommended Tools for the implementation of above assignments: Python, R, Jupyter Notebook etc. Use of the Anaconda platform is encouraged.
2. For mini project, select a real-world application in the group of 3-4 students and formulate a problem statement for application to be developed.
3. Student groups are required to continue same problem statement throughout all the assignments in order to design and develop an application as a part of mini project. Further assignments will be useful for students to develop an application.

Student groups are required to continue same problem statement throughout all the assignments in order to design and develop an application as a part of mini project. Further assignments will be useful for students to develop an application.

Suggested list of Assignments

Assignment No.	Assignment Title
1	**Feature Selection** Select any data set with high dimensions (such as Bostan dataset, breast cancer dataset) from any repository of data such as SK-Learn, UCI library, Kaggle dataset library etc. Write a program to perform the following operations on the selected dataset and display the result. i. Reduce dimensions using SelectKBest method ii. Reduce dimensions using SelectPercentile method iii. Reduce dimensions using PCA techniques
2	**Linear and Polynomial Regression** i. The following table shows the results of a recently conducted study on the correlation of the number of hours spent driving with the risk of developing acute backache. Write a program to find the equation of the best fit line for this data using linear and polynomial regression. Evaluate and compare the performance of both the models.

No. of hours spent for of driving (X)	Risk Score on a scale 0-100 (Y)
10	95
9	80
2	10
15	50
10	45
16	98
11	38
16	93

ii. Select any data set with high dimensions (such as Diabetes dataset) from any repository of data such as SK-Learn, UCI library, Kaggle dataset library etc. Implement Linear Regression, Ridge, Lasso and ElasticNet models. Evaluate and compare the performance of these models.

3

KNN Classification

A dataset collected from hospital showing details of medical test reports with symptom values observed in the patient's and medical test either positive or negative. Write a program to build k-NN classifier models. If k=3, find the class of the point (6, 6). Extend the same example for Distance-Weighted k-NN. Evaluate and compare the performance of both the models

S1	S2	Test Class
2	4	Negative
4	6	Negative
4	4	Positive
4	2	Negative
6	4	Negative
6	2	Positive

4

Mini Project

Review and analyze the literature for various machine learning techniques and applications. Using Machine Learning concepts covered in the assignments and Machine Learning theory course, design and develop an application/Decision Support System for the selected problem statement. Visualize the results with comparative performance analysis of different models (minimum 3) using suitable methods.

For Example: Health Care domain for predicting disease, Agriculture sector for Fruits Classification or Soil Classification or Leaf Disease Classification.

Note:

- Students should develop an application in the group of 3-4 students and submit the project report which will consist of documentation related to Machine Learning model design.
- Document the findings and analysis in the analysis report preferably in IEEE Research Paper format.
- A Mini Project in this course should facilitate Project Based Learning among students.

Reference Books:

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Ltd. 2017, ISBN: 978-1-78588- 962-2
2. Ethem Alpaydin, "Introduction to Machine Learning", PHI second edition-2013, ISBN: 978-0-262-01243-0
3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Intelligent Systems Laboratory, University of Bristol, United Kingdom, First Edition 2012, ISBN-10: 1107422221; ISBN-13: 978-1107422223.
4. Tom Mitchell, "Machine Learning" McGraw Hill Publication 1997, ISBN: 0070428077.
5. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", O'Reilly Media, Inc. publisher 2017, ISBN: 9781491962299.

Web references:

1. https://balasahebtarle.files.wordpress.com/2020/01/machine-learning-algorithms_text-book.pdf
2. https://www.cin.ufpe.br/~cavmj/Machine%20-%20Learning%20-%20Tom%20Mitchell.pdf
3. http://scikit-learn.org/stable/datasets/
4. https://scikit-learn.org/stable/modules/model_evaluation.html
5. https://www.kaggle.com/datasets
6. http://scikit-learn.org

Part II: Fundamental of Blockchain	
Suggested list of Assignments	
Assignment No.	**Assignment Title**
1	Write a smart contract in solidity to perform basic arithmetic operations.
2	Write a program using Solidity for bank Transactions such as get balance, deposit and withdrawal etc.
3	Write a program using Solidity to Contract Smart Construction.
4	Build any simple smart contract and Test it with Truffle framework.
5	Study of Geth and Ganache Tools to Create a private Block chain, Creation of Account and Mining using geth.
6	Create and Configure Genesis block.
7	Using the BlockChain Concepts in Theory course and assignments covered in Group A above, Students should develop an application in a group of 2-3 students. **Create a Blockchain on Testnet for storing any critical information.** Document the findings and analysis in the analysis report preferably in IEEE Research Paper format **Note:** ● Instructor should maintain the progress report of the mini project throughout the semester from the project group and assign marks as a part of the term work. ● Oral examination will be on the Solution Proposed in Mini Project and BlockChain concepts used in the laboratory assignments. ● Practical examination will be on Laboratory assignments given in Professional Elective Course- Mini Project in this course should facilitate Project Based Learning among students.

Text Books:

1. Artemis Caro, “Blockchain: The Beginners Guide to Understanding the Technology Behind Bitcoin & Cryptocurrency”, Kevin Wolhuter, 2021, ISBN: 1922590061, 9781922590060
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O'Reilly Media, Inc.2017, ISBN: 9781491954386

Reference Books:

1. Mark Watney, Blockchain for Beginners: The Complete Step by Step Guide to Understanding Blockchain Technology”, CreateSpace Independent Publishing Platform, 2017, ISBN: 1548766887, 9781548766887.
2. Alwyn Bishop, “Blockchain Technology Explained”, CreateSpace Independent Publishing Platform, 2018, ISBN: 9781986273800.

NPTEL Course lectures links:

1. NPTEL Course “Introduction to Block Chain Technology & Applications”
2. https://nptel.ac.in/courses/106/104/106104220/
3. NPTEL Course on “Block chain Architecture & Use Cases”
4. https://nptel.ac.in/courses/106/105/106105184/

Part III: Full Stack Development

Guidelines for Students

1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Journal consists of prologue, certificate, table of contents and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, Conclusion/Analysis).

Guidelines for Laboratory /TW Assessment

1. Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality, and neatness.

Guidelines for Laboratory Conduction

1. All assignments are compulsory.
2. Students are expected to work in groups of 3 to 4 for mini project.

Suggested list of Assignments

Assignment No.	Assignment Title
1	Design a registration form using AngularJS inputs, and services for web application development.
2	Prepare product registration form using modules and controller in AngularJS
3	Design a web application for Product info, e-commerce, or any other applications that can have transaction details using Node.js and Express
4	Design a web application for e-commerce or students feedback review systems or any other applications with MongoDB Backend. using Node.js and Express.
5	Mini project -Design a web application for real world scenarios

Reference Books:

1. Brad Dayley “Learning Angular JS”, Addison-Wesley Professional, First Edition, 2014.
2. Steve Hoberman “Data Modeling for MongoDB”, Technics Publication, First Edition, 2014
3. Kyle Banker, Peter Bakkum, Shaun Verch, Dough Garrett, Tim Hawkins “MongoDB in Action”, Manning Publications, Second Edition, 2016.
4. Evan M. Hahn “Express in Action”, Manning Publications, First Edition, 2014.

Web references:

1. https://www.w3schools.com/whatis/whatis_fullstack.asp
2. https://www.geeksforgeeks.org/what-is-full-stack-development/
3. https://github.com/bmorelli25/Become-A-Full-Stack-Web-Developer

Group B

Part IV: Image & Video Processing

Guidelines for Students:

1. The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Prologue, Certificate, Table of Contents, and Handwritten Write-up of each assignment (Title, Objectives, Theory- Concept in brief, Algorithm, Flowchart, Test cases, Date of Completion, Assessment grade/marks and assessor's sign, Conclusion).
2. Program codes with sample output of all performed assignments are to be submitted as softcopy.
3. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing student's programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory /TW Assessment:

1. Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage.
2. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Laboratory Conduction

1. Each student must perform all assignments provide in a list.
2. Operating System recommended: - 64-bit Open-source Linux or its derivative.
3. Programming tools recommended: - C/ C++/ JAVA/ PYTHON/ MATLAB

Suggested list of Assignments

Assignment No.	Assignment Title
1	Apply any 4 point processing techniques on sample image.
2	Apply any 4 mask processing techniques on sample image.
3	Plot the histogram of an image and perform histogram equalization.
4	Perform Edge detection using Sobel, Prewitt and Roberts gradient operators.
5	Compress given image using cosine transform.
6	Extract the visual part from digital video and perform point processing method on video frames.
7	Mini Project based on a problem statement approved by the faculty member. Note: ● Instructor should maintain progress report of mini project throughout the semester from project group and assign marks as a part of the term work ● Oral examination will be on the Solution Proposed in Mini Project and Image and video processing Concepts used in the laboratory assignments. ● Practical examination will be on Laboratory assignments given in Project Based Learning Laboratory- Image & Video processing. ● Mini Project in this course should facilitate Project Based Learning among students.

Text Books:

1. Rafael.C,Gonzalez, Richard E Woods, “Digital Image Processing”,4th Edition, Pearson India, ISBN:9353062985, 2018.
2. Jain A.K, “Fundamentals of Digital Image Processing”, 4 Edition, Prentice Hall of India.

Reference Books:

1. B.Chanda, D. DuttaMajumder, “Digital Image Processing and Analysis”, 2 nd Edition, Phi learning, ISBN- 978-81-203-4325-2, 2011.

2.William K Pratt, “Digital Image Processing”, 4 Edition, Wiley, ISBN:9780471767770, 2006.

Part V: Internet of Things

Guidelines for Students:

1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Journal consists of prologue, certificate, table of contents and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, algorithm, sample input and expected output, conclusion).
3. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing student's programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory /TW Assessment:

1. Continuous assessment of laboratory work is done based on the overall performance and laboratory performance of students.
2. Each laboratory assignment assessment should assign grade/marks based on the parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each laboratory assignment assessment includes- performance, timely completion, innovation, efficiency, punctuality, and neatness.

