GU/Acad –PG/BoS -NEP Engg. /2024/635   Date: 07.11.2024

CIRCULAR

The University has notified Ordinance OA-43 governing the Master of Engineering Degree and Post-Graduate Engineering Certificate from the Academic Year 2024-2025 onwards.

The Syllabus of Semester I of the **Master of Engineering (Information Technology and Engineering)** Programme approved by the Academic Council in its meeting held on 22nd August 2024 is attached.

The Dean, Faculty of Engineering and Principals of affiliated Colleges offering the **Master of Engineering (Information Technology and Engineering)** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

(Ashwin V. Lawande)
Deputy Registrar – Academic

To,
1. The Dean, Faculty of Engineering, Goa University.
2. The Principals of affiliated Engineering Colleges.

Copy to,
1. The Director, Directorate of Technical Education, Govt. of Goa
2. The Chairperson, BoS in Information Technology Engineering.
3. The Controller of Examinations, Goa University.
4. The Assistant Registrar Examinations (Prof.), Goa University.
5. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

MASTER OF ENGINEERING (INFORMATION TECHNOLOGY AND ENGINEERING)
RC 2024-25

TWO YEAR PROGRAMME STRUCTURE
SEMESTER I

Sr. No.	Course Code	Title of the Course	L	T	P	Credits
		Programme Specific Core (PSC) Courses				
1	ITH-500	Constrained Networks	3	0	0	3
2	ITH-501	Constrained Networks lab	0	0	1	1
3	ITH-502	Intelligent and Learning Systems	3	0	0	3
4	ITH-503	Intelligent Systems Lab	0	0	1	1
5	ITH-504	Mathematics for Information Science	3	1	0	4
		Programme Specific Elective (PSE) Courses				
6	ITH-531	Mobile and Pervasive Computing	4	0	0	4
		OR				
7	ITH-532	Natural Language Processing	4	0	0	4
		Research Specific Elective (RSE) Courses				
8	REC-561	Engineering Research and Publication	3	1	0	4
		OR				
9	REC-562	Literature Review and Technical Writing for Engineers	3	1	0	4
		TOTAL	16	2	2	20

THREE YEAR PROGRAMME STRUCTURE
SEMESTER I

Sr. No.	Course Code	Title of the Course	L	T	P	Credits
		Programme Specific Core (PSC) Courses				
1	ITH-500	Constrained Networks	3	0	0	3
2	ITH-501	Constrained Networks lab	0	0	1	1
		Programme Specific Elective (PSE) Courses				
3	ITH-531	Mobile and Pervasive Computing	4	0	0	4
		OR				
4	ITH-532	Natural Language Processing	4	0	0	4
		Research Specific Elective (RSE) Courses				
5	REC-561	Engineering Research & Publications	3	1	0	4
		OR				
6	REC-562	Literature Review & Technical Writing for Engineers				
		TOTAL	10	1	1	12

