VI Semester

MACHINE LEARNING			
Course Code	21AI63	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Define machine learning and understand the basic theory underlying machine learning.
CLO 2. Differentiate supervised, unsupervised and reinforcement learning
CLO 3. Understand the basic concepts of learning and decision trees.
CLO 4. Understand Bayesian techniques for problems appear in machine learning
CLO 5. Perform statistical analysis of machine learning techniques.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction:
Machine learning Landscape: what is ML?, Why, Types of ML, main challenges of ML

Concept learning and Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm –Remarks on VS- Inductive bias.

Text book 2: Chapter 1, Text book 1:Chapter 1 and 2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

End to end Machine learning Project: Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model.

Classification : MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification

Text book 2: Chapter 2, Chapter 3

Teaching-Learning	Chalk and board, Active Learning

Process	
Module-3	
Training Models: Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression **Support Vector Machine:** linear, Nonlinear , SVM regression and under the hood **Text book 2**: **Chapter 4, Chapter 5**	
Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration
Module-4	
Decision Trees Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability **Ensemble learning and Random Forest**: Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking **Text book 2: Chapter 6, Chapter 7**	
Teaching-Learning Process	Chalk& board, Problem based learning
Module-5	
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– example-Bayesian Belief Network – EM Algorithm **Text book 1: Chapter 6**	
Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

At the end of the course the student will be able to:

- CO 1. Understand the concept of Machine Learning and Concept Learning.
- CO 2. Apply the concept of ML and various classification methods in a project.
- CO 3. Analyse various training models in ML and the SVM algorithm to be implemented.
- CO 4. Apply the ML concept in a decision tree structure and implementation of Ensemble learning and Random Forest.
- CO 5. Apply Bayes techniques and explore more about the classification in ML.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(To have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Textbooks

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &TensorFlow , O'Reilly, Shroff Publishers and Distributors Pvt. Ltd 2019

Reference:

1. Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley, 2019
4. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/playlist?list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77
2. https://nptel.ac.in/courses/106/106/106106139/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VI Semester

DATA SCIENCE AND ITS APPLICATIONS			
Course Code	21AD62	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 T + 20 P	Total Marks	100
Credits	04	Exam Hours	03

Course Learning Objectives:

CLO 1. Demonstrate the proficiency with statistical analysis of data to derive insight from results and interpret the data findings visually

CLO 2. Utilize the

CLO 3. skills in data management by obtaining, cleaning and transforming the data.

CLO 4. Make use of machine learning models to solve the business-related challenges

CLO 5. Experiment with decision trees, neural network layers and data partition.

CLO 6. Demonstrate how social clustering shape individuals and groups in contemporary society.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1: Introduction

What is Data Science? Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, **Linear Algebra,** Vectors, Matrices, **Statistics,** Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, **Probability,** Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

Chapters 1, 3, 4, 5 and 6

Laboratory Component:

1. Installation of Python/R language, Visual Studio code editors can be demonstrated along with Kaggle data set usage.
2. Write programs in Python/R and Execute them in either Visual Studio Code or PyCharm Community Edition or any other suitable environment.
3. A study was conducted to understand the effect of number of hours the students spent studying on their performance in the final exams. Write a code to plot line chart with number of hours spent studying on x-axis and score in final exam on y-axis. Use a red '*' as the point character, label the axes and give the plot a title.

Number of hrs spent studying (x)	10	9	2	15	10	16	11	16
Score in the final exam (0 – 100) (y)	95	80	10	50	45	98	38	93

4. For the given dataset mtcars.csv (www.kaggle.com/ruiromanini/mtcars), plot a histogram to check the frequency distribution of the variable 'mpg' (Miles per gallon)

Teaching-Learning Process	1. Demonstration of different charts 2. PPT Presentation for Theorems and different distributions 3. Live coding and execution for visualization with simple examples

Module-2: Hypothesis and Inference

Statistical Hypothesis Testing, Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, Bayesian Inference, **Gradient Descent,** The Idea Behind Gradient Descent Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent, **Getting Data,** stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, **Working with Data,** Exploring Your Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction.

Chapters 7, 8, 9 and 10

Laboratory Component:

1. Consider the books dataset BL-Flickr-Images-Book.csv from Kaggle (https://www.kaggle.com/adeyoyintemidayo/publication-of-books) which contains information about books. Write a program to demonstrate the following.

- Import the data into a DataFrame
- Find and drop the columns which are irrelevant for the book information.
- Change the Index of the DataFrame
- Tidy up fields in the data such as date of publication with the help of simple regular expression.
- Combine str methods with NumPy to clean columns

Teaching-Learning Process	1. Demonstration of Hypothesis test. 2. PPT Presentation to explore and manipulate data. 3. Live coding of concepts with simple examples 4. Case Study: Extraction of data from Books dataset

Module-3: Machine Learning

Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, **k-Nearest Neighbors,** The Model, Example: The Iris Dataset, The Curse of Dimensionality, **Naive Bayes,** A Really Dumb Spam Filter, A More Sophisticated Spam Filter, Implementation, Testing Our Model, Using Our Model, **Simple Linear Regression,** The Model, Using

Gradient Descent, Maximum Likelihood Estimation, **Multiple Regression,** The Model, Further Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization, **Logistic Regression,** The Problem, The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines.

Chapters 11, 12, 13, 14, 15 and 16

Laboratory Component:

1. Train a regularized logistic regression classifier on the iris dataset (https://archive.ics.uci.edu/ml/machine-learning-databases/iris/ or the inbuilt iris dataset) using sklearn. Train the model with the following hyper parameter C = 1e4 and report the best classification accuracy.
2. Train an SVM classifier on the iris dataset using sklearn. Try different kernels and the associated hyper parameters. Train model with the following set of hyper parameters RBF-kernel, gamma=0.5, one-vs-rest classifier, no-feature-normalization. Also try C=0.01,1,10C=0.01,1,10. For the above set of hyper parameters, find the best classification accuracy along with total number of support vectors on the test data

Teaching-Learning Process	1. Demonstration of Models 2. PPT Presentation for techniques 3. Live coding of all concepts with simple examples

Module-4: Decision Trees

What Is a Decision Tree?, Entropy, The Entropy of a Partition, Creating a Decision Tree, Putting It All Together, Random Forests, **Neural Networks,** Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example: Fizz Buzz, **Deep Learning,** The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Example: XOR Revisited, Other Activation Functions, Example: Fizz Buzz Revisited, Softmaxes and Cross-Entropy, Dropout, Example: MNIST, Saving and Loading Models, **Clustering,** The Idea, The Model, Example: Meetups, Choosing k, Example: Clustering Colors, Bottom-Up Hierarchical Clustering

Chapters 17, 18, 19 and 20

Laboratory Component:

1. Consider the following dataset. Write a program to demonstrate the working of the decision tree based ID3 algorithm.

Price	Maintenance	Capacity	Airbag	Profitable
Low	Low	2	No	Yes
Low	Med	4	Yes	Yes
Low	Low	4	No	Yes
Low	Med	4	No	No
Low	High	4	No	No
Med	Med	4	No	No
Med	Med	4	Yes	Yes
Med	High	2	Yes	No
Med	High	5	No	Yes
High	Med	4	Yes	Yes
high	Med	2	Yes	Yes
High	High	2	Yes	No
high	High	5	yes	Yes

2. Consider the dataset spiral.txt (https://bit.ly/2Lm75Ly). The first two columns in the dataset corresponds to the co-ordinates of each data point. The third column corresponds to the actual cluster label. Compute the rand index for the following methods:

- K – means Clustering
- Single – link Hierarchical Clustering
- Complete link hierarchical clustering.
- Also visualize the dataset and which algorithm will be able to recover the true clusters.

Teaching-Learning Process	1. Demonstration using Python/ R Language 2. PPT Presentation for decision tree, Neural Network, Deep learning and clustering 3. Live coding for the concepts with simple examples 4. Project Work: Algorithm implementation

Module-5: Natural Language Processing

Word Clouds, n-Gram Language Models, Grammars, An Aside: Gibbs Sampling, Topic Modeling, Word Vectors, Recurrent Neural Networks, Example: Using a Character-Level RNN, **Network Analysis,** Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, **Recommender Systems,** Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization.

Chapters 21, 22 and 23

Laboratory Component:

Mini Project – Simple web scrapping in social media

Teaching-Learning Process	1. Demonstration of models 2. PPT Presentation for network analysis and Recommender systems 3. Live coding with simple examples

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO 1. Identify and demonstrate data using visualization tools.
CO 2. Make use of Statistical hypothesis tests to choose the properties of data, curate and manipulate data.
CO 3. Utilize the skills of machine learning algorithms and techniques and develop models.
CO 4. Demonstrate the construction of decision tree and data partition using clustering.
CO 5. Experiment with social network analysis and make use of natural language processing skills to develop data driven applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to **20 marks**.

Note: Minimum of 80% of the laboratory components have to be covered.

- Rubrics for each Experiment taken average for all Lab components – 15 Marks.
- Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be **scaled down to 50 marks**
(to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Joel Grus, "Data Science from Scratch", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-9352138326

Reference Books

1. Emily Robinson and Jacqueline Nolis, "Build a Career in Data Science", 1st Edition, Manning Publications, 2020. ISBN: 978-1617296246.
2. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-1492032649.
3. François Chollet, "Deep Learning with Python", 1st Edition, Manning Publications, 2017. ISBN-13: 978-1617294433
4. Jeremy Howard and Sylvain Gugger, "Deep Learning for Coders with fastai and PyTorch", 1st Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2020. ISBN-13: 978-1492045526
5. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2", 3rd Edition, Packt Publishing Limited, 2019.ISBN-13: 978-1789955750

Web links and Video Lectures (e-Resources):

1. Using Python : https://www.python.org
2. R Programming : https://www.r-project.org/
3. Python for Natural Language Processing : https://www.nltk.org/book/
4. Data set: https://bit.ly/2Lm75Ly
5. Data set: https://archive.ics.uci.edu/ml/datasets.html

6. Data set : www.kaggle.com/ruiromanini/mtcars
7. Pycharm : https://www.jetbrains.com/pycharm/
8. https://nptel.ac.in/courses/106/106/106106179/
9. https://nptel.ac.in/courses/106/106/106106212/
10. http://nlp-iiith.vlabs.ac.in/List%20of%20experiments.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Real world problem solving - Applying the machine learning techniques and developing models

VI Semester

SOFTWARE ENGINEERING & PROJECT MANAGEMENT			
Course Code	**21CS61**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to Software Engineers.
CLO 2. Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
CLO 3. Infer the fundamentals of object oriented concepts, differentiate system models, use UML diagrams and apply design patterns.
CLO 4. Explain the role of DevOps in Agile Implementation.
CLO 5. Discuss various types of software testing practices and software evolution processes.
CLO 6. Recognize the importance Project Management with its methods and methodologies.
CLO 7. Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: The evolving role of software, Software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process.

Textbook 1: Chapter 1: 1.1 to 1.3

Process Models: Prescriptive models, Waterfall model, Incremental process models, Evolutionary process models, Specialized process models.

Textbook 1: Chapter 2: 2.1, 2.2, 2.4 to 2.7

Requirements Engineering: Requirements Engineering Task, Initiating the Requirements Engineering process, Eliciting Requirements, Developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document **(Sec 4.2)**

Textbook 1: Chapter 3: 3.1 to 3.6, Textbook 5: Chapter 4: 4.2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling, abstraction, The Three models. Class Modelling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, Introduction to RUP**(Textbook: 5 Sec 2.4)** and UML diagrams

Textbook 2: Chapter 1,2,3

Building the Analysis Models: Requirement Analysis, Analysis Model Approaches, Data modeling Concepts, Object Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, class Based Modeling, Creating a Behavioral Model.

Textbook 1: Chapter 8: 8.1 to 8.8

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging.

Textbook 1: Chapter 13: 13.1 to 13.7

Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development,

Self-Learning Section:
What is DevOps?, DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools?, Challenges with DevOps Implementation.

Textbook 4: Chapter 2: 2.1 to 2.9

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-4

Introduction to Project Management:
Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.

Textbook 3: Chapter 1: 1.1 to 1.17

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-5

Activity Planning:
Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

Textbook 3: Chapter 6: 6.1 to 6.16

Software Quality:
Introduction, The place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.

Textbook 3: Chapter 13: (13.1 to 13.6 , 13.9, 13.11, 13.14),

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Understand the activities involved in software engineering and analyze the role of various process models

CO 2. Explain the basics of object-oriented concepts and build a suitable class model using modelling techniques

CO 3. Describe various software testing methods and to understand the importance of agile methodology and DevOps

CO 4. Illustrate the role of project planning and quality management in software development

CO 5. Understand the importance of activity planning and different planning models

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

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3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.

4. Deepak Gaikwad, Viral Thakkar, DevOps Tools From Practitioner's Viewpoint, Wiley.
5. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.

Reference:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

Weblinks and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://www.youtube.com/watch?v=WxkP5KR_Emk&list=PLrjkTql3jnm9b5nr-ggx7Pt1G4UAHeFlJ
3. http://elearning.vtu.ac.in/econtent/CSE.php
4. http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html
5. https://nptel.ac.in/courses/128/106/128106012/ (DevOps)

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Case study, Field visit

VI Semester

NATURAL LANGUAGE PROCESSING			
Course Code	21AI643	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Analyse the natural language text.
CLO 2. Define the importance of natural language.
CLO 3. Understand the concepts Text mining.
CLO 4. Illustrate information retrieval techniques.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same program
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

Textbook 1: Ch. 1,2

Teaching-Learning Process	Chalk and board, Online demonstration, Problem based learning

Module-2

Word level and syntactic analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

Textbook 1: Ch. 3,4

Teaching-Learning Process	Chalk and board, Online Demonstration

Module-3

Extracting Relations from Text: From Word Sequences to Dependency Paths:
Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.

A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.

Textbook 2: Ch. 3,4,5

Teaching-Learning Process	Chalk and board, Online Demonstration

Module-4

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems,

Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.

Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.

Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.

Textbook 2: Ch. 6,7,8,9

Teaching-Learning Process	Chalk and board, Online Demonstration

Module-5

INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.

Textbook 1: Ch. 9,12

Teaching-Learning Process	Chalk and board, Online Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Analyse the natural language text.
CO 2. Define the importance of natural language.
CO 3. Understand the concepts Text mining.
CO 4. Illustrate information retrieval techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummingspublishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

Weblinks and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VII Semester

DATA VISUALIZATION			
Course Code	21AD71	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Understand and use various plot types with Python
CLO 2. Explore and work with different plotting libraries
CLO 3. Create effective visualizations
CLO 4. Implement exemplary applications related to Network Programming and Web Service
CLO 5. Exhibit the awareness of the importance and limitation of the exploratory data analysis paradigm

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1: Data Visualization and Data Exploration

Introduction: Data Visualization, Importance of Data Visualization, Data Wrangling, Tools and Libraries for Visualization

Overview of Statistics: Measures of Central Tendency, Measures of Dispersion, Correlation, Types od Data, Summary Statistics

Numpy: Numpy Operations - Indexing, Slicing, Splitting, Iterating, Filtering, Sorting, Combining, and Reshaping

Pandas: Advantages of pandas over numpy, Disadvantages of pandas, Pandas operation - Indexing, Slicing, Iterating, Filtering, Sorting and Reshaping using Pandas

Text Book 1: Chapter 1

Teaching-Learning Process	5. PPT – Visualization tools 6. Demonstration of operations on data

Module-2: Plots

Comparison Plots: Line Chart, Bar Chart and Radar Chart; **Relation Plots:** Scatter Plot, Bubble Plot ,

Correlogram and Heatmap; **Composition Plots:** Pie Chart, Stacked Bar Chart, Stacked Area Chart, Venn Diagram; **Distribution Plots:** Histogram, Density Plot, Box Plot, Violin Plot; **Geo Plots:** Dot Map, Choropleth Map, Connection Map; What Makes a Good Visualization?

A Deep Dive into Matplotlib
Introduction, Overview of Plots in Matplotlib, **Pyplot Basics:** Creating Figures, Closing Figures, Format Strings, Plotting, Plotting Using pandas DataFrames, Displaying Figures**,** Saving Figures; **Basic Text and Legend**

Functions: Labels, Titles, Text, Annotations, Legends**; Basic Plots:**Bar Chart, Pie Chart, Stacked Bar Chart, Stacked Area Chart, Histogram, Box Plot, Scatter Plot, Bubble Plot; **Layouts:** Subplots, Tight Layout, Radar Charts, GridSpec; **Images:** Basic Image Operations, Writing Mathematical Expressions

Text Book 1: Chapter 2, Chapter 3

Teaching-Learning Process	3. PPT - Visualization techniques 4. Demonstration of operations on plots using Matplotlib

Module-3: Simplifying Visualizations using Seaborn

Introduction, Advantages of Seaborn **Controlling Figure Aesthetics:** Seaborn Figure Styles, Removing Axes Spines, Contexts; **Color Palettes:** Categorical Color Palettes, Sequential Color Palettes, Diverging Color Palettes; **Interesting Plots in Seaborn:** Bar Plots, Kernel Density Estimation, Plotting Bivariate Distributions, Visualizing Pairwise Relationships, Violin Plots;

Text Book 1: Chapter 4

Teaching-Learning Process	1. PPT - Visualization techniques 2. Demonstration of operations on plots using Seaborn

Module-4: Plotting Geospatial Data

Introduction, Geoplotlib, The Design Principles of Geoplotlib, Geospatial Visualizations, Tile Providers, Custom Layers, Introduction to Folium

Visualizing Data: Building a Google map from geocoded data, Visualizing networks and interconnection and Visualizing mail data

Making Things Interactive with Bokeh
Introduction, Bokeh, Concepts of Bokeh, Interfaces in Bokeh, Output, Bokeh Server, Presentation, Integrating, Adding Widgets

Text Book 1: Chapter5, Chapter 6

Teaching-Learning Process	5. PPT - Visualization techniques 6. Demonstration of operations using Geoplotlib

Module-5: Networked Programs

HyperText Transfer Protocol – HTTP, The World's Simplest Web Browser, Retrieving an image over HTTP, Retrieving web pages with urllib, Parsing HTML and scraping the web, Parsing HTML using regular expressions, Parsing HTML using BeautifulSoup, Reading binary files using urllib

Using Web Services
eXtensibleMarkup Language – XML, Parsing XML, Looping through nodes, JavaScript Object Notation – JSON, Parsing JSON

Text Book 2: Chapters 12 and Chapter 13

Teaching-Learning Process	7. PPT – On web services, browsers, HTTP, HTML 8. Demonstration of parsing and looping - XML,JSON

Course Outcomes

At the end of the course the student will be able to:

CO 1. Demonstrate the data visualization techniques.
CO 2. Analyze data represented in the form of graphs & charts
CO 3. Experiment with different visualization tools
CO 4. Identify geospatial data and interconnection of data.
CO 5. Make use of the web for data extraction

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

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Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Data Visualization workshop, Tim Grobmann and Mario Dobler, Packt Publishing.
2. Python for Everybody: Exploring Data Using Python 3, Charles R. Severance, Create Space Independent Publishing Platform, 1st Edition, 2016

Reference:

1. "Data Visualization": A Successful Design Process, Kirk, Andy, Packt Publishing Ltd,2012
2. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, Green Tea Press, 2nd Edition, 2015
3. Interactive Data visualization for the Web, Murray, Scott, O'Reilly Media, Inc., 2013
4. Visualizing Data: Exploring and Explaining Data with The Processing Environment, Fry, Ben, O'Reilly

Media, Inc., 2007

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=eFByJkA3ti4
2. https://www.youtube.com/watch?v=JhK2qVi5dC4
3. https://www.youtube.com/watch?v=UjYzNhBVIvY
4. http://book.visualisingdata.com/
5. https://matplotlib.org/
6. https://docs.python.org/3/tutorial/
7. https://www.tableau.com/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

CONCRETE TECHNOLOGY

Course Code	**18CV44**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to:

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Module-1

Concrete Ingredients Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice huskash.

Module-2

Fresh Concrete Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.

Module-3

Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

Module-4

Concrete Mix Proportioning

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.

Module-5

Special Concretes

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High Performance Concrete.

Course outcomes: After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behavior based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
4. Adopt suitable concreting methods to place the concrete based on requirement.
5. Select a suitable type of concrete based on specific application.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Neville A.M. "Properties of Concrete"-4th Ed., Longman.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
4. A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (NewEdition).

Reference Books:

1. M L Gambir, "Concrete Technology", McGraw Hill Education,2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning,2015.
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

DESIGN OF RC STRUCTURAL ELEMENTS

Course Code	**18CV53**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. Provide knowledge in analysis and design of RC elements.

Module-1

Introduction to working stress and limit State Design: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

Module-2

Limit State Analysis of Beams:
Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.

Module-3

Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.

Module-4

Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

Module-5

Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.

Course outcomes: After studying this course, students will be able to:

1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
4. Owns professional and ethical responsibility.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.

Textbooks:

1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New Delhi
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

Reference Books:

1. P C Varghese, “Limit State design of reinforced concrete” , PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, “Reinforced Concrete Design”, MacMillan Education, Palgrave publishers.
3. Kong and Evans, “Reinforced and Pre-Stressed Concrete”, Springer Publications.
4. A W Beeby and Narayan R S, “Introduction to Design for Civil Engineers”, CRC Press.
5. Robert Park and Thomas Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, Inc.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)and Outcome Based Education (OBE)
SEMESTER - V

MUNICIPAL WASTEWATER ENGINEERING

Course Code	**18CV55**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;
1. Understand the various water demands and population forecasting methods.
2. Understand and design different unit operations and unit process in involved in wastewater treatment process
3.Understand the concept and design of various physicochemical treatment units
4. Understand the concept and design of various biological treatment units
5. Understand the concept of various advance waste water and low cost treatment processes for rural areas.

Module-1

Introduction: Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm water flow, time of concentration flow, numericals.
Sewer appurtenances: Manholes, catch basins, oil and grease traps. P, Q and S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers basic principles of house drainage.

Module-2

Design of sewers: Hydraulic formula to determine velocity and discharge. Self cleansing and non scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.
Waste water characteristics: sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water
Treatment unit operations and process. Estimation of BOD. Reaction kinetics (zero order, 1st order and 2nd order).

Module-3

Treatment of municipal waste water: Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks.
Disposal of effluents: Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps equation.

Module-4

Biological Treatment Process: Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors.
Principle of stabilization ponds, oxidation ditch, Sludge digesters(aerobic and anaerobic), Equalization., thickeners and drying beds.

Module-5

Advanced Wastewater Treatment: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advance oxidation processes (AOPs), Electro coagulation.
Rural sanitation: Low cost treatment process: Working principal and design of septic tanks for small community in rural and urban areas, two-pit latrines, eco-toilet and soak pits.

Course outcomes: After studying this course, the students will be able to:
1. Select the appropriate sewer appurtenances and materials in sewer network.
2. Design the sewers network and understand the self purification process in flowing water.
3.Deisgn the varies physic- chemical treatment units
4. Design the various biological treatment units
5. Design various AOPs and low cost treatment units.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. B C Punmia, "Environmental Engineering vol-II", Laxmi Publications 2nd, 2016
3. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
4. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017

Reference Books

1. CPHEEO manual on sewage treatment, Ministry of Urban Development, Government of India, New Delhi,1999
2. Mark.J Hammer, "Water & Waste Water Technology" John Wiley & Sons Inc., New York, 2008
3. Benefield R.D., and Randal C.W, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey 2012
4. Metcalf and Eddy Inc, "Wastewater Engineering - Treatment and Reuse", Publishing Co. Ltd., New Delhi, 4th Edition, 2009.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

DESIGN OF STEEL STRUCTURAL ELEMENTS

Course Code	**18CV61**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Module -1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

Module -2

Bolted Connections: Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)and bracket connections.

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.

Module -3

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.

Module -4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Module -5

Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.

Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems].

Course Outcomes: After studying this course, students will be able to:

1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi.

Reference Books:

1. Dayarathnam P, "Design of Steel Structures", Scientific International Pvt. Ltd.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

DESIGN OF RCC AND STEEL STRUCTURES

Course Code	**18CV72**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to

1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
2. Identify, formulate and solve engineering problems in RC and Steel Structures
3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

Footings: Design of rectangular slab, slab-beam type combined footing.
Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.
Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV).**
Design of portal frames with fixed and hinged based supports.

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.
Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks
Gantry Girder: Design of gantry girder with all necessary checks.

Course Outcomes: After studying this course, students will be able to:

1. Students will acquire the basic knowledge in design of RCC and Steel Structures.
2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Question Paper Pattern:

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 50 marks.
- Code books – IS 456, IS 800, IS 3370 (Part IV), SP-16, SP (6) – Steel Tables, shall be referred for designing. The same will be provided during examination.

Textbooks:

1. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
2. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
3. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:

1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behavior"**, Pearson Publications
2. Nether Cot, et.al, **"Behavior and Design of Steel Structures to EC -III"**, CRC Press
3. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
4. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

DATA STRUCTURES AND APPLICATIONS (Effective from the academic year 2018 -2019) SEMESTER – III			
Course Code	**18CS32**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS32) will enable students to:

- Explain fundamentals of data structures and their applications essential for programming/problem solving.
- Illustrate linear representation of data structures: Stack, Queues, Lists, Trees and Graphs.
- Demonstrate sorting and searching algorithms.
- Find suitable data structure during application development/Problem Solving.