Guidelines for Laboratory Conduction

1. Operating System: 64-bit Open-source Linux or its derivative.
2. Programming Tools: Open-Source PYTHON.
3. All assignments are compulsory to perform.

Suggested list of Assignments

Assignment No.	Assignment Title
1	Study of Raspberry Pi and Arduino Uno development boards. Understand the process of OS installation on the Raspberry Pi. Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.
2	Write an application to read temperature using LM-35 temperature sensor and Arduino board. If temperature crosses certain threshold value, then notify the user with buzzer.
3	Interface IR sensor to Raspberry Pi. Write a program to detect obstacle using IR sensor and notify it using LED.
4	Automate the T-Rex Dino Game in chrome browser using servo motor, light-dependent resistor and Arduino Uno.
5	Write a program to solve a system of linear congruence by applying the Chinese Remainder Theorem.
6	Write an application to detect fire and notify the user with buzzer or by sending SMS using GSM module

7	**Mini Project**: Implement any societal problem using suitable IoT hardware and protocols. ● Security management ● Health emergencies ● Road traffic management ● Energy Conservation ● Agricultural Problems ● Rural development ● Smart city

Text Books:

1. Matt Richardson and Shawn Wallace, "Getting with Raspberry Pi", MAKER MEDIA, ISBN: 978-93-5213- 450-2
2. Dr. Simon Monk, "Raspberry PiCook-Book", O'REILLY, ISBN: 978-93-5213-389-5
3. Hands-On Internet of Things with MQTT, Packt publication

Reference Books:

1. KimmoKarvinen and TeroKarvinen, "Arduino Bots and Gadgets", O'REILLY, ISBN: 13:978-93-5023-374-0
2. Don Wilcher, "BASIC Arduino Projects", MAKER MEDIA, ISBN: 13:978-93-5110-503-9

Web Reference:

1. https://www.geeksforgeeks.org/what-is-arduino/
2. https://www.tutorialspoint.com/arduino/index.htm
3. https://realpython.com/python-raspberry-pi/
4. https://www.tutorialspoint.com/raspberry_pi/index.htm

Part VI- Software Project Management

Guidelines for Students

1. The laboratory assignments are to be performed and submitted by students in a group of 3-4 students in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis.
2. Program codes with sample output of all performed assignments are to be submitted as softcopy.
3. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing student's programs maintained by Laboratory In-charge is highly encouraged.
4. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory/TW Assessment

1. Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student.
2. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes and punctuality.

Guidelines for Laboratory Conduction

1. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic.
2. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students.
3. Use of open-source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.
4. For the elective subject's students should form group of 3-4 students. The faculty coordinator will take care that all the assignment should be assigned to class and minimum two assignments are compulsory for each group.

Programming tools recommended: Software project management-MS project/Gantt Project/Primavera

Suggested list of Assignments

Assignment No.	Assignment Title
1	Prepare Work breakdown structure (WBS) for identified and selected software Project.
2	Prepare Project Plan for selected Software Project using Critical Path Method.
3	Prepare Project Plan for selected probabilistic Software Project using PERT.
4	Prepare a detailed Project Schedule for selected Software Project considering resource allocation and leveling using CPM.
5	Identify the risk involved and Prepare RMMM plan for selected Software Project.
6	Prepare presentation on Contemporary Software Project Management topic as CMM, PCMM, Agile Project Management, SCRUM, etc.

Reference Books:

1. Roger S.Pressman, ―Software Engineering - A Practitioner's Approach‖, 7th Edition McGraw Hill
2. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.

Web reference:

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview
2. Software Project Management By Prof. Rajib Mall & Prof. Durga Prasad Mohapatra | IIT Kharagpur
3. Agilealliance.org
4. Scrum.org
5. Scrumalliance.org

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Multivariate Data Analysis using R (OEC-3)			Code: BAS6608			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior Knowledge of:

Descriptive Statistics, Inferential Statistics, Probability, Statistical Data Analysis using R Is essential

Course Objectives:

1. This course aims at enabling the students to learn multivariate data collection, visualization, and preprocessing techniques for data science.

Course Outcomes:

After learning the course, the students should be able to:

1. **Use** data preprocessing methods in R and generate quality data for analysis.
2. **Implement** R packages and related functions to data science to **analyze** multivariate data.
3. **Describe** the multivariate data. using different data visualization techniques to
4. **Analyze** the multivariate data using dependent analysis methods using the R.
5. **Analyze** the multivariate data using independent analysis methods using the R.
6. **Develop** a model for Prediction and Decision Making for a data set.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Data Wrangling** Understanding the multivariate data, Standardizing Variables, Accessing Databases with R Software, Merging multiple data sources into a single dataset for analysis, Dealing with Missing values, dealing with extreme outliers in data, discrepancies or removing.	7
II	**Multivariate Data and Multivariate Analysis** Calculating Summary Statistics for Multivariate Data: Means and Variances Per Group, Between-groups Variance and Within-groups Variance for a Variable, Between-groups Covariance and Within-groups Covariance for Two Variables, Calculating Correlations for Multivariate Data, The multivariate normal density function.	8
III	**Multivariate Data Visualization in R Software** Geometric projection techniques: Scatter plot matrix, Hyper box, Trellis display, Parallel coordinates, Icon-based techniques: Chernoff faces, Stick figures, Star plots, Color icons, Pixel-oriented techniques: Query-independent techniques: visualize the entire dataset, Query-dependent techniques: visualize a subset of data that are relevant to the context of a specific user query, Hierarchical techniques, Hybrid techniques	8
IV	**Dependent Analysis** Multiple linear regression, Conjoint Analysis, Multiple Discriminant Analysis, Linear Probability Analysis, Multivariate analysis of variance (MANOVA), Canonical Correlation Analysis, Structural Equation Modeling	7

V	**Independent Analysis** Factor Analysis: Factor analysis model, the k-factor analysis model, Estimating the parameters in the k-factor analysis model. Cluster Analysis: Cluster analysis, K-means clustering, Displaying clustering solutions graphically, multidimensional Scaling, Correspondence Analysis	**7**
VI	**Multidimensional Scaling** Models for proximity data, Spatial models for proximities: Multidimensional scaling, Classical multidimensional scaling, non-metric multidimensional scaling. **Linear Discriminant Analysis** : Loadings for the Discriminant Functions, Separation Achieved by the Discriminant Functions, A Stacked Histogram of the LDA Values, Scatter plots of the Discriminant Functions, Allocation Rules and Misclassification Rate.	**8**
	Total	**45**

Reference Books:

1. Montgomery and Runger, "Applied Statistics and Probability for Engineers", Wiley, India, 6 Edition, ISBN: 9788126562947.
2. R. Johnson, "Probability and Statistics for Engineers", Prentice India Ltd, 8 Edition, ISBN 13:978- 8120342132.
3. S.P.Gupta, "Statistical Methods", Papperbook publication, 43 edition, ISBN: 9788180549892, 8180549895.
4. Everitt and Hothorn , "Use R!" series on using R for multivariate analyses, An Introduction to Applied Multivariate Analysis with R.
5. Barbara G. Tabachnick, Using Multivariate Statistics (4th Edition), Allyn & Bacon; 4th edition (August 9, 2000), ISBN-10:0321056779.
6. Yasunori Fujikoshi, Vladimir V. Ulyanov, Ryoichi Shimizu, Multivariate Statistics: High-Dimensional and Large-Sample Approximations, John Wiley & Sons, 15-Aug-201, ISBN:0470539860

e-sources:
NPTEL Course lectures links:

1. https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ma53 (Introduction to R software)
2. https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ma37 (Descriptive statistics using R software)

***Instead of the conventional mode of examination for MTE and ETE; Examination will be conducted using R software in the laboratory through proper invigilation.**

Program:	**B. Tech. (Computer Engineering)**			**Semester: VI**			
Course:	**Remote Sensing and GIS (OEC-3)**			**Code: BCI6603A**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
03	-	03	03	20	30	50	100

Prior Knowledge of:

Fundamental related to Surveying, types and Importance of various surveys ,Global Positioning System **(GPS)**

Is essential

Course Objectives: After Completing this course, student will have adequate background :

1. To comprehend fundamentals and principles of RS and GIS techniques.
2. To enhance students' capacity to interpret images and extract information of earth surface from multi-resolution imagery at multi-scale level.
3. To develop skills of Image processing and Geographical Information System
4. To study satellite image processing, satellite image interpretation, digitization and generation of thematic maps in a GIS.
5. To learn buffering and layer analysis for various engineering applications

Course Outcomes: After learning the course, the students will be able to:

1. Articulate fundamentals and principles of RS techniques.
2. Demonstrate the knowledge of remote sensing and sensor characteristics.
3. Distinguish working of various spaces-based positioning systems.
4. Analyze the RS data and image processing to utilize in civil engineering
5. Explain fundamentals and applications of RS and GIS
6. Acquire skills of data processing and its applications using GIS

Detailed Syllabus

Unit	**Description**	**Duration (H)**
I	**Introduction to Remote Sensing:** Definition and scope, history and development of remote sensing technology, electromagnetic radiation (EMR) and electromagnetic spectrum, EMR interaction with atmosphere and earth surface; atmospheric window, RS platforms, elements of remote sensing for visual interpretation viz. tone, shape, size, pattern, texture, shadow and association, applications in civil engineering/town planning	**07**
II	**Remote Sensing Satellites and Sensor Characteristics:** Types and their characteristics, types of sensors, orbital and sensor characteristics of major earth resource satellites, Indian remote sensing satellite programs, introduction to various open-source satellite data portals, global satellite programs, sensor classification, applications of sensor, concept of Swath & Nadir, resolutions, digital image. Introduction to spatial resolution, spectral resolution, radiometric resolution and temporal resolution, visual image interpretation, image interpretation	**08**
III	**GPS and GNSS:** Introduction to GNSS and Types, IRNSS, GPS, GPS components, differential GPS, types of GPS tracking, application of GNSS in surveying, mapping and navigation	**07**

