SEMESTER 8

INDUSTRIAL ENGINEERING

SEMESTER S8

DATA SCIENCE WITH JULIA

Course Code	PEIET861	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To impart a thorough understanding of the basics of Julia software and develop skills in using Julia's package ecosystem for various applications.
2. To perform advanced analytics using Julia's powerful libraries.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Basic programming in Julia:** Overview of Julia software package, installation and set up, variables, data types and operations, data structures - arrays, tuples, dictionaries, sets; conditionals and loops, functions, methods and constructors, modules and packages, input and output.	**9**
2	**Advanced programming in Julia:** Object oriented programming and functional programming, parallel programming, metaprogramming, working with dates and time, working with data frames.	**9**
3	**Statistical analysis with Julia:** Exploratory data analysis, hypothesis testing, time series analysis. **Machine learning with Julia**: Regression analysis, classification, clustering and dimensionality reduction.	**9**
4	**Optimization with Julia:** Solving linear programming problems, solving mixed integer programming and vehicle routing problems, solving non-linear and mixed integer non-linear programming problems.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks **(8x3 = 24 marks)**	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

	Course Outcomes	**Bloom's Knowledge Level (KL)**
CO1	Develop various programs to implement projects using best practices in coding.	**K3**
CO2	Develop parallel computing strategies, and efficiently handle concurrent tasks to solve complex, large-scale computational problems.	**K3**
CO3	Make use of machine learning models using Julia, and apply these techniques to derive actionable insights from real-world data sets.	**K3**
CO4	Apply Julia's optimization libraries to design and solve various optimization problems.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	2	-	-	-	-	-	-	2
CO2	2	3	2	2	2	-	-	-	-	-	-	2
CO3	2	3	2	2	2	-	-	-	-	-	-	2
CO4	2	3	2	2	2	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Science with Julia	Paul D., McNicholas, Peter Tait	CRC Press	1st Edition, 2021
2	Julia for Data Science	Zacharias Voulgaris	Technics Publications	1st Edition, 2016
3	Statistics with Julia: Fundamentals for Data Science, Machine Learning and Artificial Intelligence	Yoni Nazarathy, Hayden Klok	Springe	1st Edition, 2021
4	Think Julia: How to Think Like a Computer Scientist	Ben Lauwens, Allen Downey	O'Reilly Media	1st Edition, 2019
5	Julia for Machine Learning	Anshul Joshi, Rahul Lakhanpal	Packt Publishing	1st Edition, 2021

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Julia Programming Projects	Adrian Salceanu	Packt Publishing	1st Edition, 2018
2	Julia High Performance	Avik Sengupta	Packt Publishing	2nd Edition, 2019
3	The Julia Programming Language: High Performance Numerical Computing and Scientific Computation	Robert Smith and Leonard Berry	CRC Press	1st Edition, 2021
4	Mastering Julia 1.0: Programming Julia for High-Performance Numerical Analysis and Computational Science	Malcolm Sherrington,	Packt Publishing	1st Edition, 2019

Video Links (NPTEL, SWAYAM…)	
Link ID	https://archive.nptel.ac.in/courses/111/106/111106164/

SEMESTER S8

PROGRAMMING AND DATA ANALYTICS WITH R

Course Code	PEIET862	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enable students to develop Proficiency in R Programming.
2. To equip students to apply statistical concepts and predictive modelling techniques in R to analyze real-world datasets.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to R**: Setting up R and RStudio, overview of the R ecosystem, installing and loading R packages, getting help with R. Basic syntax and operations, introduction to R script, Basic data types, reading data into R, vectors, matrices and arrays, data frames, lists, factors and tables.	9
2	**R programming:** Functions, control statements and loops, math functions, simulation in R, object-oriented programming - S3 classes, S4 classes, R6 classes, input and output, reading and writing files, debugging, performance enhancement, parallel R. **Rcpp**: setup, basic syntax, writing functions, and interfacing. Optimize R performance with C++ for statistical computations and data processing. Develop, compile, and debug Rcpp modules, enhancing R code efficiency for real-world applications.	9