Module 1	**Contact Hours**
Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays. **Array Operations**: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. **Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples. **Textbook 1: Chapter 1: 1.2, Chapter 2: 2.2 - 2.7 Text Textbook 2: Chapter 1: 1.1 - 1.4, Chapter 3: 3.1 - 3.3, 3.5, 3.7, Ch apter 4: 4.1 - 4.9, 4.14 Reference 3: Chapter 1: 1.4** **RBT: L1, L2, L3**	10
Module 2	
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Recursion** - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. **Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples. **Textbook 1: Chapter 3: 3.1 -3.7 Textbook 2: Chapter 6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13** **RBT: L1, L2, L3**	10
Module 3	
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples **Textbook 1: Ch apter 4: 4.1 – 4.6, 4.8, Textbook 2: Ch apter 5: 5.1 – 5.10,** **RBT: L1, L2, L3**	10
Module 4	
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples	10

Textbook 1: Chapter 5: 5.1 –5.5, 5.7; Textbook 2: Chapter 7: 7.1 – 7.9 **RBT: L1, L2, L3**	
Module 5	
Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. **Sorting and Searching**: Insertion Sort, Radix sort, Address Calculation Sort. **Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. **Files and Their Organization:** Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing **Textbook 1: Chapter 6 : 6.1 –6.2, Chapter 7:7.2, Chapter 8 : 8.1-8.3** **Textbook 2: Chapter 8 : 8.1 – 8.7, Chapter 9 : 9.1-9.3, 9.7, 9.9** **Reference 2: Chapter 16 : 16.1 - 16.7** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Use different types of data structures, operations and algorithms
- Apply searching and sorting operations on files
- Use stack, Queue, Lists, Trees and Graphs in problem solving
- Implement all data structures in a high-level language for problem solving.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Reference Books:

1. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
2. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013
4. A M Tenenbaum, Data Structures using C, PHI, 1989
5. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.

SOFTWARE ENGINEERING
(Effective from the academic year 2018 -2019)
SEMESTER – III

Course Code	**18CS35**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03

CREDITS –3

Course Learning Objectives: This course (18CS35) will enable students to:

- Outline software engineering principles and activities involved in building large software programs.Identify ethical and professional issues and explain why they are of concern to software engineers.
- Explain the fundamentals of object oriented concepts
- Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. Differentiate system models, use UML diagrams and apply design patterns.
- Discuss the distinctions between validation testing and defect testing.
- Recognize the importance of software maintenance and describe the intricacies involved in software evolution.Apply estimation techniques, schedule project activities and compute pricing.
- Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved.

Module 1	**Contact Hours**
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. **Software Processes**: Models: Waterfall Model **(Sec 2.1.1)**, Incremental Model **(Sec 2.1.2)** and Spiral Model **(Sec 2.1.3)**. Process activities. **Requirements Engineering**: Requirements Engineering Processes **(Chap 4)**. Requirements Elicitation and Analysis **(Sec 4.5).** Functional and non-functional requirements **(Sec 4.1)**. The software Requirements Document **(Sec 4.2)**. Requirements Specification **(Sec 4.3)**. Requirements validation **(Sec 4.6)**. Requirements Management **(Sec 4.7)**. **RBT: L1, L2, L3**	08
Module 2	
What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. **Introduction, Modelling Concepts and Class Modelling:** What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; **Textbook 2: Ch 1,2,3.** **RBT: L1, L2 L3**	08
Module 3	
System Models: Context models **(Sec 5.1)**. Interaction models **(Sec 5.2)**. Structural models **(Sec 5.3)**. Behavioral models **(Sec 5.4)**. Model-driven engineering **(Sec 5.5)**. **Design and Implementation**: Introduction to RUP **(Sec 2.4)**, Design Principles **(Chap 7)**. Object-oriented design using the UML **(Sec 7.1)**. Design patterns **(Sec 7.2)**. Implementation issues **(Sec 7.3)**. Open source development **(Sec 7.4)**. **RBT: L1, L2, L3**	08

Module 4	
Software Testing: Development testing **(Sec 8.1)**, Test-driven development **(Sec 8.2)**, Release testing **(Sec 8.3)**, User testing **(Sec 8.4)**. Test Automation **(Page no 212)**. **Software Evolution**: Evolution processes **(Sec 9.1)**. Program evolution dynamics **(Sec 9.2)**. Software maintenance **(Sec 9.3)**. Legacy system management **(Sec 9.4)**. **RBT: L1, L2, L3**	08
Module 5	
Project Planning: Software pricing **(Sec 23.1)**. Plan-driven development **(Sec 23.2)**. Project scheduling **(Sec 23.3)**: Estimation techniques **(Sec 23.5)**. **Quality management**: Software quality **(Sec 24.1)**. Reviews and inspections **(Sec 24.3)**. Software measurement and metrics **(Sec 24.4)**. Software standards **(Sec 24.2)** **RBT: L1, L2, L3**	08

Course Outcomes: The student will be able to :

- Design a software system, component, or process to meet desired needs within realistic constraints.
- Assess professional and ethical responsibility
- Function on multi-disciplinary teams
- Use the techniques, skills, and modern engineering tools necessary for engineering practice
- Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.

Reference Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

DESIGN AND ANALYSIS OF ALGORITHMS (Effective from the academic year 2018 -2019) SEMESTER – IV			
Course Code	**18CS42**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS42) will enable students to:

- Explain various computational problem solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis.

Module 1	**Contact Hours**
Introduction: What is an Algorithm? **(T2:1.1),** Algorithm Specification **(T2:1.2),** Analysis Framework **(T1:2.1), Performance Analysis**: Space complexity, Time complexity **(T2:1.3)**. **Asymptotic Notations:** Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples **(T1:2.2, 2.3, 2.4). Important Problem Types:** Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. **Fundamental Data Structures:** Stacks, Queues, Graphs, Trees, Sets and Dictionaries. **(T1:1.3,1.4).** **RBT: L1, L2, L3**	10
Module 2	
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum **(T2:3.1, 3.3, 3.4)**, Merge sort, Quick sort **(T1:4.1, 4.2)**, Strassen's matrix multiplication **(T2:3.8)**, Advantages and Disadvantages of divide and conquer. **Decrease and Conquer Approach:** Topological Sort. **(T1:5.3).** **RBT: L1, L2, L3**	10
Module 3	
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines **(T2:4.1, 4.3, 4.5). Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm **(T1:9.1, 9.2)**. **Single source shortest paths:** Dijkstra's Algorithm **(T1:9.3)**. **Optimal Tree problem:** Huffman Trees and Codes **(T1:9.4)**. **Transform and Conquer Approach:** Heaps and Heap Sort **(T1:6.4)**. **RBT: L1, L2, L3**	10
Module 4	
Dynamic Programming: General method with Examples, Multistage Graphs **(T2:5.1, 5.2)**. **Transitive Closure:** Warshall's Algorithm, **All Pairs Shortest Paths:** Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem **((T1:8.2, 8.3, 8.4)**, Bellman-Ford Algorithm **(T2:5.4)**, Travelling Sales Person problem **(T2:5.9)**, Reliability design **(T2:5.8)**. **RBT: L1, L2, L3**	10
Module 5	
Backtracking: General method **(T2:7.1)**, N-Queens problem **(T1:12.1)**, Sum of subsets problem **(T1:12.1)**, Graph coloring **(T2:7.4)**, Hamiltonian cycles **(T2:7.5)**. **Programme and Bound:** Assignment Problem, Travelling Sales Person problem **(T1:12.2)**, **0/1 Knapsack problem (T2:8.2, T1:12.2):** LC Programme and Bound solution **(T2:8.2)**, FIFO Programme and Bound solution **(T2:8.2)**. **NP-Complete and NP-Hard problems:** Basic concepts, non-	10

deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes **(T2:11.1)**. **RBT: L1, L2, L3**	

Course Outcomes: The student will be able to :

- Describe computational solution to well known problems like searching, sorting etc.
- Estimate the computational complexity of different algorithms.
- Devise an algorithm using appropriate design strategies for problem solving.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education).

MICROCONTROLLER AND EMBEDDED SYSTEMS (Effective from the academic year 2018 -2019) SEMESTER – IV			
Course Code	**18CS44**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS44) will enable students to:

- Understand the fundamentals of ARM based systems, basic hardware components, selection methods and attributes of an embedded system.
- Program ARM controller using the various instructions
- Identify the applicability of the embedded system
- Comprehend the real time operating system used for the embedded system

Module 1	**Contact Hours**
Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions **Text book 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5** **RBT: L1, L2**	08
Module 2	
Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants **ARM programming using Assembly language:** Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs **Text book 1: Chapter 3:Sections 3.1 to 3.6 (Excluding 3.5.2), Chapter 6(Sections 6.1 to 6.6)** **RBT: L1, L2**	08
Module 3	
Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. **Text book 2:Chapter 1(Sections 1.2 to 1.6),Chapter 2(Sections 2.1 to 2.6)** **RBT: L1, L2**	08
Module 4	
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational quality attributes ,non-operational quality attributes, Embedded	08

Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling, embedded firmware design and development **Text book 2: Chapter-3, Chapter-4, Chapter-7 (Sections 7.1, 7.2 only), Chapter-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)** **RBT: L1, L2**	
Module 5	
RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan. **Text book 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.4 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 (block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

- Describe the architectural features and instructions of ARM microcontroller
- Apply the knowledge gained for Programming ARM for different applications.
- Interface external devices and I/O with ARM microcontroller.
- Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Demonstrate the need of real time operating system for embedded system applications

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.

Reference Books:

1. Raghunandan..G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
2. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.
4. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.

COMPUTER NETWORKS AND SECURITY (Effective from the academic year 2018 -2019) SEMESTER – V			
Course Code	**18CS52**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS52) will enable students to:

- Demonstration of application layer protocols
- Discuss transport layer services and understand UDP and TCP protocols
- Explain routers, IP and Routing Algorithms in network layer
- Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard
- Illustrate concepts of Multimedia Networking, Security and Network Management

Module 1	**Contact Hours**
Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP. **T1: Chap 2** **RBT: L1, L2, L3**	10
Module 2	
Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness. **T1: Chap 3** **RBT: L1, L2, L3**	10
Module 3	
The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. **T1: Chap 4: 4.3-4.7** **RBT: L1, L2, L3**	10

Module 4	
Network Security:Overview of Network Security:Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures , Firewalls and Packet Filtering ,Packet Filtering , Proxy Server . **Textbook2: Chapter 10** **RBT: L1, L2, L3**	10
Module 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks Voice-over-IP :Limitations of the Best-Effort IP Service ,Removing Jitter at the Receiver for Audio ,Recovering from Packet Loss Protocols for Real-Time Conversational Applications , RTP , SIP **Textbook11: Chap 7** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Explain principles of application layer protocols
- Recognize transport layer services and infer UDP and TCP protocols
- Classify routers, IP and Routing Algorithms in network layer
- Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard
- Describe Multimedia Networking and Network Management

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

DATABASE MANAGEMENT SYSTEM (Effective from the academic year 2018 -2019) SEMESTER – V			
Course Code	**18CS53**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS53) will enable students to:

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems.

Module 1	**Contact Hours**
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. **Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10** **RBT: L1, L2, L3**	10
Module 2	
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to-Relational mapping. **SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. **Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5** **RBT: L1, L2, L3**	10
Module 3	
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. **Database Application Development:** Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. **Internet Applications:** The three-Tier application architecture, The presentation layer, The Middle Tier **Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.** **RBT: L1, L2, L3**	10
Module 4	
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational	10

Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms **Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6** **RBT: L1, L2, L3**	
Module 5	
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. **Introduction to Database Recovery Protocols:** Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures **Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS.
- Use Structured Query Language (SQL) for database manipulation.
- Design and build simple database systems
- Develop application to interact with databases.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

APPLICATION DEVELOPMENT USING PYTHON
[(Effective from the academic year 2018 -2019)
SEMESTER – V

Course Code	**18CS55**	**IA Marks**	40
Number of Lecture Hours/Week	03	**Exam Marks**	60
Total Number of Lecture Hours	40	**Exam Hours**	03

CREDITS – 03

Course Learning Objectives: This course (18CS55) will enable students to

- Learn the syntax and semantics of Python programming language.
- Illustrate the process of structuring the data using lists, tuples and dictionaries.
- Demonstrate the use of built-in functions to navigate the file system.
- Implement the Object Oriented Programming concepts in Python.
- Appraise the need for working with various documents like Excel, PDF, Word and Others.

Module – 1	**Teaching Hours**
Python Basics, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program,**Flow control,** Boolean Values, Comparison Operators, Boolean Operators,Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules,Ending a Program Early with sys.exit(), **Functions,** def Statements with Parameters, Return Values and return Statements,The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number **Textbook 1: Chapters 1 – 3** **RBT: L1, L2**	08
Module – 2	
Lists, The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples,References, **Dictionaries and Structuring Data,** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, **Manipulating Strings,** Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup **Textbook 1: Chapters 4 – 6** **RBT: L1, L2, L3**	08
Module – 3	
Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions,More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor, **Reading and Writing Files,** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the pprint.pformat() Function, Project: Generating Random Quiz Files, Project: Multiclipboard, **Organizing Files,** The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates,Project: Backing Up a Folder into a ZIP File, **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE's Debugger. **Textbook 1: Chapters 7 – 10**	08

RBT: L1, L2, L3	
Module – 4	
Classes and objects, Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example,The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation,**Inheritance,** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation **Textbook 2: Chapters 15 – 18** **RBT: L1, L2, L3**	08
Module – 5	
Web Scraping, Project: MAPIT.PY with the webbrowser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML, Parsing HTML with the BeautifulSoup Module, Project: "I'm Feeling Lucky" Google Search,Project: Downloading All XKCD Comics, Controlling the Browser with the selenium Module, **Working with Excel Spreadsheets,** Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns, Charts, **Working with PDF and Word Documents,** PDF Documents, Project: Combining Select Pages from Many PDFs, Word Documents, **Working with CSV files and JSON data,** The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module, Project: Fetching Current Weather Data **Textbook 1: Chapters 11 – 14** **RBT: L1, L2, L3**	08

Course Outcomes: After studying this course, students will be able to

- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Determine the need for scraping websites and working with CSV, JSON and other file formats.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Al Sweigart,**"Automate the Boring Stuff with Python",**1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
   (Chapters 1 to 18)
2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist",** 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf)
   (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above links)

Reference Books:

1. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

2. Jake VanderPlas, **"Python Data Science Handbook: Essential Tools for Working with Data",** 1st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058
3. Charles Dierbach, **"Introduction to Computer Science Using Python",** 1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
4. Wesley J Chun, **"Core Python Applications Programming",** 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

WEB TECHNOLOGY AND ITS APPLICATIONS (Effective from the academic year 2018 -2019) SEMESTER – VI			
Course Code	**18CS63**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS63) will enable students to:

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Infer Object Oriented Programming capabilities of PHP
- Examine JavaScript frameworks such as jQuery and Backbone

Module 1	**Contact Hours**
Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. **Textbook 1: Ch. 2, 3** **RBT: L1, L2, L3**	10
Module 2	
HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. **Textbook 1: Ch. 4,5** **RBT: L1, L2, L3**	10
Module 3	
JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions **Textbook 1: Ch. 6, 8** **RBT: L1, L2, L3**	10
Module 4	
PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling **Textbook 1: Ch. 9, 10** **RBT: L1, L2, L3**	10
Module 5	
Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone	10

MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.

Textbook 1: Ch. 13, 15,17

RBT: L1, L2, L3

Course Outcomes: The student will be able to :

- Adapt HTML and CSS syntax and semantics to build web pages.
- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Randy Connolly, Ricardo Hoar, **"Fundamentals of Web Development",** 1st Edition, Pearson Education India. (**ISBN:**978-9332575271)

Reference Books:

1. Robin Nixon, **"Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5",** 4th Edition, O'Reilly Publications, 2015. (**ISBN:**978-9352130153)
2. Luke Welling, Laura Thomson, **"PHP and MySQL Web Development",** 5th Edition, Pearson Education, 2016. (**ISBN:**978-9332582736)
3. Nicholas C Zakas, **"Professional JavaScript for Web Developers",** 3rd Edition, Wrox/Wiley India, 2012. (**ISBN:**978-8126535088)
4. David Sawyer Mcfarland, **"JavaScript & jQuery: The Missing Manual",** 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014

Mandatory Note:

Distribution of CIE Marks is a follows (Total 40 Marks):

- 20 Marks through IA Tests
- 20 Marks through practical assessmen

Maintain a copy of the report for verification during LIC visit.

Posssible list of practicals:

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
   a. Parameter: A string
   b. Output: The position in the string of the left-most vowel

c. Parameter: A number
d. Output: The number with its digits in the reverse order

5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Programme, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
   a. Implement simple calculator operations.
   b. Find the transpose of a matrix.
   c. Multiplication of two matrices.
   d. Addition of two matrices.
9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
   a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.
   b. Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of statesList.
   c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
   d. Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

MOBILE APPLICATION DEVELOPMENT
(Effective from the academic year 2018 -2019)
SEMESTER – VI

Course Code	**18CSMP68**	**IA Marks**	40
Number of Contact Hours/Week	0:0:2	**Exam Marks**	60
Total Number of Contact Hours	3 Hours/Week	**Exam Hours**	03

CREDITS – 02

Laboratory Objectives: Thislaboratory (18CSMP68) will enable students to

- Learn and acquire the art of Android Programming.
- ConfigureAndroid studio to run the applications.
- Understand and implement Android's User interface functions.
- Create, modify and query on SQlite database.
- Inspect different methods of sharing data using services.

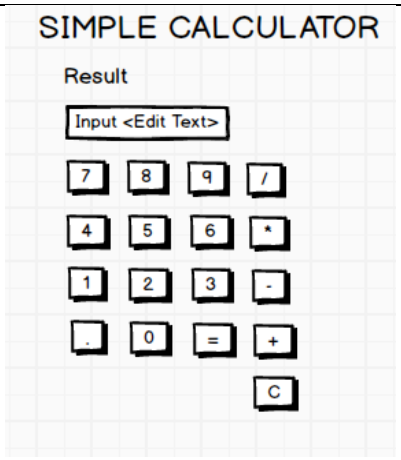
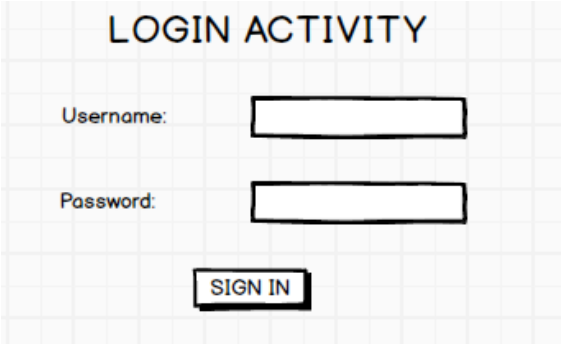
Descriptions (if any):

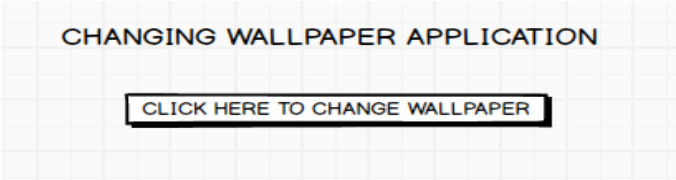
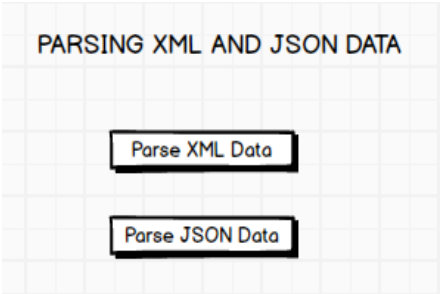
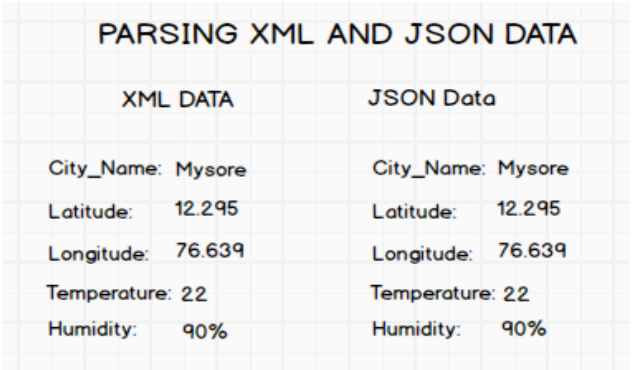
1. The installation procedure of the Android Studio/Java software must be demonstrated and carried out in groups.
2. Students should use the latest version of Android Studio/Java/ Kotlin to execute these programs. Diagrams given are for representational purposes only, students are expected to improvise on them.
3. **Part B programs should be developed as an application and are to be demonstrated as a mini project in a group by adding extra features or the students can also develop their application and demonstrate it as a mini-project. (Projects/programs are not limited to the list given in Part B).**

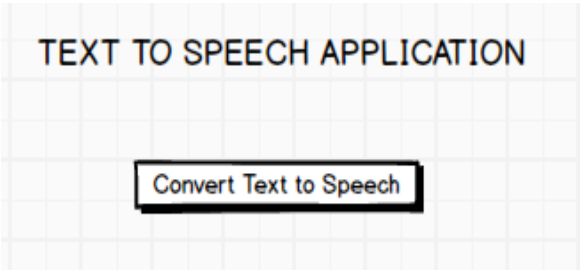
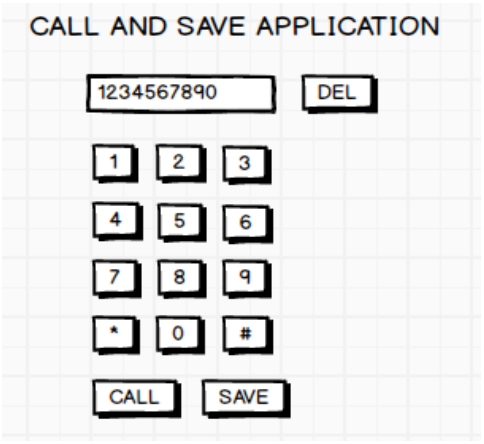
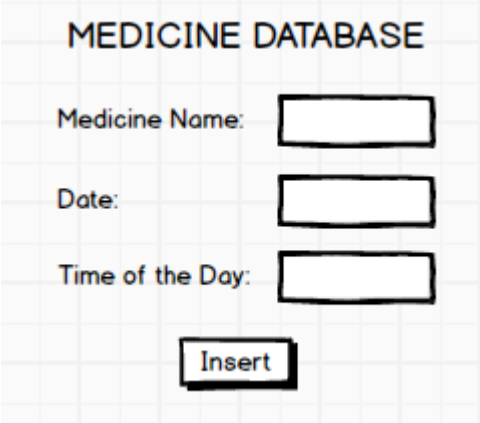
Programs List:

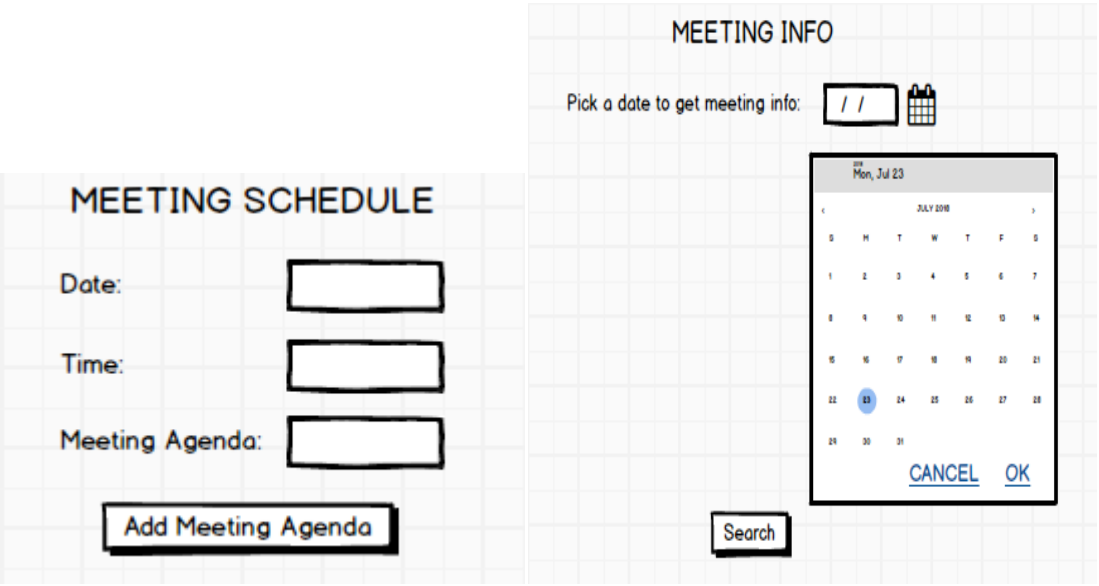
PART – A

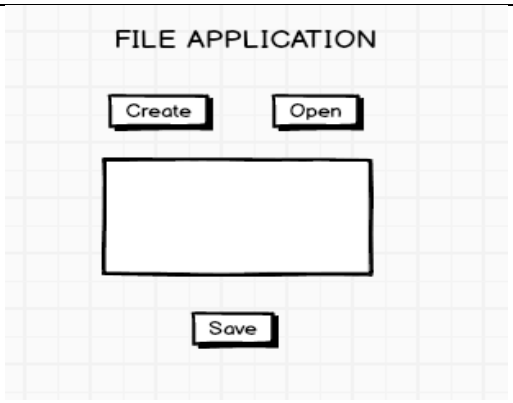
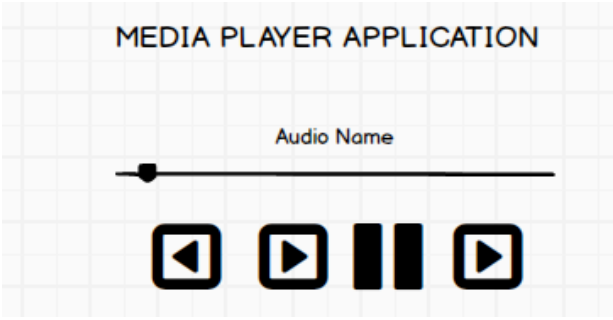
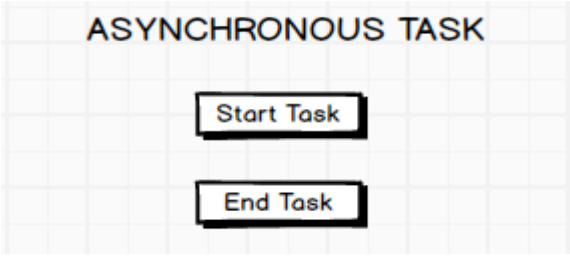
1	Create an application to design aVisiting Card. The Visiting card should havea companylogoatthe top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address isto be displayed. Insert a horizontal line between the job title and the phone number. 
2	Develop an Android application usingcontrols like Button, TextView, EditText for designing a calculatorhaving basic functionality like Addition, Subtraction, Multiplication,andDivision.