IV	**Image Processing and Analysis:** Digital image, visual image interpretation, image interpretation keys, concept of spectral signatures curve, digital image processing, preprocessing and post processing, image registration, image enhancement, image transformations, digital image classification (supervised & unsupervised). Digital elevation model (DEM) and its derivatives, triangular irregular network model (TIN) and other models & their applications.	**08**
V	**Fundamentals of GIS:** Geographic information system, definition, spatial and non-spatial data, data inputs, data storage and retrieval, data transformation, Introduction to cloud computing (types & applications), data reporting, advantages of GIS, essential elements of GIS hardware, software GIS data types, applications of RS and GIS in civil engineering, hydrogeology, engineering geology, surveying and mapping.	**07**
VI	**GIS Data and Case Studies:** GIS data types and data representation, data acquisition, geo-referencing of data, projection systems, raster and vector data, raster to vector conversion, attribute data models and its types, remote sensing data in GIS, GIS database and database management system. Case studies:	**08**
	Total	**45**

Textbooks:

1. J. George "Fundamentals of Remote Sensing", Universities Press, Hyderabad, 2005
2. Principles of Remote Sensing, Panda B C, Viva Books Private Limited, 2008
3. Remote Sensing & Geographical Information System, M. Anji Reddy, BS Publications, Hyderabad, 4th Edition, 2022
4. S.K. Sinha "Fundamental of Remote Sensing and GIS", Ayushman Publication House,2014

Reference Books:

1. Remote Sensing & Digital Image Processing, John R. Jensen, Department of Geography University of South Carolina Columbia, 4th Edition, 2017
2. Remote Sensing and Image Interpretation, Lillesand Thomas M. and Kiefer Ralph, John, 7th Edition, 2015
3. Textbook on Remote Sensing, C. S. Agarwal and P. K. Garg, Wheeler Publishing House, 2000

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ce84/preview
2. https://onlinecourses.nptel.ac.in/noc23_ce52/preview
3. https://onlinecourses.nptel.ac.in/noc22_ce26/preview
4. https://elearn.nptel.ac.in/shop/nptel/remote-sensing-and-gis/
5. https://www.classcentral.com/course/swayam-remote-sensing-and-gis-14272

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Building Services and Maintenance (OEC-3)					Code: BCI6603B	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Course Objectives:

1. To understand the different building services provisions.
2. To study the suitable electrical and mechanical services, fire protection, acoustic, water supply and sound Insulations.
3. To examine the purpose and type of building maintenance.

Course Outcomes: After learning the course, the students should be able to:

1. Understand different building services provisions.
2. Interpret the importance of building ventilation.
3. Distinguish the suitable electrical as well mechanical services for particular requirements of buildings.
4. Discover the knowledge of Fire Protection, Acoustic, and Sound Insulations.
5. Provide awareness of laws and regulations of water supply systems related to building services.
6. Select different types of maintenance in building services.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to Building Services**: Definitions, Objective and uses of services-different types building, Classification of building services, Types of services and selection of appropriate services for given project.	07
2	**Building Ventilation:** Natural and artificial lighting principles and factors, Arrangement of luminaries, Distribution of illumination, Utilization factors, Necessity of Ventilation Types – Natural and Mechanical Factors to be considered in the design of Ventilation.	08
3	**Electrical Services & Mechanical Services in Buildings:** Electrical services in the building technical terms and symbols for electrical installations and Accessories of wiring, Systems of wiring Plumbing & Air-Conditioning, Air Distribution system, Cleaners,	08
4	**Fire Protection, Acoustic and Sound Insulations:** Introduction, causes of fire and Effects of fire, General Requirements of Fire Resisting building as per IS and NBC 2005, Requirement of good Acoustic, Various sound absorbent, Factors to be followed for noise control in residential building.	08
5	**Water and Sanitation Water quality Purification and treatment**: - water supply systems-distribution systems municipal bye laws and regulations, Rain Water Harvesting Sanitation in buildings, arrangement of sewerage systems in housing.	07

6	**Building Maintenance:** Role of maintenance in durability and serviceability of buildings, Economic aspects of maintenance. Different types of maintenance.	**07**
	Total	**45**

Text Books:

1. A text book on Building Services R. Udaykumar Eswar Press, Chennai
2. Building Services S. M. Patil Seema Publication, Mumbai Revised edition
3. National Building Code of India - 2005 Bureau of Indian Standards BIS, New Delhi.

Reference Books:

1. Building Construction Dr. B. C. Punmia Laxmi Publications (P) Ltd., New Delhi
2. Building Construction P. C. Varghese PHI Learning (P) Ltd., New Delhi
3. Building repair and Maintenance Management P. S. Gahlot CBS Publishers & Distribution(P) Ltd

E-resource-https://nptel.ac.in/courses/105102176

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Designing with Raspberry Pi (OEC-3)			Code: BET6601			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior Knowledge of:
Basics of Programming
Is essential

Course Objectives:

1. To explain fundamentals of Raspberry pi (Rpi) and installation of OS in Rpi
2. To demonstrate the Python programming and interfacing of sensors and actuators with Rpi
3. To describe the Node-RED tool used in Rpi and its applications.

Course Outcomes:

After completion of this course, students should be able to:

1. **Describe** the basic specifications and operating systems of Raspberry Pi.
2. **Illustrate** the usage of Node-RED tool for Raspberry Pi programming.
3. **Understand** the Python programming concepts.
4. **Apply** the concepts of programming for sensor interfacing with RPi.
5. **Apply** the concepts of programming for actuator interfacing with RPi.
6. **Design** IoT based applications with Python programming and Raspberry Pi.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Getting started with Raspberry Pi** Basic functionality of Raspberry Pi board, Physical design and specifications, GPIO Pin description of Rpi, Reading the datasheet of RPi, comparison of various Rpi models, Rpi as mini- computer. Introduction of various operating systems of Rpi, Installation of Raspbian/Noobs/OSMC operating system on Rpi, first boot and basic configuration of Rpi, Introduction to Linux commands required to configure Rpi, Overview of Graphic User Interface (GUI).	08
II	**Getting started with Node-RED tool on Rpi** Prerequisite for Node-RED, Installing and upgrading Node-RED, Running Node-RED app locally and as a service on network, auto-start on boot, opening the editor, installation of various libraries for Node-RED, adding node, add debug node, wire the nodes, deploy the flow.	06
III	**Programming the Raspberry Pi** Introduction to Python programming language: Python Programming Environment, Python Expressions, Strings, Functions, Data types in python, importing libraries, flow control, conditional statement, Loops.	10
IV	**Sensor interfacing with Rpi** Basics of sensors: What are sensors? Types of sensors Sensor interfacing: Temperature and Humidity sensor (DHT11), PIR Motion sensor, obstacle detection using Ultrasonic sensor, soil moisture sensor	06

V	**Actuator interfacing with Rpi** Basics of actuators: What are actuators?, Their need in making a closed loop system Actuator interfacing: Electronic Relays, LED's, Buzzers/Fan, DC Motor, Stepper motor, LCD.	**07**
VI	**Case Study based following topics** Home Automation, Smart City, Smart Farming, Smart Transportation, Health and Lifestyle, Pollution Monitoring system	**08**
	Total	**45**

Text Books:

1. Gary Mitnick,"Raspberry Pi 3: An Introduction to using Python Scratch, javascript and more", 1st edition Createspace Independent publishing Platform 2017.
2. Tim Cox, "Raspberry Pi for python program cookbook" Packt Publishing Limited, 2nd edition, 2016
3. John C. Shovic,"Raspberry Pi IoT Projects: Prototyping Experiments for Makers", 1st edition Apress Berkeley CA, 2016

Reference Books:

1. Sean McManus, Mike Cook, "Raspberry Pi for Dummies", Wiley Publishers, 4th edition, 2021
2. Maik Schmidt, "Raspberry Pi: A Quick-Start Guide", The pragmatic programmers, 1st edition LLC, 2012
3. Simon Monk,"Programming the Raspberry Pi", 2nd Edition, McGraw Hill publications, 2012
4. Matt Richardson,"Getting started with Raspberry pi", 3rd Edition, Make community, LLC 2016
5. Derek Molloy,"Exploring Raspberry pi", 1st Edition, Wiley, 2016

MOOCs Courses:

1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs74/preview

Program:	**B. Tech. (Computer Engineering)**			**Semester: VI**			
Course:	**Basics of Automotive Electronics (OEC-3)**			**Code: BET6602**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
03	-	03	03	20	30	50	100

Prior Knowledge of:
Electrical & Electronics
Is essential

Course Objectives:

1. To introduce Electronics Control Unit(ECU) used in Automotive applications.
2. To apply operating principles of sensors and actuators used in automotive.
3. To explore the role of electronic systems in Active and passive safety systems.

Course Outcomes:

1. To apply the concept of electronics systems in automotive applications.
2. To explore different sensors and actuators.
3. Illustrate vehicle motion control systems.
4. Understand algorithms used in Engine Control System.
5. Describe the role of electronics in Active and passive safety systems.
6. Make use of automotive components, subsystems, and basics of Electronic Engine Control in the automotive industry.