3	**Data manipulation**: Group manipulation - apply family, aggregate, plyr, data table, faster group manipulation with dplyr-pipes, tbl, select, filter, slice, mutate, summarize, group by, arrange, do; iterating with purr, data reshaping, tidyverse, string manipulation, manipulating time series data with xts and zoo packages.	9
4	**Statistical analysis**: Probability distributions, exploratory data analysis, creating and customizing graphs, inferential statistics, parametric and nonparametric inference, linear regression models - simple and multiple regression, generalized linear models, experimental designs, multivariate statistical analysis, time series analysis.	9

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 = 24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	60

Course Outcomes (COs)

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

	Course Outcomes	Bloom's Knowledge Level (KL)
CO1	Make use of R data types and structures and prepare datasets for complex analysis and visualisation tasks.	K3
CO2	Develop functions, apply control structures, and automate tasks to solve practical data analysis and statistical computing challenges.	K3
CO3	Utilize various packages in R like dplyr and data.table for efficient data manipulation, preparing and transforming datasets for analysis and reporting.	K3
CO4	Perform robust statistical analyses, interpret data effectively, and produce actionable insights from various types of statistical models.	K4

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	-	-	-	-	-	-	2
CO2	2	2	2	2	2	-	-	-	-	-	-	2
CO3	2	2	2	2	2	-	-	-	-	-	-	2
CO4	2	2	2	2	2	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	The Art of R Programming: A Tour of Statistical Software Design	Norman Matloff	No Starch Press	1st Edition, 2011
2	R for Everyone: Advanced Analytics and Graphics	Jared P Lander	Addison-Wesley	2nd Edition, 2017
3	A Course in Statistics with R	Prabhanjan N. Tattar, Suresh Ramaiah and B.G. Manjunath	John Wiley & Sons, Ltd	1st Edition, 2016
4	R for Data Science	Hadley Wickham & Garrett Grolemund	O'Reilly Media	1st Edition, 2017

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Analysis and Graphics Using R: An Example-Based Approach	John Maindonald and John Braun	Cambridge University Press	3rd Edition, 2010
2	Practical Statistics for Data Scientists: 50 Essential Concepts Using R and Python	Peter Bruce, Andrew Bruce, and Peter Gedeck	O'Reilly Media	2nd Edition, 2020
3	R Graphics Cookbook: Practical Recipes for Visualizing Data	Winston Chang	O'Reilly Media	2nd Edition, 2019

Video Links (NPTEL, SWAYAM…)	
Link ID	https://archive.nptel.ac.in/courses/111/104/111104146/
	https://archive.nptel.ac.in/courses/110/107/110107092/
	https://archive.nptel.ac.in/courses/106/106/106106179/

SEMESTER S8

QUANTUM COMPUTING WITH PYTHON

Course Code	PEIET863	CIE Marks	40
Teaching Hours/Week (L:T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To develop a foundational understanding of quantum mechanics principles, quantum computing algorithms, and their applications using Python programming.

2. To equip students with skills to implement and simulate quantum algorithms and protocols using Python-based quantum computing frameworks like Qiskit.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to quantum mechanics:** Basic concepts - dirac notations, qubits, bell state, superposition, entanglement, quantum states, quantum bits, and the Bloch sphere, introduction to quantum gates and circuits.	**9**
2	**Quantum algorithms:** Overview of quantum computation algorithms - Cirq, Qiskit, Deutsch-Jozsa, Bernstein-Vazirani, Simon's Algorithm, Grover's Algorithm, Shor's Algorithm.	**9**
3	**Quantum protocols and quantum error correction:** Quantum teleportation and superdense coding, quantum key distribution (BB84 and E91 protocols), basics of quantum error correction.	**9**
4	**Practical quantum computing and quantum hardware:** Review of current quantum computers and quantum supremacy, quantum hardware technologies (superconducting qubits, trapped ions), quantum machine learning and deep learning, future trends and challenges in quantum computing.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks **(8x3 = 24 marks)**	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	60