SEMESTER I
Name of the Programme : **M.E in Information Technology Engineering**
Course code : **ITH-500**
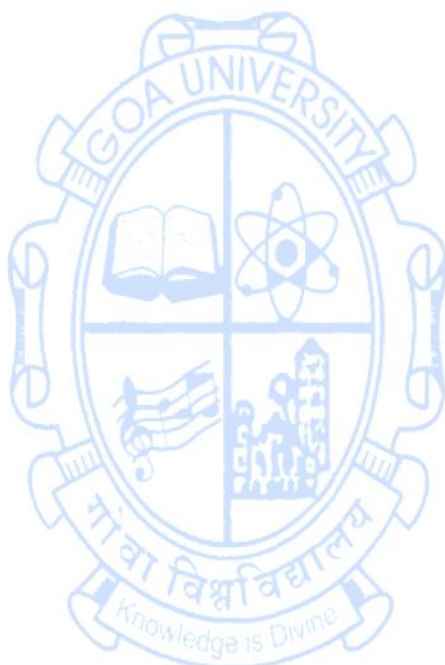**Title of the course** : **Constrained Networks**
Number of Credits : **3 (3L)**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Basic knowledge of Networking	
Course Objectives:	This course will enable students to: 1. Understand how networks and Internet of things helps in solving real life problems. 2. Gain knowledge on various IoT technologies. 3. Understand the operational issues in the constrained environment.	
Contents:	**Topics**	No. of Hours
Unit 1	**Internet/Web and Networking**: Reference models- The OSI Reference Model- the TCP/IP Reference Model, IP Addressing, Network Topologies, Sub-netting, Different networks, Connection of networks, Tunneling, Packet Fragmentation, Web Servers, Cloud Computing basics.	10
Unit 2	**Application Layer:** DNS—The Domain Name System, The DNS Name Space, Domain Resource Records, Name Servers. **Electronic MAIL:** Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery. **World Wide Web:** Architectural Overview. **Streaming Audio and Video:** Streaming Stored Media, Streaming Live Media. Content Delivery.	10
Unit 3	Evolution of IoT, Web 3.0 view of IoT, Definition and characteristics of IoT, IoT Enabling Technologies, IoT Architecture, Fog, Edge and Cloud in IoT, Functional blocks of a IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects, IoT levels and deployment templates, IoT applications. **Overview of IoT supported Hardware platforms**: Raspberry pi and Arduino.	10
Unit 4	**IoT Access Technologies:** Constrained Nodes and Constrained Networks – **Optimizing IP for IoT:** 6LoWPAN, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition -Application Layer Protocols: CoAP and MQTT- Data aggregation & dissemination.	15
Pedagogy:	Inquiry Based Learning, Reflective, Integrative Learning	
References/ Readings:	**Text Books:** 1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Pearson Education, 5th Edition, 2014. 2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, 2015. 3. W. Richard Stevens, "Unix Network Programming", Prentice	

	Hall/Pearson Education, 3rd Edition, 2009.
	Reference Books:
	1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1/e, 2013.
Course Outcomes:	After going through this course, the students will be able to:
	CO 1. Explain the conceptual and practical aspects of operating in constrained environments.
	CO 2. Apply the knowledge gained in understanding networks and IoT.
	CO 3. Analyse scenarios to design applications.
	CO 4. Create solutions for real life scenarios using Constrained devices.

Name of the Programme : M.E in Information Technology Engineering
Course code : ITH-501
Title of the course : Constrained Networks lab
Number of Credits : 1 (1P)
Effective from AY : 2024-25

| Pre-requisites for the Course:	Basics of Networking and programming language.	
Course Objectives:	This course will enable students to: 1. Understand how networks are created 2. Gain knowledge on implementing IoT applications 3. Understand the operational issues in the constrained environment.	
Contents:	**Topics**	**No. of Hours**
	1. Implementation of Subnetting. 2. Audio Streaming of data 3. Video Streaming of data 4. Designing IoT applications 5. Implementing IoT protocols (CoAP). 6. Implementing IoT protocols (MQTT). 7. Application with MQTT 8. Mini project on IoT 9. Using the cloud 10. Data storage on Cloud	30
Pedagogy:	Constructive, Collaborative and Inquiry Based Learning	
Instructions:	Minimum 8 experiments to be performed from above list.	
References/ Readings:	**Text Books:** 1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Pearson Education, 5th Edition, 2014. 2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st edition, 2015. 3. W. Richard Stevens, "Unix Network Programming", Prentice Hall/Pearson Education, 3rd Edition, 2009. **Reference Books:** 1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1/e, 2013.	
Course Outcomes:	After going through this course, the students will be able to: CO 1. Explain the conceptual and practical aspects of designing networks CO 2. Apply the knowledge gained in understanding networks and IoT. CO 3. Analyse scenarios to design IoT applications. CO 4. Create solutions for real life scenarios using Constrained devices.	