Detailed Syllabus

Unit	**Description**	**Duration (H)**
1	**Automotive Systems Overview:** Automotive vehicle technology, Present trends in automobiles with emphasis on increasing role of electronics and software, Overview of typical automotive subsystems and components, Body, Chassis, and Powertrain Electronics	**07**
2	**Sensors :** Basic sensor arrangement, Types of sensors such as oxygen sensors, Crankshaft angle position sensors, Fuel metering/ vehicle speed sensors, Flow sensor, Temperature, Exhaust Gas Oxygen (O2/EGO), Air mass flow sensors, Throttle position sensor, Strain Gauge MAP sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Engine Coolant Temperature (ECT) Sensor, Piezoelectric Knock Sensor. **Actuators :** Solenoids, Stepper Motors, Relays, Fuel Injector, EGR Actuator, Ignition System	**09**
3	**Vehicle Motion Control:** Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS)	**07**
4	**Engine Control System:** Algorithms for engine control including open loop and closed loop control system, Electronic ignition, EGR for exhaust emission control.	**07**

5	**Active and passive safety systems:** Body electronics including lighting control, Remote keyless entry, Immobilizers, Electronic instrument clusters and dashboard electronics, Antilock braking system, Computer vision based ADAS	**07**
6	**Future Automotive Electronic Systems:** Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control	**08**
	Total	**45**

Text Books:

1. William B. Ribbens, "Understanding Automotive Electronics- An Engineering Perspective", 7th edition, Butterworth-Heinemann Publications, 2017.
2. Ronald K. Jurgen, "Automotive Electronics Handbook", Mc-Graw Hill, 1999
3. oliverscheid, "Autosar Compendium, Part 1: Application & RTE", Create Space Independent Publishing Platform, 2015

Reference Books:

1. Robert Bosch, "Automotive Hand Book", 10th edition, Wiley Publications, 2018
2. Kiencke, Uwe, Nielsen & Lars, "Automotive Control Systems for Engine, Driveline and Vehicle", Second edition, Springer Publication, 2005.
3. John F. Kershaw, James D. Halderman, "Automotive Electrical and Electronic Systems", 5thEdition, Pearson Prentice Hall, 2007

e-resource:

1. https://autosartutorials.com/
2. https://www.udemy.com/course/learn-autosar-from-scratch/

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Web Technology (OEC-3)					Code: BIT6601	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior knowledge of

Computer Fundamentals , Any one computer Language

Is essential

Course Objectives:

1. To write a valid standards-conformant HTML document involving a variety of element types, including hyperlinks, images, lists, tables, and forms
2. To use CSS to implement a variety of presentation effects in HTML and XML documents, including explicit positioning of elements
3. To demonstrate techniques for improving the accessibility of an HTML document
4. To learn the concepts commonly used in dynamic language programming, such as introspection, higher-order functions, and closures.

Course Outcomes:

After learning the course, the students will be able to:

1. Illustrate static website development using HTML and CSS.
2. Demonstrate static and dynamic website development using Bootstrap.
3. Discuss the basics of JavaScript in Web Development.
4. Make use of AJAX and JQuery in mobile website development
5. Describe MVC architecture as Front end framework.
6. Build responsive web application using ReactJS

Detailed Syllabus

Unit	Description	Duration (H)
1.	**HTML** Getting started with HTML, Why HTML, Tags and Elements, Attributes, Properties, Headings list, Links, Tables, Images, HTML Form, Media (Audio, Video), Semantic HTML5 Elements. **CSS:** Types of CSS, How to use CSS, Properties, Classes, Child-Class (Nested CSS), Colors, Text, Background, Border, Margin, Padding, Positioning (flex, grid, inline, block), Animation, Transition.	6
2.	**BOOTSTRAP** CSS over Bootstrap, How to Use Bootstrap, Bootstrap Grid System, Bootstrap Responsive, Bootstrap Classes, Bootstrap Components (i.e., Button, Table, List, etc.),Bootstrap as a Cross Platform. W3C: What is W3C, How W3C handles /Supports Web Technologies.	6

3.	**JavaScript** Introduction to Scripting languages, Introduction to JavaScript (JS), JS Variables and Constants, JS Variable Scopes, JS Data Types, JS Functions, JS Array, JS Object, JS Events. Advanced JavaScript: JSON - JSON Create, Key-Value Pair, JSON Access, JSON Array, JS Arrow Functions, JS Callback Functions, JS Promises, JS Async-Await Functions, JS Error Handling	**7**
4.	**AJAX** Why AJAX, Call HTTP Methods Using AJAX, Data Sending, Data Receiving, AJAX Error Handling. JQUERY :Why JQuery, How to Use, DOM Manipulation with JQuery, Dynamic Content Change with JQuery, UI Design Using JQuery.	**10**
5.	**Front-End Frameworks** Web Framework Types. MVC: What is MVC, MVC Architecture, MVC in Practical, MVC in Web Frameworks. TypeScript: Introduction to TypeScript (TS), Variables and Constants, Modules in TS.	**6**
6.	**ReactJS** Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook, useContext() hook	**10**
	Total	**45**

Text Books:

1. Ralph Moseley & M. T. Savaliya, “Developing Web Applications”, Wiley publications, ISBN 13: 978812653867
2. Jeremy McPeak& Paul Wilton,” Beginning JavaScript”, Wrox Publication, ISBN-13: 978-0470525937

Reference Books:

1. Steven Holzner,”HTML Black Book”, Dremtech press.
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications: Concepts and Real World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson.

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	3D Printing and Modeling (Open Elective-III)					Code: BME6603A	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior knowledge of basics of

Materials Engineering ,CAD software are essential

Is essential

Course Objectives:

1. To understand the importance of 3D Printing process for various applications.
2. To be familiar with the different 3D printing process.
3. To create CAD model that satisfy product development/prototyping requirements.

Course Outcomes:

The Students will be able to,

1. Understand the meaning and generic steps of the 3D printing process.
2. Identify the effects of critical parameters in the Stereo lithography and Solid ground curing process.
3. Identify the effects critical parameters in the Laminated object manufacturing and Fused Deposition Modeling Process.
4. Identify the effects critical parameters in the Selective laser sintering process and Direct Energy deposition.
5. Develop the STL file and create sliced model by using open source software
6. Understand the various application of 3D printing process.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to 3D Printing**: Meaning of 3D Printing, The Generic/steps in 3D printing Process, Materials used in 3D Printing, Types of 3D Printing process and Benefits of 3D printing, Design for Additive manufacturing (DFAM).	8
2	**Liquid based systems:** Stereo lithography apparatus (SLA): Specifications, parameters, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages. Solid ground curing (SGC): Specifications, parameters, process, working, principle, applications, advantages and disadvantages.	7
3	**Solid based systems:** Laminated object manufacturing (LOM): Specifications, parameters, Process, Working principle, Applications, Advantages and disadvantages. Fused Deposition Modeling (FDM): Specifications, Process, parameters, Working principle, Applications, Advantages and disadvantages.	7
4	**Powder Based Systems:** Selective laser sintering (SLS): Specifications, process, parameters, working principle, applications, advantages and disadvantages. Direct Energy deposition (DED): Specification, parameters, process, working principle, applications, advantages and disadvantages.	8

5	**Modelling in 3D printing:** Meaning of STL file, Special rules for the STL format, Meaning of Slicing, Components of Slicing software, Preparation of CAD models, Converting into STL file, slicing by using open source software.	**8**
6	**Applications of 3D Printing**: Prototyping and manufacturing, Medical applications, Automotive applications, Aerospace & Defence applications, Constructions applications. Art and Jewellery applications.	**7**
	Total	**45**

Text Books:

1. Ian Gibson, David Rosen, Brent Stucker, Additive Manufacturing Technologies, Third Edition, Springer Publications,2020. ISBN 978-1-4939-2112-6.
2. Vannessa Goodship , Bethany Middleton, Ruth Cherrington, Design and Manufacture of Plastic Components for Multi functionality, First Edition, Elsevier Publications, 2016, ISBN: 978-0-323-34061-8.

Reference Books:

1. Henrique Amorim Almeida and Paulo Jorge da Silva Bártolo, Mathematical Modeling of 3D Tissue Engineering Constructs, First Edition, Springer International Publishing, 2018, ISBN: 978-3-319-45444-3

Program:	**B. Tech. (Computer Engineering)**			**Semester: VI**			
Course:	**Material Informatics (Open Elective-III)**			**Code: BME6603B**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
03	-	03	03	20	30	50	100

Prior knowledge of :
Data Science , Machine Learning ,Python/R programming
Is essential

Objectives:

1. To Aquitaine students about materials, their properties, structure property relationship.
2. To create awareness about the importance of statistics in materials data analysis.
3. To imbibe significance of data science, machine learning in use, selection and analysis of materials.

Outcomes:
The Students will be able to,

1. Compare different materials based on their structures.
2. Interpret material property data and draw conclusions.
3. Apply statistical methods for materials data analysis.
4. Use programming languages like python/R programming for materials data analysis.
5. Apply machine learning algorithm for interpretation of materials data.

Detailed Syllabus

Unit	**Description**	**Duration (H)**
1.	**Introduction to materials:** Classification of materials, structure of materials **:** Atomic structure, crystal structure and microstructure, material properties: Physical, Mechanical, Electrical, Magnetic etc.	**7**
2.	**Materials Information:** Structure property relationship**,** Applications and selection of materials, Analysis and synthesis of materials.	**7**
3.	**Statistics and Materials:** Basic probability and statistics, basic R/ Python , Inaccurcacies and error and its propagation, Descriptive data analysis, Probability distributions, Probability distributions using R/Python, Fitting functions to data: regression, testing significance of fit.	**8**
4.	**Experimental data**: Processing of experimental data using R/Python, R/Python for graphical handling of data and fitting.	**7**
5.	**Feature extraction:** Statistical features, Principal Component Analysis. Feature selection: Ranking, Decision tree - Entropy reduction and information gain, Exhaustive, best first, Greedy forward & backward, Applications of feature extraction and selection algorithms in materials Engineering.	**8**
6.	**Classification:** Decision tree, Random forest, Naive Bayes, Support vector machine. Regression: Logistic Regression, Support Vector Regression. Regression trees: Decision tree, random forest, K-Means, K-Nearest Neighbor (KNN). Applications of classification and regression algorithms in materials Engineering.	**8**
	Total	**45**

Text Books:

1. William D.Callister, ‘Material Science and engineering an introduction’, Wiley Publication, 2013
2. B Joshi, ‘Machine Learning and Artificial Intelligence’, Springer, 2020.
3. Emmanuel Paradis, ‘R for Beginners’, Open source online
4. Databases: MaterialsProject.org, MaterialsWeb.org
5. PYMATGEN, MPINTERFACES software for materials analysis.