Course Outcomes (COs)

At the end of the course, students should be able to:

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Apply quantum mechanics principles to construct and simulate quantum gates and circuits using Python.	K3
CO2	Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's to evaluate their efficiency in solving computational problems compared to classical approaches.	K3
CO3	Develop and simulate key quantum communication protocols and error correction schemes .	K3
CO4	Compare the performance of different quantum computing technologies and forecast potential developments and challenges in the field.	K4

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	3	-	-	-	-	-	-	2
CO2	2	2	3	2	3	-	-	-	-	-	-	2
CO3	2	2	3	2	3	-	-	-	-	-	-	2
CO4	2	2	3	2	3	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Quantum Computing for Everyone	Chris Bernhardt	MIT Press	1st Edition, 2019
2	Programming Quantum Computers: Essential Algorithms and Code Samples	Eric R. Johnston, Nic Harrigan, Mercedes Gimeno-Segovia	O'Reilly Media	1st Edition, 2019
3	Learn Quantum Computing with Python and Q#	Sarah C. Kaiser and Christopher E. Granade	Manning Publications	1st Edition, 2020

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hands-On Quantum Machine Learning With Python: Volume I: Get Started	Frank Zickert	Apress	1st Edition, 2020
2	Quantum Computing: An Applied Approach	Jack D. Hidary	Springer	1st Edition, 2019

Video Links (NPTEL, SWAYAM…)	
Link ID	https://archive.nptel.ac.in/courses/106/106/106106232/

SEMESTER S8

INTRODUCTION TO NATURAL LANGUAGE PROCESSING

Course Code	PEIET864	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enable students to familiarize the fundamental principles of natural language processing (NLP) and implement NLP techniques in Python.

2. To equip students to construct and train machine learning models to address and evaluate common NLP problems using standard metrics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to NLP:** The study of language, evaluating language understanding systems, different levels of language analysis, representations and understanding, organization of natural language understanding systems, linguistic background - An outline of english syntax, challenges in NLP. **Machine learning, deep learning, and NLP**: An overview, approaches to NLP, heuristics-based NLP, machine learning & deep learning for NLP, NLP pipeline, applications of NLP - machine translation, speech recognition, image captioning, spam detection, text prediction.	9
2	**Regular expression and text processing:** Importance, properties, working and python package, common regex function, meta characters- big brackets, cap, backslash, squared brackets, special sequences, asterisk, plus, and question mark, curly brackets **Understanding pattern objects:** Match method Vs search method,	9

	finditer method, logical Or, beginning and end patterns, parenthesis string modification**,** sentiment classification, language independent tokenization, string matching and spelling correction.	
3	**Vector models and text preprocessing:** Vectors, bag of words, countvectorizer, tokenization, stopwords, stemming, and lemmatization, Countvectorizer, vector similarity. TF-IDF, word-to-index mapping, building TF-IDF, neural word embeddings. Vector models, text preprocessing summary, steps of NLP analysis. **Language modeling:** Importance, types of language modeling, the curse of dimensionality, language model Markov assumption and N-Grams, language model implementation -setup, Ngrams function, update counts function, probability model function, reading corpus, language model implementation sampling text, Markov models, article spinning, cipher decryption with language modeling and genetic algorithm.	9
4	**NLP using machine learning:** Spam detection - problem, Naive Bayes theorem, intuition, spam detection using Naïve Bayes, class imbalance, ROC, AUC, AND F1 SCORE, implementing spam detection in python, sentiment analysis, text summarization, topic modeling, latent semantic modeling (Indexing). **Deep learning:** Word embeddings, nonlinear neural networks, Neuron - introduction, fitting a line, classification code preparation, text classification in tensorflow. Feed forward neural networks, convolution neural networks, recurrent neural networks.	9

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 = 24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course, students should be able to:

	Course Outcomes	**Bloom's Knowledge Level (KL)**
CO1	Utilize regular expressions and Python libraries such as NLTK, spaCy, and Pandas for text processing tasks.	**K3**
CO2	Apply suitable machine learning models to solve various NLP tasks and compare them using appropriate performance metrics.	**K3**
CO3	Apply advanced NLP techniques to perform complex tasks like text summarization, topic modeling, and cipher decryption and compare their performance.	**K3**
CO4	Develop and implement deep learning architectures for advanced NLP tasks.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	2	3	-	-	-	-	-	-	2
CO2	2	2	2	2	3	-	-	-	-	-	-	2
CO3	2	2	3	2	3	-	-	-	-	-	-	2
CO4	2	2	3	2	3	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Natural Language Processing with Python	Steven Bird, Ewan Klein, and Edward Loper	O'Reilly Media	1st Edition, 2009
2	Foundations of Statistical Natural Language Processing	Christopher D. Manning and Hinrich Schütze	The MIT Press	1st Edition, 1999
3	Deep Learning for Natural Language Processing: Creating Neural Networks with Python	Palash Goyal, Sumit Pandey, and Karan Jain	Apress	1st Edition, 2018
4	Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems	Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, and Harshit Surana	O'Reilly Media	1st Edition, 2020

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Natural Language Processing with Transformers: Building Language Applications with Hugging Face	Lewis Tunstall, Leandro von Werra, Thomas Wolf	O'Reilly Media	1st Edition, 2022
2	Neural Network Methods for Natural Language Processing	Yoav Goldberg	Springer	1st Edition, 2017
3	Taming Text: How to Find, Organize, and Manipulate It	Grant S. Ingersoll, Thomas S. Morton, Andrew L. Farris	Manning Publications	1st Edition, 2013
4	Speech and Language Processing	Daniel Jurafsky, James H. Martin	Pearson	3rd Edition, 2021
5	Natural Language Processing Recipes Unlocking Text Data with Machine Learning and Deep Learning using Python	Akshay Kulkarni, Adarsha Shivananda	Apress	2nd Edition, 2021

Video Links (NPTEL, SWAYAM…)

Link ID	https://archive.nptel.ac.in/courses/106/101/106101007/

DATA ANALYTICS AND MACHINE LEARNING WITH PYTHON

Course Code	PEIET865	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	ESE Marks	60
Credits	5/3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Equip students with the skills to perform advanced data preprocessing, feature engineering, and selection using Python libraries to optimize machine learning models.

2. Develop proficiency in building, evaluating, and refining machine learning models using Python and implementing deep learning techniques for real-world applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to data analytics with python**: Introduction to Python; using pandas for data manipulation; cleaning and preparing data. Feature engineering with pandas and NumPy; techniques for creating and transforming features for analytical models. Introduction to data visualization with Matplotlib and Seaborn; exploring data distributions and relationships.	9
2	**Statistical analysis and feature selection**: Descriptive and inferential statistics with SciPy; understanding data through statistical metrics. Feature selection techniques; using scikit-learn for automated feature selection methods like RFE (Recursive Feature Elimination). Dimensionality reduction techniques; PCA and t-SNE with scikit-learn for feature extraction and data visualization.	9
3	**Machine learning models and handling imbalanced data**: Overview of machine learning algorithms (classification, regression)	9

	with scikit-learn. Handling imbalanced datasets; techniques like SMOTE, and balanced random forests with imbalanced-learn. Model evaluation and hyperparameter tuning using cross-validation and GridSearchCV in scikit-learn.	
4	**Advanced machine learning techniques and applications**: Introduction to deep learning with TensorFlow and Keras; basics of neural networks. Building and training deep learning models for classification and regression problems. Advanced topics in machine learning: ensemble methods, boosting, and stacking models to improve performance.	9

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)
Continuous Internal Evaluation Marks (CIE):