Name of the Programme : **M.E in Information Technology Engineering**
Course code : **ITH-502**
Title of the course : **Intelligent and learning systems**
Number of Credits : **3 (3L)**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Basic concepts of Artificial Intelligence.	
Course Objectives:	This course will enable students to: 1. Understand principles of Artificial intelligence toward problem solving, inference, perception, and learning. 2. Investigate applications of AI techniques in intelligent agents, artificial neural networks and other machine learning models. 3. Experiment with a machine learning model for simulation and analysis. 4. Explore the current scope, potential, limitations, and implications of intelligent systems.	
Contents:	**Topics**	**No. of Hours**
Unit 1	**Introduction:** Foundation of AI, Agents and environments, the nature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies. **Knowledge representation:** Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation.	**10**
Unit 2	**Learning:** Learning from observations, Inductive Learning, Concept Learning, Version Spaces and Candidate Eliminations, Inductive bias, Decision Tree learning. **Instant based learning**: Locally weighted Regression – Radial Bases Functions, Case Based Learning	**10**
Unit 3	**Advanced learning:** Analytical Learning (Perfect Domain Theories – Explanation Base Learning (FOCL Algorithm), Reinforcement Learning, Q-Learning, Temporal Difference Learning. **Learning in Neural network:** Neural Network Representation, Problems Perceptron, Multilayer Networks and Back Propagation Algorithms.	**15**
Unit 4	**Introduction to Robotics:** Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Introduction to AI based programming Tools.	**10**
Pedagogy:	Inquiry Based Learning, Reflective, Integrative Learning	
References/ Readings:	**Text Books:** 1. S. Sridhar and M. Vijayalakshmi, "Machine learning", 1st Edition, 2021, ISBN:978-0190127275. 2. S. R. Deb, "Robotics Technology and flexible automation", Tata McGraw-Hill Education 2nd Edition ,2010. 3. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern	

|	Approach", Pearson Education, 3rd Edition, 2015.
	Reference Books:
	1. Ronald J. Brachman, Hector J. Levesque, "Knowledge Representation and Reasoning", Elsevier, 1st edition ,2004.
	2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Taylor & Francis, 2nd edition, 2014.
	3. Tom M. Mitchell, "Machine Learning", McGraw-Hill Science, 1st edition, 2017.
Course Outcomes:	After going through this course, the students will be able to:
	CO 1. Explain the concept of learning and its significance to the design of intelligence machines.
	CO 2. Analyse the range of machine learning algorithms along with their strengths and weaknesses.
	CO 3. Design various machine learning algorithms for real time applications.
	CO 4. Implement the learning models to various language, speech, vision applications related to society.
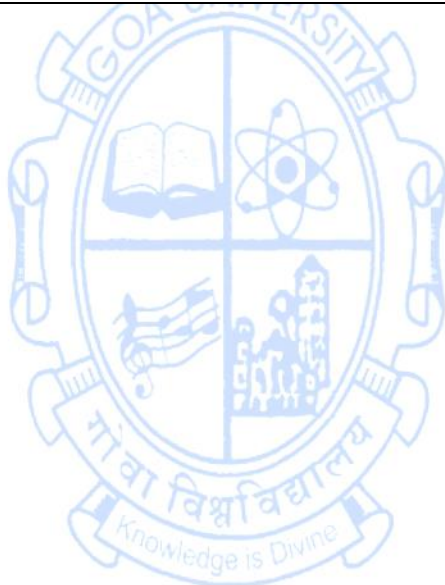
Name of the Programme	: M.E in Information Technology Engineering
Course Code	: ITH-503
Title of the course	: Intelligent Systems Lab
Number of Credits	: 1 (1P)
Effective from AY	: 2024-25

Pre-requisites for the Course:	Basic knowledge of Artificial Intelligence and programming language	
Course Objectives:	This course will enable students to: 1. Understand principles of Artificial intelligence toward problem solving, inference, perception, and learning. 2. Investigate applications of AI techniques in intelligent agents, artificial neural networks and other machine learning models. 3. Experiment with a machine learning model for simulation and analysis. 4. Explore the current scope, potential, limitations, and implications of intelligent systems.	
Contents:	**Topics**	**No. of Hours**
	1. Implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. 2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. 3. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. 4. Implement Q learning algorithm for an appropriate data set. 5. Implement FOCL algorithm for an appropriate data set 6. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. 7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. 8. Introduction to basic robotic programming using visual ROS IDE 9. Robotic programming using visual ROS IDE 10. Write a program to construct a Bayesian network considering stock market data	**30**
Pedagogy:	Constructive, Collaborative and Inquiry Based Learning	
Instructions:	Minimum 8 experiments to be performed from above list.	
References/ Readings:	**Text Books:** 1. S. Sridhar and M. Vijayalakshmi, "Machine learning", 1st Edition, 2021, ISBN:978-0190127275. 2. S.R. Deb, "Robotics Technology and flexible automation", 2nd Edition,	