Reference books:

1. O. Isayev, A. Tropsha and S. Curtarolo, ‘Materials Informatics: Methods, Tools, and Applications’, Wiley, 2019
2. K. Rajan, ‘Informatics for Materials Science and Engineering’, Elsevier, 2013
3. Solanki, Kumar, Nayyar , ‘Emerging Trends and Applications of Machine Learning’, IGI Global, 2018.model

Program:	**B. Tech. (Computer Engineering)**			**Semester: VI**			
Course:	**Smart Cities & Building Automations (OEC-4)**			**Code: BCI6604A**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
03	-	03	03	20	30	50	100

Prior Knowledge of:

Physics ,Mathematics Programming Language
Is essential

Course Objectives:

1. To understand the concept of smart city and associated challenges
2. To understand latest technologies used in intelligent building
3. To recognize the concepts of Internet of Things and able to build IoT applications
4. To apply the programming and use of Arduino and Raspberry Pi boards for Smart Cities

Course Outcomes:

After learning the course, the students will be able to:-

5. Understand the concept of smart city and associated challenges
6. Identify latest technologies used in intelligent building
7. Implement program and configure Arduino boards for various designs
8. Demonstrate Python programming and interfacing for Raspberry Pi.
9. To design IoT applications in different domains

Detailed Syllabus

Unit	**Description**	**Duration (H)**
1	**Introduction to Smart cities** Introduction to city planning, Concept, Principle stakeholders, key trends in smart cities developments	**07**
2	**Smart Cities Regulations** Understanding smart cities, Global Standards and performance benchmarks, Practice codes for smart city development	**07**
3	**Smart Cities Planning and Development** Smart city planning and development, Dimension of smart cities, Financing smart cities development, Governance of smart cities	**07**
4	**IoT in Construction** Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.	**08**
5	**Introduction to Arduino Programming,** Integration of Sensors and Actuators with Arduino for smart city applications	**08**
6	**Introduction to Python and Raspberry pi for Smart Cities** Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi for Smart Cities and Smart Homes	**08**
	Total	**45**

Text Books:

1. Jo Beall (1997); "A city for all: valuing differences and working with diversity"; Zed books limited, London (ISBN: 1-85649-477-2).
2. UN-Habitat; "Inclusive and sustainable urban planning: a guide for municipalities"; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4).
3. Arup Mitra; "Insights into inclusive growth, employment and wellbeing in India"; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2).
4. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases"(2018), by Pethuru Raj and Anupama C. Raman (CRC Press).
5. "Make sensors"(2014) Terokarvinen, Kemo, Karvinen and Villey Valtokari, 1st edition, Maker media.
6. "Internet of Things: A Hands-on Approach"(2018), by Arshdeep Bahga and Vijay Madisetti.

Reference Books

1. "Urban Planning and cultural identity" (2004); William J. V. Neill, Routledge, London (ISBN: 0- 415-19747-3)
2. "Remaking the city: Social science perspective on urban design"(2015) John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); State University of New York Press, Albany (ISBN: 0-87395-678-8)
3. "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science (2007) Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers
4. "Draft Concept Note on Smart City Scheme". Government of India – Ministry of Urban Development (http://indiansmartcities.in/downloads/CONCEPT_NOTE_- .12.2014__REVISED_AND_LATEST_.pdf)
5. "Internet of Things: A Hands-On Approach"(2018) Vijay Madisetti, Arshdeep Bahga,
6. "Fundamentals of Wireless Sensor Networks: Theory and Practice" (2018), Waltenegus Dargie,Christian Poellabauer,

Beginning Sensor networks with Arduino and Raspberry Pi (2013) Charles Bell, A press.

e-References

1. Smart City Mission Guidelines, India, https://smartcities.gov.in/guidelines
2. Smart Cities – Management of Smart Urban Infrastructures by Coursera, https://www.coursera.org/learn/smart-cities
3. e-Learning Course on Smart City by edx, https://www.edx.org/course/smart-city

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Mechanical Electrical Plumbing (MEP) Systems (OEC-4)			Code: BCI6604B			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior Knowledge of:

Basics of air conditioning , Basics of Electrical Engineering ,Basics of Mechanical Engineering Is essential

Course Objectives:

After Completing this course, student will have adequate background :

1. To learn the concept of HVAC
2. To recognize the technologies used in electrical services
3. To understand the concepts of plumbing services
4. To learn the fire protection system

Course Outcomes: After learning the course, the students will be able to:

1. Analyse and design HVAC system
2. Implement the technologies used in electrical services
3. Apply plumbing services
4. Design fire protection system

Detailed Syllabus

Unit	Description	Duration (H)
1	**HVAC** Introduction to HVAC, Basic Components of Air-Conditioning and Refrigeration machines, Classification of Air-Conditioning System , Categories of Air Conditioning , Study of sychometric Charts , Load Calculation, Air Distribution System, Static Pressure Calculation, Hydronic System, VRF/VRV System, Air Conditioning Concepts, Ventilation systems.	07
2	**Basics of Electrical Implementations** General, Codes & Standards to be followed, Electrical equipment's and its application used in the installation, Means of electrical distribution for installation, Major electrical loads used in the installation, Electrical design calculations, Various design stages & Sequence of electrical design procedure.	08
3	**Electrical Analysis and Design** Major electrical loads used in the installation, Electrical design calculations, Various design stages & Sequence of electrical design procedure.	07
4	**Plumbing** Plumbing Systems, Design of Domestic Water Supply and Distribution System, Design of Sanitary Drainage System, Drawings – Plumbing Layouts.	08
5	**Fire Protection system** Introduction To Fire Fighting, Classification Of Fire (Description), Fire Extinguisher Types- Using Procedure And General Maintenance, Fire Protection Systems-1. Active 2. Passive Refuge Areas – Rules & Regulations.	07

6	**Fire Alarm System** Designing of fire alarm system, NFPA, NBA & FSAI Code For Fire Fighting System Designing, Fire Fighting, Hydraulic Calculation For High Rise Buildings, Fire norms for new project construction.	**08**
	Total	**45**

Text Books:

1. Design of Mechanical & Electrical Systems. Trost, Pearson Publishing, ISBN 978-0-13097235-4 .
2. MEP Planning Manual: Become a Professional Construction Engineer: 1 (Arabmep H), ISBN-1: 1677068930, ISBN-13 : 978-1677068937.
3. MEP Databook (Construction Databooks) Hardcover – 16 August 2000 by Sidney Levy, McGraw-Hill Education.
4. Electrical and Mechanical Services in High Rise Building (English, Paperback, Mittal A.K.), CBS Publisher and Distrubutor Pvt.Ltd.

Reference Books:

1. MEP Guide for Planning and Scheduling by Planningengineer.net
2. Handbook of Building Construction; Data for Architects, Designing and Construction Engineers, and Contractors by Hool George, Publisher: Nabu Press.

e-Reference:

1. Online Mechanical, Electrical and Plumbing Design Training Course by Advance Electrical Design & Engineering Institute (AEDEI) https://www.advanceelectricaldesign.com/
2. Revit MEP Essentials by CADD Centre, India. https://www.cloudkampus.com/clp/revit-mep-essentials
3. MEP Course by MEP Training Institute, India. https://www.mepcentre.com/course/mep
4. Foundation Course on Building MEP Services by MEPA (Mechanical Electrical Plumbing engineers Association) http://www.mepaworld.com/training

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Designing with Arduino platform (OEC-4)			Code: BET6603			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior knowledge of:

The Basics of programming
Is essential

Course Objectives:

1. To make the students aware of the Arduino platform in terms of the physical board, Arduino IDE and libraries.
2. To make the students aware of circuit prototyping, and interfacing of peripherals with Arduino.

Course Outcomes:

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

1. Summarize the features of the Arduino board.
2. Apply the programming concepts to the Arduino board.
3. Make use of analog and digital pins of Arduino.
4. Develop a system to monitor the real-time parameters using Arduino.
5. Illustrate the Object detection using Arduino.
6. Realize the Sound sensing and distance measurement using Arduino.

Detailed Syllabus

Unit	Description	Duration (H)
1.	**Knowing Your Arduino:** Introduction of Arduino Uno, Atmega328P,Arduino Shields, getting to know the Arduino Uno Pins, power, clock, Using the digital input and output pins, analog input and output pins, Introduction to Serial (UART) communications, I²C (TWI) communications, SPI communications	07
2.	**Arduino Ide And Programming Concepts.** An introduction to the Arduino IDE: Getting and installing the Arduino IDE and uploading a sketch to your Arduino. An introduction to Arduino programming, Understand the basic parts of an Arduino sketch, custom functions Creating custom functions and the return keyword, Using variables, constants, Introduction to control structures: The "if”,” while", "For”,” Switch" statement	08
3.	**Arduino Programming Hands On** Digital input/output - how to read the state of a button control an LED, Analog input/ output - how to read the state of a potentiometer and create a fading LED, Introduction to the RGB (color) LED, Wiring the RGB LED, RGB LED: creating colors, using a library to control an RGB LED with PWM.	08
4.	**Monitoring Real Time Parameters Using Arduino** Interfacing of Ultra -violet light sensor, RGB color sensor, DHT22 sensor, LM 35 to Arduino for monitoring the parameters like temperature, humidity, etc.	07

5.	**Interfacing With Arduino - I.** Introduction to detecting acceleration with the ADXL335, Plugging the ADXL335 directly in the Arduino, and detect its orientation, A demonstration of using the IR and PIR sensor with the Arduino	**07**
6.	**Interfacing With Arduino - II.** Introduction to the ultrasonic distance sensor, Wiring and understanding Trigger and Echo, and calculating distance. Introduction to the analog sound sensor, A demonstration and sketch of the analog sound sensor and the digital sound sensor. Case study elaborating the use of Arduino in various applications.	**08**
	Total	**45**

Text Books:

1. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury, CRC Press, Taylor & Francis Group, 1st edition 2017.
2. Arduino Made Simple by Ashwin Pajankar, BPB Publication, 1st edition 2018.