Attendance	Internal Examination	Analyse	Evaluate	Total
5	15	10	10	40

Criteria for Assessment (Analyse and Evaluate): 20 marks

Phases	Assessment Criteria	Marks
Analyse	***Problem Definition*** a. *Clearly defines the real-world quality issue.* b. *Examine and identify relevant contextual factors.*	**5**
	Problem Analysis a. *Present a structured realistic solution methodology.* b. *Compare and justify the proposed solutions with evidence and logical reasoning*	**5**
Evaluate	***Validation of Results*** a. *Thoroughly evaluate the proposed solutions.* b. *Compares trade-offs, advantages, and disadvantages.* c. *Considers feasibility, scalability, and practical implications.*	**5**
	Conclusion and Report Writing a. *Summarizes procedure, findings and insights, limitation, and scope for future work.* b. *Preparation of Report with all components of project report.*	**5**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 = 24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

	Course Outcomes	Bloom's Knowledge Level (KL)
CO1	Apply data manipulation and preprocessing techniques using pandas; construct and assess new features to enhance model accuracy.	**K3**
CO2	Identify statistical methods for insights; apply advanced feature selection strategies to optimize predictive models in scikit-learn.	**K3**
CO3	Apply various machine learning algorithms; address imbalanced data issues using specialized techniques to ensure robust model performance.	**K3**
CO4	Experiment deep learning with TensorFlow and Keras; enhance model predictions through ensemble methods and practical implementations.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	-	-	-	-	-	-	2
CO2	2	2	3	2	3	-	-	-	-	-	-	2
CO3	2	2	2	2	3	-	-	-	-	-	-	2
CO4	2	2	3	2	3	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Python for Data Analysis	Wes McKinney	O'Reilly Media	2nd Edition, 2017
2	Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists	by Alice Zheng and Amanda Casari	O'Reilly Media	1st Edition, 2018
3	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media	2nd Edition, 2019
4	Deep Learning with Python	François Chollet	Manning Publications	1st Edition, 2017
5	Imbalanced Learning: Foundations, Algorithms, and Applications	Haibo He and Yunqian Ma	Wiley-IEEE Press	1st Edition, 2013

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Applied Predictive Modelling	Max Kuhn and Kjell Johnson	Springer	1st Edition, 2013
2	Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python	Peter Bruce, Andrew Bruce, and Peter Gedeck	O'Reilly Media	2nd Edition, 2020

Video Links (NPTEL, SWAYAM…)

Link ID	
	https://archive.nptel.ac.in/courses/106/107/106107220/
	https://archive.nptel.ac.in/courses/106/105/106105152/

FINANCIAL MANAGEMENT FOR ENGINEERS

Course Code	OEIET831	CIE Marks	40
Teaching Hours/Week (L:T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enable students to apply techniques of financial decisions and analysis.
2. To equip students to utilize tools of capital structure and working capital management.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Financial management:** Finance, financial management and financial objectives. Scope of financial management, objectives of financial management, nature and scope of financial management, goal of financial management, financial management decisions. Time value of money - computations using compounding and discounting techniques. Securities and valuation of securities. Major financial decision areas – factors influencing financial decisions, internal and external factors. Financial management for engineers.	9
2	**Financial statements and analysis:** Financial statements, important concepts of financial accounting and financial statements. Major financial statements - income statement, balance sheet, fund flow statement and cash flow statement. Ratio analysis - balance sheet ratios, income statement ratios, cash flow statement ratios and composite ratios. Leverages - financial leverage, operating leverage and composite leverage.	9

3	**Capital structure and capital structure theories:** Capital structure - meaning, scope and patterns of capital structure, capital structure decisions, capital structure theories / approaches - Net Income Approach; Net Operating Income Approach; Traditional Approach and Modigliani-Miller (MM) Approach. Cost of capital. Planning for sources of finance (domestic and international).	9
4	**Working capital management:** Working capital - working capital planning, working capital management. management of cash (various theoretical models), inventories (including risk analysis), trade receivables, trade payables and short-term financing. Operating cycles. Capital budgeting – Conventional and discounted cash flow (DCF) Methods. Decision criteria in capital budgeting, net present value (NPV) – internal rate of return (IRR) comparisons, capital rationing and risk analysis. Introduction to international capital budgeting.	9

