

E.G.S. PILLAY ENGINEERING COLLEGE(Autonomous)

Approved by AICTE, New Delhi

Affiliated to Anna University, Chennai | Accredited by NAAC with „A++ “Grade

Accredited by NBA (B.Tech-IT, B.E-CSE and ECE)(Tier-1)

NAGAPATTINAM – 611002



B. TECH - Artificial Intelligence & Data Science

R-2023

SEMESTER-4

Course Code	Course Title	L	T	P	C
1901MA405	Discrete Mathematics	3	0	0	3
1902AS401	Operating Systems	3	0	0	3
1902AS402	Data Mining	3	0	0	3
1902AS403	Data Analytics and Visualization	3	0	2	4
1902AS404	Artificial Intelligence	3	0	0	3
1901HS401	Engineering Economics	2	0	0	2
Laboratory Course					
1902AS451	Data Mining Laboratory	0	0	2	1
1902AS452	Statistical Analysis and Computing	0	0	2	1
1901MCX01	Environmental Science	2	0	0	0
1904GE451	Life Skills: Verbal Reasoning	0	0	2	1
Total Credits					21

1901MA405	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3
PREREQUISITE:					
1. Basic concepts of functions. 2. Basic concept of Graph theory.					
COURSE OBJECTIVES:					
To introduce concepts of mathematical logic for analyzing propositions and proving theorems. To work with relations and investigate their properties. To investigate functions as relations and their properties. To introduce basic concepts of graphs, digraphs and trees .					
COURSE OUTCOMES:					
On the successful completion of the course, students will be able to					
CO1:Make use of the concepts of set theory and apply them to situations involving inclusion and exclusion. CO2:Correlate the properties of different kinds of functions and solve recurrence relations. CO3:Compute the validity of logical arguments and construct simple mathematical proofs. CO4:Determine whether given graphs are isomorphic and apply Dijkstra’s algorithm to find the shortest path. CO5:Apply the concept and significance of lattice and Boolean algebra in computer science.					
COURSE CONTENTS:					
MODULE I	SET THEORY AND RELATIONS				9 Hours
Algebra of sets – The power set – Ordered pairs and Cartesian product – principle of inclusion and exclusion.Relations on sets –Types of relations and their properties - Equivalence relations –Relational matrix and the graph of relation – Operations on relations.					
MODULE II	FUNCTIONS AND RECURRENCE RELATIONS				9 Hours
Functions –Type of functions – Injective, surjective and bijective functions –Composition of functions – Inverse functions –Permutation functions - Recurrence relations-Solving linear recurrence relations.					
MODULE III	LOGIC				9 Hours
Propositions- Logical operators- Normal forms –Rules of inference-Consistency and inconsistency-Propositional logic- Proofs-Predicates- Quantifiers- Universe of discourse – Logical equivalences and implications for quantified statements-Rules of specification and generalization – Validity of arguments.					
MODULE IV	GRAPH THEORY				9 Hours
Graphs- Types of graphs- Matrix representation of graphs- Graph isomorphism- Walk – Path - Cycles- Eulerian graphs -Hamiltonian graphs- Planar graphs- Euler formula- Shortest path algorithm: Dijkstra’s algorithm.					
MODULE V	LATTICES AND BOOLEAN ALGEBRA				9 Hours
Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.					

TOTAL: 45 HOURS

REFERENCES:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
3. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
4. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
5. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
6. https://onlinecourses.nptel.ac.in/noc20_cs82/preview (Link for NPTEL/SWAYAM/MOOC Courses)