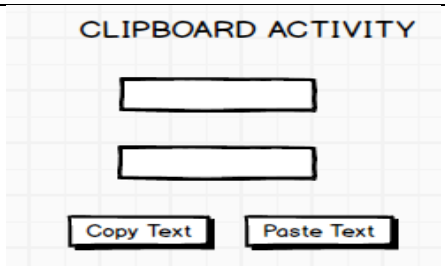
	
3	Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules: • Password should contain uppercase and lowercase letters. • Password should contain letters and numbers. • Password should contain special characters. • Minimum length of the password (the default value is 8). On successful **SIGN UP** proceed to the next Login activity. Here the user should **SIGN IN** using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity whichdisplays a message saying "Successful Login" or else display a toast message saying "Login Failed".The user is given only two attempts and after thatdisplay a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.  

4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds. 
5	Write a program to create an activity with two buttons START and STOP. On pressingoftheSTART button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a TextViewcontrol. 
6	Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature,andHumidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.  

7	Develop a simple application withoneEditTextso that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice. 
8	Create an activity like a phone dialer withCALLand SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts. 
PART - B	
1	Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Eveningor Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name. 

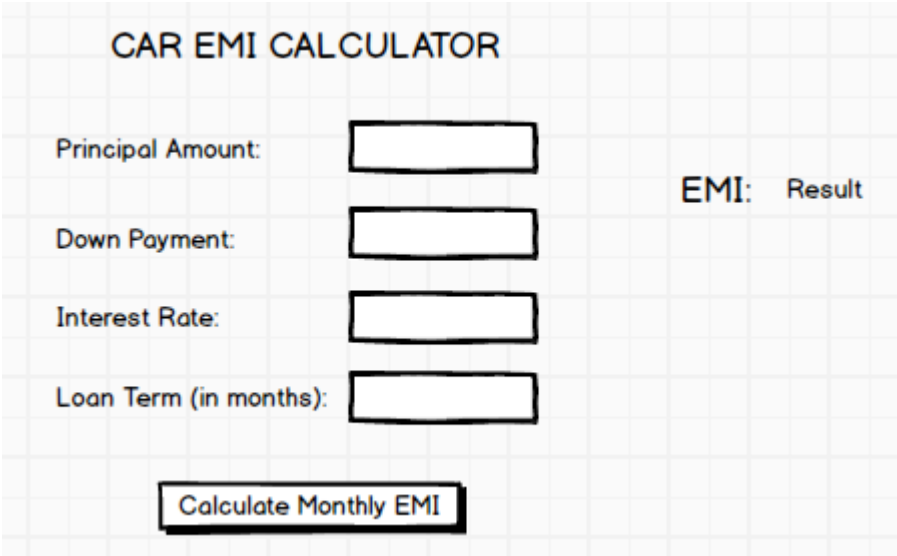
2	Develop a content provider application with an activity called “Meeting Schedule” which takes Date, Time and Meeting Agenda as input from the user and store this information into the SQLite database. Create another application with an activity called “Meeting Info” having DatePicker control, which on the selection of a date should display the Meeting Agenda information for that particular date, else it should display a toast message saying “No Meeting on this Date”. 
3	Create an application to receive an incoming SMS which is notified to the user. On clicking this SMS notification, the message content and the number should be displayed on the screen. Use appropriate emulator control to send the SMS message to your application. 
4	Write a program to create an activity having a Text box, and also Save, Open and Create buttons. The user has to write some text in the Text box. On pressing the Create button the text should be saved as a text file in MkSDcard. On subsequent changes to the text, the Save button should be pressed to store the latest content to the same file. On pressing the Open button, it should display the contents from the previously stored files in the Text box. If the user tries to save the contents in the Textbox to a file without creating it, then a toast message has to be displayed saying “First Create a File”.

	
5	Create an application to demonstrate a basic media playerthat allows the user to Forward, Backward, Play and Pause an audio. Also, make use of the indicator in the seek bar to move the audio forward or backward as required. 
6	Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On pressing the **Start Task** button, the banner message should scrollfrom right to left. On pressing the **Stop Task** button, the banner message should stop.Let the banner message be "Demonstration of Asynchronous Task". 
7	Develop an application that makes use of the clipboard framework for copying and pasting of the text. The activity consists of two EditText controls and two Buttons to trigger the copy and paste functionality.

<table>
<tr><td></td><td> 
</td></tr>
<tr><td>8</td><td>Create an AIDL service that calculates Car Loan EMI. The formula to calculate EMI is

$E = P * (r(1+r)^n)/((1+r)^n-1)$
where
E = The EMI payable on the car loan amount
P = The Car loan Principal Amount
r = The interest rate value computed on a monthly basis
n = The loan tenure in the form of months

The down payment amount has to be deducted from the principal amount paid towards buying the Car. Develop an application that makes use of this AIDL service to calculate the EMI. This application should have four EditText to read the PrincipalAmount, Down Payment, Interest Rate, Loan Term (in months) and a button named as “Calculate Monthly EMI”. On click of this button, the result should be shown in a TextView. Also, calculate the EMI by varying the Loan Term and Interest Rate values.

 
</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Laboratory Outcomes:After studying theselaboratory programs, students will be able to</td></tr>
<tr><td colspan="2">• Create, test and debug Android application by setting up Android development environment.
• Implement adaptive, responsive user interfaces that work across a wide range of devices.
• Infer long running tasks and background work in Android applications.
• Demonstrate methods in storing, sharing and retrieving data in Android applications.</td></tr>
</table>

- Infer the role of permissions and security for Android applications.

Procedure to Conduct Practical Examination

- Experiment distribution
  - For laboratories having only one part: Students are allowed to pick oneexperiment from the lot with equal opportunity.
  - For laboratories having PART A and PART B: Students are allowed to pick oneexperiment from PART A and one experiment from PART B, with equalopportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.

- Marks Distribution (Courseed to change in accordance with university regulations)
  - For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15= 100 Marks
  - For laboratories having PART A and PART B
    i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks

    ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

Text Books:

1. Google Developer Training, **"Android Developer Fundamentals Course – Concept Reference",** Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details
   (Download pdf file from the above link)

Reference Books:

1. Erik Hellman, **"Android Programming – Pushing the Limits",** 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197
2. Dawn Griffiths and David Griffiths, **"Head First Android Development",** 1st Edition, O'Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
3. Bill Phillips, Chris Stewart and Kristin Marsicano, **"Android Programming: The Big Nerd Ranch Guide",** 3rd Edition, Big Nerd Ranch Guides, 2017. ISBN-13: 978-0134706054

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS71**	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS71) will enable students to:

- Explain Artificial Intelligence and Machine Learning
- Illustrate AI and ML algorithm and their use in appropriate applications

Module 1	**Contact Hours**
What is artificial intelligence?, Problems, problem spaces and search, Heuristic search techniques **Texbook 1: Chapter 1, 2 and 3** **RBT: L1, L2**	10
Module 2	
Knowledge representation issues, Predicate logic, Representaiton knowledge using rules. Concpet Learning: Concept learning task, Concpet learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm. **Texbook 1: Chapter 4, 5 and 6** **Texbook2: Chapter 2 (2.1-2.5, 2.7)** **RBT: L1, L2, L3**	10
Module 3	
Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3 algorith. Aritificil Nueral Network: Introduction, NN representation, Appropriate problems, Perceptrons, Backpropagation algorithm. **Texbook2: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.5)** **RBT: L1, L2, L3**	10
Module 4	
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Navie Bayes classifier, BBN, EM Algorithm **Texbook2: Chapter 6** **RBT: L1, L2, L3**	10
Module 5	
Instance-Base Learning: Introduction, k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function, Case-Based reasoning. Reinforcement Learning: Introduction, The learning task, Q-Learning. **Texbook 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3)** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Appaise the theory of Artificial intelligence and Machine Learning.
- Illustrate the working of AI and ML Algorithms.
- Demonstrate the applications of AI and ML.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Tom M Mitchell,**"Machine Lerning",** 1st Edition, McGraw Hill Education, 2017.
2. Elaine Rich, Kevin K and S B Nair, **"Artificial Inteligence",** 3rd Edition, McGraw Hill Education, 2017.

Reference Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage learning
2. Stuart Rusell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition
3. AurÈlienGÈron,"Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017.
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
5. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press
6. Srinvivasa K G and Shreedhar, " Artificial Intelligence and Machine Learning", Cengage

BIG DATA AND ANALYTICS (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS72**	**CIE Marks**	40
Number of Contact Hours/Week	4:0:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03
CREDITS –4			

Course Learning Objectives: This course (18CS72) will enable students to:

- Understand fundamentals of Big Data analytics
- Explore the Hadoop framework and Hadoop Distributed File system
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
- Employ MapReduce programming model to process the big data
- Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

Module 1	**Contact Hours**
Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies. **Text book 1: Chapter 1: 1.2 -1.7** **RBT: L1, L2, L3**	10
Module 2	
Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. **Hadoop Distributed File System Basics (T2):** HDFS Design Features, Components, HDFS User Commands. **Essential Hadoop Tools (T2):** Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase. **Text book 1: Chapter 2 :2.1-2.6** **Text Book 2: Chapter 3** **Text Book 2: Chapter 7 (except walk throughs)** **RBT: L1, L2, L3**	10
Module 3	
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases. **Text book 1: Chapter 3: 3.1-3.7** **RBT: L1, L2, L3**	10
Module 4	
MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig. **Text book 1: Chapter 4: 4.1-4.6** **RBT: L1, L2, L3**	10

Module 5	
Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining. **Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics: **Text book 1: Chapter 6: 6.1 to 6.5** **Text book 1: Chapter 9: 9.1 to 9.5**	10

Course Outcomes: The student will be able to:

- Understand fundamentals of Big Data analytics.
- Investigate Hadoop framework and Hadoop Distributed File system.
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
- Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
- Use Machine Learning algorithms for real world big data.
- Analyze web contents and Social Networks to provide analytics with relevant visualization tools.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Raj Kamal and Preeti Saxena, "**Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning",** McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, **"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem",** 1st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351

Reference Books:

1. Tom White, **"Hadoop: The Definitive Guide",** 4th Edition, O'Reilly Media, 2015.ISBN-13: 978-9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, **"Professional Hadoop Solutions",** 1st Edition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer, **"Hadoop Operations: A Guide for Developers and Administrators",**1st Edition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. Arshdeep Bahga, Vijay Madisetti, **"Big Data Analytics: A Hands-On Approach",** 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

USER INTERFACE DESIGN (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS734**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS734) will enable students to:

- To study the concept of menus, windows, interfaces
- To study about business functions
- To study the characteristics and components of windows andthe various controls for the windows.
- To study about various problems in windows design with color, text, graphics a
- nd To study the testing methods

Module 1	**Contact Hours**
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design **Textbook 1: Ch. 1,2** **RBT: L1, L2**	08
Module 2	
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards. **Textbook 1: Part-2** **RBT: L1, L2**	08
Module 3	
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu**,** Selecting menu choices, Navigating menus, Kinds of graphical menus. **Textbook 1: Part-2** **RBT: L1, L2**	08
Module 4	
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls. **Textbook 1: Part-2** **RBT: L1, L2**	08
Module 5	
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests. **Textbook 1: Part-2** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

- Design the User Interface, design, menu creation, windows creation and connection between menus and windows

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks

- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Wilbert O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition 2002.

Reference Books:

1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
2. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

CRYPTOGRAPHY (Effective from the academic year 2018 -2019) SEMESTER – VII			
Course Code	**18CS744**	**CIE Marks**	40
Number of Contact Hours/Week	3:0:0	**SEE Marks**	60
Total Number of Contact Hours	40	**Exam Hours**	03
CREDITS –3			

Course Learning Objectives: This course (18CS744) will enable students to:

- Define cryptography and its principles
- Explain Cryptography algorithms
- Illustrate Public and Private key cryptography
- Explain Key management, distribution and ceritification
- Explain authentication protocols
- Tell about IPSec

Module – 1	**Contact Hours**
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm **Textbook 1: Ch. 2.1,2.2, Ch. 3** **RBT: L1, L2**	08
Module – 2	
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, desription of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack,Elgamal Cryptographic systems **Textbook 1: Ch. 9, Ch. 10.1,10.2** **RBT: L1, L2**	08
Module – 3	
Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA. **Key Management and Distribution:** Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory,public key	08

authority, public keys certificates. **Textbook 1: Ch. 10.3-10.5, Ch.14.1 to 14.3** **RBT: L1, L2**	
Module – 4	
X-509 certificates. Certificates, X-509 version 3, public key infrastructure .**User Authentication:** Remote user Authentication principles, Mutual Authentication, one wayAuthentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication. **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **Textbook 1: Ch. 14.4, Ch. 15.1 to 15.4, Ch.19** **RBT: L1, L2**	08
Module – 5	
IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service **Transport and tunnel modes**, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **Textbook 1: Ch. 20.1 to 20.3** **RBT: L1, L2**	08
Course outcomes: The students should be able to:	
• Define cryptography and its principles • Explain Cryptography algorithms • Illustrate Public and Private key cryptography • Explain Key management, distribution and ceritification • Explain authentication protocols • Tell about IPSec	
Question paper pattern: • The question paper will have ten questions. • There will be 2 questions from each module. • Each question will have questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. William Stallings: Cryptography and Network Security, Pearson 6th edition.	
Reference Books:	
1. V K Pachghare: Cryptography and Information Security, PHI 2nd Edition.	

ELECTRONIC DEVICES

Course Code	: 18EC33	CIE Marks : 40
Lecture Hours/Week	: 03	SEE marks : 60
Total Number of Lecture Hours : 40 (8 Hours / Module)		Exam Hours : 03
CREDITS – 03		

Course Learning Objectives: This course will enable students to:

- Understand the basics of semiconductor physics and electronic devices.
- Describe the mathematical models BJTs and FETs along with the constructional details.
- Understand the construction and working principles of optoelectronic devices
- Understand the fabrication process of semiconductor devices and CMOS process integration.

Module-1

Semiconductors

Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect.

(Text 1: 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.3, 3.2.4, 3.4.1, 3.4.2, 3.4.3, 3.4.5). L1,L2

Module-2

pn Junctions

Forward and Reverse biased junctions- Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. **(Text 1: 5.3.1, 5.3.3, 5.4, 5.4.1, 5.4.2, 5.4.3)** Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials.

(Text 1: 8.1.1, 8.1.2, 8.1.3, 8.2, 8.2.1), **L1,L2**

Module – 3

Bipolar Junction Transistor

Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.

(Text 1: 7.1, 7.2, 7.3, 7.5.1, 7.6, 7.7.1, 7.7.2, 7.7.3) **L1,L2**

Module-4

Field Effect Transistors

Basic pn JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET- Two terminal MOS structure- Energy band diagram, Ideal Capacitance – Voltage Characteristics and Frequency Effects, Basic MOSFET Operation-MOSFET structure, Current-Voltage Characteristics.

(Text 2: 9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2). L1,L2

Module-5

Fabrication of p-n junctions

Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization.

(Text 1: 5.1)

Integrated Circuits

Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. **(Text 1: 9.1, 9.2, 9.3.1, 9.3.3). L1,L2**

Course outcomes: After studying this course, students will be able to:

1. Understand the principles of semiconductor Physics
2. Understand the principles and characteristics of different types of semiconductor devices
3. Understand the fabrication process of semiconductor devices
4. Utilize the mathematical models of semiconductor junctions for circuits and systems.
5. Identify the mathematical models of MOS transistors for circuits and systems.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices", 7th Edition, Pearson Education, 2016, ISBN 978-93-325-5508-2.
2. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4th Edition, McGraw Hill Education, 2012, ISBN 978-0-07-107010-2.

Reference Book:

1. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3rd Edition, Wiley, 2018.
2. Adir Bar-Lev, "Semiconductor and Electronic Devices", 3rd Edition, PHI, 1993.

POWER ELECTRONICS AND INSTRUMENTATION

Course Code : 18EC36	CIE Marks : 40
Lecture Hours/Week : 03	SEE marks : 60
Total Number of Lecture Hours : 40 (8 Hrs / Module)	Exam Hours : 03
CREDITS – 03	

Course Learning Objectives: This course will enable students to:

- Study and analysis of thyristor circuits with different triggering conditions.
- Learn the applications of power devices in controlled rectifiers, converters and inverters.
- Understand types of instrument errors.
- Develop circuits for multirange Ammeters and Voltmeters.
- Describe principle of operation of digital measuring instruments and Bridges.
- Understand the operation of Transducers, Instrumentation amplifiers and PLCs.

Module - 1

Introduction: History, Power Electronic Systems, Power Electronic Converters and Applications (**1.2, 1.3 1.5 & 1.6 of Text 1).**

Thyristors: Static Anode-Cathode characteristics and Gate characteristics of SCR, Turn-ON methods, Turn-OFF mechanisms (**2.3, 2.6 without 2.6.1), 2.7, 2.9 of text 1**),

Turn-OFF Methods: Natural and Forced Commutation – Class A and Class B types (**refer 2.10 without design considerations**),

Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit (**refer 3.5 up to 3.5.2 of Text 1**),

Unijunction Transistor: Basic operation and UJT Firing Circuit (**refer 3.6, up to 3.6.4, except 3.6.2**).

L1, L2

Module - 2

Phase Controlled Converter: Control techniques, Single phase half wave and full wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode (**refer Chapter 6 of Text 1 up to 6.4.1 without derivations**).

Choppers: Chopper Classification, Basic Chopper operation: step-down, step-up and step-up/down choppers. (**refer Chapter 8 of Text 1 up to 8.3.3**)

L1, L2, L3

Module - 3

Inverters: Classification, Single phase Half bridge and full bridge inverters with R and RL load (**refer Chapter 9 of Text 1 up to 9.4.2 without Circuit Analysis**).

Switched Mode Power Supplies: Isolated Flyback Converter, Isolated Forward Converter (**only refer to the circuit operations in section 16.3 of Text 1 up to 16.3.2 except 16.3.1.3 and derivations**).

Principles of Measurement: Static Characteristics, Error in Measurement, Types of Static Error. (Text 2: 1.2-1.6)

Multirange Ammeters, Multirange voltmeter. (Text 2: 3.2, 4.4)

L1, L2, L3

Module - 4

Digital Voltmeter: Ramp Technique, Dual slope integrating Type DVM, Direct Compensation type and Successive Approximations type DVM (Text 2: 5.1-5.3, 5.5, 5.6)

Digital Multimeter: Digital Frequency Meter and Digital Measurement of Time, Function Generator.

Bridges: Measurement of resistance: Wheatstone's Bridge, AC Bridges - Capacitance and Inductance Comparison bridge, Wien's bridge.

(Text 2: refer 6.2, 6.3 up to 6.3.2, 6.4 up to 6.4.2, 8.8, 11.2, 11.8-11.10, 11.14).

L1, L2

Module - 5

Transducers: Introduction, Electrical Transducer, Resistive Transducer, Resistive position Transducer, Resistance Wire Strain Gauges, Resistance Thermometer, Thermistor, LVDT.

(Text 2: 13.1-13.3, 13.5, 13.6 up to 13.6.1, 13.7, 13.8, 13.11).

Instrumentation Amplifier using Transducer Bridge, Temperature indicators using Thermometer, Analog Weight Scale (Text 2: 14.3.3, 14.4.1, 14.4.3).

Programmable Logic Controller: Structure, Operation, Relays and Registers (Text 2: 21.15, 21.15.2, 21.15.3, 21.15.5, 21.15.6).

L1, L2, L3

Course Outcomes: At the end of the course students should be able to:

1. Build and test circuits using power electronic devices.
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters and SMPS.
3. Analyze instrument characteristics and errors.
4. Describe the principle of operation and develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency.
5. Explain the principle, design and analyze the transducers for measuring physical parameters.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897
2. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.

Reference Books:

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
3. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.
4. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN: 9789332556065.

MICROCONTROLLER

Course Code	: **18EC46**	CIE Marks : 40
Lecture Hours/Week : 03		SEE Marks : 60
Total Number of Lecture Hours : 40 (8 Hours / Module)		Exam Hours:03

CREDITS – 03

Course Learning Objectives: This course will enable students to:

- Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.
- Familiarize the basic architecture of 8051 microcontroller.
- Program 8051microprocessor using Assembly Level Language and C.
- Understand the interrupt system of 8051 and the use of interrupts.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
- Interface 8051 to external memory and I/O devices using its I/O ports.

Module-1

8051 Microcontroller: Microprocessor vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

L1, L2

Module -2

8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.

L1, L2

Module-3

8051 Stack, I/O Port Interfacing and Programming: 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops.

Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status. **L1, L2, L3**

Module -4

8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode-2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS-232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. **L1, L2, L3**

Module -5

8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming.

L1, L2, L3

Course outcomes: At the end of the course, students will be able to:

1. Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
2. Write 8051 Assembly level programs using 8051 instruction set.
3. Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051.
4. Write 8051 Assembly language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.
5. Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/ Cengage Learning.

Reference Books:

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

MICROCONTROLLER LABORATORY

Laboratory Code : **18ECL47**	CIE Marks : 40	SEE Marks : 60
Lecture Hours/Week : 02 Hours Tutorial (Instructions) + 02 Hours Laboratory		
RBT Levels : L1, L2, L3		Exam Hours : 03
CREDITS 02		

Course Learning Objectives: This laboratory course enables students to

- Understand the basics of microcontroller and its applications.
- Have in-depth knowledge of 8051 assembly language programming.
- Understand controlling the devices using C programming.
- The concepts of I/O interfacing for developing real time embedded systems.

Laboratory Experiments

I. PROGRAMMING

1. Data Transfer: Block Move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX.
7. Programs to generate delay, Programs using serial port and on-Chip timer/counter.

II. INTERFACING

1. Interface a simple toggle switch to 8051 and write an ALP to generate an interrupt which switches on an LED (i) continuously as long as switch is on and (ii) only once for a small time when the switch is turned on.
2. Write a C program to (i) transmit and (ii) to receive a set of characters serially by interfacing 8051 to a terminal.
3. Write ALPs to generate waveforms using ADC interface.
4. Write ALP to interface an LCD display and to display a message on it.
5. Write ALP to interface a Stepper Motor to 8051 to rotate the motor.
6. Write ALP to interface ADC-0804 and convert an analog input connected to it.

Course Outcomes: On the completion of this laboratory course, the students will be able to:

1. Enhance programming skills using Assembly language and C.
2. Write Assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051.
3. Interface different input and output devices to 8051 and control them using Assembly language programs.
4. Interface the serial devices to 8051 and do the serial transfer using C programming.
5. Develop applications based on Microcontroller 8051.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

DIGITAL SIGNAL PROCESSING

Course Code : **18EC52**	CIE Marks : 40
Lecture Hours/Week : 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)	Exam Hours : 03
CREDITS : 04	

Course Learning Objectives: This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.
- Understand the architecture and working of DSP processor

Module-1

Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties.

[Text 1], **L1,L2,L3**

Module-2

Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long data Sequences.

Fast-Fourier-Transform (FFT) algorithms: Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms.

[Text 1], **L1,L2, L3**

Module-3

Design of FIR Filters: Characteristics of practical frequency –selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR filters using windows - Rectangular, Hamming, Hanning, Bartlett windows. Design of FIR filters using frequency sampling method. Structure for FIR Systems: Direct form, Cascade form and Lattice structures.

[Text1], **L1, L2, L3**

Module-4

IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Lowpass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II.

[Text 2], L1,L2,L3

Module-5

Digital Signal Processors: DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors, Floating point processors, FIR and IIR filter implementations in Fixed point systems.

[Text 2], L1, L2, L3

Course Outcomes: After studying this course, students will be able to:

1. Determine response of LTI systems using time domain and DFT techniques.
2. Compute DFT of real and complex discrete time signals.
3. Compute DFT using FFT algorithms and linear filtering approach.
4. Design and realize FIR and IIR digital filters.
5. Understand the DSP processor architecture.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60

Text Book:

1. Proakis & Manolakis, "Digital Signal Processing – Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2. Li Tan, Jean Jiang, "Digital Signal processing – Fundamentals and Applications", Academic Press, 2013, ISBN: 978-0-12-415893.

Reference Books:

1. Sanjit K Mitra, "Digital Signal Processing, A Computer Based Approach", 4th Edition, McGraw Hill Education, 2013,
2. Oppenheim & Schaffer, "Discrete Time Signal Processing" , PHI, 2003.
3. D.Ganesh Rao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

ELECTROMAGNETIC WAVES

Course Code	: **18EC55**	CIE Marks	: 40
Lecture Hours/Week	: 3	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (8 Hrs / Module)	Exam Hours	: 03
	CREDITS – 03		

Course Learning Objectives: This course will enable students to:

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart's, Ampere's Law and Stokes' theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behavior in different media.
- Acquire knowledge of Poynting theorem and its application of power flow.

Module-1

Revision of Vector Calculus – **(Text 1: Chapter 1)**

Coulomb's Law, Electric Field Intensity and Flux density: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**

L1, L2, L3

Module -2

Gauss's law and Divergence: Gauss law, Application of Gauss law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ∇ and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).**

Energy, Potential and Conductors: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and 4.6).** Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**

L1, L2, L3

Module-3

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation **(Text: Chapter 7.1 to 7.3)**

Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems. (**Text: Chapter 8.1 to 8.6)**

L1, L2, L3

Module -4

Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).**

Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems **(Text: Chapter 9.6 to 9.7).**

Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**

L1, L2, L3

Module -5

Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)**

Uniform Plane Wave: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (γ, α, β, η) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**

L1, L2, L3

Course Outcomes: After studying this course, students will be able to:

1. Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
2. Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.

3. Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
4. Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
5. Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:

1. W.H. Hayt and J.A. Buck, —Engineering Electromagnetics, 8th Edition, Tata McGraw-Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books:

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4th Edn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balmain, PHI, 2nd Edn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. Fundamentals of Electromagnetics for Engineering - N. Narayana Rao, Pearson.

DIGITAL SIGNAL PROCESSING LABORATORY

Course Code : **18ECL57**	CIE Marks : 40	SEE Marks : 60
Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory		
RBT Level : L1, L2, L3	Exam Hours : 03	
CREDITS – 02		

Course Learning Objectives: This course will enable students to

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

Laboratory Experiments

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Verification of sampling theorem (use interpolation function).

2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.

3. Auto and cross correlation of two sequences and verification of their properties

4. Solving a given difference equation.

5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).

6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
   (ii) DFT computation of square pulse and Sinc function etc.

7. Design and implementation of Low pass and High pass FIR filter to meet the desired specifications (using different window techniques) and test the filter with an audio file. Plot the spectrum of audio signal before and after filtering.

8. Design and implementation of a digital IIR filter (Low pass and High pass) to meet given specifications and test with an audio file. Plot the spectrum of audio signal before and after filtering.

Following Experiments to be done using DSP kit

9. Obtain the Linear convolution of two sequences.
10. Compute Circular convolution of two sequences.
11. Compute the N-point DFT of a given sequence.
12. Determine the Impulse response of first order and second order system.
13. Generation of sine wave and standard test signals

Course Outcomes:

On the completion of this laboratory course, the students will be able to:

1. Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
2. Model the discrete time signals and systems and verify its properties and results.
3. Implement discrete computations using DSP processor and verify the results.
4. Realize the digital filters using a simulation tool and analyze the response of the filter for an audio signal.
5. Write programs using Matlab / Scilab/Octave to illustrate DSP concepts.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

Reference Books:

1. Vinay K Ingle, John G Proakis, Digital Signal Processing using MATLAB, Fourth Edition, Cengage India Private Limited, 2017.

EMBEDDED SYSTEMS

Course Code	: 18EC62	CIE Marks : 40
Lecture Hours/Week	: 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)		Exam Hours : 03
CREDITS : 04		

Course Learning Objectives: This course will enable students to:

- Explain the architectural features and instructions of 32 bit microcontroller -ARM Cortex M3.
- Develop Programs using the various instructions of ARM Cortex M3 and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Module 1

ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence **(Text 1: Ch-1, 2, 3)**

L1,L2

Module 2

ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming **(Text 1: Ch-4, Ch-10.1 to 10.6)**

L1,L2,L3

Module 3

Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Princeton, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only)

(Text 2: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only).

L1, L2

Module 4

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). **Text 2: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)**

L1,L2,L3

Module 5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques **(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch-12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)**

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
2. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
3. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
4. Develop the hardware software co-design and firmware design approaches.
5. Explain the need of real time operating system for embedded system applications.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

Reference Books:

1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0-471-72180-2.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd Ed. Man Press LLC ©2015 ISBN: 0982692633 9780982692639.
3. K.V. K. K Prasad, Embedded Real Time Systems, Dreamtech publications, 2003.
4. Rajkamal, Embedded Systems, 2nd Edition, McGraw hill Publications, 2010.

MICROWAVE and ANTENNAS

Course Code	: **18EC63**	CIE Marks : 40
Lecture Hours/Week	: 03 + 2 (Tutorial)	SEE marks : 60
Total Number of Lecture Hours : 50 (10 Hrs / Module)		Exam Hours : 03
CREDITS : 04		

Course Learning Objectives: This course will enable students to:

- Describe the microwave properties and its transmission media
- Describe microwave devices for several applications
- Understand the basics of antenna theory
- Select antennas for specific applications

Module 1

Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). **(Text 1: 9.1, 9.2.1)**

Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching.
(Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching)
L1,L2

Module 2

Microwave Network theory: Introduction**,** Symmetrical Z and Y-Parameters for reciprocal Networks, S matrix representation of Multi-Port Networks. **(Text1: 6.1, 6.2, 6.3)**

Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees.
(Text 1: 6.4.2,6.4.14, 6.4.15, 6.4.16) **L1,L2**

Module 3

Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines**. (Text 2: 11.1, 11.2, 11.3, 11.4)**

Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Radio Communication Link, Antenna Field Zones. **(Text 3: 2.1 - 2.7, 2.9 – 2.11, 2.13)** **L1,L2,L3**

Module 4

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Arrays of two isotropic point sources, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.
(Text 3: 5.1 – 5.6, 5.9, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole, Radiation Resistance of a Short Electric Dipole, Thin Linear Antenna (Field Analyses)
(Text 3: 6.1 - 6.5)

L1,L2,L3,L4

Module 5

Loop and Horn Antenna: Introduction, Small loop, The Loop Antenna General Case, The Loop Antenna as a special case, Radiation resistance of loops, Directivity of Circular Loop Antennas with uniform current, Horn antennas Rectangular Horn Antennas.
(Text 3: 7.1, 7.2, 7.4, 7.6, 7.7, 7.8, 7.19, 7.20)

Antenna Types: The Helix geometry, Helix modes, Practical Design considerations for the mono-filar axial mode Helical Antenna, Yagi-Uda array, Parabolic reflector
(Text 3: 8.3, 8.4, 8.5, 8.8, 9.5)

L1,L2,L3

Course outcomes: At the end of the course students will be able to:

1. Describe the use and advantages of microwave transmission
2. Analyze various parameters related to microwave transmission lines and waveguides
3. Identify microwave devices for several applications
4. Analyze various antenna parameters necessary for building a RF system
5. Recommend various antenna configurations according to the applications.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das, TMH, Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Samuel Y Liao, Pearson Education
3. **Antennas and Wave Propagation**- John D. Krauss, Ronald J Marhefka, Ahmad S Khan, 4th Edition, McGraw Hill Education, 2013

Reference Books:

1. **Microwave Engineering** - David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2nd Edn, 2015
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007

OPERATING SYSTEM

Course Code	: 18EC641	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40 (08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to:

- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management.
- Describe the structure and organization of the file system
- Understand interprocess communication and deadlock situations.

Module-1

Introduction to Operating Systems

OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems

(Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).

L1,L2

Module-2

Process Management: OS View of Processes, PCB, Fundamental State Transitions of a process, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux

(Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2 , Selected scheduling topics from 4.2 and 4.3 , 4.6, 4.7 of Text).

L1,L2,L3

Module – 3

Memory Management: Contiguous Memory allocation, Non-Contiguos Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux

(Topics from Sections 5.5 to 5.9, 6.1 to 6.3 except Optimal policy and 6.3.1, 6.7,6.8 of Text).

L1,L2,L3

Module-4

File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access

(Topics from Sections 7.1 to 7.8 of Text). L1,L2

Module-5

Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention

(Topics from Sections 10.1 to 10.3, 11.1 to 11.5 of Text). L1,L2

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

1. Explain the goals, structure, operation and types of operating systems.
2. Apply scheduling techniques to find performance factors.
3. Explain organization of file systems and IOCS.
4. Apply suitable techniques for contiguous and non-contiguous memory allocation.
5. Describe message passing, deadlock detection and prevention methods.

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:

Operating Systems – A Concept based Approach, by Dhamdhere, TMH, 2nd edition.

Reference Books:

1. Operating Systems Concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition,2001.
2. Operating System–Internals and Design System, William Stalling, Pearson Education, 4th ed, 2006.
3. Operating Systems - Design and Implementation, Tanenbaum, TMH, 2001.

PYTHON APPLICATION PROGRAMMING

Course Code	: 18EC646	CIE Marks	: 40
Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40(08 Hrs/module)	Exam Hours	: 03
CREDITS – 03			

Course Learning Objectives: This course will enable students to

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

Module – 1

Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions,

L1, L2, L3

Module – 2

Iteration, Strings, Files,

L1, L2, L3

Module – 3

Lists, Dictionaries, Tuples, Regular Expressions,

L1, L2, L3

Module – 4

Classes and objects, Classes and functions, Classes and methods,

L1, L2, L3

Module – 5

Networked programs, Using Web Services, Using databases and SQL,

L1, L2, L3

Course outcomes: The students will be able to:

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

Question paper pattern:

- The question paper will have TEN questions.
- There will be TWO questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016 (Chapters 1 – 13, 15).
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015 (Chapters 15,16,17)

References:

1. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13:978-9350232873.
2. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
3. Reema Thareja, "Python Programming using problem solving approach", Oxford university press, 2017

COMMUNICATION LABORATORY

Course Code : **18ECL67**	CIE Marks : 40	SEE Marks : 60
Lecture Hours/Week: 02 Hours Tutorial (Instructions) + 02 Hours Laboratory		
RBT Level : L1, L2, L3	Exam Hours : 03	
CREDITS – 02		

Course Learning Objectives: This course will enable students to:

- Design and test the communication circuits for different analog modulation schemes.
- Design and demonstrate the digital modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Understand the probability of error computations of coherent digital modulation schemes.

Laboratory Experiments

PART-A: Expt. 1 to Expt. 5 have to be performed using discrete components.

1. Amplitude Modulation and Demodulation: i) Standard AM, ii)DSBSC (LM741 and LF398 ICs can be used)
2. Frequency modulation and demodulation (IC 8038/2206 can be used)
3. Pulse sampling, flat top sampling and reconstruction
4. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
5. FSK and PSK generation and detection
6. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
7. Obtain the Radiation Pattern and Measurement of directivity and gain of microstrip dipole and Yagi antennas.
8. Determination of
   a. Coupling and isolation characteristics of microstrip directional coupler.
   b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
   c. Power division and isolation of microstrip power divider.

PART-B: Simulation Experiments using SCILAB/MATLAB/Simulink or LabVIEW

1. To Simulate NRZ, RZ, half-sinusoid & raised cosine pulses and generate eye diagram for binary polar signaling.
2. Pulse code modulation and demodulation system.

3. Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their performance curves.
4. Digital Modulation Schemes i) DPSK Transmitter and Receiver, ii) QPSK Transmitter and Receiver.

Course Outcomes: On the completion of this laboratory course, the students will be able to:

1. Design and test circuits for analog modulation and demodulation schemes viz., AM, FM, etc.
2. Determine the characteristics and response of microwave waveguide.
3. Determine characteristics of microstrip antennas and devices & compute the parameters associated with it.
4. Design and test the digital and analog modulation circuits and display the waveforms.
5. Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes.

Conduct of Practical Examination:

- All laboratory experiments are to be considered for practical examination.
- For examination one question from **PART-A** and one question from **PART-B or** only one question from **PART-B** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

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(Effective from the academic year 2021 – 22)

III Semester

Basic Signal Processing			
Course Code	**21EC33**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 13 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

Preparation: To prepare students with fundamental knowledge/ overview in the field of Signal Processing with Familiarization with the concept of Vector spaces and orthogonality with a qualitative insight into applications in communications.

Core Competence: To equip students with a basic foundation of Signal Processing by delivering the basics of quantitative parameters for Matrices & Linear Transformations, the mathematical description of discrete time signals and systems, analyzing the signals in time domain using convolution sum, classifying signals into different categories based on their properties, analyzing Linear Time Invariant (LTI) systems in time and transform domains

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
- Encourage collaborative (Group) Learning in the class.
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
- Give Programming Assignments.

Module-1

Vector Spaces: Vector spaces and Null subspaces, Rank and Row reduced form, Independence, Basis and dimension, Dimensions of the four subspaces, Rank-Nullity Theorem, Linear Transformations Orthogonality: Orthogonal Vectors and Subspaces, Projections and Least squares, Orthogonal Bases and Gram-Schmidt Orthogonalization procedure

(Refer Chapters 2 and 3 of Text 1)

Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3

Module-2	
Eigen values and Eigen vectors: Review of Eigen values and Diagonalization of a Matrix, Special Matrices (Positive Definite, Symmetric) and their properties, Singular Value Decomposition. **(Refer Chapter 5, Text 1)**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-3	
Introduction and Classification of signals: Definition of signal and systems with examples, Elementary signals/Functions: Exponential, sinusoidal, step, impulse and ramp functions **Basic Operations on signals:** Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal. Expression of triangular, rectangular and other waveforms in terms of elementary signals **System Classification and properties:** Linear-nonlinear, Time variant -invariant, causal-noncausal, static-dynamic, stable-unstable, invertible. **(Text 2) [Only for Discrete Signals & Systems]**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-4	
Time domain representation of LTI System: Impulse response, convolution sum. Computation of convolution sum using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular. **LTI system Properties in terms of impulse response:** System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution and step response **(Text 2) [Only for Discrete Signals & Systems]**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-5	
The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform by partial fraction, Causality and stability, Transform analysis of LTI systems. **(Text 2)**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC	
Sl.No	**Experiments**
1	a. Program to create and modify a vector (array). b. Program to create and modify a matrix.
2	Programs on basic operations on matrix.
3	Program to solve system of linear equations.
4	Program for Gram-Schmidt orthogonalization.
5	Program to find Eigen value and Eigen vector.
6	Program to find Singular value decomposition.

7	Program to generate discrete waveforms.
8	Program to perform basic operation on signals.
9	Program to perform convolution of two given sequences.
10	a. Program to perform verification of commutative property of convolution. b. Program to perform verification of distributive property of convolution. c. Program to perform verification of associative property of convolution.
11	Program to compute step response from the given impulse response.
12	Programs to find Z-transform and inverse Z-transform of a sequence.

Course outcomes (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the basics of Linear Algebra
2. Analyse different types of signals and systems
3. Analyse the properties of discrete-time signals & systems
4. Analyse discrete time signals & systems using Z transforms

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Programming assignment at the end of 9th week of the semester, which can be implemented using programming languages like C++/Python/Java/Scilab

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 will be scaled down to 50 marks.

Suggested Learning Resources:

Text Books

1. Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4th Edition, 2006, ISBN 97809802327
2. Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN9971-51-239-4.

Reference Books:

1. **Michael Roberts,** "Fundamentals of Signals & Systems",2nd edition, Tata McGraw-Hill, 2010, ISBN978-0-07-070221-9.
2. **Alan** V **Oppenheim, Alan** S **WiIlsky and** S **Hamid Nawab,** "Signals and Systems" Pearson Education Asia / PHI, 2"" edition, 1997. Indian Reprint 2002.
3. **H P Hsu, R Ranjan,** "Signals and Systems", Schaum's outlines, TMH, 2006.
4. **B P Lathi,** "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga,** "Signals and Systems", Pearson/Sanguine.
6. **Seymour Lipschutz, Marc Lipson**, "Schaums Easy Outline of Linear Algebra", 2020.

Web links and Video Lectures (e-Resources):

Video lectures on Signals and Systems by Alan V Oppenheim

Lecture 1, Introduction | MIT RES.6.007 Signals and Systems, Spring 2011 - YouTube

Lecture 2, Signals and Systems: Part 1 | MIT RES.6.007 Signals and Systems, Spring 2011 - YouTube

NPTEL video lectures signals and system:

https://www.youtube.com/watch?v=7Z3LE5uM-6Y&list=PLbMVogVj5nJQQZbah2uRZIRZ_9kfoqZyx

Video lectures on Linear Algebra by Gilbert Strang

https://www.youtube.com/watch?v=ZK3O402wf1c&list=PL49CF3715CB9EF31D&index=1

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

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III Semester

Analog Electronic Circuits			
Course Code	**21EC34**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: This course will enable students to

- Explain various BJT parameters, connections and configurations.
- Design and demonstrate the diode circuits and transistor amplifiers.
- Explain various types of FET biasing and demonstrate the use of FET amplifiers.
- Analyze Power amplifier circuits in different modes of operation.
- Construct Feedback and Oscillator circuits using FET.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1.Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2.Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class
4.Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5.Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6.Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7.Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

BJT Biasing: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.

Small signal operation and Models: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid Π model, The T model.

MOSFETs: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor.

Small signal operation and modeling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance, The T equivalent circuit model.

[Text 1: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.7), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.7)]

Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Basic BJT Amplifier Configurations- Design of Common Emitter and Common collector amplifier circuits. **RBT Level:** L1, L2, L3

Module-2

MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance RS, Source follower.

MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency model.

Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.

Oscillators: FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation) [Text 1: 4.7(4.7.1 to 4.7.4, 4.7.6) 4.8(4.8.1, 4.8.2, 4.8.3), 4.9, 12.2.2, 12.3.1, 12,3,2]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Discrete Circuit MOS Amplifier – The common source amplifier and the source follower. **RBT Level:** L1, L2, L3
Module-3	
Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis). **Output Stages and Power Amplifiers:** Introduction, Classification of output stages, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier. [Text 1: 7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 13.1, 13.2, 13.3(13.3.1, 13.3.2, 13.3.3, 13.4, 13.7)]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Class D power amplifier. **RBT Level:** L1, L2, L3
Module-4	
Op-Amp Circuits: Op-amp DC and AC Amplifiers, DAC - Weighted resistor and R-2R ladder, ADC-Successive approximation type, Small Signal half wave rectifier, Absolute value output circuit, Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. **555 Timer and its applications:** Monostable and Astable Multivibrators. [Text 2: 6.2, 8.11(8.11.1a, 8.11.1b), 8.11.2a, 8.12.2,8.13 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 9.4.1, 9.4.1(a), 9.4.3, 9.4.3(a)]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Clippers and Clampers, Peak detector, Sample and hold circuit. **RBT Level:** L1, L2, L3
Module-5	
Overview of Power Electronic Systems: Power Electronic Systems, Power Electronic Converters and Applications. **Thyristors:** Static Anode-Cathode characteristics and Gate characteristics of SCR, Turn-ON methods, Turn-off Mechanism, Turn-OFF Methods: Natural and Forced Commutation – Class A without design consideration. **Gate Trigger Circuit:** Resistance Firing Circuit, Resistance capacitance firing circuit, Unijunction Transistor: Basic operation and UJT Firing Circuit. [Text 3: 1.3, 1.5,1.6, 2.2,2.3,2.4,2.6, 2.7,2.9, 2.10,3.2,3.5.1, 3.5.2, 3.6.1, 3.6.3,3.6.4]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:** Basic Construction, working and applications of DIAC, TRIAC, IGBT, GTO. **RBT Level:** L1, L2, L3

Course Outcomes (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the characteristics of BJTs and FETs for switching and amplifier circuits.
2. Design and analyze FET amplifiers and oscillatorswith different circuit configurations and biasing conditions.
3. Understand the feedback topologies and approximations in the design of amplifiers and oscillators.
4. Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.
5. Understand the power electronic device components and its functions for basic power electronic circuits.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored out of 100 shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Books

1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6thEdition, Oxford, 2015.ISBN:978-0-19-808913-1
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4thEdition, Pearson Education, 2018. ISBN: 978-93-325-4991-3
3. **MD Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897'**

Web links and Video Lectures (e-Resources):

- Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, McGraw-Hill, 2015.
- Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

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III Semester

Analog and Digital Electronics Lab			
Course Code	**21ECL35**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This laboratory course enables students to

- Understand the electronic circuit schematic and its working
- Realize and test amplifier and oscillator circuits for the given specifications
- Realize the opamp circuits for the applications such as DAC, implement mathematical functions and precision rectifiers.
- Study the static characteristics of SCR and test the RC triggering circuit.
- Design and test the combinational and sequential logic circuits for their functionalities.
- Use the suitable ICs based on the specifications and functions.

Sl.No.	**Experiments**
1	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.
2	Design and set-up BJT/FET i) Colpitts Oscillator, ii) Crystal Oscillator and iii) RC Phase shift oscillator
3	Design and set up the circuits using opamp: i) Adder, ii) Integrator, iii) Differentiator and iv) Comparator
4	Obtain the static characteristics of SCR and test SCR Controlled HWR and FWR using RC triggering circuit.
5	Design and implement (a) Half Adder & Full Adder using basic gates and NAND gates, (b) Half subtractor & Full subtractor using NAND gates, (c) 4-variable function using IC74151(8:1MUX).
6	Realize (i) Binary to Gray code conversion & vice-versa (IC74139), (ii) BCD to Excess-3 code conversion and vice versa
7	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop b) Realize the shift registers using IC7474/7495: (i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring counter and (vi) Johnson counter.
8	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476 c) Synchronous counter using IC74192

9	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16
10	Pseudorandom sequence generator using IC7495
11	Test the precision rectifiers using opamp: i) Half wave rectifier ii) Full wave rectifier
12	Design and test Monostable and Astable Multivibrator using 555 Timer

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Design and analyze the BJT/FET amplifier and oscillator circuits.
2. Design and test Opamp circuits to realize the mathematical computations, DAC and precision rectifiers.
3. Design and test the combinational logic circuits for the given specifications.
4. Test the sequential logic circuits for the given functionality.
5. Demonstrate the basic electronic circuit experiments using SCR and 555 timer.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Fundamentals of Electronic Devices and Circuits Lab Manual, David A Bell, 5th Edition, 2009, Oxford University Press.
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3.
3. Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, Cengage Learning, 7th Edition.

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(Effective from the academic year 2021 – 22)

IV Semester

Digital Signal Processing			
Course Code	21EC42	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

1. **Preparation:** To prepare students with fundamental knowledge/ overview in the field of Digital Signal Processing
2. **Core Competence:** To equip students with a basic foundation of Signal Processing by delivering the basics of Discrete Fourier Transforms & their properties, design of filters and overview of digital signal processors

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts of Digital Signal Processing
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes
10. Give Programming Assignments

Module-1

Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution **[Text 1]**

Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3

Module-2

Additional DFT Properties, **Linear filtering methods based on the DFT:** Use of DFT in Linear Filtering, Filtering of Long data Sequences. Fast-Fourier-Transform (FFT) algorithms: Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT decimation in-time **[Text 1]**

Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3

Module-3

Design of FIR Filters: Characteristics of practical frequency-selective filters, Symmetric and Anti-symmetric FIR filters, Design of Linear-phase FIR (low pass and High pass) filters using windows - Rectangular, Hamming, Hanning, Bartlett windows. Structure for FIR Systems: Direct form, Cascade form and Lattice structures **[Text1]**

Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3

Module-4

IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Low pass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth (Lowpass and Highpass) Filter Design using BLT. Realization of IIR Filters in Direct form I and II **[Text 2]**

Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3

Module-5

Digital Signal Processors: DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors, FIR and IIR filter implementations in Fixed point systems. **[Text 2]**

Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

List of Programs to be implemented & executed using any programming languages like C++/Python/Java/Scilab / MATLAB/CC Studio (but not limited to)

1. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
2. Computation of circular convolution of two given sequences and verification of commutative, distributive and associative property of convolution.
3. Computation of linear convolution of two sequences using DFT and IDFT.
4. Computation of circular convolution of two given sequences using DFT and IDFT
5. Verification of Linearity property, circular time shift property & circular frequency shift property of DFT.
6. Verification of Parseval's theorem
7. Design and implementation of IIR (Butterworth) low pass filter to meet given specifications.
8. Design and implementation of IIR (Butterworth) high pass filter to meet given specifications.
9. Design and implementation of low pass FIR filter to meet given specifications.
10. Design and implementation of high pass FIR filter to meet given specifications.
11. To compute N- Point DFT of a given sequence using DSK 6713 simulator
12. To compute linear convolution of two given sequences using DSK 6713 simulator
13. To compute circular convolution of two given sequences using DSK 6713 simulator

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Determine response of LTI systems using time domain and DFT techniques
2. Compute DFT of real and complex discrete time signals
3. Compute DFT using FFT algorithms
4. Design FIR and IIR Digital Filters
5. Design of Digital Filters using DSP processor

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Programming assignment at the end of 9th week of the semester, which can be implemented using programming languages like C++/Python/Java/Scilab

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Text Books:

1. Proakis & Manolakis, “Digital Signal Processing - Principles Algorithms & Applications”, 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2. Li Tan, Jean Jiang, “Digital Signal processing - Fundamentals and Applications”, Academic Press, 2013, ISBN: 978-0-12-415893.

Reference Books:

1. Sanjit K Mitra, “Digital Signal Processing, A Computer Based Approach”, 4th Edition, McGraw Hill Education, 2013,
2. Oppenheim & Schaffer, “Discrete Time Signal Processing", PHI, 2003.
3. D Ganesh Rao and Vineeth P Gejji, “Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

Web links and Video Lectures (e-Resources):

By Prof. S. C. Dutta Roy, IIT Delhi

https://nptel.ac.in/courses/117102060

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

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IV Semester

Circuits & Controls			
Course Code	**21EC43**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

1. Apply mesh and nodal techniques to solve an electrical network.
2. Solve different problems related to Electrical circuits using Network Theorems and Two port network.
3. Familiarize with the use of Laplace transforms to solve network problems.
4. Understand basics of control systems and design mathematical models using block diagram reduction, SFG, etc.
5. Understand Time domain and Frequency domain analysis.
6. Familiarize with the State Space Model of the system.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
- Encourage collaborative (Group) Learning in the class .
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
- Give Programming Assignments.