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 = 24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	60

Course Outcomes (COs)

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

	Course Outcomes	Bloom's Knowledge Level (KL)
CO1	Apply the tools for financial management decisions.	**K3**
CO2	Identify techniques for the analysis of major financial reports.	**K3**
CO3	Make use of tools for capital structure decisions.	**K3**
CO4	Apply the techniques for working capital management.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	-	3	-	-	-	-	-	-	2
CO2	2	-	3	-	3	-	-	-	-	-	-	2
CO3	2	-	3	-	3	-	-	-	-	-	-	2
CO4	2	-	3	-	3	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Financial Management: Theory and Practice	Chandra P.	Tata McGraw Hill	9th Edition, 2017
2	Management Accounting	Gupta, S. K., Sharma, R. K.	Kalyani Publishers	1st Edition, 2017
3	Financial Management, Text, Problems & Cases	Khan, M. Y., Jain, P. K.	Tata McGraw-Hill	8th Edition, 2018
4	Financial Management	Pandey I. M.	Vikas Publishing House	11th Edition, 2016

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Financial Management and Policy: Text and Cases	Bhalla V. K.	Anmol Publications	9th Edition, 2009
2	Fundamentals of Financial Management	Brigham E. F., Houston J. F.	Cengage Learning	10th Edition, 2015
3	Principles of Managerial Finance,	Gitman L. J., Zutter C. J	Pearson Education	13th Edition, 2017
4	Principles of Financial Management	Horne, J. C. V., Wachowicz J.	Pearson Education Limited	13th Edition, 2010

Video Links (NPTEL, SWAYAM…)	
Link ID	https://archive.nptel.ac.in/courses/110/107/110107144/
	https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-mg06/

SEMESTER S8

INTRODUCTION TO FINANCIAL MARKETS

Course Code	OEIET832	CIE Marks	40
Teaching Hours/Week (L:T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enable students to gain knowledge about various trading and investment activities.
2. To equip students to reap the benefits of financial markets for achieving financial freedom.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Primary and secondary equity market**: Public issue, right issue, private placement. Secondary market - BSE, NSE, NASDAQ, trading and settlement, open outcry system, screen-based system, rolling settlement, transaction costs, buying and selling of shares, buying on margin and short sale. **Stock market quotations and indices:** Individual stock quotation, types of stock market indices, stock market indices in India - S&P CNX Nifty, Sensex.	9
2	**Mutual funds**: Definition of mutual fund, types and classification of mutual funds, advantages and disadvantages of passive investing over active investing, concepts about systematic investment plan and systematic withdrawal plan. **Bonds:** Bond characteristics, valuation of bonds, price of bond, yield, bond yield measures, yield to maturity, macaulay duration, intrinsic value of bond.	9

3	**Investment management and algorithmic trading**: Market impact and the order book, optimal execution- sell side perspective, impact models - buy side perspective, popular algorithmic trading strategies - volume weighted average price, time weighted average price, participation, market on close, arrival price.	9
4	**Derivative Securities**: Forward contracts, forward prices, swaps, futures contracts, futures prices, hedging, speculation. options theory- mechanics of options market, properties of stock options, nature of option values, put-call parity, European and American options.	9

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	60

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Explain the concepts of primary and secondary equity markets, and market indices.	K2
CO2	Identify suitable mutual funds and bonds for investments.	K3
CO3	Apply various strategies of algorithm trading in investments.	K3
CO4	Apply the concepts of option pricing and derivative trading.	K3