1902AS401	Operating Systems			L	T	P	C
				3	0	0	3
PREREQUISITE:							
NIL							
COURSE OBJECTIVES:							
<p>The major objective of this course is that the students will learn the importance of an Operating System in order to provide runtime supports for applications esp. in general purpose computing. The major objectives are the following.</p> <ul style="list-style-type: none"> • To introduce the difference between a process and a program and how an Operating System provides its services through system calls. • To introduce and get the appreciation of processes and threads, virtual components of a compute machines for a process. • Introduce the concepts of CPU Scheduling and explain the method of evaluations of various scheduling algorithms vis-à-vis optimality in terms of SJF scheduling. • Explain and build applications using inter-process communication mechanisms. • To learn different synchronization techniques and build concurrent process executions. • To understand the deadlocks and livelock mechanisms between processes and how to build systems to avoid deadlocks. • To learn about memory management, memory allocation by an OS to processes, virtual memory concepts including paging, segmentation and demand paging. • To understand the concepts of files and directories and build systems around these constructions. To understand the disk storage organization and file allocations on the disk. • To appreciate the concerns of data security and protection of resources. • To appreciate the operating system complexities with reference to contemporary case studies. 							
Module I	Introduction						9 Hours
Operating System structure, Process management, Memory management, Storage management, Distributed systems, System calls, OS design and implementation, Virtual machines							
Module II	Process Management						9 Hours
Process concept – scheduling, Inter process communication, Multithreading models, process scheduling, scheduling algorithms, thread scheduling,							
Module III	Process Coordination						9 Hours
Synchronization, critical section problem, semaphores, atomic transactions, deadlocks – model, characterization, handling deadlocks, prevention, avoidance, detection and recovery							
Module IV	Memory Management						9 Hours
Contiguous memory allocation, paging, segmentation, virtual memory management							
Module V	Storage Management						9 Hours
File concept, access methods, structure, implementation,, directory implementation, free space management, secondary storage structure – disk structure, scheduling, management, swap-space management, RAID structure							
Total Hours: 45							
Mode of Assessment: CAT/Assignment/Quiz/Seminar/Presentation/ESE							
Course Outcomes:							
<ol style="list-style-type: none"> 1. Understand and build applications using inter-process and inter-thread data sharing and communication mechanisms. 2. Understand the concepts of memory managements and appreciate the need of memory management from the view point of safety, separation of memory spaces etc. 3. Understand the concepts related to files and directories and the disk allocation and scheduling algorithms and appreciate the ways to optimize the storage utilization and random access to files. 4. Appreciate the concerns of data security and mechanisms to implement data safety and security including 							

access controls.

5. Understand the features of contemporary operating systems through case studies.

FURTHER READING:

1. A. Silberschatz and P.B. Galvin, Operating System Concepts, 8th Ed., Wiley, 2008.
2. W. Stalling, Operating Systems: Internals and Design Principles, 6th ed., Pearson Education, 2008.

REFERENCES:

1. A.S. Tanenbaum, Modern Operating System, 3rd Ed., Pearson, 2007.
2. Ekta Walia, Operating System Concepts, Khanna Book Publishing, 2019.
3. D.M. Dhamdhare, Operating Systems-A Concept Based Approach, McGraw-Hill, 2008.

1902AS403	Data Analytics and Visualization	L	T	P	C
		3	0	2	4
PREREQUISITE:					
	Database Management Systems				
COURSE OBJECTIVES:					
This course is intended to provide a broad overview of data analysis and visualization techniques. Students will be given hands-on training in data analytics to build descriptive and predictive models, and validating their models against the actual outcomes. The course will provide various techniques and tools for data analysis of noisy, real life data. Students will be taught how to perform data wrangling, cleaning, and sampling to get a suitable data set; exploratory data analysis; generating hypotheses and building intuition; prediction or statistical learning; communication – summarizing results through various visualization techniques and providing interpretable summaries.					
Module I	Introduction to Data Analytics and Business Intelligence				05 Hours
Course Introduction: Course overview, Expectations and learning outcomes, Data and its importance in business: Types of data, Data lifecycle, Data quality, Business intelligence and its applications: BI concepts and terminology, BI architecture, BI tools and technologies, Data visualization and its role in BI: Visualization principles and best practices, Popular data visualization tools					
Module II	Data Collection and Preparation				08 Hours
Data sources and collection methods: Internal and external data sources, Data collection strategies and techniques, Data cleaning and pre-processing: Data wrangling techniques, Handling missing values, Data transformation					
Module III	Exploratory Data Analysis and Descriptive Statistics				09 Hours
Exploratory data analysis (EDA): Identifying trends and patterns, Discovering relationships between variables, Outlier detection, Descriptive statistics: Measures of central tendency, Measures of variability, Data distribution analysis					
Module IV	Data Analysis Techniques				09 Hours
Statistical analysis: Hypothesis testing, Regression analysis, Time series analysis, Machine learning: Introduction to machine learning algorithms, Supervised learning (linear regression, decision trees, etc.), Unsupervised learning (clustering, dimensionality reduction, etc.)					
Module V	Data Visualization				09 Hours
Data visualization principles and best practices: Choosing the right chart type for the data (Quantitative data & Qualitative data), Effective use of color, fonts, and layout, Creating interactive dashboards, Design principles for effective data visualization, Data visualization tools: Tableau, Power BI, Python libraries (matplotlib, seaborn), Other visualization tools, Best practices for presenting data visualizations					
Module VI	Communicating Data Insights				05 Hours
Effective storytelling with data: Structuring a compelling narrative, Using data to support key points, Avoiding common pitfalls, Presentation skills: Delivering clear and concise presentations, Engaging your audience, Answering questions effectively					
					TOTAL: 45 HOURS
Mode of Assessment: Activity/CAT/ESE					
Course Outcomes:					
<ol style="list-style-type: none"> 1. Define and explain key data analytics and business intelligence concepts. 2. Collect, clean, and prepare data for analysis. 3. Perform exploratory data analysis (EDA) and descriptive statistics. 4. Apply various data analysis techniques, including regression analysis, time series analysis, and machine 					