|	2010, Tata McGraw-Hill Education.
	3. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 3rd Edition, 2015.
	Reference Books:
	1. Ronald J. Brachman, Hector J. Levesque, "Knowledge Representation and Reasoning", Elsevier, 1st edition, 2004.
	2. Stephen Marsland, Taylor & Francis, "Machine Learning: An Algorithmic Perspective", 2nd edition, 2014.
	3. Tom M. Mitchell, "Machine Learning", McGraw-Hill Science, 1st Edition ,2017.
Course Outcomes:	After going through this course, the students will be able to:
	CO 1. Understand the implementation procedures for the machine learning algorithms
	CO 2. Design programs for various Learning algorithms.
	CO 3. Apply appropriate data sets to the Machine Learning algorithms
	CO 4. Identify and apply Machine Learning algorithms to solve real world problem.

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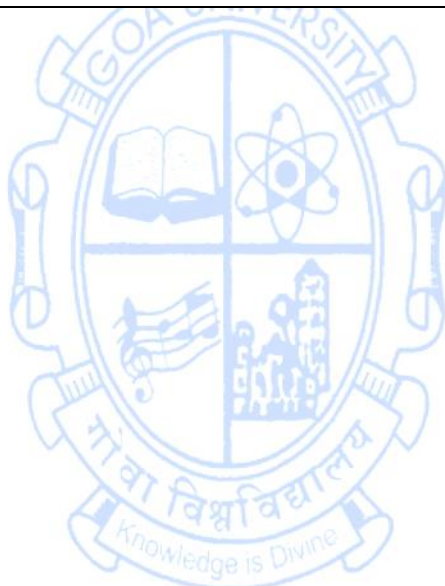
Name of the Programme : M.E in Information Technology Engineering
Course code : ITH-504
Title of the course : Mathematics for Information Science
Number of Credits : 4 (3L+1T)
Effective from AY : 2024-25

Pre-requisites for the Course:	Fundamentals of mathematics.	
Course Objectives:	This course will enable students to: 1. Understand fundamental mathematical concepts used in computer science 2. Gain knowledge of Mathematics and linear Algebra in solving engineering related problems 3. Model Engineering problems with the concepts and techniques of Mathematics	
Contents:	**Topics**	**No. of Hours**
Unit 1	**Propositional Calculus:** propositions and connectives, syntax, Semantics – truth assignments and truth tables, validity and satisfiability, tautology, Adequate set of connectives, Equivalence and normal forms, Natural deduction system and axiom system.	11+3T
Unit 2	**Techniques for proving theorems:** Direct Proof, Proof by Contrapositive, Proof by exhausting cases and proof by contradiction, Principle of mathematical induction, Principle of complete induction. Recursive definitions, function of sequences calculating coefficient of generating function, solving recurrence relation by substitution and generating functions Solution methods for linear, first-order recurrence relations with constant coefficient, characteristic roots, Generating functions.	12+4T
Unit 3	**Algebraic Structures:** Groups and subgroups, homomorphism theorems, cosets and normal subgroups, Lagrange's theorem, Rings and Fields (Definition and examples only)	10+4T
Unit 4	**Linear Algebra:** Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings. Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions.	12+4T
Pedagogy:	Inquiry Based Learning, Reflective, Integrative Learning	
References/ Readings:	**Text Books:** 1. Hoffman, K. and Kunze, R., "Linear Algebra", Prentice-Hall, 2nd Edition 2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw Hill Inc, 7/e, 2011 **Reference Books:** 1. Bernard Kolman, Robert C Busby, Sharon Kutler Ross, "Discrete Mathematical Structures", Prentice-Hall India Private Limited,2/e, 1996. 2. E. Mendelsohn, "Introduction to Mathematical Logic", Van-Nostrand,	

	London, 2nd ed. 1979.
	3. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Application to Computer Science", Tata McGraw Hill, 1st Edition, 2000.
	4. J. Truss, "Discrete Mathematics for Computer Scientists", Addison Wesley, 2/e, 1999.
Course Outcomes:	After going through this course, the students will be able to: CO 1. Explain the fundamental mathematical concepts used in computer science CO 2. Apply knowledge of Mathematics and linear Algebra in solving problems related to computer Science and Engineering CO 3. Analyze and compare the properties of various Mathematical techniques CO 4. Model Engineering problems with the concepts and techniques of Mathematics