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	-	-	-	-	2	2
CO2	2	3	3	-	-	-	-	-	-	-	2	2
CO3	2	3	3	-	-	-	-	-	-	-	2	2
CO4	2	3	3	-	-	-	-	-	-	-	2	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Financial Management, Text Problems and Cases	Khan M. Y., Jain P. K.	McGraw Hill Education	8th Edition, 2014
2	Quantitative Trading: How to Build Your Own Algorithmic Trading Business	Chan E. P.	Wiley	1st Edition, 2021
3	Applied Quantitative Methods for Trading and Investment	Dunis C.L., Laws J., Naim P.	Wiley	1st Edition, 2003
4	An introduction to derivatives and Risk Management	Chance D.M., Robert Brooks	Cengage	9th Edition, 2013

		Reference Books			
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Applied Multiple Regression/ Correlation Analysis for the Behavioral Sciences	Cohen J., Cohen P., West S. G., Aiken L. S.	Routledge	3rd Edition, 2003
2	Multivariate Data Analysis	Hair J. F., Black W. C., Babin B. J., Anderson R. E., Tatham R. L.	Pearson India	7th Edition, 2015
3	Investment Analysis and Portfolio Management	Chandra P.	Tata McGraw-Hill	4th Edition, 2013
4	Machine Learning for Algorithmic Trading	Jansen S.	Packt	2nd Edition, 2020
5	Hedge Fund Investing: A Practical Approach to Understanding Investor Motivation, Manager Profits, and Fund Performance	Kevin R. Mirabile	John Wiley	1st Edition, 2013
6	Python Algorithmic Trading Cookbook	Dagade P.	Packt	1st Edition, 2020

Video Links (NPTEL, SWAYAM…)	
Link ID	https://archive.nptel.ac.in/courses/111/103/111103126/

SEMESTER S8

COST AND MANAGEMENT ACCOUNTING FOR ENGINEERS

Course Code	OEIET833	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enable the students to understand the main principles of cost and management accounting.
2. To apply various tools and techniques to ascertain the financial condition of organizations.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to accounting**: Cost accounting, Management Accounting, Financial accounting. Scope, objectives and significance of cost accounting, elements of cost, cost accounting standards, cost accounting records, ledgers and cost statements.	9
2	**Financial accounting**: Salient features of balance sheet and profit and loss statement, cash flow and fund flow analysis(elementary), working capital management, ratio analysis - types, computation and interpretation of financial ratios. Depreciation-definition and methods.	9
3	**Cost accounting systems**: Cost concepts relating to income measurement and profit planning, cost concepts for control and decision making, job costing, process costing, allocation of overheads, activity based costing, standard costing and variance analysis, marginal costing, break even analysis.	9
4	**Budget and budgeting systems**: Introduction, planning process, budget - definition, meaning and purpose, requirements for a sound budget, fixed budgets - preparation of sales and production budgets,	9

financial budgets, flexible budgets, zero based budgets and budgetary control, construction of various budgets.	

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Apply the basic concepts of accounting in organisations.	K3
CO2	Apply techniques of accounting principles to prepare financial statements.	K3
CO3	Apply cost accounting concepts for managerial decision making.	K3
CO4	Construct various types of budgets for planning and decision making in organisations.	K3

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	-	3	-	-	-	-	-	3	2
CO2	2	3	2	-	3	-	-	-	-	-	3	2
CO3	2	3	2	-	3	-	-	-	-	-	3	2
CO4	2	3	2	-	3	-	-	-	-	-	3	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Cost and Management Accounting	M. P. Gupta, Ajai Gupta	Sultan Chand & Sons	1st Edition, 2023
2	Management Accounting	M. Y. Khan, P. K. Jain	McGraw Hill	8th Edition, 2021

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Management Accounting	Horngren, Surdem, Stratton, Burgstahler, Schatzberg	PHI Learning	16th Edition, 2013
2	Cost Accounting: Text, Problems and Cases	Jawahar Lal, Seema Srivastav, Manisha Singh	McGraw Hill	6th Edition, 2019
3	Financial and Managerial accounting - The basis for business decisions	Jan Williams	Tata McGraw Hill	16th Edition, 2017
4	Fundamental of Financial Management	James C., Van Horne	Pearson Education	13th edition, 2015