learning.
<ol style="list-style-type: none"> 5. Design and create effective data visualizations using industry-standard tools. 6. Communicate data-driven insights to stakeholders in a clear and concise manner.
FURTHER READING:
<ol style="list-style-type: none"> 1. Skiena, Steven S, The Data Science Design Manual, CRC press 2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, Introduction to Data Mining (Second Edition)
REFERENCES:
<ol style="list-style-type: none"> 1. V.K. Jain, Data Science and Analytics (with Python, R and SPSS Programming), Khanna Book Publishing Company. 2. V.K. Jain, Big Data and Hadoop, Khanna Book Publishing Company, 2022. 3. Tamara Munzner, “Visualization Analysis and Design”, A K Peters/CRC Press; 1st edition (December 1, 2014) 4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013. 5. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015. 6. Gururajan Govindan, Shubhangi Hora, Konstantin Palagachev, “The Data Analysis Workshop”, July 2020, Publisher(s): Packt Publishing 7. https://www.oreilly.com/library/view/the-data-analysis/9781839211386/ 8. https://github.com/Harvard-IACS/2019-CS109A.git 9. https://learn.microsoft.com/en-us/power-bi/learning-catalog/learning-catalog-data-analyst
LIST OF EXPERIMENTS [SUGGESSTED]
1. Explore Data sources and collection methods
2. Explore Data cleaning and pre-processing
3. Perform Exploratory data analysis (EDA)
4. Perform Descriptive statistics
5. Perform Hypothesis testing
6. Perform Regression analysis
7. Perform Time series analysis
8. Perform Supervised Learning
9. Perform Unsupervised Learning
10. Choosing the right chart type for the data (Quantitative data & Qualitative data)
11. Creating interactive dashboards
12. Communicating Data Insights
13. Capstone Project
Total Hours:30
Mode of Assessment: Continues Assessment, PAT, ESP

1902AS402	Data Mining	L	T	P	C
		3	0	0	3
PREREQUISITE:					
1. 1902AS30X – Database Management Systems					
COURSE OBJECTIVES:					
Many new data mining methodologies, systems, and applications have been developed, especially for handling new kinds of data, including information networks, graphs, complex structures, and data streams, as well as text, Web, multimedia, time-series, and spatiotemporal data. Such fast development and rich, new technical contents make it difficult to cover the full spectrum of the field in this course.					
Module I	Introduction				07 Hours
Data mining, kinds of data can be mined, kinds of pattern can be minded, Technologies, applications, Issues in data mining, Data objects and attribute types, data pre-processing, data mining KDD process					
Module II	Data warehousing and OLAP				07 Hours
Data warehousing, OLTP vs OLAP, Data Cube and OLAP, Data warehouse design and usage, data warehouse implementation, data generalization, data cube concepts					
Module III	Frequent pattern mining				07 Hours
Basic concepts, market basket analysis, frequent itemset mining methods, apriori algorithm, pattern growth method, pattern evaluation methods, advanced pattern mining					
Module IV	Classification				07 Hours
Basic concepts, decision tree induction, bayes classification methods, rule-based classification methods, techniques to improve classification accuracy, classification by belief networks, back propagation, support vector machines					
Module V	Cluster Analysis				07 Hours
Cluster analysis, partitioning methods, hierarchical methods, density methods, grid methods, evaluation of clustering, probabilistic model based clustering, clustering high dimensional data					
Module VI	Outlier detection				07 Hours
Outlier and Outlier analysis, Outlier detection techniques, statistical approaches, proximity-based approaches, clustering/classification based approaches, outliers in high dimensional data					
Module VII	Data mining trends				03 Hours
Mining complex data types, data mining applications, mining big data, mining unstructured data – techniques, methods and case study.					
					TOTAL: 45 HOURS
Mode of Assessment: Activity/CAT/ESE					
Course Outcomes:					
<ol style="list-style-type: none"> 1. Relate data mining and data warehousing with respect to OLAP vs OLTP 2. Sketch data preprocessing techniques and data cubes for data warehouses 3. Use association rule mining for solving real-time data mining problems 4. Use classification techniques for solving real-time data mining problems 5. Use clustering techniques for solving real-time data mining problems 6. Use Outlier analysis to improve the overall process of data mining 7. Discover various aspects of mining knowledge from unstructured data while appraising applications of data mining 					
FURTHER READING:					
<ol style="list-style-type: none"> 1. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining concepts and techniques”, 3rd edition, Morgan Kauffman publishing 2. Ian. H. Walton, Eibe Frank, “Data Mining”, Practical machine learning tools and techniques, 3rd edition, Morgan Kauffman publishing 					