Module-1

Basic concepts and network theorems

Types of Sources, Loop analysis, Nodal analysis with independent DC and AC Excitations.
(Textbook 1: 2.3, 4.1, 4.2, 4.3, 4.4, 10.6)

Super position theorem, Thevenin's theorem, Norton's Theorem, Maximum Power transfer Theorem.
(Textbook 2: 9.2, 9.4, 9.5, 9.7)

Teaching-Learning Process	Chalk and Talk, YouTube videos, Demonstrate the concepts using circuits **RBT Level:** L1, L2, L3

Module-2	
Two port networks: Short- circuit Admittance parameters, Open- circuit Impedance parameters, Transmission parameters, Hybrid parameters (Textbook 3: 11.1, 11.2, 11.3, 11.4, 11.5) **Laplace transform and its Applications**: Step Ramp, Impulse, Solution of networks using Laplace transform, Initial value and final value theorem (Textbook 3: 7.1, 7.2, 7.4, 7.7, 8.4)	
Teaching-Learning Process	Chalk and Talk **RBT Level:** L1, L2, L3
Module-3	
Basic Concepts and representation: Types of control systems, effect of feedback systems, differential equation of physical systems (only electrical systems), Introduction to block diagrams, transfer functions, Signal Flow Graphs (Textbook 4: Chapter 1.1, 2.2, 2.4, 2.5, 2.6)	
Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3
Module-4	
Time Response analysis: Time response of first order systems. Time response of second order systems, time response specifications of second order systems (Textbook 4: Chapter 5.3, 5.4) **Stability Analysis:** Concepts of stability necessary condition for stability, Routh stability criterion, relative stability Analysis (Textbook 4: Chapter 5.3, 5.4, 6.1, 6.2, 6.4, 6.5)	
Teaching-Learning Process	Chalk and Talk, Any software tool to show time response **RBT Level:** L1, L2, L3
Module-5	
Root locus: Introduction the root locus concepts, construction of root loci (Textbook 4: 7.1, 7.2, 7.3) **Frequency Domain analysis and stability**: Correlation between time and frequency response and Bode plots (Textbook 4: 8.1, 8.2, 8.4) **State Variable Analysis:** Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous –Time systems, solution of state equations. (Textbook 4: 12.2, 12.3, 12.6)	
Teaching-Learning Process	Chalk and Talk, Any software tool to plot Root locus, Bode plot **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Using suitable hardware and simulation software, demonstrate the operation of the following circuits:

Sl.No	Experiments
1	Verification of Superposition theorem
2	Verification of Thevenin's theorem
3	Speed torque characteristics of i)AC Servomotor ii) DC Servomotors
4	Determination of time response specification of a second order Under damped System, for different damping factors.
5	Determination of frequency response of a second order System
6	Determination of frequency response of a lead lag compensator
7	Using Suitable simulation package study of speed control of DC motor using i) Armature control ii) Field control

8	Using suitable simulation package, draw Root locus & Bode plot of the given transfer function.
Demonstration Experiments (For CIE only, not for SEE)	
9	Using suitable simulation package, obtain the time response from state model of a system.
10	Implementation of PI, PD Controllers.
11	Implement a PID Controller and hence realize an Error Detector.
12	Demonstrate the effect of PI, PD and PID controller on the system response.

Course Outcomes

At the end of the course the student will be able to:

1. Analyse and solve Electric circuit, by applying, loop analysis, Nodal analysis and by applying network Theorems.
2. Evaluate two port parameters of a network and Apply Laplace transforms to solve electric networks.
3. Deduce transfer function of a given physical system, from differential equation representation or Block Diagram representation and SFG representation.
4. Calculate time response specifications and analyse the stability of the system.
5. Draw and analyse the effect of gain on system behaviour using root loci.
6. Perform frequency response Analysis and find the stability of the system.
7. Represent State model of the system and find the time response of the system.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and

scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 shall be reduced proportionally to 50.

Suggested Learning Resources:

Text Books

1. Engineering circuit analysis, William H Hayt, Jr, Jack E Kemmerly, Steven M Durbin, Mc Graw Hill Education, Indian Edition 8e.
2. Networks and Systems, D Roy Choudhury, New age international Publishers, second edition.
3. Network Analysis, M E Van Valkenburg, Pearson, 3e.
4. Control Systems Engineering, I J Nagrath, M. Gopal, New age international Publishers, Fifth edition.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108106098
- https://nptel.ac.in/courses/108102042

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

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IV Semester

Communication Laboratory I			
Course Code	**21ECL46**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This laboratory course enables students to

- Model an analog communication system signal transmission and reception.
- Realize the electronic circuits to perform analog and pulse modulations and demodulations.
- Verify the sampling theorem and relate the signal and its spectrum before and after sampling.
- Understand the process of PCM and delta modulations.
- Understand the PLL operation.

Sl.No.	**Experiments**
1	Design of active second order Butterworth low pass and high pass filters.
2	Amplitude Modulation and Demodulation of (a) Standard AM and (b) DSBSC (LM741 and LF398 ICs can be used)
3	Frequency modulation and demodulation
4	Design and test Time Division Multiplexing and Demultiplexing of two bandlimited signals.
5	Design and test i) Pulse sampling, flat top sampling and reconstruction. ii) Pulse amplitude modulation and demodulation.
6	Design and test BJT/FET Mixer
7	Pulse Code Modulation and demodulation
8	Phase locked loop Synthesis
9	Illustration of (a) AM modulation and demodulation and display the signal and its spectrum. (b) DSB-SC modulation and demodulation and display the signal and its spectrum. (Use MATLAB/SCILAB)
10	Illustration of FM modulation and demodulation and display the signal and its spectrum. (Use MATLAB/SCILAB)
11	Illustrate the process of sampling and reconstruction of low pass signals. Display the signals and its spectrums of both analog and sampled signals. (Use MATLAB/SCILAB).
12	Illustration of Delta Modulation and the effects of step size selection in the design of DM encoder. (Use MATLAB/SCILAB)

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Demonstrate the AM and FM modulation and demodulation by representing the signals in time and frequency domain.
2. Design and test the sampling, Multiplexing and PAM with relevant circuits.
3. Demonstrate the basic circuitry and operations used in AM and FM receivers.
4. Illustrate the operation of PCM and delta modulations for different input conditions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by

examiners.
General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners).
Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
The duration of SEE is 03 hours.

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Louis E Frenzel, Principles of Electronic Communication Systems, McGraw Hill Education (India) Private Limited, 2016.
2. B P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2015.

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V Semester

Digital Communication			
Course Code	**21EC51**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
- Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Understand the principles of spread spectrum communications.
- Understand the basic principles of information theory and various source coding techniques.
- Build a comprehensive knowledge about various Source and Channel Coding techniques.
- Discuss the different types of errors and error detection and controlling codes used in the communication channel.
- Understand the concepts of convolution codes and analyze the code words using time domain and transform domain approach.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby PSUs such as BHEL, BEL, ISRO, etc., and small-scale communication industries.
3. Show Video/animation films to explain the functioning of various modulation techniques, Channel, and source coding.
4. Encourage collaborative (Group) Learning in the class
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize & analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM. Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability. Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation).

Teaching-Learning Process	Chalk and talk method, Simulation of modulation techniques, Power Point Presentation, YouTube videos Animation of BPSK, QPSK, BFSK and DPSK. Problems on Generation and detection of DPSK, QPSK. **Self-study topic**: Minimum shift keying and Non-coherent BFSK **RBT Level:** L1, L2, L3

Module-2	
Signalling Communication through Band Limited AWGN Channels: **Signalling over AWGN Channels**- Introduction, Geometric representation of signals, Gram- Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel (without statistical characterization), Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver. **Signal design for Band limited Channels**: Design of band limited signals for zero lSI-The Nyquist Criterion (statement only), Design of band limited signals with controlled lSI-Partial Response signals, Probability of error for detection of Digital PAM: Symbol-by-Symbol detection of data with controlled lSI.	
Teaching-Learning Process	Chalk & talk method, PowerPoint Presentation, YouTube videos **Self-study topics**: Maximum Likelihood detection, Channel equalization **RBT Level:** L1, L2, L3
Module-3	
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95.	
Teaching-Learning Process	Chalk & talk method, Seminar about security issues in communication systems **RBT Level:** L1, L2, L3
Module-4	
Introduction to Information Theory: Measure of information, Average information content of symbols in long independent sequences. **Source Coding:** Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon-Fano Encoding Algorithm, Huffman coding. **Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes.	
Teaching-Learning Process	Chalk and talk method, Problems on source coding, error control codes **RBT Level:** L1, L2, L3
Module-5	
Linear Block Codes: Matrix description of Linear Block Codes, Error Detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array. **Convolution codes:** Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram.	
Teaching-Learning Process	Chalk and talk method, Animation of convolution encoders **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Analyze different digital modulation techniques and choose the appropriate modulation technique for the given specifications.
2. Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.
3. Differentiate various spread spectrum schemes and compute the performance parameters of communication system.
4. Apply the fundamentals of information theory and perform source coding for given message
5. Apply different encoding and decoding techniques with error Detection and Correction.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
3. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
4. Hari Bhat, Ganesh Rao, "Information Theory and Coding", Cengage, 2017.
5. Todd K Moon, "Error Correction Coding", Wiley Std. Edition, 2006.

Reference Books:

1. Bernard Sklar, "Digital Communications – Fundamentals and Applications", Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
2. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/108102096

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

V Semester

Computer Organization & ARM Microcontrollers			
Course Code	**21EC52**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 13 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

1. Explain the basic organization of a computer system.
2. Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.
3. Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
4. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
5. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group) Learning in the class.
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Give Programming Assignments.

Module-1

Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
Text Book 1: Chapter 1 – 1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7), Chapter 2 – 2.2 to 2.10
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.
Text Book 1: Chapter 4 – 4.1, 4.2, 4.4, 4.5, 4.6, 4.7

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-2

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations.
Text book 1: Chapter 5 – 5.1 to 5.4, 5.5 (5.5.1, 5.5.2), 5.6

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Basic concepts of pipelining,

Text book 1: Chapter7, Chapter 8 – 8.1

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-3

ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware – AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications.
ARM Processor Fundamentals, ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions.
Text book 2: Chapter 1, 2

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-4

Introduction to the ARM Instruction set: Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution.
Text book 2: Chapter 3

Teaching-Learning Process	Chalk and Talk, Power point presentations, Programming assignments **RBT Level:** L1, L2, L3

Module-5

Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions.
Efficient C Programming: Overview of C Compilers and optimization, Basic C Data types, C looping structures.
Text book 2: Chapter 4, 5

Teaching-Learning Process	Chalk and Talk, Power point presentations, Programming assignments **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation board/simulator and the required software tool.

Sl.No	Experiments
1	Write an ALP to i) multiply two 16-bit binary numbers. ii) add two 64-bit numbers.
2	Write an ALP to find the sum of first 10 integer numbers.
3	Write an ALP to find factorial of a number.
4	Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM.
5	Write an ALP to find the square of a number (1 to 10) using look-up table.
6	Write an ALP to find the largest/smallest number in an array of 32 numbers.
7	Write an ALP to arrange a series of 32-bit numbers in ascending/descending order.
8	i) Write an ALP to count the number of ones and zeros in two consecutive memory locations. ii)Write an ALP to Scan a series of 32-bit numbers to find how many are negative.

Demonstration Experiments (For CIE only not for SEE)	
Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil µvision-4 tool/compiler.	
9	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
10	Interface a DAC and generate Triangular and Square waveforms.
11	Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between.
12	Interface a simple Switch and display its status through Relay, Buzzer and LED.

Course Outcomes

At the end of the course the student will be able to:

1. Explain the basic organization of a computer system.
2. Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.
3. Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
4. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Textbooks

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 8).
2. Andrew N Sloss, Dominic System and Chris Wright, "ARM System Developers Guide", Elsevier, Morgan Kaufman publisher, 1st Edition, 2008.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

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(Effective from the academic year 2021 – 22)

V Semester

ELECTROMAGNETIC WAVES			
Course Code	**21EC54**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory	Total Marks	100
Credits	03	Exam Hours	03

Course objectives: This course will enable students to :

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb‘s law and Gauss law to different charge distributions and the applications of Laplace‘s and Poisson‘s Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart‘s, Amperes‘s Law and Stokes‘theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell‘ equations and applications for Plane waves for their behavior in different media.
- Acquire knowledge of Poynting theorem and its application of power flow.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes criticalthinking
3. Adopt Problem Based Learning (PBL), which fosters students’ analytical skills, develop thinkingskills such as the ability to evaluate, generalize & analyze information rather than simply recall it.
4. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
5. Using videos for demonstration of the fundamental principles to students for better understandingof concepts.

Module-1

Revision of Vector Calculus – **(Text 1: Chapter 1)**

Coulomb’s Law, Electric Field Intensity and Flux density: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**

Teaching-LearningProcess	Chalk and Talk would be helpful for the quantitative analysis. Videos of the Basicprinciples of the devices would help students to grasp better. **RBT Level:** L1, L2, L3

Module-2

Gauss's law and Divergence: Gauss 'law, Application of Gauss' law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).**

Energy, Potential and Conductors: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and 4.6).**Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

Module-3

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation **(Text: Chapter 7.1 to 7.3)**

Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magneticflux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems. (**Text: Chapter 8.1 to 8.6)**

Teaching-LearningProcess	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3

Module-4

Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).**

Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutualreactance, Numerical problems **(Text: Chapter 9.6 to 9.7).**

Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**

Teaching-LearningProcess	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

Module-5

Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)**

Uniform Plane Wave: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave

propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (**γ, α, β, η**) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**	
Teaching-LearningProcess	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

Course Outcomes

At the end of the course the student will be able to:

- Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applyingconventional methods and charge in a volume.
- Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
- Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different currentconfigurations
- Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
- Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text Book:

1. W.H. Hayt and J.A. Buck, —Engineering Electromagnetics‖, 8th Edition, Tata McGraw-Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books:

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4th Edn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2nd Edn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. N. NarayanaRao, —Fundamentals of Electromagnetics for Engineering‖, Pearson

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/104/108104087/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Quizzes, Seminars

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V Semester

Communication Lab II			
Course Code	**21ECL55**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This laboratory course enables students to

- Design and demonstrate communication circuits for different digital modulation techniques.
- To simulate Source coding Algorithms using C/C++/ MATLAB code.
- To simulate Error correcting and detecting codes using C/C++/ MATLAB code.
- Simulate the networking concepts and protocols using C/C++/ Network simulation tool.
- Understand entropies and mutual information of different communication channels.

Sl.No.	**Experiments**
	Implement the following using discrete components
1	FSK generation and detection
2	PSK generation and detection
3	DPSK Transmitter and receiver
4	QPSK Transmitter and Receiver
	Implement the following in C/C++/MATLAB/Scilab/Python or any other Suitable software
5	Write a program to encode binary data using Huffman code and decode it.
6	Write a program to encode binary data using a (7,4) Hamming code and decode it.
7	Write a program to encode binary data using a ((3,1,2)/suitably designed) Convolution code and decode it.
8	For a given data, use CRC-CCITT polynomial to obtain the CRC code. Verify the program for the cases a) Without error b) With error
	Implement the following algorithms in C/C++/MATLAB/Network simulator
9	Write a program for congestion control using leaky bucket algorithm.
10	Write a program for distance vector algorithm to find suitable path for transmission.
11	Write a program for flow control using sliding window protocols.
12	Configure a simple network (Bus/star) topology using simulation software **OR** Configure a simple network (Ring/Mesh) topology using simulation software.
	Demonstration Experiments (For CIE)
13	Configure and simulate simple Wireless Local Area network.
14	Simulate the BER performance of (2, 1, 3) binary convolutional code with generator sequences g(1) =(1 0 1 1) and g(2) =(1 1 1 1) on AWGN channel. Use QPSK modulation scheme. Channel decoding is to be performed through Viterbi decoding. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size 3 lakh bits. Also find the coding gain.
15	Simulate the BER performance of (7, 4) Hamming code on AWGN channel. Use QPSK modulation

	scheme. Channel decoding is to be performed through maximum-likelihood decoding. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size 5 lakh bits. Use the following parity check matrix for the (7, 4) Hamming code. Also find the coding gain. $$H = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{bmatrix}$$
16	Simulate the BER performance of rate 1/3 Turbo code. Turbo encoder uses two recursive systematic encoders with $G(D) = \left[1, \frac{1+D^4}{1+D+D^2+D^3+D^4}\right]$ and pseudo-random interleaver. Use QPSK modulation scheme. Channel decoding is to be performed through maximum a-posteriori (MAP) decoding algorithm. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size of around 3 lakh bits and the block length as 10384 bits. Also find the coding gain.

Course outcomes (Course Skill Set):

On the completion of this laboratory course, the students will be able to:

1. Design and test the digital modulation circuits and display the waveforms.
2. To Implement the source coding algorithm using C/C++/ MATLAB code.
3. To Implement the Error Control coding algorithms using C/C++/ MATLAB code.
4. Illustrate the operations of networking concepts and protocols using C programming and network simulators.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by

the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners).

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours.

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
3. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

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V Semester

IoT (Internet of Things) Lab			
Course Code	21EC581	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- To impart necessary and practical knowledge of components of Internet of Things
- To develop skills required to build real-life IoT based projects.

Sl.No	**Experiments**
1	i) To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds. ii) To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.
2	i) To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. ii) To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to 'turn ON' motor when push button is pressed.
4	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
6	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
7	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
8	To install MySQL database on Raspberry Pi and perform basic SQL queries.
9	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
10	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.
11	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
12	Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop real life IoT based projects

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things. "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill

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VI Semester

Microwave Theory and Antennas			
Course Code	**21EC62**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to :

1. Describe the microwave properties and its transmission media.
2. Describe the microwave devices for several applications.
3. Understand the basic concepts of antenna theory.
4. Identify antenna types for specific applications.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
3. Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize & analyze information rather than simply recall it.
4. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
5. Using videos for demonstration of the fundamental principles to students for better understanding of concepts.
6. Demonstration of microwave devices and Antennas in the lab environment where students can study them in real time.

Module-1

Microwave Sources: Introduction, Gunn Diode (Text 2: 7.1,7.1.1,7.1.2)

Microwave transmission lines: Microwave frequencies, Microwave devices, Microwave systems. Transmission line equations and solutions, Reflection Coefficient and Transmission Coefficient. Standing wave and standing wave ratio. Smith chart, Single stub matching.

Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 (except double stub matching)

Teaching-Learning Process	Chalk and Talk would be helpful for the quantitative analysis. Videos of the Basic principles of the devices would help students to grasp better. **RBT Level:** L1, L2, L3

Module-2

A Closer Look at Methods and classes: Overloading methods, Using objects as parameters, Returning **Microwave Network Theory**: Introduction, S matrix representation of multi-port networks (Text 1: 6.1, 6.3, 6.3.1, 6.3.2)

Microwave passive devices: Coaxial connectors and Adapters, Attenuators, Phase shifters, waveguide Tees, Magic Tee, Circulator, Isolator. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16, 6.4.17 A, B)

Teaching-Learning	Chalk and Talk, PowerPoint Presentation

Process	**RBT Level:** L1, L2, L3
Module-3	
Strip Lines: Introduction, Microstrip lines, Parallel Strip lines (Text 2: 11.1,11.2) **Antenna Basics**: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity,Beam efficiency, Directivity and Gain, Antenna Aperture Effective height, Bandwidth, Radio communication Link, Antenna Field Zones (Text 3: 2.1-2.7, 2.9-2.11, 2.13).	
Teaching-Learning Process	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3
Module-4	
Point sources and arrays: Introduction, Point Sources, Power patterns, Power theorem, Radiation Intensity, Arrays of 2 isotropic point sources, Pattern multiplication, Linear arrays of n Isotropic sources of equal amplitude and Spacing. (Text 3: 5.1-5.6, 5.9, 5.13) **Electric Dipole**: Introduction, Short Electric dipole, Fields of a short dipole. Radiation resistance of a short dipole. Thin linear antenna (field analysis). (Text 3: 6.1-6.5)	
Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3
Module-5	
Loop and Horn antenna: Introduction: Small loop, Comparison of far fields of small loop and Short dipole. Radiation resistance of small loop, Horn Antennas, Rectangular antennas. (Text 3: 7.1,7.2, 7.4, 7.6, 7.7, 7.8, 7.19, 7.20) **Antenna Types**: The Helix geometry, Helix modes, Practical design consideration for mono-filar axial mode Helical Antenna, Yagi Uda array, Parabolic Reflector (Text 3: 8.3, 8.4, 8.5, 8.8, 9.5)	
Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC	
Sl.No	**Experiments**
1	Study of characteristics of Magic Tee.
2	Coupling and Isolation characteristics of microstrip directional coupler.
3	Determination of power division of microstrip power divider.
4	Determination of resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
5	Measurement of frequency, guide wavelength, power and attenuation in a microwave Test bench.
6	Study of characteristics of E plane Tee / H plane Tee.
7	To measure unknown impedance using Smith chart through test bench setup.
8	Measurement of VSWR and reflection coefficient and attenuation in a microwave test bench setup.
9	Obtain the radiation pattern of a Yagi-Uda Antenna array and calculate its directivity.
10	Calculate the aperture of a Dipole Antenna.
11	Obtain the near and far fields of a given antenna and compare the fields.
12	Obtain the bandwidth of a given Antenna.

Course Outcomes

At the end of the course the student will be able to:

1. Describe the use and advantages of microwave transmission
2. Analyze various parameters related to transmission lines.
3. Identify microwave devices for several applications.
4. Analyze various antenna parameters and their significance in building the RF system.
5. Identify various antenna configurations for suitable applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks.

Marks of all experiments' write-ups are added and scaled down to 15 marks.

- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Text Books:

1. Microwave Engineering -Annapurna Das, Sisir K Das, TMH Publication, 2nd Edition, 2010.
2. Microwave Devices and Circuits – Samuel Y Liao, Pearson Education.
3. Antennas and Wave Propagation -John D Krauss, Ronald J Marhefka, Ahmad S Khan, 4th Edition, McGraw Hill Education, 2013.

Reference Books:

1. Microwave Engineering -David M Pozar, John Wiley India Pvt Ltd., Pvt Ltd., 3rd edition, 2008.
2. Microwave Engineering-Sushrut Das, Oxford Higher Education, 2nd Edn, 2015.
3. Antennas and Wave Propagation- Harish and Sachidananda, Oxford University Press, 2007.

Web links and Video Lectures (e-Resources):

- https://www.tutorialspoint.com/antenna_theory/antenna_theory_horn.html
- http://www.antenna-theory.com/antennas/smallLoop.php

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Quizzes, Seminars

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VI Semester

Python Programming			
Course Code	**21EC643**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- To learn programming using Python
- Develop application using Python

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and programming skills.
2. State the need for learning Programming with real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short, related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Module-1

Python Basics, Python language features, History , Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number
Textbook 1: Chapters 1 – 3

Teaching-Learning Process	Chalk and talk method, Simulation of modulation techniques **RBT Level:** L1, L2, L3

Module-2

Data Structures: Lists: The List Data Type, Working with Lists Strings: Manipulating Strings, Working with Strings, Useful String Methods Tuples and Dictionaries, basics Using Data Structures to Model Real-World Things, Manipulating Strings.
Textbook 1: Chapters 4 – 6

Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Module-3	
Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions,, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols. Reading and Writing Files, Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint. pformat() Function Textbook 1: Chapters 7, 8	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation **RBT Level:** L1, L2, L3
Module-4	
Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning, Classes and methods: Object-oriented features, Printing objects, Another example, The init method, The__str__ method, Operator overloading, Type-based dispatch, Polymorphism. Textbook 2: Textbook 2: Chapters 15 – 18	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation **RBT Level:** L1, L2, L3
Module-5	
HTTP, The World's simplest Web Browser, Retrieving an image over HTTP, Retrieving web pages with urllib, Parsing html and scraping the web, Parsing HTML using RE, BeautifulSoup, Reading binary files using urllib, XML, Parsing XML, Looping through nodes, JSON, Parsing JSON, API, geocoding Web Service, Security & API usage, What is database?, Database Concepts, Database Browser, Creating a database table, SQL, Spidering Twitter, Basic data modeling, Programming with multiple tables, Three kinds of Keys, JOIN Text book : Chapter 2, 13, 15	
Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. To acquire programming skills in Python
2. To demonstrate data structure representation using Python
3. To develop the skill of pattern matching and files in Python
4. To acquire Object Oriented Skills in Python
5. To develop the ability to write database applications in Python

Assessment Details (both CIE and SEE)

The weightage of Continuous 5 End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Al Sweigart, "Automate the Boring Stuff with Python",1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 8)
2. Allen B Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15 - 18) (Download pdf/html files from the above links)
3. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st, Create Space Independent Publishing Platform, 2016

Web links and Video Lectures (e-Resources)

- https://www.youtube.com/watch?v=_xQNeOTRyig
- https://www.youtube.com/watch?v=kqtD5dpn9C8

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Write a program to generate Fibonacci series
- Write a program to find factorial of a number using function.
- Write a menu driven program to implement stack using Lists
- Create a DB using dictionaries containing key as USN and related fields containing Name, gender, Marks1, Marks2 & Marks3 of students. Implement the following functions to perform i) Update Name/gender/marks ii) search for usn and display the relevant fields iii) delete based on search for name iv)generate the report with avg marks more than 70%
- Write a program to implement search and replace multiple occurrences of a given substring in the main string in a list.
- Write a function called most_frequent that takes a string and prints the letters in decreasing order of frequency.
- Write a program that reads a file, display the contents, builds a histogram of the words in the file and print most common words in the file.
- Write a program that searches a directory and all of its subdirectories, recursively, and returns a list of complete paths for all files with a given suffix.

- Write python code to extract From: and To: Email Addresses from the given text file using regular expressions. https://www.py4e.com/code3/mbox.txt.
- Consider the sentence *"From rjlowe@iupui.edu Fri Jan 4 14:50:18 2008",* Write python code to extract email address and time of the day from the given sentence
- Write a program to read, display and count number of sentences of the given file.
- Write a program that gets the current date and prints the day of the week.
- Write a function called print_time that takes two Time objects and prints total time it in the form hour:minute:second.
- Write a program that takes a birthday as input and prints the user's age and the number of days, hours, minutes and seconds until their next birthday.