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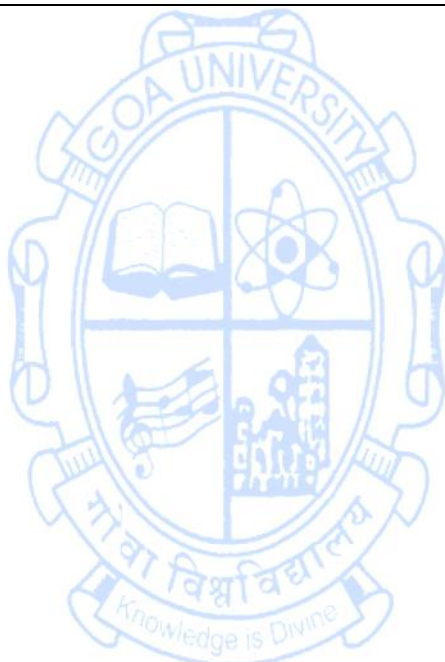
Programme Specific Elective (PSE) Courses
Name of the Programme   : **M.E in Information Technology Engineering**
Course code   : **ITH-531**
Title of the course   : **Mobile and Pervasive Computing**
Number of Credits   : **4 (4L)**
Effective from AY   : **2024-25**

Pre-requisites for the Course:	Basics of wireless communication	
Course Objectives:	This course will enable students to: 1. Understand the Emerging Technologies in Wireless Networks. 2. Explain about the Transmission Methods and Data Management. 3. Compare the working of wireless Routing Protocols. 4. Outline the characteristics of Pervasive Computing Applications including the major system components & architectures of the systems.	
Contents:	**Topics**	**No. of Hours**
Unit 1	**Introduction to Pervasive Computing:** Internet and Ubiquitous computing, Pervasive Computing and Ubiquitous Computing, Ambient Computing. **Wireless Networks:** Emerging technologies- Blue tooth, Wi-Fi, WiMAX, 3G, WATM-Mobile IP protocols -WAP push architecture-WML scripts and applications. **Mobile Computing:** Mobile computing environment—functions-architecture-design considerations, content architecture- CC/PP exchange protocol, context manager. Data management in WAE-Coda file system- caching schemes-Mobility QOS. Security in mobile computing.	15
Unit 2	**Pervasive Computing:** Pervasive Computing – Principles, Characteristics- interaction transparency, context aware, automated experience capture. Architecture for pervasive computing- Pervasive devices-embedded controls- smart sensors and actuators -Context communication and access services. **Architecture:** Requirements of computational infrastructure failure management security performance dependability Pervasive Computing devices and Interfaces Device technology trends, Connecting issues and protocols.	15
Unit 3	**Location Management:** Handoff in wireless mobile networks-model-handoff schemes. Location management in cellular networks - Mobility models- location and tracking management schemes- time, movement, profile and distance-based update strategies. ALI technologies. **WAP & WML:** Pervasive Computing and web-based Applications XML and its role in Pervasive Computing, Wireless Application Protocol (WAP) Architecture and Security Introduction to Wireless Mark-Up language (WML).	15

	PDA In pervasive computing: Introduction, PDA software Components, Standards, emerging trends, PDA Device characteristics, PDA Based Access Architecture.	
Unit 4	**Pervasive Computing and Security:** Voice Enabling Pervasive Computing Voice Standard Speech Applications in Pervasive Computing and security. **Service Discovery:** Open protocols- Service discovery technologies- SDP, Jini, SLP, UpnP protocols–data synchronization SyncML framework - Context aware mobile services -Contex aware sensor networks, addressing and communications. Contex aware security.	**15**
Pedagogy:	Inquiry Based Learning, Reflective, Integrative Learning	
References/ Readings:	**Text Books:** 1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing: Technology, Applications & Service Creation" 2nd Edition, Tata McGraw Hill Education Pvt Ltd, 2005 7 West Patel Nagar, New Delhi 110008 (ISBN (13): 978-0-07-014457-6, ISBN (10): 0-07-014457-5) 2. Ivan Stojmenovic, "Handbook of Wireless Networks and Mobile Computing", A Wiley-Interscience Publication, John Wiley & sons Inc, 2nd Edition, Canada, 2002. (Print ISBN:9780471419020, Online ISBN:9780471224563 3. Uwe Hansman, Lothat Merk, Martin S Nicklous & Thomas Stober, "Principles of Mobile Computing", Second Edition, Springer, Verlag, New Delhi, 2003. **Reference Books:** 1. Frank Adelstein Sandeep K. S. Gupta Golden G. Richard III Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill, 2nd Edition 2005. 2. Jochen Burkhardt, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Pearson Education, 2nd Edition, 2009.	
Course Outcomes:	After going through this course, the students will be able to: CO 1. Explain the concept of wireless networks, transmission methods & data management. CO 2. Develop Markup language for wireless application protocols. CO 3. Compare the working of wireless routing protocols. CO 4. Apply Pervasive techniques to real world problems.	