REFERENCES:	
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1. Gareth James, Daniela Witten, Trevor Hastie, Rob Tibshirani, “an Introduction to Statistical Learning”, Springer Publishing
2. Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, “ Principles and Theory for Data Mining and Machine Learning”, Springer Publishing
3. Galit Shmueli, Peter C.Bruce,“Data Mining for Business Analytics: Concepts, Techniques, and Applications in R”, Wiley Publishers
4. Peter C.Bruce, “ Data Mining for Business Analytics: Concepts, Techniques, and Applications with XLMiner”, 3rd edition, Wiley
5. <https://subscription.packtpub.com/book/data/9781783554393/5>

1902AS404	Artificial Intelligence	L	T	P	C
		3	0	0	3
PREREQUISITE:					
1. 1902AS301 - Programming using Python 2. 1902AS302 - Data Structures and Algorithms					
COURSE OBJECTIVES:					
Artificial Intelligence is a major step forward in how computer system adapts, evolves and learns. It has widespread application in almost every industry and is considered to be a big technological shift, similar in scale to past events such as the industrial revolution, the computer age, and the smart phone revolution. This course will provide an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science through classroom program that covers fascinating and compelling topics related to human intelligence and its applications in industry, defence, healthcare, agriculture and many other areas. This course will provide the students a rigorous, advanced and professional graduate-level foundation in Artificial Intelligence.					
Module I	Introduction				6 Hours
Concept of AI, History, Current status, Scope, Agents, Environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree, Case study: Talkie.ai, ada.cx.					
Module II	Search Algorithms				12 Hours
Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search, Hill climbing search, Search with nondeterminism, Constraint satisfaction problems, Map coloring, Job-shop scheduling, Backtracking for CSPs.					
Module III	Probabilistic Reasoning				7 Hours
Probability, Conditional probability, Bayes Rule, Bayesian Networks- representation, Construction and inference, Temporal model, Hidden Markov model.					
Module IV	Markov Decision process				7 Hours
MDP formulation, Utility theory, Utility functions, Value iteration, Policy iteration and partially observable MDPs. Case study: Patient admission process, Reducing wait time at a traffic intersection.					
Module V	Reinforcement Learning				8 Hours
Passive reinforcement learning, Direct utility estimation, Adaptive dynamic programming, Temporal difference learning, Active reinforcement learning - Q learning. Case Study: AWS Deep Racer, DeepMind's AlphaZero, Arcade Learning Environment & Progen.					
Module VI	AI Applications & AI Ethics				5 Hours
IBM Watson - Create a retail customer service chatbot, AWS AI Services - Monitor and predict health data using AWS AI services, Automate insurance document processing with AI, The Ethics of AI - Lethal autonomous weapons, Surveillance, Security and privacy, Fairness and bias, Trust and transparency, Robot rights, AI Safety.					
TOTAL: 45 HOURS					
Mode of Assessment: Activity/CAT/ESE					
Course Outcomes:					
<ol style="list-style-type: none"> 1. Provides a foundational understanding of AI concepts, intelligent agents for search, problem-solving techniques, and the ability to apply these concepts to real-world case studies. 2. Equip students with a strong foundation in various search algorithms, heuristic techniques, and the application of these methods in solving real-world problems, especially in the context of Constraint Satisfaction Problems. 3. Provide students with knowledge in probability theory, Bayesian modeling, and the application of these concepts in temporal modeling and Hidden Markov Models. 4. To analyze Markov Decision Process (MDP) formulation , utility functions, and their application in addressing real-world challenges. 5. To explore various reinforcement learning techniques and to analyze their performance using case studies. 6. Appraise AI Ethics and industrial use cases for real-time problem solving using AI. 					