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VII Semester

Optical & Wireless Communication			
Course Code	**21EC72**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:0:1	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	2	Exam Hours	3

Non-MCQ pattern of CIE and SEE

Course objectives:

This course will enable students to:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Understand the concepts of propagation over wireless channels from a physics standpoint
- Understand the multiple access techniques used in cellular communications standards.
- Application of Communication theory both Physical and networking to understand GSM systems that handle mobile telephony.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Optical Fiber Structures: Optical Fiber Modes and Configurations, Mode theory for circular waveguides, Single mode fibers, Fiber materials.

Attenuation and Dispersion: Attenuation, Absorption, Scattering Losses, Bending loss, Signal Dispersion: Modal delay, Group delay, Material dispersion.

[Text1 : 3.1, 3.2, 2.3[2.3.1 to 2.3.4], 2.4[2.4.1, 2.4.2],2.5, 2.7].

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

Optical Sources and detectors: Light Emitting Diode: LED Structures, Light source materials, Quantum efficiency and LED power, Laser Diodes: Modes and threshold conditions, Rate equations, External quantum efficiency, Resonant frequencies, Photodetectors: The pin Photodetector, Avalanche Photodiodes.

WDM Concepts: Overview of WDM, Isolators and Circulators, Fiber grating filters, Dielectric thin-film filters, Diffraction Gratings. [Text1: 4.2 ,4.3, 6.1, 10.1, 10.3, 10.4, 10.5, 10.7]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-3	
Mobile Communication Engineering: Wireless Network generations, Basic propagation Mechanisms, Mobile radio Channel. **Principles of Cellular Communications:** Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Frequency Reuse Distance, Cochannel Interference and signal quality. [Text2: 1.4, 2.4, 2.5, 4.1 to 4.4, 4.6, 4.7]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Hybrid Multiple Access Techniques, Multicarrier Multiple Access Schemes. **A Basic Cellular System:** A basic cellular system connected to PSTN, Parts of basic cellular system, Operation of a cellular system. [Text2: 8.2, 8.3, 8.4.5, 8.5, 8.6, 8.10, 9.2.2, 9.2.3, 9.3]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Global System for Mobile (GSM): GSM Network Architecture, GSM signalling protocol architecture, Identifiers used in GSM system, GSM Channels, Frame structure for GSM, GSM Call procedures, GSM hand-off Procedures, GSM Services and features. [Text2: 11.1, 11.2,11.3,11.4, 11.5, 11.8, 11.9. 11.10]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Classification and characterization of optical fibers with different modes of signal propagation.
2. Describe the constructional features and the characteristics of optical fiber and optical devices used for signal transmission and reception.
3. Understand the essential concepts and principles of mobile radio channel and cellular communication.
4. Describe various multiple access techniques used in wireless communication systems.
5. Describe the GSM architecture and procedures to establish call set up, call progress handling and call tear down in a GSM cellular network.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE will be the same as other core theory courses.

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
Semester End Examination (SEE):

For non-MCQ pattern of CIE and SEE

Continuous Internal Evaluation (CIE):

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of CIE for the course.

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

1. Gerd Keiser, Optical Fiber Communication, 5th Edition, McGraw Hill Education (India) Private Limited, 2016. ISBN:1-25-900687-5.
2. T L Singal, Wireless Communications, McGraw Hill Education (India) Private Limited, 2016, ISBN:0-07-068178-3.

Reference Books

1. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3
2. Theodore Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.
3. Gary Mullet, Introduction to Wireless Telecommunications Systems and Networks, First Edition, Cengage Learning India Pvt Ltd., 2006, ISBN - 13: 978-81-315-0559-5.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

VII Semester

Digital Image Processing			
Course Code	**21EC732**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Understand the fundamentals of digital image processing.
- Understand the image transform used in digital image processing.
- Understand the image enhancement techniques in spatial domain used in digital image processing.
- Understand the Color Image Processing and frequency domain enhancement techniques in digital image processing.
- Understand the image restoration techniques and methods used in digital image processing.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Show Video/animation films to explain the functioning of various image processing concepts.
2. Encourage cooperative (Group) Learning through puzzles, diagrams, coding etc., in the class.
3. Encourage students to ask questions and investigate their own ideas helps improve their problem-solving skills as well as gain a deeper understanding of academic concepts.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Students are encouraged to do coding based projects to gain knowledge in image processing.
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding
9. Arrange visits to nearby PSUs such as CAIR (DRDO), NAL, BEL, ISRO, etc., and small-scale software industries to give industry exposure.

Module-1

Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels.
[Text 1: Chapter 1, Chapter 2: Sections 2.1 to 2.5]

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Videos on Image processing applications Self-study topics: Arithmetic and Logical operations Practical topics: Problems on Basic Relationships Between Pixels. **RBT Level:** L1, L2, L3

Module-2	
Image Transforms: Introduction, Two-Dimensional Orthogonal and Unitary Transforms, Properties of Unitary Transforms, Two-Dimensional DFT, cosine Transform, Haar Transform. Text 2: Chapter 5: Sections 5.1 to 5.3, 5.5, 5.6, 5.9]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos of various transformation techniques and related applications. Self-study topics: Sine transforms, Hadamard transforms, KL transform, Slant transform. Practical topics: Problems on DFT and DCT **RBT Level:** L1, L2, L3
Module-3	
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters [Text: Chapter 3: Sections 3.2 to 3.6]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos and animations of Intensity Transformation Functions, Histogram Processing, Spatial domain filters. Self-study topics: Point, line and edge detection. Practical topics: Problems on Intensity Transformation Functions, Histogram, Spatial domain filters **RBT Level:** L1, L2, L3
Module-4	
Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters. **Color Image Processing:** Color Fundamentals, Color Models, Pseudo-color Image Processing. [Text 1: Chapter 4: Sections 4.7 to 4.9 and Chapter 6: Sections 6.1 to 6.3]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos on frequency domain filtering, Color image processing. Self-study topics: Basic concept of segmentation. Practical topics: Problems on Pseudo-color Image Processing **RBT Level:** L1, L2, L3
Module-5	
Restoration: A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering. [Text 1: Chapter 5: Sections 5.1, to 5.4.3, 5.7, 5.8]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos on Noise models, filters and its applications. Self-study topics: Linear position invariant degradation, Estimation of degradation function. **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Understand image formation and the role of human visual system plays in perception of gray and color image data.
2. Compute various transforms on digital images.
3. Conduct independent study and analysis of Image Enhancement techniques.
4. Apply image processing techniques in frequency (Fourier) domain.
5. Design image restoration techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Digital Image Processing- Rafael C Gonzalez and Richard E Woods, PHI, 3rd Edition 2010.
2. Fundamentals of Digital Image Processing- A K Jain, PHI Learning Private Limited 2014.

Reference Book:

Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014.

Web links and Video Lectures (e-Resources)

- Image databases, https://imageprocessingplace.com/root_files_V3/image_databases.htm
- Student support materials, https://imageprocessingplace.com/root_files_V3/students/students.htm
- NPTEL Course, Introduction to Digital Image Processing, https://nptel.ac.in/courses/117105079
- Computer Vision and Image Processing, https://nptel.ac.in/courses/108103174
- Image Processing and Computer Vision – Matlab and Simulink,
- https://in.mathworks.com/solutions/image-video-processing.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Verilog /VHDL coding for Image manipulation.
- Simulink models for Image processing.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

COMPUTER AIDED MACHINE DRAWING

Course Code	**18ME36A/46A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	1:4:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire the knowledge of CAD software and its features.
- To familiarize the students with Indian Standards on drawing practices.
- To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- To make the students understand and interpret drawings of machine components leading to preparation of assembly drawings manually and using CAD packages.
- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.

Part A

Part A

Introduction:
Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section). Hidden line conventions. Precedence of lines.
Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections.
Conversion of pictorial views into orthographic projections of simple machine parts. Hidden line conventions. Precedence of lines.
Conversion of pictorial views into orthographic projections of simple machine parts (with section planes indicated on the part).
Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.
Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

Part B

Keys: Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.
Joints: Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.
Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)

Part C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.
Assembly Drawings: (Part drawings shall be given)
1. Plummer block (Pedestal Bearing)
2. Lever Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool head of shaper

Course Outcomes: At the end of the course, the student will be able to:

CO1: Identify the national and international standards pertaining to machine drawing.

CO2: Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings

CO3: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.

CO4: Interpret the Machining and surface finish symbols on the component drawings.

CO5: Preparation of the part or assembly drawings as per the conventions.

Scheme of Examination: Two questions to be set from each Part A, part B and Part C. Student has to answer one question each from Part A and Part B for 25 marks each and one question from Part C for 50 marks.

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C, 3D environment should be used for parts and assembly, and extract 2D views of assembly.
6. Part A and Part B
   25 Marks (15 marks for sketching and 10 marks for computer work)
7. Part C
   50 Marks (20 marks for sketching and 30 marks for computer modelling)

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Machine Drawing	K.R. Gopala Krishna	Subhash Publication	2005
2	Machine Drawing	N.D.Bhat&V.M. Panchal	Charoratar publishing house	2005
Reference Books				
3	A Text Book of Computer Aided Machine Drawing	S. Trymbaka Murthy	CBS Publishers, New Delhi	2007
4	Engineering drawing	P.S.Gill	S K Kataria and Sons	2013
5	Machine Drawing	N. Siddeshwar, P. Kanniah, V.V.S. Sastri	Tata McGraw Hill	2006

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – III

MATERIAL TESTING LAB

Course Code	**18MEL37A/47A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
- To understand mechanical behaviour of various engineering materials by conducting standard tests.
- To learn material failure modes and the different loads causing failure.
- To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

Sl. No.	Experiments
	PART A
1	Preparation of specimen for Metallographic examination of different engineering materials. To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel. Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3	Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4	To study the defects of Cast and Welded components using Non-destructive tests like: a) Ultrasonic flaw detection b) Magnetic crack detection c) Dye penetration testing.
	PART B
5	Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
6	Torsion Test on steel bar.
7	Bending Test on steel and wood specimens.
8	Izod and Charpy Tests on Mild steel and C.I Specimen.
9	To study the wear characteristics of ferrous and non-ferrous materials under different parameters.
10	Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
11	Fatigue Test (demonstration only).

Course Outcomes: At the end of the course, the student will be able to:

CO1: Acquire experimentation skills in the field of material testing.

CO2: Develop theoretical understanding of the mechanical properties of materials by performing experiments.

CO3: Apply the knowledge to analyse a material failure and determine the failure inducing agent/s.

CO4: Apply the knowledge of testing methods in related areas.

CO5: Understand how to improve structure/behaviour of materials for various industrial applications.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
Total:	100 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – III

WORKSHOP AND MACHINE SHOP PRACTICE

Course Code	**18MEL38A/48A**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To guide students to use fitting tools to perform fitting operations.
- To provide an insight to different machine tools, accessories and attachments.
- To train students into fitting and machining operations to enrich their practical skills.
- To inculcate team qualities and expose students to shop floor activities.
- To educate students about ethical, environmental and safety standards.

	Experiments
Sl. No	**PART A**
1	Preparation of at least two fitting joint models by proficient handling and application of hand tools- V-block, marking gauge, files, hack saw drills etc.
	PART B
2	Preparation of three models on lathe involving - Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning. Exercises should include selection of cutting parameters and cutting time estimation.
	PART C
3	Cutting of V Groove/ dovetail / Rectangular groove using a shaper. Cutting of Gear Teeth using Milling Machine. Exercises should include selection of cutting parameters and cutting time estimation.
	PART D (DEMONSTRATION ONLY)
	Study & Demonstration of power tools like power drill, power hacksaw, portable hand grinding, cordless screw drivers, production air tools, wood cutter, etc., used in Mechanical Engineering.

Course Outcomes: At the end of the course, the student will be able to:

CO1: To read working drawings, understand operational symbols and execute machining operations.
CO2: Prepare fitting models according to drawings using hand tools- V-block, marking gauge, files, hack saw, drills etc.
CO3: Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used.
CO4: Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.
CO5: Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.
CO6:Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:	
One Model from Part-A or Part-C:	30 Marks
One Model from Part-B:	50 Marks
Viva – Voce:	20 Marks
TOTAL:	100 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

FOUNDRY, FORGING AND WELDING LAB

Course Code	**18MEL38B/48B**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To provide an insight into different sand preparation and foundry equipment.
- To provide an insight into different forging tools and equipment and arc welding tools and equipment.
- To provide training to students to enhance their practical skills in welding, forging and hand moulding.

Sl. No.	Experiments
	PART A
1	**Testing of Molding sand and Core sand.** **Preparation of sand specimens and conduction of the following tests:** 1. Compression, Shear and Tensile tests on Universal Sand Testing Machine. 2. Permeability test 3. Sieve Analysis to find Grain Fineness Number (GFN) of Base Sand 4. Clay content determination on Base Sand. **Welding Practice:** Use of Arc welding tools and welding equipment Preparation of welded joints using Arc Welding equipment L-Joint, T-Joint, Butt joint, V-Joint, Lap joints on M.S. flats
	PART B
2	**Foundry Practice:** **Use of foundry tools and other equipment for Preparation of molding sand mixture.** **Preparation of green sand molds kept ready for pouring in the following cases:** 4. Using two molding boxes (hand cut molds). 5. Using patterns (Single piece pattern and Split pattern). 6. Incorporating core in the mold.(Core boxes). • Preparation of one casting (Aluminium or cast iron-Demonstration only)
	PART C
3	**Forging Operations:** Use of forging tools and other forging equipment. • Calculation of length of the raw material required to prepare the model considering scale loss. • Preparing minimum three forged models involving upsetting, drawing and bending operations.

Course Outcomes: At the end of the course the student will be able to:

- Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine.
- Demonstrate skills in determining permeability, clay content and Grain Fineness Number of base sands.
- Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:

1. One question is to be set from Part-A: 30 marks. (20 marks for sand testing+ 10 Marks for welding)
2. One question is to be set from either Part-B or Part-C: 50 Marks
3. Viva – Voce: 20 marks

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand needs, functions, roles, scope and evolution of Management.

CO2: Understand importance, purpose of Planning and hierarchy of planning and also53nalyse its types.

CO3: Discuss Decision making, Organizing, Staffing, Directing and Controlling.

CO4: Select the best economic model from various available alternatives.

CO5: Understand various interest rate methods and implement the suitable one.

CO6: Estimate various depreciation values of commodities.

CO7: Prepare the project reports effectively.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the	Name of the Publisher	Edition and
Textbook/s				
1	Mechanical estimation and costing	T.R. Banga & S.C. Sharma	Khanna Publishers	17th edition 2015
2	Engineering Economy	Riggs J.L	McGraw Hill	4th
3	Engineering Economy	Thuesen H.G	PHI	2002
4	Principles of Management	Tripathy and Reddy	Tata McGraw Hill	3rd edition 2006
Reference Books				
1	Management Fundamentals - Concepts, Application, Skill Development	Robers Lusier Thomson	Pearson Education	
2	Modern Economic Theory	Dr. K. K. Dewett& M. H. Navalur,	Chand Publications	
3	Economics: Principles of Economics	N Gregory Mankiw,	Cengage Learning	
4	Basics of Engineering Economy	Leland Blank & Anthony Tarquin	McGraw Hill Publication (India) Private Limited	

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

DESIGN OF MACHINE ELEMENTS I

Course Code	**18ME52**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand the various steps involved in the Design Process.
- To explain the principles involved in design of machine elements, subjected to different kinds of forces, from the considerations of strength, rigidity, functional and manufacturing requirements.
- To understand and interpret different failure modes and application of appropriate criteria for design of machine elements.
- To learn to use national and international standards, standard practices, standard data, catalogs, and standard components used in design of machine elements.
- Develop the capability to design elements like shafts, couplings, welded joints, screwed joints, and power screws.

Module-1

Introduction: Design Process: Definition of design, phases of design, and review of engineering materials and their properties and manufacturing processes; use of codes and standards, selection of preferred sizes.
Review of axial, bending, shear and torsion loading on machine components, combined loading, two- and three dimensional stresses, principal stresses, stress tensors, Mohr's circles.
Design for static strength: Factor of safety and service factor.
Failure mode: definition and types. , Failure of brittle and ductile materials; even and uneven materials; Theories of failure: maximum normal stress theory, maximum shear stress theory, distortion energy theory, strain energy theory, Columba –Mohr theory and modified Mohr's theory. Stress concentration, stress concentration factor and methods of reducing stress concentration.

Module-2

Impact Strength: Introduction, Impact stresses due to axial, bending and torsion loads.
Fatigue loading: Introduction to fatigue failure, Mechanism of fatigue failure, types of fatigue loading, S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit.
Modifying factors: size effect, surface effect, Stress concentration effects Notch sensitivity, Soder berg and Goodman relationships, stresses due to combined loading, cumulative fatigue damage, and Miner's equation.

Module-3

Design of shafts: Torsion of shafts, solid and hollow shaft design with steady loading based on strength and rigidity, ASME and BIS codes for power transmission shafting, design of shafts subjected to combined bending, torsion and axial loading. Design of shafts subjected to fluctuating loads
Design of keys and couplings :Keys: Types of keys and their applications, design considerations in parallel and tapered sunk keys, Design of square and rectangular sunk keys.
Couplings: Rigid and flexible coupling-types and applications, design of Flange coupling, and Bush and Pin type coupling.

Module-4

Design of Permanent Joints: Types of permanent joints-Riveted and Welded Joints.
Riveted joints: Types of rivets, rivet materials, Caulking and fullering, analysis of riveted joints, joint efficiency, failures of riveted joints, boiler joints, riveted brackets.
Welded joints: Types, strength of butt and fillet welds, eccentrically loaded welded joints

Module-5

Design of Temporary Joints: Types of temporary joints- cotter joints, knuckle joint and fasteners. Design of Cotter and Knuckle Joint.
Threaded Fasteners: Stresses in threaded fasteners, effect of initial tension, design of threaded fasteners under static, dynamic and impact loads, design of eccentrically loaded bolted joints.

Power screws: Mechanics of power screw, stresses in power screws, efficiency and self-locking, design of power screws.

Assignment:

Course work includes a **Design project**. Design project should enable a group of students (maximum four in a group) to design a mechanical system (like couplings, screw jack, welded joints, bracket mounting using fasteners, etc.). Student should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report. Design project should be given due credit in internal assessment.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Apply the concepts of selection of materials for given mechanical components.

CO2: List the functions and uses of machine elements used in mechanical systems.

CO3: Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue.

CO4: Analyse the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure.

CO5: Demonstrate the application of engineering design tools to the design of machine components like shafts, couplings, power screws, fasteners, welded and riveted joints.

CO6: Understand the art of working in a team.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the	Edition and Year
Textbook/s				
1	Shigley's Mechanical Engineering Design	Richard G. Budynas, and J. Keith Nisbett	McGraw-Hill Education	10th edition, 2015.
2	Fundamentals of Machine Component Design	Juvinall R.C, and Marshek K.M.	John Wiley & Sons	Third Edition, 2007 student
3	Design of Machine Elements,	V B Bhandari	Tata McGraw Hill	4th Ed., 2016.
4	Design of Machine Elements-I	Dr.M H Annaiah Dr. J Suresh Kumar	New Age International (P)	1s Ed., 2016
Reference Books				
1	Machine Design- an integrated approach	Robert L. Norton	Pearson Education	2nd edition.
2	Design and Machine Elements	Spotts M.F., Shoup T.E	Pearson Education	8th edition,2006
3	Machine Component Design	Orthwein W	Jaico Publishing Co	2003
4	Machine Design	Hall, Holowenko, Laughlin (Schaum's Outline series)	Tata McGraw Hill Publishing	Special Indian Edition, 2008
5	Elements of Machine Design	H.G.Patil, S.C.Pilli, R.R.Malagi, M.S.Patil	IK International	First edition,2019

6	Design of Machine Elements Volume I	T. Krishna Rao	IK international publishing house,	2012
7	Hand book of Mechanical Design	G. M. Maithra and L.V.Prasad	Tata McGraw Hill	2nd edition, 2004.

Design Data Hand Book:

[1] Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd edition, 2003.

[2] Design Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS publication.

[3] Design Data Hand Book, H.G.Patil, I. K. International Publisher, 2010

[4] PSG Design Data Hand Book, PSG College of technology, Coimbatore.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

DESIGN OF MACHINE ELEMENTS II

Course Code	**18ME62**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand various elements involved in a mechanical system.
- To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
- To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
- To design a mechanical system integrating machine elements.
- To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

Module-1

Springs: Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs; springs under fluctuating loads.
Leaf Springs: Stresses in leaf springs, equalized stresses, and nipping of leaf springs.
Introduction to torsion and Belleville springs.
Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.
Selection of flat and V belts- length & cross section from manufacturers' catalogues. Construction and application of timing belts.
Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

Module-2

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, lubrication of gears, and gear tooth failure modes.
Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.
Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Module-3

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.
Worm Gears: Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Module-4

Design of Clutches: Necessity of a clutch in an automobile, types of clutch, friction materials and its properties. Design of single plate, multi-plate and cone clutches based on uniform pressure and uniform wear theories.
Design of Brakes: Different types of brakes, Concept of self-energizing and self-locking of brakes. Practical examples, Design of band brakes, block brakes and internal expanding brakes.

Module-5

Lubrication and Bearings: Lubricants and their properties, bearing materials and properties; mechanisms of lubrication, hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated. Numerical examples on hydrodynamic journal and thrust bearing design.

Antifriction bearings: Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep grove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds;probability of survival.

Assignment:

Course work includes a **Design project**. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, etc.) A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report. Design project should be given due credit in internal assessment.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Apply design principles for the design of mechanical systems involving springs, belts, pulleys, and wire ropes.
CO2: Design different types of gears and simple gear boxes for relevant applications.
CO3: Understand the design principles of brakes and clutches.
CO4: Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue.
CO6: Apply engineering design tools to product design.
CO7: Become good design engineers through learning the art of working in a team.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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Textbook/s				
1	Shigley's Mechanical Engineering Design	Richard G. Budynas,and J. Keith Nisbett	McGraw-Hill Education	10th Edition, 2015
2	Fundamentals of Machine Component Design	Juvinall R.C, and Marshek K.M	John Wiley & Sons	Third Edition 2007 Wiley student edition
3	Design of Machine Elements	V. B. Bhandari	Tata Mcgraw Hill	4th Ed 2016.
4	Design of Machine Elements-II	Dr.M H Annaiah Dr. J Suresh Kumar Dr.C N Chandrappa	New Age International (P) Ltd.,	1s Ed., 2016
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2	Design and Machine Elements	Spotts M.F., ShoupT.E	Pearson Education	8th edition, 2006

3	Machine design Hall, Holowenko, Laughlin (Schaum's Outline Series	adapted by S.K.Somani	Tata McGraw Hill Publishing Company Ltd	Special Indian Edition, 2008
4	Elements of Machine Design	H.G.Patil, S.C.Pilli, R.R.Malagi, M.S.Patil	IK International	First edition,2019
5	Design of Machine ElementsVolume II	T. Krishna Rao	IK international publishing house	2013
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[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010
[4] PSG Design Data Hand Book, PSG College of technology, Coimbatore

B. E. MECHANICAL ENGINEERING
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SEMESTER - VI

HEAT TRANSFER

Course Code	**18ME63**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

Module-1

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Types of boundary conditions. General three dimensional Heat Conduction Equation: Derivation of the equation in (i) Cartesian, coordinate only. Discussion of three dimensional Heat Conduction Equation in (ii) Polar and (iii) Spherical Co-ordinate Systems.

Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) without heat generation and (ii) constant thermal conductivity - in Cartesian system with various possible boundary conditions. Brief Introduction to variable thermal conductivity and heat generation [No numerical on variable thermal conductivity and heat generation] Thermal Resistances in Series and in Parallel. Critical Thickness of Insulation in cylinder and spheres Concept. Derivation

Module-2

Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts.

Module-3

Numerical Analysis of Heat Conduction: Introduction, one-dimensional steady conduction and one dimensional unsteady conduction, boundary conditions, solution methods.

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's displacement law, Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange between parallel plates, concentric cylinders, and concentric spheres, Radiation Shield.

Module-4

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions.

Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

Module-5

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts.

Introduction to boiling: pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the modes of heat transfer and apply the basic laws to formulate engineering systems.

CO2: Understand and apply the basic laws of heat transfer to extended surface, composite material and unsteady state heat transfer problems.

CO3: Analyze heat conduction through numerical methods and apply the fundamental principle to solve radiation heat transfer problems.

CO4: Analyze heat transfer due to free and forced convective heat transfer.

CO5: Understand the design and performance analysis of heat exchangers and their practical applications, Condensation and Boiling phenomena.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Principals of heat transfer	Frank Kreith, Raj M. Manglik, Mark S. Bohn	Cengage learning	Seventh Edition 2011.
2	Heat transfer, a practical approach	Yunus A. Cengel	Tata Mc Graw Hill	Fifth edition
Reference Books				
1	Heat and mass transfer	Kurt C, Rolle	Cengage learning	second edition
2	Heat Transfer A Basic Approach	M. NecatiOzisik	McGraw Hill, New York	2005
3	Fundamentals of Heat and Mass Transfer	Incropera, F. P. and De Witt, D. P	John Wiley and Sons, New York	5th Edition 2006
4	Heat Transfer	Holman, J. P.	Tata McGraw Hill, New York	9th Edition 2008

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

HEAT TRANSFER LAB

Course Code	**18MEL67**	CIE Marks	40
Teaching Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum.
- Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

Sl. No.	Experiments
	PART A
1	Determination of Thermal Conductivity of a Metal Rod.
2	Determination of Overall Heat Transfer Coefficient of a Composite wall.
3	Determination of Effectiveness on a Metallic fin.
4	Determination of Heat Transfer Coefficient in free Convection
5	Determination of Heat Transfer Coefficient in a Forced Convention
6	Determination of Emissivity of a Surface.
	PART B
7	Determination of Stefan Boltzmann Constant.
8	Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
9	Experiments on Boiling of Liquid and Condensation of Vapour.
10	Performance Test on a Vapour Compression Refrigeration.
11	Performance Test on a Vapour Compression Air – Conditioner.
12	Experiment on Transient Conduction Heat Transfer.
	PART C (OPTIONAL)
13	Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).
14	Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package).