Reference Books:

1. Exploring Arduino: Tools and Techniques for Engineering Wizardry 1st Edition,by Jeremy Blum , SBN- 13: 978-1118549360,ISBN-10: 1118549368

e-Reference:

1. https ://www.arduino.cc/en/Tutorial/HomePage
2. https://spoken-tutorial.org/tutorial-search/?search_foss=Arduino&search_language=English

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Communication Protocols for e-Vehicle (OEC-4)					Code: BET6604	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior knowledge of

Fundamentals of computer networks , Electric machines

Is essential

Course Objectives:

1. To make student understand basics of EVs, including EV Components, architecture, and energy management.
2. To make student able to compare various topologies of EV communication systems.
3. To introduce student about connectors and chargers in EV's
4. To make student to evaluate the impact of EVs in Connected Mobility and Autonomous Mobility

Course Outcomes:

After learning the course, the students should be able to:

1. Understand the basics of e-vehicles
2. Illustrate the EV Components and controlling units.
3. Compare various EV Communication protocols & their need in the e-Mobility business
4. Understand the fundamentals of EVSE Communication
5. Analyze connectors and chargers in EVs
6. Apply the Knowledge of e-Mobility through Indian Roadmap Perspective

Detailed Syllabus

Unit	Description	Duration (H)
1	**EV Basics** Overview of EVs and challenges, the architecture of EVs, EV market and promotion, infrastructure needs, energy sources used in EVs & HEVs, medium of power transfer (conductive and wireless), and wireless power transfer.	**07**
2	**EV Components** Battery Management System (BMS), BLDC Motors, Inverter Unit, Powertrain Unit and Couplers with Chassis, PDU (Power Distribution Unit), BCM (Body Control Module, ECU, and Tuning Parameters.	**07**
3	**EV Communication protocols** Communication Systems in EV (CAN and LIN), V2V, V2G and its applications in power systems, power saving & coordinated charging, the layout of power converters, electrification challenges	**08**
4	**Electric vehicle supply equipment (EVSE)** Basics of EVSE, EVSE Power Module selection and technical specification, Selection of EVSE Communication Protocol (PLC / Ethernet / Modbus/ CAN Module), Communication gateway.	**08**

5	**Connectors and Chargers** Types of EV charging connectors, EV Plug Standards, Selection and Sizing of Common Types of Connectors and Applications, Selection of AC and DC charger types.	**07**
6	**Charging communication & e-Mobility** Communication Interface between the charger and CMS, CCS (Combined Charging System), CHAdeMO, Tesla, Specification of open charge point protocol, Connected Mobility and Autonomous Mobility, e-Mobility: Indian Roadmap Perspective, EV integration in smart grid, social dimensions of EVs.	**08**
	Total	**45**

Text Books:

1. William Ribbens, Understanding Automotive. Electronics. An Engineering Perspective. 7th edition, 2017.
2. Jack Erjavec and Nathan Smith, Hybrid, Electric and Fuel-Cell Vehicles, 3rd Edition, 2022.
3. Tom Denton, Electric and Hybrid Vehicles, 2nd Edition, 2016.

Reference Books:

1. Wireless Communications Principles and Practice; by Theodore S Rappaport, Pearson Education, 2nd edition 2018
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2010.
3. Wei Liu (General Motors, USA), Hybrid Electric Vehicle System Modelling and Control, John Wiley & Sons, Inc., 2nd edition, 2017.
4. Teresa Donateo, Hybrid Electric Vehicles, , Published by ExLi4EvA,1st edition , 2017

NPTEL Online Courses / MOOCs:

1. NPTELcourse on Fundamentals of Electric vehicles: Technology & Economics, IIT Madras, Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan https://nptel.ac.in/courses/108106170
2. NPTEL course onElectric Vehicles - Part 1, IIT Delhi, Prof. Amit Jain https://nptel.ac.in/courses/108102121
3. NPTEL Archives on Electricvehicles and renewable energy, IIT Madras https://archive.nptel.ac.in/courses/108/106/108106182/
4. Electric Vehicles Comprehensive Course, Udemy.com https://www.udemy.com/course/electric-vehicles-comprehensive-course/

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Mobile Application Development (OEC-4)					Code: BIT6602	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior knowledge of
Java Programming Language
Is essential

Course Objectives:

1. To learn a new mobile application development environment.
2. To develop problem solving skills with mobile applications.
3. To develop competency for the design, coding and debugging for mobile app development.
4. To build the programming skills using 'Android Programming Language.

Course Outcomes:

After learning the course, the students will be able to:

1. Explore the android environment for mobile application development.
2. Design android user interface for Mobile application.
3. Explore different notification interfaces to facilitate communication between components.
4. Apply different persistent storage techniques used to store and retrieve data in android applications.
5. Make use of SQLite in android application development,
6. Explore android services in android application development.

Detailed Syllabus

Unit	Description	Duration (H)
1.	**Introduction to Android Operating System** Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools. Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application, Activities, Activity lifecycle,	**08**
2.	**Android User Interface** Measurements – Device and pixel density independent measuring units, Layouts – Linear, Relative, Grid and Table Layouts etc. User Interface (UI) Components – Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers etc Event Handling – Handling clicks or changes of various UI components.Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.	**08**

3.	**Intents and Broadcasts** Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts	**08**
4.	**Persistent Storage** Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference	**05**
5.	**Database** Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)	**08**
6.	**Android Services** Introduction of android services and its lifecycle. Location Services,Types of Services, Best practices- Performance, Testing,Privacy, Security etc. Deployment of Application.	**08**
Total		**45**

Text Books:

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

Reference Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013
2. Android Application Development Black Book Pradeep Kothari, KLSI,Dreamtech Press

Web references:

1. https://www.javatpoint.com/android-service-tutorial
2. https://developer.android.com/guide/components/services

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Model Based System Engineering (Open Elective IV)					Code: BME6604A	
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Hours	Credit	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior Knowledge of: Not required

Course Objectives:

Students are expected to:

1. Acquire Fundamentals of systems and subsystems which should include different processes, properties.
2. Develop structural and behavioral aspects of general diagramming.
3. Perform a functional analysis.
4. Construct systems engineering requirements.

Course Outcomes:

The Students will be able to,

1. DESCRIBE the methods, Processes and practices of systems engineering.
2. UNDERSTAND Fundamentals of systems and subsystems.
3. DIFFERENTIATE between traditional document-based and model based systems engineering.
4. ANALYZE three pillars of MBSE: languages, methods, and tools.
5. CREATE models and diagrams using modelling language.
6. APPLY Model Based Systems Engineering (MBSE) approach to Engineering problems.

Detailed Syllabus

Unit	Description	Duration (H)
1.	**Introduction to Systems Engineering** History / Background, Industrial revolution, Discover Systems Engineering, Systems Engineering definition INCOSE, V-Cycle. Cyber physical systems – Advantages, Necessity and its challenges: a) Security: Control of interfaces, emergent vulnerabilities. b) Data: Privacy, data capture, analysis, access issues, data adequacy and accuracy. c) Regulations and Standards: Policy, Standards. d) Life cycle Sustainment.	8
2.	**Fundamentals of MBSE :** Introduction, Systems, subsystems and levels, Concrete and abstract objects, Properties, States, event, process, behavior and fact, Systems of interest.	8
3.	**Three Pillars of MBSE :** Modelling methods, Modelling tools and Modelling language	7
4.	**Overview of System Modeling Language** SysML Diagram overview, General diagram concepts**,** the structural aspect and the behavioural aspect, The relationships between behavioural diagrams and structural diagrams	8

5.	**Process Modelling with MBSE** Approach, The Process Modelling Framework, Using the process modelling framework	**7**
6.	**Requirements Modelling with MBSE** Introduction, The Requirements modelling Framework, Using the Requirements modelling Framework (ACRE Process)	**7**
	Total	**45**

Text Books:

1. **SysML for Systems Engineering, A model-based approach**, Jon Holt and Simon Perry, 3rd Edition, The Institution of Engineering and Technology, 2019

Reference books:

1. Practical Model-Based Systems Engineering, Jose L. Fernandez and Carlos Hernandez, Artech House, 2019
2. System Requirements Analysis, Jeffrey O. Grady, Elsevier, 2nd Edition, 2016.
3. Systems Engineering Fundamentals and Applications, Reinhard Haberfellner, Olivier de Weck Ernst Fricke, Siegfried Vössner, Springer Nature Switzerland AG 2019.
4. NASA Systems Engineering Handbook, National Aeronautics and Space Administration NASA Headquarters Washington, D.C. 20546 December 2007.
5. Systems Engineering: Design Principle and Models, Dahai Liu, CRC Press Taylor & Francis Group, 2016.
6. Systems Engineering Guidebook-A process for developing systems and Products, James N Martin, CRC Press, 2000.
7. INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, Wiley, 2015.

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Electronics Cooling (Open Elective-IV)			Code: BME6604B			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior knowledge:

Engineering Physics, Electronics Components and its mountings, Electronics Packaging Is essential

Course Objectives:

1. To describe the need for thermal management of electronic components.
2. To introduce the fundamental heat transfer mechanisms of conduction, convection and radiation.
3. To introduce the concept of thermal resistance and illustrate its applications.
4. To provide simple equations and tabulate commonly used thermal properties to enable the learner to perform a first order analysis of heat transfer from an electronic package.
5. To describe various cooling methods typically used or considered.

Course Outcomes:

After learning the course, students should be able to

1. Realize the need of thermal management of electronics.
2. Summarize sources of heat generation and modes of heat dissipation.
3. Apply the concept of electrical analogy to determine thermal resistance.
4. Examine the appropriate cooling methods as per the application.
5. Evaluate the cooling requirement of electronic packages.
6. Compare the methods of cooling employed in diverse electronics applications.