FURTHER READING:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 4th Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill
3. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.
4. SarojKaushik, “Artificial Intelligence”, Cengage Learning India, 2011
5. David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010.

REFERENCES:

<https://nptel.ac.in/courses/106105077>
<https://nptel.ac.in/courses/106106126>
<https://aima.cs.berkeley.edu>
https://ai.berkeley.edu/project_overview.html
<https://developer.ibm.com/tutorials/create-your-first-assistant-powered-chatbot/>
https://youtu.be/UDFL_bBGDzQ
<https://youtu.be/vRCMzNs0o2s>

1902AS451	Data Mining Laboratory	L	T	P	C
		0	0	2	1
PREREQUISITE:					
1. 1902AS303 – Database Management Systems					
COURSE OBJECTIVES:					
This course is intended for students					
<ol style="list-style-type: none"> To Learn how to build a data warehouse and query it Learn to perform data mining tasks using a data mining toolkit Understand the data sets and data preprocessing. Demonstrate the working of algorithms for data mining tasks such as association rule mining, classification, clustering and regression. Obtain Practical Experience Working with all real datasets. 					
LIST OF EXPERIMENTS [SUGGESTED]					
<ol style="list-style-type: none"> Create data warehouses including multi-dimensional data cubes Apply data preprocessing techniques for preparing data for mining Implementation of association mining techniques Implementation of classification techniques Implementation of clustering algorithms Implementation of outlier analysis Mini Project: Mining Unstructured Data from NoSQL Database/Data warehouse, Evaluate and Present 					
					Total Hours:30
Mode of Assessment: Continues Assessment, PAT, ESP					
Course Outcomes:					
<ol style="list-style-type: none"> Relate data mining and data warehousing with respect to OLAP vs OLTP Sketch data preprocessing techniques and data cubes for data warehouses Use association rule mining for solving real-time data mining problems Use classification techniques for solving real-time data mining problems Use clustering techniques for solving real-time data mining problems Use Outlier analysis to improve the overall process of data mining Discover various aspects of mining knowledge from unstructured data while appraising applications of data mining 					
FURTHER READING:					
TEXT BOOKS:					
<ol style="list-style-type: none"> Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining concepts and techniques”, 3rd edition, Morgan Kaufman publishing Ian. H. Walton, Eibe Frank, “Data Mining”, Practical machine learning tools and techniques, 3rd edition, Morgan Kaufman publishing 					
REFERENCES:					
<ol style="list-style-type: none"> Gareth James, Daniela Witten, Trevor Hastie, Rob Tibshirani, “an Introduction to Statistical Learning”, Springer Publishing Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, “ Principles and Theory for Data Mining and Machine Learning”, Springer Publishing Galit Shmueli, Peter C. Bruce, “Data Mining for Business Analytics: Concepts, Techniques, and Applications in R”, Wiley Publishers Peter C. Bruce, “ Data Mining for Business Analytics: Concepts, Techniques, and Applications with XLMiner”, 3rd edition, Wiley https://subscription.packtpub.com/book/data/9781783554393/5 					