Course Outcomes: At the end of the course, the student will be able to:

CO1: Determine the thermal conductivity of a metal rod and overall heat transfer coefficient of composite slabs.

CO2: Determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.

CO3: Evaluate temperature distribution characteristics of steady and transient heat conduction through solid cylinder experimentally.

CO4: Determine surface emissivity of a test plate and Stefan Boltzmann constant

CO5: Estimate performance of a refrigerator and effectiveness of a fin and Double pipe heat exchanger

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made

Scheme of Examination:

One Question from Part A - 40 Marks

One Question from Part B - 40 Marks

Viva-Voce - 20 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII
Professional Elective 3

MECHATRONICS

Course Code	**18ME744**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.
- To understand the evolution and development of Mechatronics as a discipline.
- To substantiate the need for interdisciplinary study in technology education
- To understand the applications of microprocessors in various systems and to know the functions of each element.
- To demonstrate the integration philosophy in view of Mechatronics technology
- To be able to work efficiently in multidisciplinary teams.

Module-1

Introduction: Scope and elements of mechatronics, mechatronics design process, measurement system, requirements and types of control systems, feedback principle, Basic elements of feedback control systems, Classification of control system. Examples of Mechatronics Systems such as Automatic Car Park system, Engine management system, Antilock braking system (ABS) control, Automatic washing machine.
Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, Potentiometers, LVDT, Capacitance sensors, force and pressure sensors, Strain gauges, temperature sensors, proximity switches and Hall Effect sensors.

Module-2

Signal Conditioning: Introduction – Hardware – Digital I/O, Analog to digital conversions, resolution, Filtering Noise using passive components – Registers, capacitors, amplifying signals using OP amps. Digital Signal Processing – Digital to Analog conversion, Low pass, high pass, notch filtering. Data acquisition systems (DAQS), data loggers, Supervisory control and data acquisition (SCADA), Communication methods.
Electro Mechanical Drives: Relays and Solenoids – Stepper Motors – DC brushed motors – DC brushless motors – DC servo motors – 4-quadrant servo drives, PWM's – Pulse Width Modulation.

Module-3

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.
Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor.

Module-4

Programmable Logic Controller: Introduction to PLCs, Basic structure of PLC, Principle of operation, input and output processing, PLC programming language, ladder diagram, ladder diagrams circuits, timer counters, internal relays, master control, jump control, shift registers, data handling, and manipulations, analogue input and output, selection of PLC for application.
Application of PLC control: Extending and retracting a pneumatic piston using latches, control of two pneumatic pistons, control of process motor, control of vibrating machine, control of process tank, control of conveyer motor etc.

Module-5

Mechatronics in Computer Numerical Control (CNC) machines: Design of modern CNC machines - Machine Elements: Different types of guide ways, Linear Motion guideways. Bearings: anti-friction bearings,

hydrostatic bearing and hydrodynamic bearing. Re-circulating ball screws. Typical elements of open and closed loop control systems. Adaptive controllers for machine tools.

Mechatronics Design process: Stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Automatic car park barrier.

Course Outcomes: At the end of the course the student will be able to:

CO1: Illustrate various components of Mechatronics systems.

CO2: Assess various control systems used in automation.

CO3: Design and conduct experiments to evaluate the performance of a mechatronics system or component with

respect to specifications, as well as to analyse and interpret data.

CO4: Apply the principles of Mechatronics design to product design.

CO5: Function effectively as members of multidisciplinary teams.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechatronics-Principles Concepts and Applications	Nitaigour Premchand Mahalik	Tata McGraw Hill	1st Edition, 2003
2	Mechatronics–Electronic Control Systems in Mechanical and Electrical Engineering,	W.Bolton	Pearson Education	1stEdition, 2005
Reference Books				
1	Mechatronics	HMT Ltd	Tata Mc Graw Hill	1st Edition, 2000 ISBN:978007 4636435
2	Mechatronics: Integrated Mechanical Electronic Systems	K.P. Ramachandran, G.K. Vijayaraghavan, M.S. Balasundaram.	Wiley India Pvt. Ltd. New Delhi	2008
3	Introduction to Mechatronics and Measurement Systems	David G. Aldatore, Michael B. Histand	McGraw-Hill Inc USA	2003
4	Introduction to Robotics: Analysis, Systems, Applications.	Saeed B. Niku,	Person Education	2006
5	Mechatronics System Design	Devdas Shetty, Richard A. kolk	Cengage publishers.	second edition

Scheme of Examination:
One question from Part A: 40 marks
One question from Part B: 40 Marks
Viva voce: 20 Marks
Total: 100 Marks

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VIII

ENERGY ENGINEERING

Course Code	**18ME81**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand energy scenario, energy sources and their utilization
- Learn about energy conversion methods
- Study the principles of renewable energy conversion systems.

Module-1

STEAM GENERATORS Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures, LaMount, Benson, Velox, Loeffer, Schmidt steam generators, Cooling towers and Ponds, Accessories such as Superheaters, De-superheater, Economizers, Air preheaters.

Module-2

Solar Energy: Introduction, Solar radiation at the earth's surface, Solar radiation measurements, Flat plate collectors, Focussing collectors, Solar pond, Solar electric power generation-Solar photovoltaics.
Biomass Energy: Photosynthesis, photosynthetic oxygen production, energy plantation. Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, Bio gas plants-KVIC, Janta, Deenbhandu models, factors affecting bio gas generation. Thermal gasification of biomass, updraft and downdraft

Module-3

Geothermal Energy: Forms of geothermal energy, Dry steam, wet steam, hot dry rock and magmatic chamber systems.
Tidal Energy: Tidal power, Site selection, Single basin and double basin systems, Advantages and disadvantages of tidal energy.
Wind Energy: Wind energy-Advantages and limitations, wind velocity and wind power, Basic components of wind energy conversion systems, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor, Applications of wind energy.

Module-4

Hydroelectric plants: Advantages & disadvantages of water power, Hydrographs and flow duration curves-numericals, Storage and pondage, General layout of hydel power plants- components such as Penstock, surge tanks, spill way and draft tube and their applications, pumped storage plants, Detailed classification of hydroelectric plants, water hammer.
Ocean Thermal Energy: Ocean thermal energy conversion, Principle and working of Rankine cycle, Problems associated with OTEC.

Module-5

NUCLEAR ENERGY Principles of release of nuclear energy-Fusion and fission reactions. Nuclear fuels used in the reactors, Chain reaction, Moderation, breeding, Multiplication and thermal utilization factors. General components of a nuclear reactor and materials, Brief description-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shielding, Nuclear waste, Radioactive waste disposal.

Course Outcomes: At the end of the course the student will be able to:
CO1: Understand the construction and working of steam generators and their accessories.

CO2: Identify renewable energy sources and their utilization.

CO3: Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Power Plant Engineering	P. K. Nag	Tata McGraw Hill Education Private Limited, New Delhi	Third Edition, 2012.
2	Power Plant Engineering	Arora and Domkundwar	Dhanpat Rai & Co. (P) Ltd.	Sixth Edition, 2012.
3	Non-conventional Sources of Energy	G.D.Rai	Khanna Publishers, New Delhi	Fifth Edition, 2015.
4	Non-conventional energy resources	B H Khan	McGraw Hill Education	3rd Edition
Reference Books				
1	Power Plant Engineering	R. K. Rajput	Laxmi publication New Delhi	
2	Principles of Energy conversion	A. W. Culp Jr	McGraw Hill	1996
3	Power Plant Technology	M.M. EL-Wakil	McGraw Hill International	1994
4	Solar Energy: principles of Thermal Collection and Storage	S.P. Sukhatme	Tata McGraw-Hill	1984

4th Semester MBA HR Electives

CONFLICT & NEGOTIATION MANAGEMENT			
Course Code	**22MBAHR403**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**2:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

1. To understand the nature of various dimensions of conflict.
2. To learn various strategies and techniques to manage conflicts.
3. To understand the importance and role of negotiation in conflict resolution.
4. To understand the importance of cross-cultural and gender dimensions of negotiation.

Module-1 **6 Hours**

Introduction: Conflict: Definition, Meaning, Theories, Types of Conflicts - Productive (functional) and Destructive (dysfunctional). Levels of conflict – intrapersonal, interpersonal, group & organizational conflicts, Process and Structural Models. Myths about conflicts - of conflicts: cognitive (Pseudo conflict), process (simple conflict) and Inter-personal conflict (ego conflict), causes of conflict: common causes, organizational and interpersonal of conflict: traditional, Contemporary and Integrationist, Causes for work place conflicts – Harassment and discrimination.

Module-2 **7 Hours**

Analogy of Conflict: Stages of conflicts: grievances- personal needs, lack of monetary benefits and Incentives, promotion and recognition, harassment, discrimination, prejudice and Bias, identity unconcern attitudes of administration, frustration, escalation of Conflicts, and violence, Cost and effect of conflicts. Perspectives of conflict - organizational and individuals. Spectrum of conflicts- Persona conflicts, group conflicts, labour conflicts, social and political conflicts, Contingency conflic management process, Cost of Workplace Conflict, conflict mapping and tracking

Module-3 **7 Hours**

Conflict Management: Nature of conflict Management, Managing conflict: Thomas conflict resolution approach (Avoiding, Accommodating, Compromising, Competing, Collaboration) behavioural style and conflict handling, Cosier Schank model of conflict resolution. Strategies for resolving Individual, Team and organizational level conflict, Conflict Resolution Process – Persuasion, Counselling and Reconciliation Skills, Negotiation and Arbitration, Skills for conflict management – Listening, Mentoring, Mediating, Negotiating, Counselling, Diplomacy, EI (Emotional Intelligence). Conflict Regulation Reduction, Resolution, Transformation

Module-4 **6 Hours**

Negotiation: Negotiations/ Negotiation strategies –Meaning , Six Foundations of Negotiation, Negotiations, negotiation process, Principles for successful negotiations, Factors and essential skills for negotiation, tricks used in negotiation process, psychological advantage of negotiations, Techniques of negotiation, issues in negotiations. Negotiation strategies: Strategy and tactics for

distributive bargaining

Module-5 **7 Hours**

Negotiation - Resolving Disputes: Dispute Settlement Negotiation (DSN) and Deal Making Negotiation (DMN), importance of BATNA (Best alternative to a negotiated agreement) and ZOPA (Zone of possible agreement) in Dispute Settlement, Negotiation Strategy and tactics for integrative negotiation, negotiation strategy and planning. Finding and using negotiation power, sources of power, Implications of Negotiation on Policy making, Ethics in negotiation.

Module-6 **7 Hours**

Managing Impasse and difficult negotiations

Impasse - Meaning, Definition Third party approaches: Third party interventions, formal intervention methods – Arbitration, Mediation and Process Consultation, Informal intervention methods, best practices in negotiation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:

a) Tests (for 25Marks) and

b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full questions from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.

COMPENSATION AND REWARD MANAGEMENT			
Course Code	**22MBAHR306**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Learning objectives:

- The student will be able to describe and identify the application of Compensation Management in the Organisation
- The student will be able to describe and explain in her/his own words, the relevance and importance of Compensation Management in the Organisation
- The student will be able to apply and solve the workplace problems through application of Compensation Management
- The student will be able to classify and categories different models and approaches of Compensation Management adopted in the Organisation
- The student will be able to formulate and prepare Compensation Management to be adopted in the Organisation
- 6. The student will be able to design and develop an original framework and model in dealing with compensation problems in the organisation.

Module-1 (7 Hours)

Compensation: Compensation, Meaning of compensation, Total Compensation/Reward and Its Components and Types, Importance of the Total Compensation Approach, Wages/Salaries, Some Other Terms, Theories of Wages, Does Compensation Motivate Behaviour?, Compensation Philosophy, Compensation Strategy, Compensation Policy, Base of Compensation Management, The Psychological Contract, Compensation and Legal Issues in Compensation Management, Factors Affecting Employee Compensation/Wage Rates/Wage Structure/Levels of Pay.

Module-2 (7 Hours)

Compensation Management: Meaning of Compensation Management, Methods of Wage Payment, Essentials of a Satisfactory Wage System, National Wage Policy in India, Wage Policy at the Organisational Level, Wage Problems in India, Components/Functions of Compensation Management/W&S Admin, Divergent Systems and Institutions for Wage Fixation in India.

Module -3 (9 Hours)

Wage Determination Practices: Divergent Systems for Wage Determination in Practice in Indian Organisations Introduction, Management's Strategy, Reward Policy, Reward Management Processes, Reward Management Procedures, Pay Reviews, Planning and Implementing Pay Reviews, Procedures for Grading Jobs and Pay, Rates Fixation, Controlling Payroll Costs, Evaluation of Reward Processes, Some Other Trends, Boardroom Pay; Divergent Systems and Institutions for Wage Fixation in Practice in India, Management Strategy; Fringe Benefits, Fringe Benefits and Current Practices, Internal Audit of Compensation and Benefits; Different types of Direct and Indirect compensation include: Base Pay / Base pay; Commissions; Overtime Pay; Bonuses, Profit Sharing, Merit Pay; Stock Options; Travel/Meal/Housing Allowance; Benefits including: dental, insurance, medical, vacation, leaves, retirement, taxes; Merit pay; Incentive Pay; Deferred Pay ; Pay for time; Recreational facilities

Module-4 (9 Hours)

Contingent Pay, Pay for Performance, Competence: Competency-Based Pay, Skill-Based Pay, Team-Based Rewards, Gainsharing, Profit-Sharing Profit-Related Pay and Beyond Other Cash Payments and Allowances Overtime Payments Attendance Bonuses, Shift Pay, Clothing Allowances, Honoraria, Payments for Qualifications, Pay for Person, Pay for Excellence, Managerial Compensation and Rewards, Sales Force Incentive Programmes, Competency based Pay- Framework, Model and Challenges; Pay for Performance : Steps involved in the design for pay for performance - Intent ; Eligibility; Participation; Performance and Goal Criteria-Measurements ; Funding; Pay Outs and Timing; Benefits Impact & Administration; Evaluation.
Module-5 (9 Hours)
Administration & Controlling Salary Costs and Salary Review: Salary Survey data, Salary Costs, Salary Planning, Salary Budget, Salary Control, Salary Reviews, Guidelines for Salary Review Process, Responding to Negative Salary Review, Five Key Steps: Manager's Guide to Annual Salary Review, Fixing of Salary, Method of Paying Salary, Flexibility, Process of Wage and Salary Fixation.
Module-6 (9 Hours)
Operating, Non-financial Benefits(Intrinsic and Relational Rewards: Role of Non-financial Benefits/Rewards on Employee Motivation, Types of Non-financial Benefits/Rewards, Planning the Non-financial Benefits/Rewards, A Few Most Effective Non-Financial Benefits/Rewards to Motivate Employees, Heineken's Refreshing Approach to Reward, Non-financial Metrics Intellectual Capital Assessment and Market Implications of Human Capital, Recognition, Praise, Learning and Development, Achievement, Value Addition in Personality Others.

HUMAN RESOURCE MANAGEMENT			
Course Code	**22MBA21**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Learning objectives: The student will be able to

- Recite the theories and various functions of Human Resources Management
- Describe and explain in her/his own words, the relevance and importance of Human Resources Management at workplace
- Apply and solve the workplace problems through Human Resources Management intervention
- Compare and contrast different approaches of HRM for solving the complex issues and problems at the workplace
- Design and develop an original framework and model in dealing with the problems in the organization.

Module-1 (7 Hours)

Introduction HRM: Introduction, meaning, nature, scope of HRM, Importance and Evolution of the concept of HRM, Major functions of HRM, Principles of HRM. Human Resource Management and Personnel Management, Models of Human Resource Management, HRM in India, The Factors Influencing Human Resource Management, The HR Competencies, Human Resource Management and Firm Performance.

Module-2 (9 Hours)

HR Planning: Importance of HR Planning, Manpower Planning to HR Planning, Factors Affecting HR Planning, Benefits of HR Planning, HRP Process, Tools for Demand Forecasting, Attributes of an Effective HR Planning, Barriers to HR Planning, The Challenges for HR, Process of Job Analysis, Job Description and Job Evaluation.

Recruitment and Selection: Importance of Recruitment, Recruitment Policies, Factors Influencing Recruitment, Recruitment Process, Sources, Evaluation of Recruitment Process, Recruitment Strategy, Future Trends in Recruitment; Selection Process; Selection Tests; Factors Influencing Selections.

Module-3 (9 Hours)

Performance Management and Appraisal: Objectives of Performance Management, Performance Management and Performance Appraisal, Common Problems with Performance Appraisals, Performance Management Process, Types of Performance Rating Systems, Future of Performance Management.

Compensation and Benefits: Introduction, Definitions, Total Compensation, Total Rewards System, Forms of Pay, External and Internal Factors, Establishing Pay Rates, Employee Benefits.

Industrial Relations: Decent Workplace, International Labour Organisation, Industrial Relations, The Objectives of Industrial Relations, Approaches of Industrial Relations Systems, The Actors in Industrial Relations, Indian Context, Industrial Relations and Human Resource Management.

Module-4 (9 Hours)

Human Resource Management in Small and Medium Enterprises: Introduction to SMEs, The Difference in Adoption of Human Resource Management, SMEs and Large Firms, Indian Experience, Impact of Weak Adoption of Human Resource Management in SMEs,

Human Resource Management in the Service Sector: Introduction, The Emergence of the Services Sector, Implications for Human Resource, Management Function, Differences Between Services Sector and the Manufacturing Sector, Difference in Human Resource Management in Services and Manufacturing Sectors, Human Resource Management and Service Quality Correlation, Trade Unions in Services Sector, Models of Union Strategies.

Module-5 (9 Hours)

Human Resource Management and Innovations: Factors Affecting the Innovation Process in organisations, Current Trends in Human Resource Management, Innovative Human Resource Management Practices in India, Sustainable and innovative Human Resource Management.

Module-6 (7 Hours)

Future trends in Human Resource Management: Hybrid work model, Employee skill development, Internal mobility, Diversity and inclusion in workforce, People analytics, Employee well-being, Multi-generational workforces and All-in-One HR tools.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:

a) Tests (for 25Marks) and

b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full questions from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.

Industrial Relations And legislations

Course Code	**22MBAHR304**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Learning Objectives:

This course will enable the students

- To describe and Identify the application of Labour Laws regulating Industrial Relations in Organisation
- To describe and explain in her/his own words, the relevance and importance of Labour Laws and Industrial Relations in Organisation
- To apply and solve the workplace problems through Labour Laws
- To classify and categorise different Laws and Codes
- To create and reconstruct Industrial Relations System to be adopted in the Organisation
- To appraise and judge the practical applicability of Labour Laws regulating Industrial Relations in Organisation

Module-1 (9 Hours)

Introduction – Industrial Relation: Definitions, Scope, Objectives, Types, Characteristics, Importance, approaches of Industrial Relations, Model of Industrial relations, Recent Trends in Industrial Relations, Managing IR Changes. The Participants of Industrial Relation Activities.

Module-2 (9 Hours)

Evolution of Labour Legislation in India - History of Labour Legislation in India, Objectives of Labour Legislation, Types of Labour Legislations in India, Constitutional Provisions for the Protection of Labour Workforce in India, Rights of Woman Workers; The Present Labour Laws and Codes. **Concept and steps of Grievance,** Need for a Grievance Redressal procedure, Legislative aspects of the grievance redressal procedure in India, Model of Grievance redressal Procedure.

Module-3 (9 Hours)

Collective bargaining: Concept – function and Importance – principles and forms of Collective bargaining, importance of Collective Bargaining, Process of Collective Bargaining, Negotiation, form of negotiation

Workers' Discipline Management, causes of indiscipline, disciplinary Action - service rules, misconduct, investigation of allegations, showcase notice, charge sheet, domestic enquiry, Report of findings, punishments to be imposed. Workers participation In Management.

Module-4 (9 Hours)

Introduction to Employee Relation, meaning and significance of employee relation in industry, Advantages and limitations of maintaining employee relations through unions. Legal provisions to maintain employee relation- works committee, conciliation, board of conciliation, voluntary arbitration, and adjudication.

Module-5 (9 Hours)

Factory Act 1948, Contract labour Act (Regulation and Abolition)Act 1970, The Payment of Wages Act, 1936 – the Minimum Wages Act, 1948.

Module-6 (7 Hours)

Industrial Dispute Act 1947, Trade Union act 1926. Employee State Insurance Act 1948, Employee Compensation Act 1923, Maternity Benefit Act 1961, Employee provident Fund and Miscellaneous Provisions Act 1952 , Gratuity Act 1972, Bonus Act 1965.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:

a) Tests (for 25Marks) and

b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full question from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.

Suggested Learning Resources:

Books

1. Industrial relation, S. Venkata Ratam and Manoranjan Dhal, Oxford Publicatio, 2017 (2nd edition).
2. Essentials of HRM and Industrial Relation, Rao, P Subba, Himalaya Publishing House, 2013 (5th edition).
3. Industrial Relations, Trade Union and Labour Legislation. PRN Sinha, Indu Bala Sinha, Seema Shekhar, Pearson, 2017 (3rd edition).
4. Industrial Relations and Labour Laws-Emerging Paradigms, B.D.Singh, Excel Book, 2008.

Web links and Video Lectures (e-Resources):

Principles of Management and Organisational Behaviour			
Course Code	**22MBA11**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Objectives: This course will enable the students

- To understand theories and models of Management and OB.
- To classify and differentiate between various methods of problem solving.
- To compile an adept framework for solving the problems at the workplace.
- To acquaint the students with industry relevant skill sets.

Module-1 (8 Hours)

Introduction: Meaning, Objectives, Differences between Administration and Management, Levels of Management, Kinds of Managers, Managerial roles, History of Management, Recent trends in Management.

Module-2 (9 Hours)

Planning: Importance, Process, Benefits of Planning, Types of Plans, Planning tools and techniques.
Organising: Meaning, Types of Organisation structures, Traditional structures, Directions in organisation structures.
Leading: Meaning, Nature, Traits and Behaviour, Contingency approaches to Leadership, Transformational leadership.
Controlling: Meaning, Importance, Steps in the control process, Types of Control.

Module-3 (9 Hours)

Organisational Behaviour: Introduction, Meaning, History of Organisational Behaviour, Organisational effectiveness, Organisational learning process, Stakeholders, Contemporary challenges for Organisations.

Module-4 (9 Hours)

Behavioural Dynamics: MARS Model of individual behaviour and performance, Types of Individual behaviour, Personality in Organisation, Values in the work place, Types of values, **Perception,** Meaning, Model of Perceptual process. Emotions in work place, Types of emotions, Circumplex Model of Emotion, Attitudes and Behaviour, Work-related stress and its management. **Motivation,** Meaning, Maslow's Hierarchy of Needs, Four Drive Theory of Motivation.

Module-5 (9 Hours)

Teams: Advantages of Teams, Model of Team Effectiveness, Stages of Team Development. Power , Meaning, Sources, and Contingencies of Power, Consequences of Power.

Module-6 (7 Hours)

Culture: Meaning, Elements of Organisational Culture, Importance of Organisational Culture. Organisational Change , Meaning, Resistance to change, Approaches to Organisational Culture, Action Research Approach, Appreciative Inquiry Approach, Large Group Intervention Approach, Parallel Learning Structure Approach, and Ethical issues of Organisational Behaviour.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:

a) Tests (for 25Marks) and

b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full question from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.

Suggested Learning Resources:

Books

1. MGMT ,Chuck Williams & Manas Ranjan Tripathy, 5/e, Cengage Learning, 2013.
2. Organizational Behavior,Steven L. McShane & Mary Ann Von Glinow, 6/e, McGraw Hill Education, 2015.
3. Management & Organisational Behaviour , Laurie J. Mullins, 7/e, Prentice Hall, 2005.
4. Essentials of Management , Koontz, McGraw Hill, 8/e, 2014.
5. Management, John R. Schermerhorn, Jr., 8/e, Wiley India, 2010.

3rd Semester MBA HR Electives

RECRUITMENT AND SELECTION			
Course Code	**22MBAHR303**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Learning Objectives:

This course will enable the students

- To recite the theories and various steps involved in Recruitment and Selection
- To describe and explain in her/his own words, the relevance and importance of Recruitment and Selection in the Organization
- To apply and solve the workplace problems through Recruitment and Selection intervention
- To classify and categorize in differentiating between the best method to be adopted by organization related to Recruitment and Selection
- To compare and contrast different approaches of Recruitment and Selection framework for solving the complex issues and problems
- To design and develop an original framework and framework in dealing with the problems in the organization.

Module-1 (8 Hours)

Workforce Planning and Recruitment Analytics:

Concept of Work, Organisation's Work and Jobs; Millennials at the work place; Key Characteristics of Millennials; Types of Millennial; The Evolution of Work Structure; Organising the Work; Strategic Job Redesign and Its Benefits; Strategic Issues in Recruitment; What make Bad Recruitment; Overview of the Hiring Process; Recruitment Metrics; Factors Affecting Recruitment; Recruitment Strategy: An Internal Approach; Recruitment Strategy: An External Approach; Legal and Ethical Considerations; Organisational Best Practices.

Module-2 (9 Hours)

Job Analysis, Job Description and Job Design:

Identify the Job to Examine; Determine Appropriate Information Sources and Collect Job-Related Data; Job Description; Competency and Competency Ice Berg Model; Why Competency Based Recruitment; Sources of Recruitment; Different steps of job search; Motivational Job Specification; Creation of Functional Specification; Creation of Behavioural Specification; Employer branding; Social Media; Job Design.

Module-3 (9 Hours)

Job Evaluation:

The Job Evaluation Process; Obtain Job KSAOs, Qualifications, Working Conditions, and Essential Duties; Examine Compensable Factors Using the Rating/Weighting Evaluation Method; Determine Overall Job Value; Hay Group—Pioneer in Job Evaluation; Determining Compensation using Job Evaluation Data; Legal and Ethical Considerations for Job Evaluation; Online Salary Survey.