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Name of the Programme : M.E in Information Technology Engineering
Course code : ITH-532
Title of the course : Natural Language Processing
Number of Credits : 4 (4L)
Effective from AY : 2024-25

Pre- requisites for the Course:	Fundamentals of Machine Learning	
Course Objectives:	This course will enable students to: 1. Understand Natural Language processing 2. Explain about parsing, sentiment analysis and speech processing 3. Analyse different semantics. 4. Implement Sentiment analysis and Speech processing	
Contents:	**Topics**	**No. of Hours**
Unit 1	**Foundations of Natural Language Processing:** Introduction, Natural Language Processing - Problems and perspectives, Introduction to probability calculus, N-grams and Language Models, Markov Models, Introduction to Machine Learning and Deep Learning, Recurrent Neural Network Language Models, The evaluation of NLP applications. **Corpora and their construction:** representativeness, Concordances, collocations and measures of words association, Methods for Text Retrieval, Regular expressions. **Shallow Parsing:** Part-of-Speech Tagging, Statistical POS Tagging, Neural POS Tagging, Chunking	15
Unit 2	**Deep Parsing:** Linguistics of Parsing, Algorithmic of Parsing, Constituency Parsing: Rule Based, Statistical Parsing, Dependency Parsing, Neural Parsing. **Computational Phonetics and Speech Processing:** Speech samples: properties and acoustic measures, Analysis in the frequency domain, Spectrograms, Applications in the acoustic-phonetic field. Speech recognition with HMM and Deep Neural Networks, Tokenisation and Sentence splitting, Computational Morphology: Morphological operations, Static lexica, Two-level morphology, Computational Syntax, Part-of-speech tagging, Grammars for natural language, Natural language Parsing, Supplementary worksheet: formal grammars for NL	15
Unit 3	**Computational Semantics:** Lexical semantics: WordNet and Frame Net, Word Sense Disambiguation, Distributional Semantics & Word-Space models, Logical approaches to sentence semantics. **Sentiment Analysis:** Problem Statement, Ambiguity for Sentiment Analysis, Lexicons for Sentiment Analysis, Rule-Based Sentiment Analysis, Statistical Sentiment Analysis, Neural Approaches to Sentiment Analysis, Sentiment Analysis in Different Languages	15

Unit 4	**Applications and Case studies:** Solving Downstream Tasks: Document classification, Sentiment Analysis, Named Entity Recognition, Semantic Textual Similarity, Prompting Pre-Trained Language Models, Network Embedding **Question Answering:** Problem Formulation, Ambiguity in Question Answering, Dataset Creation, Rule-based Q&A, Second Generation, Third Generation **Conversational AI:** Problem Definition, Ambiguity Resolution in Conversational AI, Rule-Based Approaches to Conversational AI, Statistical Approaches, Neural Approaches	**15**
Pedagogy:	Inquiry Based Learning, Reflective, Integrative Learning	
References/ Readings:	**Text Books** 1. Allen, James, "Natural Language Understanding", 2nd Edition, Benjamin/Cumming, 2018. 2. Pushpak Bhattacharya and Aditya Joshi, "Natural language Processing", Wiley Emerging Technology Series, 1st edition, 2019. **Reference Books** 1. Jurafsky, Dan and Martin, James, "Speech and Language Processing", 2nd Edition, Prentice Hall, 2008. 2. Manning, Christopher and Heinrich, Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1st Edition, 1999. 3. Tamburini, F., "Neural Models for the Automatic Processing of Italian", Bologna: Pàtron. 2022.	
Course Outcomes:	After going through this course, the students will be able to: CO 1. Explain the basic concepts in natural language processing and different areas in Natural Language Processing. CO 2. Apply the Natural Language Processing algorithms. CO 3. Analyse the association of Natural Language Processing with Artificial Intelligence CO 4. Develop Natural Language Processing models contributing towards real life linguistic problem.	