1902AS452	Statistical Analysis and Computing	L	T	P	C
		0	0	2	1
PREREQUISITE:					
2. 1902AS301 - Programming using Python 3. 1902AS303 – Database Management Systems					
COURSE OBJECTIVES:					
This course is intended for students to get introduced to methods and tools for statistical computing. The course aims at the contemporary tools and languages for the same using languages such as R, Python and MATLAB. The course shall be accompanied by computational lab for statistical analysis.					
LIST OF EXPERIMENTS [SUGGESTED]					
1. Implement random number generation using R/Python or MATLAB drawn from various distributions such as Uniform, Normal, Exponential etc. Plot the histograms of the generated numbers and compute the mean and standard deviations. 2. Implement the sampling and verify the central limit theorem. 3. Use the generators for certain distribution and compute the various moments and measures of the central tendency and statistical tests of significance. 4. Use census data from the Govt. of India and perform statistical analysis as defined by the instructor (for example multivariate analysis to find correlation between various attributes of data) 5. Perform linear regression to study the dependency of a dependent variable on various input/predictor variables. 6. Study various types of regularizations and determine which predictor variables are significant. 7. Form a hypothesis and using the given dataset perform hypothesis testing (as defined by the instructor) 8. Perform various types of resampling to address mixed distributions, removing bias.					
					Total Hours: 30
Course Outcomes:					
1. Process datasets via statistical packages 2. Apply various statistical tests to determine the measures of central tendency 3. Identify the distribution of the datasets and perform statistical measurements. 4. Understand multivariate analysis and perform the same 5. Determine the important predictor variables in a regression analysis of the dataset 6. Formulate hypothesis and perform a suitable hypothesis test 7. Apply resampling to address mixed data distributions, identify and remove biases from the datasets.					
FURTHER READING:					
1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing House, 2010.					
REFERENCES:					
1. B. L. S. Prakasa Rao, A First Course in Probability and Statistics, World Scientific/Cambridge University Press India, 2009. 2. R. V. Hogg, J. W. McKean and A. Craig, Introduction to Mathematical Statistics, 6th Ed., Pearson Education India, 2006. 3. Gareth M. James, Introduction to statistical learning: With applications to R, Springer 2013.					
Mode of Assessment: Continuous Assessment, PAT, ESP					

1904GE451	LIFE SKILLS : VERBAL ABILITY	L	T	P	C
		0	0	2	1
COURSE OBJECTIVES:					
<ol style="list-style-type: none"> To help students comprehend and use vocabulary To apply appropriate reading strategies for interpreting technical and non-technical documents used in job-related settings. To ensure students will be able to use targeted grammatical structures meaningfully and appropriately in oral and written production. To enable the students to arrange the sentences in meaningful unit and to determine whether constructions rely on active or passive voice To Apply the principles of effective business writing to hone communication skills 					
MODULE I	VOCABULARY USAGE	6 hours			
Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.					
MODULE II	COMPREHENSION ABILITY				
Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages					
MODULE III	BASIC GRAMMAR AND ERROR DETECTION	6 hours			
Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence improvement – Error Detection FAQ in Competitive exams.					
MODULE IV	REARRANGEMENT AND GENERAL USAGE	6 hours			
Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.					
MODULE V	APPLICATION OF VERBAL ABILITY	6 hours			
Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.					
TOTAL: 30 HOURS					
COURSE OUTCOMES					
CO1	Construct new words in their day to day communication.				
CO2	Predict the information swiftly while reading passages.				
CO3	Elaborate their oral and written communication.				
CO4	Rephrase the sentences and able to identify the voice of the sentence.				
CO5	Summarize their knowledge of the best practices to craft effective business documents				
CO6	Make use of the etiquette in business.				
REFERENCES:					
1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017					
2. R S Aggarwal and Vikas Aggarwal , Quick Learning Objective General English ,S.Chand Publishing House, 2017					
3. Dr.K.Alex , Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014					
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007					