Module-4 (9 Hours)

Selection and Interview Strategy:
Interview Strategy and Process; Millennials shaping the Recruitment landscape in the organizations; Strategies for recruiting and selecting Generation Y into the workforce Developing Effective. Interviewers; Interviewing Techniques; Legal and Ethical Considerations in the Interview Process; The overall BEI Process; Assessment Centre's; Simulations.

Module-5 (9 Hours)

Testing and Assessment:
Testing in Occupational Selection; Test related to Assessment of Knowledge, Skills, and Abilities; Personality Assessment; The Birkman method and MBTI® comparison; FIRO-B; Honesty and Integrity Assessment; Various Non-Interviewing Methods; Graphology; Skills Assessment; Games and Group Activity for Leadership Assessment; Administration of Tests and Assessments; Key Interviewer Skills.

Module-6 (7 Hours)

Making the Hire; Assessment of Candidate and Job Fit:
Unique Recruitment strategies; Biodata and Application Forms; Implications of Using Social Media Content in Hiring Decisions; Background Checks; Reference Checks; Pre-employment Testing; Making a Job Offer; Transitioning from Job Candidate to Employee; Induction; Placement.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:
There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:
a) Tests (for 25Marks) and
b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full questions from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.

3rd Semester MBA Marketing Electives

CONSUMER BEHAVIOUR			
Course Code	**22MBAMM303**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Learning objectives:

- To develop an understanding of consumer behaviour theories and apply this understanding in a marketing decision making context.
- To identify the multitude of factors influencing consumers so that each of us will be able to apply this knowledge to improve market strategy.
- To Create better marketing programs and strategies basing on the knowledge of consumer behaviour.

Module-1 (7 Hours)

Introduction to consumer behaviour: Meaning of Consumer Behaviour; Difference between Consumer & Customer; Nature & characteristics of Indian Consumers; Consumerism: meaning; Consumer Movement in India; Rights & Responsibilities of consumers in India; Benefits of consumerism.

Module-2 (9 Hours)

Consumer Decision Making: Consumer Buying Decision Process, Levels of Consumer Decision Making – Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages. Situational Influences- Nature of Situational Influence, Situational Characteristics and consumption behaviour. Models of Consumer Behaviour: Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Class Exercise: Conducting consumer experiments.

Module-3 (9 Hours)

Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, and Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals. Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives.

Personality: Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, NeoFreudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity, Brand Personality, Self and Self-Image.

Perception: Basics of Perception & Marketing implications, Elements of Perception, Dynamics of Perception, Influence of perception on consumer behavior, Consumer Imagery, Perceived price, Perceived quality, price/quality relationship, Perceived Risk, Types of risk, How to consumers'

handle risk.

Module-4(9 Hours)

Learning: Elements of Consumer Learning, Marketing Applications of Behavioural Learning Theories, Classical Conditioning – Pavlovian Model, Instrumental Conditioning.

Attitude: Basics of attitude, the nature of attitude, Models of Attitude and Marketing Implication, (Tricomponent Model of attitude, Multi attribute attitude models. Elaboration Likelihood Model).

Persuasive Communication: Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation.

Module-5 (9 Hours)

Social Class: Social Class Basics, What is Social Class? (Social class & Social status, the dynamics of status consumption), Features of Social Class, Five Social-Class Categories in India.

Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour. Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures. Cross Culture - Cross-cultural consumer analysis - Cross-cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problem

Groups: Meaning and Nature of Groups, Types Family: The changing structure of family, Family decision making and roles in decision making, Dynamics of husband-wife decision making, The family life cycle & marketing strategy, Traditional family life cycle & marketing implications,

Reference Groups: Understanding the power & benefits of reference groups, Types of reference group, Reference Group Appeals.

Module-6 (7 Hours)

Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders.

Diffusion of Innovations: Diffusion Process, Adoption Process: Stages, categories of adopters, Post Purchase Processes.

Customer Relationship Management- Meaning & Significance of CRM, Types of CRM Strategies for building relationship marketing,

DIGITAL AND SOCIAL MEDIA MARKETING			
Course Code	**22MBAMM405**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**2:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning Objectives:

This course will enable the students

- Understand how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy.
- Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media.
- Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan.
- Learn how to measure digital marketing efforts and calculate ROI.
- Explore the latest digital ad technologies.

Module-1 (5 Hours)

Digital Marketing Overview: Concept of Digital Marketing, Traditional Vs Digital Marketing, Understanding Digital Marketing Process, Digital Landscape. Digital advertising Market in India. Skills required in Digital Marketing, Digital Marketing Planning and Strategy.

Module-2 (6 Hours)

Display Advertising: Concept of Display Advertising, types of display ads, buying models, display plan, Segmenting and customizing Messages, Targeting- contextual targeting placement targeting, remarketing, interest categories, geographic and language tagging. Programmatic digital advertising, You Tube Advertising. The P-O-E-M Framework.

Module-3 (7 Hours)

Digital Advertising (PPC, Digital Display and YouTube campaign): Google Ad Words Overview; Understanding AdWords Algorithm; Creating Search Campaigns; Understanding Ad Placement, Understanding Ad Ranks, Types of Search Campaigns - Standard, All features, dynamic search & product listing. Tracking

Performance/Conversion: conversion tracking and its importance, setting up of conversion tracking, Optimizing Search Ad Campaigns. Display ads and its features, Types of display campaigns, Creating Display Campaign, Optimizing Display Campaign and Re-marketing, customer engagement on e-portals.

Concept of Online Advertising: Types of Online Advertising, Contextual advertising, Payment Modules, Different Online advertising platforms Creating Banner Ads Using Tools

Module-4 (8 Hours)

Emerging trends in Digital Marketing: Affiliate Marketing- Affiliate marketing history**,** Affiliate marketing scenario in India**,** Different ways to do affiliate marketing. **Email Marketing-** email marketing and process. Types of email marketing- Opt-in & bulk emailing; Setting up email marketing account, creating a broadcast email. auto responders, Setting up auto responders; Tricks to land in inbox instead of spam folder; **Social Media Marketing-**Concept **of** social media marketing, Understanding Facebook marketing, LinkedIn Marketing, Twitter Marketing, Video Marketing **and** VIDEO & AUDIO (PODCASTING) marketing; **and** **Content Marketing-**Introduction to content marketing, Objective of content marketing, Content marketing 7 step strategy building process, writing a great compelling content, optimizing content for search engines, opt-in email list with content marketing examples.
Module-5 (7 Hours)
Search Engine Optimization (SEO): Introduction to SEO. Search engine Major functions and operating algorithm, Introduction to SERP, search engine keywords and types, Google keyword planner tool; Keywords research process; Understanding keywords; On page optimization; Off Page optimization; Top tools for SEO; Monitoring SEO process; Preparing SEO reports, creating SEO Strategy, link juice, Importance of domain and page authority, Optimize exact keywords for impactful search. Google Panda Algorithm, Google Penguin and Google EMD Update. How to save your site from Google Panda, Penguin and EMD Update, how to recover your site from Panda, Penguin and EMD.
Module-6 (7 Hours)
E-Commerce and Payment Gateway: Concept of e-commerce, Top ecommerce websites around the world, software Payment Gateways, Merchant Accounts & Logistics for physical goods. Integrating Woo-commerce and setting up an ecommerce store on Word Press. Case studies on ecommerce websites. Google Product Listing Ads (PLA) for ecommerce websites. Practical Process of SEO for an ecommerce website.

MARKETING MANAGEMENT			
Course Code	**22MBA15**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Learning objectives:

- To make students understand the fundamental concepts of marketing and environment in which marketing system operates.
- To gain knowledge on consumer buying behaviour and influencing factors
- To describe major bases for segment marketing, target marketing, and market positioning.
- To develop a Conceptual framework, covering basic elements of the marketing mix.
- To understand fundamental premise underlying market driven strategies and hands on practical approach.

Module-1 (7 Hours)

Introduction to Marketing: Importance of marketing, Definitions of market and marketing, Types of Needs, Elements of Marketing Concept, Functions of Marketing, evolution of marketing, Marketing V/s Selling, Customer Value and Satisfaction, 4P's of Marketing, Marketing Environment, Techniques used in environment analysis, Characteristics (Micro and Macro), Marketing to the 21st century customer.

Module-2 (9 Hours)

Analysing Consumer Behaviour: Meaning and Characteristics, Importance of consumer behaviour, Factors influencing Consumer Behaviour, Consumer characteristics influencing buying behaviour personal factors and cultural factors. Consumer Buying Decision Process, Buying Roles, Buying Motives. The black box model of consumer behaviour. Psychological factors consumer.

Module-3 (9 Hours)

Product management and Pricing: Importance and primary objective of product management, product levels, product hierarchy, Classification of products, product mix, product mix strategies, Managing Product Life Cycle. New Product Development, packing as a marketing tool, Role of labeling in packing. Concept of Branding, Brand Equity, branding strategies, selecting logo, brand extension- effects. Introducing to pricing, Significance of pricing, factor influencing pricing (Internal factor and External factor), objectives, Pricing Strategies-Value based, Cost based, Market based, Competitor based, Pricing Procedure.

Module-4 (9 Hours)

Distribution and Promotion: Roles and purpose of Marketing Channels, Factors Affecting Channel Choice, Channel Design, Channel Management Decision, Channel Conflict, Designing a physical Distribution System. Promotions- Marketing communications- Integrated Marketing Communications (IMC)-communication objectives, steps in developing effective communication. Advertising: Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model, Traditional Vs Modern Media- Online and Mobile Advertising, social media for Advertising. Push-pull strategies of promotion.

Module-5 (9 Hours)

Market segmentation, Targeting and Brand Positioning: Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Types of Segmentation. Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Tasks involved in Positioning. Monitoring brands performance and positioning. Product Differentiation Strategies.

Module-6 (7 Hours)

Emerging Trends in Marketing: Marketing Planning. Concepts of B2B marketing, Service Marketing, Digital and social media Marketing, Green Marketing, Event Marketing, Marketing Audit, Sponsorship, Cause Related Marketing, Marketing for Non-Profit Organizations, Relationship marketing, Marketing Strategies for Leaders, Challengers, Followers and Startups. Social Responsibility of marketing, Neuro Marketing, Sensory Marketing, societal marketing concept, premiumization.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:

a) Tests (for 25Marks) and

b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full questions from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.

4th Semester MBA Marketing Electives

STRATEGIC BRAND MANAGEMENT			
Course Code	**22MBAMM403**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**2:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- To appreciate the relationship between corporate strategy and Brand Management.
- To explore the various issues related to Brand Management, brand association, brand identity, brand architecture, leveraging brand assets, brand portfolio management.
- To develop familiarity and competence with the strategies and tactics involved in building, leveraging and defending strong brands in different sectors.

Module-1 (7 Hours)

Introduction: Meaning of Brand, Concepts, Evolution of Brands, Functions of Brand to consumer, Role of Brand-Advantages of Brand, Product Vs Brand. **Branding-** Meaning, Creation of Brands through goods, services, people, Organization, Retail stores, places, online, entertainment, ideas, challenges to Brand builders. **Brand Management**-Meaning & Definition. Strategic Brand Management Process-Meaning, Steps in Brand Management Process, Strong Indian Brands.

Module-2 (5 Hours)

Meaning, Model of CBBE: Brand Equity: Meaning, Sources, Steps in Building Brands, Brand building blocks Resonance, Judgments, Feelings, performance, imagery, salience-Brand Building Implications, David Aaker's Brand Equity Model. Brand Identity & Positioning: Meaning of Brand identity, Need for Identity & Positioning, Dimensions of brand identity, Brand identity prism.
Brand positioning: Meaning, Point of parity & Point of difference, positioning guidelines, Brand Value: Definition, Core Brand values, Brand mantras, Internal branding.

Module-3 (7 Hours)

Meaning of Brand Knowledge: Dimensions of Brand Knowledge, Meaning of Leveraging Secondary Brand Knowledge & Conceptualizing the leverage process. Criteria for choosing brand elements, options & tactics for brand elements-Brand name, Naming guidelines, Naming procedure, Awareness, Brand Associations, Logos & Symbols & their benefits, Characters & Benefits, Slogans & Benefits, Packaging. Leveraging Brand Knowledge.

Module-4 (7 Hours)

Brand hierarchy, Branding strategy, Brand extension and brand transfer, Managing Brands overtime. Brand Architecture and brand consolidation. Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation Vs Later market entry,

First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies.
Module-5 (7 Hours)
Establishing brand Equity Management Systems. Methods for measuring Brand Equity-Quantitative Techniques & Quantitative Techniques, Making Brands go Global: Geographic extension, sources of opportunities for global brand, single name to global brand, consumers & globalization, conditions favoring marketing, barriers to globalization, managerial blockages.
Module-6 (7 Hours) **Global branding:** Organization for a global brand, pathways to globalization. Luxury Brand Management: Luxury definition and relativity, luxury goods and luxury brands, basic psychological phenomena associated with luxury purchase, luxury marketing mix, luxury retail, international luxury markets: historical leaders and emerging countries.

SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT			
Course Code	**22MBAFM304**	CIE Marks	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**50**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Course Learning objectives:

- To acquaint students with fundamental concepts of capital market and its instruments.
- To understand techniques to evaluate and analyze risk and return characteristics of securities such as individual stocks, mutual funds etc.
- To provide basic knowledge of the theories and practices of modern portfolio choice and investment decision

Module-1 (6 Hours)

Introduction to Investment: Investment Avenues, Attributes, Investor V/s speculator, Features of a good Investment, Investment Process.
Financial Instruments: Money Market Instruments, Capital Market Instruments, Derivatives.
Securities Market: Trading & Settlement Procedure, Stock Market Indicators- Indices of Indian Stock Exchanges (only Theory).

Module-2 (9 Hours)

Return and Risk Concepts: Concept of Risk, Causes of Risk, Types of Risk- Systematic risk- Market Price Risk, Interest Rate Risk, Purchasing Power Risk, Unsystematic Risk- Business risk, Financial Risk, Insolvency Risk, Risk-Return Relationship, Concept of diversifiable risk and non-diversifiable risk. Calculation of Return and Risk of Individual Security & Portfolio (Theory & Problems).

Module-3 (9 Hours)

Valuation of Securities: Bond – Meaning, features, types, determinants of interest rates, Bond Valuation, Bond Duration, Bond Management Strategies. Preference Shares- Concept, Valuation. Equity Shares- Concept, Valuation, Dividend Valuation Models, P/E Ratio valuation model. (Theory & Problems).

Module-4 (8 Hours)

Fundamental & Technical Analysis: Macro-Economic and Industry Analysis: Fundamental analysis-EIC Frame Work, Economy Analysis, Industry Analysis, Company Analysis- Financial Statement Analysis. Market Efficiency: Efficient Market Hypothesis, Forms of Market Efficiency, Empirical test for different forms of market efficiency. Technical Analysis – Concept, Theories- Dow Theory, Eliot Wave theory. Charts-Types, Trends and Trend Reversal Patterns. Mathematical Indicators –Moving Average Convergence-Divergence, Relative Strength Index (Theory only).

Module-5 (9 Hours)

Modern Portfolio Theory: Markowitz Model- Diversification, Portfolio Return, Portfolio Risk, Efficient Frontier. Sharpe's Single Index Model, Capital Asset Pricing Model: Assumptions, CAPM Equation, Capital Market Line, Security Market Line, CML V/s SML. Sharpe's Optimum Portfolio Construction. (Theory & Problems).

Module-6 (9 Hours)

Portfolio Management Strategies and Performance Evaluation: Portfolio Management Strategies: Active and Passive Portfolio Management strategy. Portfolio Revision: Portfolio Revision Strategies – Objectives, Performance plans. Mutual Funds: Concept of Mutual Funds, Participants in Mutual Funds, Advantages of Investment in Mutual Fund, Measure of Mutual Fund Performance. Portfolio performance Evaluation: Measures of portfolio performance (Theory & Problems).

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:

a) Tests (for 25Marks) and

b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full question from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Accounting for Managers			
Course Code	**22MBA13**	CIE Marks	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**50**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Course Learning objectives:

- To enable the students to understand the conceptual framework of accounting, reporting and financial statements.
- To enable the students in preparation of books of accounts and accounting records leading to final accounts and interpretation there-off.
- To acquaint the students with interpretation of accounting information and analyses of financial statements for decision making.

Module-1 (7 Hours)

Introduction to Accounting: Meaning and objectives, Need and Types of Accounting, Single Entry System, Double Entry System, Basics of Generally Accepted accounting Principles (GAAP) , IFRS, Indian Accounting Standards. Concepts and Conventions of Accounting. (Theory only)

Module-2 (9 Hours)

Accounting Cycle: Journal, Ledgers, Trial balance, Accounting equation, Users of Accounting information, subsidiary books including cash book with two and three column cashbook only. (Theory and Problems).

Module-3 (9 Hours)

Final Accounts of companies: Preparation of final accounts of companies in vertical form as per Companies Act of 2013 (Problems of Final Accounts with adjustments), Window dressing. Case Study problem on Final Accounts of Company-Appropriation accounts. (Theory and Problems).

Module-4 (9 Hours)

Analysis of Financial Statements: Meaning and Purpose of Financial Statement Analysis, Trend Analysis, Comparative Analysis, Financial Ratio Analysis, Preparation of Financial Statements using Financial Ratios, Case Study on Financial Ratio Analysis. Preparation of Cash flow Statement (indirect method). Lab compulsory for Financial Statement Analysis using Excel.
(Theory and Problems).

Module-5 (6 Hours)

Bank Reconciliation statement: Rules for recording Receipts and Payments in cash book and bank pass book, reasons for differences in the balances of cash book and bank pass book. Meaning and Preparation of Bank reconciliation statement with Tally. (Theory and Problems).

Module-6 (10 Hours)

Depreciation and Emerging Issues in Accounting: Depreciation: Meaning, characteristics and causes of depreciation, Types of Depreciation. Tax implication of depreciation. (Problems only on straight line and WDV method).

Direct Taxation: Basic Concepts and definitions, Capital and revenue – receipts, expenditures, Basis of charge and scope of total income, Tax Planning, Tax Evasion and Tax Management, (Theory Only).

Emerging Issues in Accounting: Human Resource Accounting, Forensic Accounting, Green Accounting, Sustainability Reporting. (Theory only).

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There shall be a maximum of 50 CIE Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE.

CIE Marks shall be based on:

a) Tests (for 25Marks) and

b) Assignments, presentations, Quiz, Simulation, Experimentation, Mini project, oral examination, field work and class participation etc., (for 25 Marks) conducted in the respective course. Course instructors are given autonomy in choosing a few of the above based on the subject relevance and should maintain necessary supporting documents for same.

Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
- Each full question is for 20 marks with 3 sub questions.
- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full question from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.
- 40 percent theory and 60 percent problems in the SEE.

Suggested Learning Resources:

Books

1. Financial Accounting: A Managerial Perspective, Narayanaswamy R, 5/e, PHI, 2014.
2. A Text book of Accounting For Management, Maheswari S. N, Maheswari Sharad K. Maheswari , 2/e, Vikas Publishing house (P) Ltd.
3. Computerized Accounting, Neeraj Goyal, Rohit Sachdeva, Kalyani Publishers, 1e, 2018.
4. Accounting for Management-Text & Cases, S.K.Bhattacharya & John Dearden, Vikas Publishing House Pvt. Ltd., 3e, 2018.
5. Accounting and Finance for Non-finance Managers, Jai Kumar Batra, Sage Publications, 1e, 2018.
6. Financial Accounting, Jain S. P and Narang K L, Kalyani Publishers.
7. Direct Taxes Law and practice, Vinod Singhania and Kapil Singhania, Taxman Publications.

Web links and Video Lectures (e-Resources):

Banking & Services Operations

Course Code	**22MBAFM306**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course Learning objectives:

- To understand the Structure and functions of Public sector Banks and Commercial Banking in India.
- To learn the functions of various Financial Services in India.
- To understand role of Banking and Financial Services in Business organizations
- To know the functioning of NBFC 's in India

Module-1 (8 Hours)

1Banking System and Structure in India: Types of banks –Public Sector, Regional Banks, Credit creation and Deployment of Funds. Role of Reserve Bank and GOI as regulator of banking system, Banking sector reforms, Provisions of Banking Regulation Act & Reserve Bank of India Act, Quantitative and Qualitative Measures of Credit Control, Recent trends in Banking- Banking Technology, Neo banking, Payment banking, Fintech, Crypto currency, Bank Performance analysis and Future of Banking. (Theory)

Module-2 (8 Hours)

Commercial Banking: Structure, Functions - Primary & Secondary functions, Services rendered. Concept of Universal Banking, Analysis of Banks' Financial statements, Financial statement of Banks, Comparison of bank ratios of Public sector banks, Private sector and Foreign banks operating in India. (Theory)

Module-3 (8 Hours)

Merchant Banking: Categories, Services offered, Issue management – Pre and Post issue management, Issue pricing, Preparation of Prospectus, Underwriting, Private Placement, Book Building Vs. Fixed price issues. (Theory)

Module-4 (10 Hours)

NBFCs; Micro-finance; Leasing & Hire Purchase Banking:

NBFCs: An Overview -Types of NBFCs in India- Growth, Functions and Regulatory framework. (Theory)

Micro-finance: The paradigm-NGOs and SHGs-Microfinance delivery mechanisms, Models Services, Challenges. -Future of Micro finance(Theory)

Leasing & Hire Purchase: Nature and scope of leasing, Types of leasing, Problems in Evaluation of Leasing. Nature and forms of Hire purchase agreements, Problems in Evaluation of Hire Purchase. (Theory and Problems)

Module-5 (8 Hours)

Credit Rating; Venture Capital; Depository System, Securitization of Debt: **Credit Rating**: Meaning, Process, Methodology, Agencies And Symbol **Venture Capital**: Concept, features, Process ,Stages. Private equity- Investment banking perspectives in private equity. Performance of Venture Capital Funded Companies In India.(Theory) **Depository System**: Objectives of Depository System, Activities, NSDL& CDSL. Process of Clearing and Settlement. **Securitization of Debt**: Meaning, process, Types, Benefits. (Theory)
Module-6 (8 Hours)
Mutual Funds -Meaning, Structure, Functions, Participants, Types of Funds, Types of Schemes, Performance of Mutual Funds, Factors contributing for the growth of mutual funds in India, Marketing of mutual funds. (Theory)

FINANCIAL MANAGEMENT			
Course Code	**22MBA22**	CIE Marks	**50**
Teaching Hours/Week (L:P:SDA)	**4:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**50**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Course Learning Objectives:

- To familiarise the students with basic concepts of financial management and financial system.
- To understand the concept of time value of money and its implication.
- To evaluate investment proposals.
- To understand the management of working capital in an organization.
- To analyse the capital structure and dividend decision of an organisation

Module-1 (7 Hours)

Introduction: Financial Management: Definition and scope- objectives of Financial Management-role and functions of finance managers. Interface of Financial Management with other functional areas. **Indian Financial System:** Structure-types-Financial markets- Financial Instruments -Financial institutions and financial services- Non-Banking Financial Companies(NBFCs). Emerging areas in Financial Management: Risk Management- Behavioural Finance- Financial Engineering- Derivatives (Theory).

Module-2 (9 Hours)

Time value of money: Time value of money –Future value of single cash flow & annuity – Present value and discounting-present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest - Capital recovery factor & equated annual instalments. (Theory & Problem).

Module-3 (9 Hours)

Long term sources of Finance & Cost of Capital: Shares- Debentures- Term loans and deferred credit-Lease financing- Hybrid financing- Venture Capital-Angel investing- private equity- Crowd funding (Theory Only). **Cost of Capital**: Basic concepts-Components and computation of cost of capital- Cost of debentures- cost of term loans- cost of preferential capital-cost of equity (Dividend discounting and CAPM model) - Cost of retained earnings - Determination of Weighted average cost of capital (WACC) (Theory & Problem).

Module-4 (7 Hours)

Capital structure and Dividend Decisions: Capital structure– Planning the capital structure-optimum capital structure- determination of capital structure- Governance of Equity and Debt-Leverages- EBIT and EPS analysis-Return of Investment (ROI) &Return on Earnings (ROE) analysis.(Theory & Problem).

Dividend decisions & policies – Factors affecting the dividend policy – types of Dividend Policy-forms of dividend-bonus issue-stock split (Theory only)

Module-5 (9 Hours)

Long term Investment Decisions (Capital Budgeting): Need and importance of capital budgeting and its process-Techniques of capital budgeting – [Payback period, time adjusted payback period, accounting rate of return , Net present value, Internal rate of return, Modified internal rate of return, Profitability index method,). Capital Rationing. Estimation of cash flows for new projects and replacement projects. (Theory & Problem).

Module-6 (9 Hours)

Working Capital Management: Sources of working capital- Factors influencing working capital requirements - Current asset policy and current asset finance policy- Determination of operating cycle and cash cycle - Estimation of working capital requirements of a firm. (Theory Only).

Case study on Working Capital Determination and the impact of negative working capital.

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

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Semester End Examination:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have 8 full questions carrying equal marks.
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- Each full question will have sub question covering all the topics.
- The students will have to answer five full questions; selecting four full questions from question number one to seven in the pattern of 3, 7 & 10 Marks and question number eight is compulsory.
- 40 percent theory and 60 percent problem in SEE.

Suggested Learning Resources:
Books

1. Financial Management: Text, Problems & Cases M.Y. Khan & P.K. Jain, TMH,7/e, 2017
2. Financial Management: Theory and Practice, Prasanna Chandra, TMH, 10/e, 2019
3. Financial Management Dr. G. Nagarajan & Dr. Binoy Mathew, Jayvee Digital Publishing, 2/e, 2022
4. Financial Management, Prahlad Rathod, Babitha Thimmaiah and Harish Babu, HPH, 1/e, 2015.
5. Financial Management, I.M. Pandey, Vikas Publishing, 11/e.

Web links and Video Lectures (e-Resources):