Detailed Syllabus

Unit	Description	Duration (H)
1.	**Introduction to Thermal Management:** Electronics Component Packaging Trends, Sources of heat generation, Electronic component failure analysis, Need of Thermal Management, modes of heat dissipation	7
2.	**Heat Transfer Principals in Electronics Cooling:** Conduction Heat Transfer, Steady and Transient Conduction, Natural Convection in Electronic Devices, Forced Convection Heat Transfer, Radiation Heat Transfer	7
3.	**Thermal Resistance:** Concept of Electrical Analogy, Thermal Resistance of conduction, convection and radiation, Thermal Contact Resistance, Thermal resistance network, thermal interface material applications, thermal adhesives	8
4.	**Electronics Cooling Methods in Industry:** Thermal interface and phase change materials, Passive and novel air cooling approaches, microchannel, jet impingement, Thermoelectric Cooling, Immersion Cooling, Vapor Chambers, Cooling Techniques for High Density Electronics.	8

5.	**Evaluating Cooling Requirement:** Conduction cooling for chassis and circuit boards, Concentrated heat sources, distributed heat sources, Circuit boards with Aluminum Heat Sink, heat transfer across interfaces by conduction and convection	**8**
6.	**Electronics Cooling Applications:** Avionics, Data Centers, Mobile, High-Performance Computing, Automotive	**7**
	Total	**45**

Text Books:

1. Dave S. Steinberg, Cooling Techniques for Electronic Equipment, a Wiley-Interscience Publication, John Wiley & Sons, Inc, 1991
2. S M Sohel Murshed, Electronics Cooling, ExLi4EvA Publication, 2016.

Reference Books:

1. Y.A. Cengel and A. J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited, 2019
2. F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, 2009
3. J. P. Holman, Heat Transfer, McGraw – Hill publications, 2008

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Project Management (HSMC - 6)			Code: BHM6114			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	02	02	30	-	20	50

Course Objectives:

1. To help the students gain understanding regarding the concept of projects and Project Management
2. To enable the students to know the key components of project management including project time, cost & Risk management.
3. Recognize issues in a realistic project scenario.

Course Outcomes:

After learning the course, the students will be able to :

1. Understand how to initiate, define and organize a project.
2. Optimize results while managing the triple constraints.
3. Apply appropriate approaches to plan a new project and develop project schedule
4. Analyze the risk associated with various project

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to Project Management** Concept and Definition of Project, Characteristics of Project, Concept and definition of Project Management, Functions of Project Management, Importance of Project Management, Who is a Project Manager, Roles & Responsibilities of Project Manager. Understanding the Phases in the Lifecycle of Projects and their Significance, Different types of Projects: Industrial, Telecommunication, Research and more, Project Selection Methods : Agile method & Waterfall methods	7
2	**The Triple Constraint in Project Management :** The concept of the Triple Constraint in Project Management : Scope, Cost and Time, Project Cost Management : Concept, Consideration, Five types of Costs involved in a project, Cost Management process, Project Time Management and methods of Time estimation, Communications Management in Project , Work Breakdown Structure (WBS). Case studies based on Mega Projects of the World.	7
3	**Planning and Execution of Project**: Developing a Mission, Vision, Goals of the project. Concept and definition of Project Planning. Importance of Project Planning. Concept and definition of Network Scheduling ,Critical Path Method, Concept of Project Execution, Phases of Project Execution, Project Evaluation; The Review Technique – Planning and Scheduling of Activity Networks - Concept of PERT/CPM, Assumptions in PERT Modeling – Time-cost, Trade-offs, HRM issues in Project Management & How they can be tackled, Quality Circle, Reasons for Failures of Project , Case Study with respect to different Domains	8

4.	**Project Monitoring and Risk Management** : Concept of Project Monitoring , How to Building a Suitable Monitoring; Control System, Concept of Conflict Management, Concept & Definition of Risk and Risk Management, Concept of Risk Matrix Analysis, Strategies to Manage Risks, An Overview of Useful Techniques and Tools Used in Project Management. Case Studies	**8**
	Total	**30**

Text Books:

1. Joseph Heagney, Fundamentals of Project Management, American Management Association, 2012.

Reference Books:

1. Erik W Larson, Clifford Gray, Rohit Joshi; Project Management-The managerial process, MacGraw Hill Publication, 2021
2. Punmia, Project Management with CPM /PERT, Laxmi Publications, 2001
3. Robert L Kimmons, Project Management Basics, Taylor & Francis Ltd, 2018
4. N. D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

e-sources:

1.https://www.youtube.com/watch?v=RjOA7AxOVj8&list=PLLy_2iUCG87AUusGVo2wsXvRZ4zlbbKUu
2.https://www.youtube.com/watch?v=W2EdffbwgcM&list=PL3MO67NH2XxIRneBXA3yA1RacZQIuX7Yl
3.https://www.youtube.com/watch?v=RQNZWCl6eXI&list=PLBd76GK9sWTwVXm9FlVHOTXXbGY2vZR8z

Program:	**B. Tech. (Computer Engineering)**			**Semester: VI**			
Course:	**Financial Management (HSMC - 6)**			**Code: BHM6115**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**IE**	**MTE**	**ETE**	**Total**
02	-	02	02	30	-	20	50

Prior knowledge of:
Basic Financial Literacy
Is essential

Course Objectives:

This course aims at enabling students

1. To develop an understanding of day-to-day working capital decisions; and also longer-term dealing, involving major capital investment decisions and raising long-term finance.
2. To improve students 'understanding of the time value of money concept and the role of finance in the current competitive business scenario.

Course Outcomes:

After learning the course, the students will be able to

1. Understand the basics of financial management and its terms and concepts
2. Understand financial markets and the role of financial institutions
3. Apply knowledge of capital budgeting; its allocation, management and funding.
4. Analyze financial statements and read documents and books of accounts.

Detailed Syllabus

Unit	**Description**	**Duration (H)**
1.	**Introduction to Financial Management**- Concept of Business Finance, Objective function in Finance, Traditional and Modern Approaches to Financial Management, Financial Planning - Principles and Steps in Financial Planning and its practical approach.	**7**
2.	**Financial Markets, Institutions and instruments:** Introductions to Financial Markets – Nature –Functions and Types of Financial markets, Different Financial Instruments, Sources of financing -Shares, Debentures, Term Loans, Lease & Hire Purchase, Retained Earnings, Public Deposits, Bonds, Trade Credit, Introduction to Bank Finance.	**7**
3.	**Time Value of Money and capital budgeting:** Timelines for cash flow, Annuities, Perpetuities, Need and Importance of Capital Budgeting, Different Techniques of Evaluating the Project on the Basis of Payback Period, ARR, NPV, IRR, PPP	**8**
4.	**Financial Statement Analysis:** Concept of Financial Statements: Balance Sheet, Profit and Loss Statement, Cash Flow Statement, Tools of Analysis of Financial Statements: Comparative Statements, and Ratio analysis.	**8**
	Total	**30**

Text Books:

1. Prasanna Chandra, Financial Management, Tata McGraw Hill, 2011.

Reference Books:

1. Agrawal M R, Financial Management, Garima Publications, Jaipur, 2021
2. Khan and Jain, Financial Management, Tata McGraw Hill, 2008
3. Paramasivan C, Subramanian T, Financial Management, New Age International (L) Publishers, 2017
4. R. M.Srivastava, Financial Management, Himalaya Publishers, 2005
5. Vanhorne J, Financial Management & Policy, Pearson Education, Delh,2015
6. Gupta Pratik, Arora Amit, Financial Management, Vayu Education of India, 2020

e-sources:

1. https://www.youtube.com/watch?v=TgF2XvjquUU&list=PLLy_2iUCG87CXY2B6fPex1SOIqxzzD5Wj
2. https://www.youtube.com/watch?v=CCQwz_Gwo6o
3. https://www.youtube.com/watch?v=OT5RdoJAkhY&list=PLPjSqITyvDeUTeAOGhip_ubjN3y8oqT13.

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Entrepreneurship Development (HSMC - 6)			Code: BHM6116			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	02	02	30	-	20	50

Course Objectives:

1. To understand the role and importance of entrepreneurship for economic development
2. To seek necessary knowledge and develop skills required for organizing and carrying out entrepreneurial activities.
3. To develop the ability to analyze and understand business situations in which entrepreneurs act.

Course Outcomes:

After learning the course, the students will be able to :

1. Understand the entrepreneurship as an opportunity
2. Optimize the business opportunities that suit aspirant entrepreneurs
3. Appraise the financial schemes and support systems for Entrepreneurship Development.
4. Design a comprehensive business plans.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to the Entrepreneurship Development** : Concept and definition of Entrepreneurship, The concept of Opportunity Window, Challenges and Misconceptions Related to Entrepreneurship with Indian Context, McClelland's Need Achievement Theory, Concept of Entrepreneur, Entrepreneurship as a Career, Traits of Successful Entrepreneur, Types of Entrepreneur (proprietary, partnership, collaboration etc), Entrepreneur v/s Intrapreneur, Woman Entrepreneur – A Paradigm Shift , Factors Affecting Entrepreneurship, Types of Enterprises and their Features: Manufacturing, Service and Trading Case Study: Indian Entrepreneurs Pre and Post Covid World, Success stories for few Entrepreneurs.	7
2	**Entrepreneurial Opportunities and Process Selection:** Concept of Business Opportunity, How to Generate Business Ideas? Identification of Ideal and Viable Business Opportunities, Elements of a good business idea. the entrepreneurial process, Challenges in the Selection of Business Opportunities, Business Opportunities Identification Process, Required Licenses, Approvals and Expertise, Business Value Chain, Different Sections of the Business Value Chain for Potential Opportunities, Understanding Product Costs and Operations Costs; Legal Aspects.	7
3	**Finance and Support Systems**: Raising Capital, Venture Capital, Angel Investors, Seed Funding, Role of Government in Promoting Entrepreneurship in India, Start-up India, Atmanirbhar Bharat, Make in India, Assistance to an Entrepreneur, Industrial park, Special Economic Zone, MSME Act, MSME Policy in India, Financial Assistance to MSME, Various Government Schemes - PMEGP, CGTMSE, PMKVY, Mudra Loan, Incubation, Role of Incubation Centers, Support from Incubation Centers	8

4.	**Business Plan:** Concept and definition of Business Plan, Contents of Business Plan: Executive Summary, Business Concept, Business Strategy, Management Summary, Marketing Plan, Operations Plan, Financial Plan, Presenting Business Plan, Procedure for setting up an Enterprise, Why Do Some Business Plans Fail?	**8**
	Total	**30**

Text Books:

1. C. B. Gupta and N. P. Srinivasan, Entrepreneurial Development, Sultan Chand & Sons, New Delhi, 2008.

Reference Books:

1. Dr. Radha, Entrepreneurial Development, Prasana Publishers, Chennai, 2007.
2. S.S.Khanka, Entrepreneurial Development, Sultan Chand & Co., Ltd., New Delhi 2005
3. Stevenson, H. Perspective on entrepreneurship. Boston: Harvard Business Press, 2007

e-sources:

1. https://www.entrepreneur.com/
2. http://dst.gov.in/scientific-programme/t-d-tdb.htm
3. https://www.youtube.com/

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Android Application Development (Proficiency Course-3)					Code: BCE6915	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	-	02	-	-	-	-

Prior knowledge of

Java Programming

Is essential.