1901HS401	Engineering Economics	L	T	P	C
		2	0	0	2
PREREQUISITE: NIL					
COURSE OBJECTIVES:					
<ol style="list-style-type: none"> 1. This course aims at providing the student with advanced concepts of engineering economic analysis and its role in engineering decision making. 2. Additionally, the course also covers topics such as depreciation, after tax analysis, replacement analysis, uncertainty, inflation, deflation, and estimation of future events. 					
Module I	Introduction of Engineering Economics				6 Hours
Definition – Nature – Scope and Significance of Economics for Engineers. Demand and Supply: Demand – Types – Determinants – Law of Demand – Elasticity of Demand – Types – Significance – Supply – Market price determination – Case Study in Demand Forecasting – Meaning – Methods – Consumer Survey – Trend Projections – Moving average.					
Module II	Market Structure				6 Hours
Perfect Competition – Characteristics – Price and output determination in short run and long run – Monopoly – Price Discrimination – Monopolistic Competition – Product Differentiation – Oligopoly and Duopoly.					
Module III	Concept of Market Failure, Cost & Revenue				6 Hours
Market Failure: Causes – Type of Goods – Rivalrous and Non-rivalrous goods – Excludable and Non-excludable goods – Solutions – Government Intervention. Cost and Revenue: Concepts – Classifications – Short run and long run cost curves – Revenue – Concepts – Measurement of Profit (Case Study).					
Module IV	Theory of Money and Banking & Foreign Exchange				6 Hours
Money and Banking: Money – Functions – Quantity theory of money – Banking – Commercial Banks – Functions – Central Bank (RBI) – Functions – Role of Banks in Economic Development. Foreign Exchange: Balance of Payments – Exchange rate determination – Methods of foreign payments – International Institutions – IMF, IBRD.					
Module V	Business Cycle and National Income				6 Hours
Business Cycle and National Income: Meaning – Phases of business cycle – Inflation – Causes – Control measures – Deflation – National Income – Concepts – Methods of calculating national income – Problems in calculating national income.					
					TOTAL: 30 HOURS
Mode of Assessment: Activity/CAT/ESE					
Course Outcomes:					
<ol style="list-style-type: none"> 1. Describe the role of economics in the decision making process and perform calculations in regard to interest formulas. 2. Estimate the Present, annual and future worth comparisons for cash flows. 3. Calculate the rate of return, depreciation charges and income taxes. 4. Enumerate different cost entities in estimation and costing. 5. Explain the importance of finance functions, financial ratios and solve related problems. 6. Explain the elements of budgeting and benchmarking. . 					
FURTHER READING:					
<ol style="list-style-type: none"> 1. Dewett. K.K., Navalur M. H., “Modern Economic Theory”, S. Chand and Company Ltd, New Delhi, 24thEdn., 2014. 2. Lipsey & Chrystal, “Economics”, Oxford University Press, 2010. 3. Premvir Kapoor, “Sociology and Economics for Engineers”, Khanna Book Publishing Company Private Limited, 2018. . 					

REFERENCES:	
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| <ol style="list-style-type: none">1. Paul A Samuelson & William, "Economics", Tata McGraw Hill, New Delhi, 2012.2. Francis Cherinullem "International Economics", McGraw Hill Education, 2011.3. William A McEachern and Simrit Kaur, "Micro ECON", Cengage Learning, 2013.4. William A McEachern and Indira A., "Macro ECON", Cengage Learning, 2014. | |
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1901MCX01	ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	0
COURSE OBJECTIVES:					
<ol style="list-style-type: none"> 1. Realize the interdisciplinary and holistic nature of the environment. 2. Understand how natural resources and environment affect the quality of life and stimulate the quest for sustainable development. 3. Recognize the socio-economic, political and ethical issues in environmental science. 					
<p>Module 1: ECOSYSTEMS AND BIODIVERSITY - Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot – spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Documentation of the medicinal plants in your native place</p> <p>Module 2: ENVIRONMENTAL POLLUTION -Definition – Source, causes, effects and control measures of: (a) Air pollution – Mitigation procedures – Control of particulate and gaseous emission, Control of SOX, NOx, CO and HC) – E-Waste - Technology for capturing CO2 (metallo- organic frame works) (b) Water pollution – Waste water treatment processes. (c) Soil pollution – soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – role of an individual in prevention of pollution – pollution case studies. Documentation study of local polluted site – Urban / Rural / Industrial / Agricultural.</p> <p>Module 3: SOCIAL ISSUES AND THE ENVIRONMENT - From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – environmental ethics: Issues and possible solutions – 12 Principles of green chemistry – consumerism and waste products – environment protection act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments – scheme of labeling of environmentally friendly products (Ecomark) central and state pollution control boards – disaster management: floods, earthquake – Public awareness. Analyze the recent steps taken by government of India to prevent pollution (Green India and Clean India).</p> <p>Module 4: HUMAN POPULATION AND THE ENVIRONMENT - Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA) – GIS – remote sensing – role of information technology in environment and human health</p>					
				TOTAL:	30 HOURS
COURSE OUTCOMES:					
<p>After completion of the course, Student will be able to</p> <p>CO1: Describe the importance of ecosystem and its conservation.</p> <p>CO2: Differentiate various natural resources and the urgent need to conserve the natural resources.</p> <p>CO3: Explain the different types of pollution and its effects.</p> <p>CO4: Describe the various environmental protection acts.</p> <p>CO5: Explain the major diseases, women, child development and the impacts of population explosion.</p>					

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1. Trivedi. R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.
2. Cunningham, W.P.Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan. R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
5. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
6. Ravikrishnan. A., "Environmental Science and Engineering", Sri Krishna Hi-tech Publishing Company Pvt. Ltd.