Video Links (NPTEL, SWAYAM…)	
Link ID	https://archive.nptel.ac.in/courses/110/101/110101003/

INTRODUCTION TO FINANCIAL ECONOMICS

Course Code	OEIET834	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To enable students to apply tools of financial economics, derivative markets, bonds and securities.
2. To equip students to utilize models and tools for financial risks and asset returns.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to financial economics:** Investment theory and structure of interest rates. Time value of money - future value, present value, future value of an annuity, present value of annuity, present rate of perpetuity. investment criteria: net present value (NPV), benefit cost ratio (BCR), internal rate of return (IRR), modified internal rate of return. Apply time value of concepts to practical problems in financial economics.	9
2	**Financial derivative markets**: Introduction to financial derivatives: types and uses of derivatives; forward contracts: determination of forward prices, futures contract: theories of future prices - the cost of carry model, the expectation model, relation between spot and future prices. Options: types, value of an option and important option pricing models with application cases. **Bonds and securities**: Fundamentals of bonds and securities, valuation of securities, valuation of bonds and stocks, bond yield, yield to maturity, equity valuation and dividend discount models.	9

3	**Financial risks and returns:** Introduction to financial risks and returns, types of risks, historical returns, and risk, computing historical returns, average annual returns, variance of returns, estimation of risk and return of an asset, measurement of risk and return of a portfolio, determinants of beta, risk-return trade off. Effect of diversification, minimum variance portfolio, perfectly correlated assets, minimum variance opportunity set, optimal portfolio choice, mean- variance frontier of risky and risk-free assets.	9
4	**Financial models for asset returns:** Introduction to advanced asset return models, multi-index models, single index model, equilibrium models, capital asset pricing model (CAPM), arbitrage pricing theory (APT), capital market line, security market line and estimation models of beta for investors. Cost of Capital - debt and equity, cost of debt, cost of preference capital and equity capital, capital market lines, security market lines and use of models in investment analysis.	9

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks **(8x3 = 24 marks)**	● Each question carries 9 marks. ● Two questions will be given from each module, out of which 1 question should be answered. ● Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	60

Course Outcomes (COs)

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

	Course Outcomes	Bloom's Knowledge Level (KL)
CO1	Apply time value of money tools in financial economics	**K3**
CO2	Identify techniques on derivative markets, bonds, and securities.	**K3**
CO3	Make use of tools for estimation of financial risks and returns	**K3**
CO4	Apply advanced tools and models for asset returns	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	-	3	-	-	-	-	-	-	2
CO2	2	-	3	-	3	-	-	-	-	-	-	2
CO3	2	-	3	-	3	-	-	-	-	-	-	2
CO4	2	-	3	-	3	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Financial Institutions and Markets	L. M. Bhole, J. Mahukud	Tata McGraw Hill	5th Edition, 2011
2	Options, Futures and Other Derivatives	John C. Hull	Pearson Education	6th Edition,2005
3	Financial Theory and Corporate Policy	Thomas E. Copeland, J. Fred Weston, Kuldeep Shastri	Prentice Hall	4th Edition, 2003
4	Principles of Corporate Finance	Richard A. Brealey, Stewart C. Myers	McGraw-Hill	7th Edition, 2002
5	Fundamentals of Corporate Finance	Stephen A. Ross, Randolph W. Westerfield, Bradford D. Jordan,	McGraw-Hill	7th Edition, 2005

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Financial Theory and Corporate Policy	Copeland, T. E., J. F. Weston	Addison Wesley	1st Edition, 1992
2	Modern Portfolio Theory & Investment Analysis	Elton, E. J., M. J. Gruber	John Wiley & Sons	4th Edition, 1991
3	Economics of Financial Markets	Houthakker H. S., P. J. Williamson	Oxford University Press	1st Edition, 1996

Video Links (NPTEL, SWAYAM…)	
Link ID	https://archive.nptel.ac.in/courses/130/104/130104116/