Course Objectives:

1. To learn Basic UI elements of android
2. To learn local Database connectivity of android.
3. To learn foreground and background services
4. To learn read/write operation on files

Course Outcomes:

After learning the course, students will be able to:

1. Install and configure and android.
2. Develop UI Based android applications
3. Demonstrate the data manipulation using Content Providers, embedded database SQLite
4. Choose suitable software tools, IDE and APIs for the development of Mobile Application
5. Develop android application for file sharing.
6. Acquire skill set to execute applications in Android based devices.

Suggested List of Assignments

Assignment No.	Assignment Title
1	**Introduction** Install the Android SDK, Introduction to Basic UI design and Form widgets. **Assignment Title: Build** a simple UI for sign in page for any application using UI Widgets, Layouts and Adapters. Validate the required fields.
2	**SQLite/Room Database, Handling User Input** **Assignment Title: Connect** sign in page designed in assignment 1 to database and perform data manipulation operations such as add, delete, update on it.
3	**Networking in Android** **Assignment Title:** Design an android-based application to implement chat application using socket programming
4	**Audio files, Recycler/list view, services (foreground and background services)** **Assignment Title: Develop** a mobile application to fetch all audio files and play the audio file when user clicks on any audio file from recycler/list view. Application should play music in background.
5	**Working with images** **Assignment Title:** Develop a mobile application to fetch images from the sdcard/internal memory. Also provide the facility of deleting, renaming the images.

6	**File sharing in Android.** **Assignment Title:** Develop an android-based application to implement file Sharing through Bluetooth/wi-fi. Use Java/ Kotlin for programming.

Text Books:

1. Java the Complete Reference, Ninth Edition, by Herbert Schildt, McGraw Hill Education

Reference Books:

1. Head First Servlets and JSP, Kathy Sierra, Bryan Basham, Bert Bates, O'Reilly Media, Inc.

Program:	B. Tech. (Computer Engineering)					Semester: VI	
Course:	Advanced Java Programming – II (Proficiency Course-3)					Code: BCE6916	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	IE	MTE	ETE	Total
02	-	-	02	-	-	-	-

Prior knowledge of.

Java Programming

Is essential.

Course Objectives:

1. To develop web-based, network-centric or enterprise applications.
2. To create maintainable, extensible, and flexible web applications using Java Framework like Struts, Hibernate, Spring.

Course Outcomes:

After learning the course, students will be able to:

1. Comprehend cycle of MVC architecture.
2. Design web application using Struct, hibernate and Spring framework.
3. Implement web services using java.
4. Integrate technological stack to develop an application.

Guidelines for Students:

1. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment.
2. Each assignment write-up should have Title, Objectives and Outcomes, Theory- Concept in brief, Algorithm, Flowchart, Test cases, Conclusion, Assessment grade/marks and assessor's sign.
3. Program codes with sample output of all performed assignments are to be submitted as soft copy.

Suggested List of Assignments

Assignment No.	Assignments
1	**MVC & Struts Framework** MVC, MVC Type1 and Type2 architecture, truts framework? Struts 1 overview, Struts 1 and Struts 2 comparison, Components of Model, Views and Controller in Struts Framework, Declarative and Annotations configuration approaches, **Assignment Title:** Develop Signin and Signout Application using Struts Framework
2	**Assignment Title:** Create Hello World Using Struts – 2
3	**Hibernate Framework** ORM, ORM principle, ORM Implementation, Introduction to Hibernate, Hibernate Architecture, Peristent classes, Hibernate CRUD, setting up connection to DB using Hibernate **Assignment Title:** Insert the Record of user in database using Hibernate Framework
4	**Spring Framework** Introduction to Spring, Spring Architecture explanation and all its components, Spring MVC, Spring DAO, setting up of Spring framework Download JARs, Configure XML files. **Assignment Title:** Create a Web Application/Page using Spring Framework

5	**Web Services Using Java** Web services such as protocols, SOAP, RESTful, java web service implementation, JAX-WS and JAX- RS **Assignment Title:** Create a Web Service in Java using SOAP & RESTful
6	**Assignment Title:** Integrate Hibernate application with spring application and use mysql database.

Text Books:

1. Java The Complete Reference, Ninth Edition, by Herbert Schildt, McGraw Hill Education

Reference Books:

1. Spring Microservices in Action, Second Edition, John Carnell, Manning Publications
2. Cloud Native Java, Kenny Bastani, Josh Long, O'Reilly Media, Inc..
3. Core and Advanced Java, Black Book, Dreamtech Press
4. Java Web Services: Up and Running, 2nd Edition, by Martin Kalin, O'Reilly Media, Inc.

Web reference:

1. https://struts.apache.org/
2. https://hibernate.org/orm/documentation/6.0/
3. https://docs.spring.io/spring-framework/docs/current/reference/html/

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Professional Development Training - II			Code: BHM6918			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	-	03	-	-	-	-

Course Objectives:
This course aims at enabling the students

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities.
2. To improve the overall professional development of students

Course Outcomes: Students will be able to
After learning the course, the students will be:

1. Having adaptive thinking and adaptability through various Quantitative ability concepts.
2. Having critical thinking and innovative skills.
3. Having interest in lifelong learning & developing verbal competencies in the students.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Modern Maths** Profit loss, Ratio & Proportion, LCM & HCF, Time speed and Distance, Average, Mean, mode, median, permutation & combination, Probability, Pipe & systems, Mixture validation, Allegations and Mixtures, Simple Interest and Compound Interest.	6
II	**Algebra** Linear equations, Quadratic equations, Triplets. **Geometry** Triangles, Polygons (questions on Area Perimeter).	6
III	**Mensuration** Cube cuboids cone cylinder sphere (questions on volume surface Area) **Trigonometry** **Number System** **Statistics.**	6
IV	**Logical Reasoning** Clocks and Calendar, Direction sense, Family tree, Syllogism, Seating arrangement, Team formation, Coding and Decoding, Number Series and Letter Series, Ranking and Arrangements, Game-Based Aptitude.	6
V	**Data Interpretation** Data charts, Data tables, Bar, Pie, Line graphs, Venn diagram.	6
VI	**Verbal Ability & Reading Comprehension** Subject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Para Jumbles.	6
	Total	36

Reference Books:

1. Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.
2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd.
3. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.
4. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Lt.

** Students should get a passing grade if they will clear at least two online aptitude tests and achieve minimum criteria of attendance.

Program:	B. Tech. (Computer Engineering)			Semester: VI			
Course:	Environmental Sciences (Audit Course - 3)			Code: BHM9961			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
01	-	-	01	-	-	-	-

Course Objectives:

1. To gain an understanding on the concepts and strategies related to sustainable development and identify and analyse various conservation methods for renewable and non-renewable resources.
2. To examine biotic and abiotic factors within an ecosystem and to identify energy flow in ecosystem.
3. To understand the value of biodiversity and identify current efforts for it‘s conservation at national and local level
4. To provide comprehensive overview of environmental pollution and technology associated with monitoring and control.

Course Outcomes:

After learning the course, the students should be able to:

1. Demonstrate an integrative approach to environmental issues with a focus on sustainability and identify the role of organism in energy transfer in different ecosystem.
2. Distinguish between renewable and non-renewable resources and analyse consumption of resources
3. Identify key threats to biodiversity and develop appropriate policy options for it‘s conservation.
4. Analyse the impact of environmental pollution and the science behind those problems and potential solutions.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Multidisciplinary nature of environmental studies** Definition, scope and importance, Need for Public awareness, Natural Resources: Renewable and non- renewable resources: Natural resources and associated problems a) Forest b) Water c) Mineral d) Food e) Land f) Energy, Role of an individual in conservation of natural resources, Use of resources for sustainable lifestyle.	**03**
II	**Ecosystems** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposer, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Characteristic features, Case study on Forest ecosystem, Aquatic ecosystem.	**03**
III	**Biodiversity and its conservation** Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hotspots of biodiversity, Threats to biodiversity, Conservation of biodiversity, Case study on any one Hotspot of biodiversity.	**03**

IV	**Environmental Pollution** Definition, Cause, effects and control measures of different pollution: a. Air b. Water soil d. Noise e. Thermal f. nuclear hazards, Solid waste Management, Relevance of environmental ethics for environmental protection, Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, Impact of Climate change, Innovative ideas for creating public environmental awareness.	**03**
	Total	**12**

Text Books:

1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., ―Environmental Encyclopedia‖, Jaico Publications House, 1st edition, 2000, ISBN-13: 978-8172247867
2. 2.Agarwal, K.C, ―Environmental Biology‖, Nidhi Publishers, 2nd edition ,2008, ISBN-13978-8189153021

Reference Books:

1. 1.BharuchaErach, ―The Biodiversity of India‖, Mapin Publishing Pvt. Ltd., 1st edition, 20021, ISBN- 108188204064

Vision and Mission of Computer Department

Department Vision

To be a premier Computer Engineering program by achieving excellence in Academics and Research for creating globally competent and ethical professionals.

Department Mission

M1: To develop technologically competent and self-sustained professionals through contemporary curriculum.

M2: To nurture innovative thinking and collaborative research, making a positive impact on society.

M3: To provide state-of-the art computing environment and learning opportunities through Center of Excellence.

M4: To foster leadership skills and ethics with holistic development.