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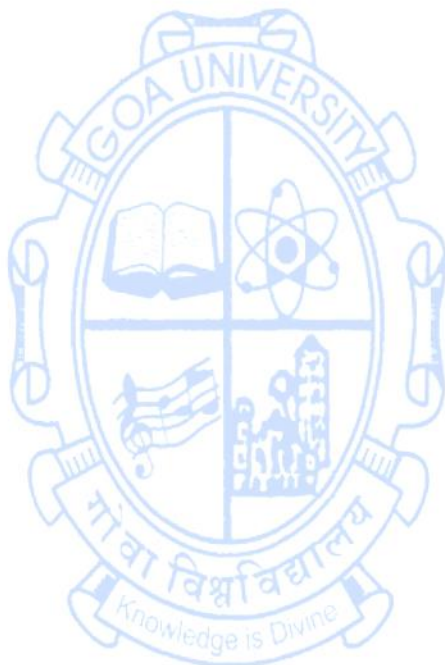**Research Specific Elective (RSE) Courses**
Name of the Programme   : Master of Engineering (Artificial Intelligence and Data Science)
Course code   : REC-561
Title of the course   : Engineering Research & Publication
Number of credits   : 4(3L+1T)
Effective from AY   : 2024-25

Pre-requisites for the Course:	Knowledge of research requirements in real life	
Course Objectives:	The course will enable the students to 1. Understand the importance of literature review, defining the research objectives. 2. Explain qualitative and quantitative methods of data analyses and its importance. 3. Classify research publications, select appropriate journals based on research areas. 4. Practice ethics in publication and academic integrity	
Content:		No of Hours
Unit -1	**Overview of scientific research in engineering**, foundational and fundamental concepts like types of research and considerations for research in specific domains, motivation to do research, critical thinking, assumptions and hypotheses, basic and applied research, importance of formulation of broad research objectives	11 + 4T
Unit -2	**Purpose and Methodology of Literature Search and Review** of the scientific and engineering publications. Sources such as scholarly databases, public domain, open access, current literature, review articles, critical review and gap analysis, defining research objectives	11 + 4T
Unit -3	**Quantitative and qualitative Data** – importance of data in research, types of data, data collection techniques, Quantitative methods for analysis of data – statistical tools, mathematical modeling, simulation, experimental data, optimization methods; Qualitative data collection, preparing questioners, rating scale, conducting survey, validation of models.	12 + 4T
Unit- 4	**Preparation of Publications**- Elements of research publications, types of publications, writing for journal publications, basic requirements for publication, selection of journals, journal quality indicators, peer review, reply to comments and responses, publication ethics, references, citations, authorship, plagiarism, academic integrity	11 + 3T
Pedagogy:	Inquiry based learning, Integrative, Reflective Learning , Constructive learning and Collaborative learning	
References/ Readings:	1. Herman Tang, 'Engineering Research-Design, Methods and Publications', John Wiley and Sons, 2021, ISBN:9781119624486. 2. Michael Jay Katz, 'From Research to Manuscript', Springer Publication,	

	2009, ISBN:9781402094668.
	3. Rob Dekkers, Lindsey Casey, Peter Langhorne, 'Making Literature Review Work', Springer Publications, 2022, ISBN:9783030900243
	4. Meikang Qiu, Han Qiu, Yi Zeng, 'Research & Technical Writing for Science and Engineering', Taylor & Francis Publications, 2022, ISBN:9781003139058.
Course Outcomes:	CO 1. Understand the importance of literature review, defining the research objectives.
	CO 2. Explain qualitative and quantitative methods of data analyses and its importance.
	CO 3. Classify research publications, select appropriate journals based on research areas.
	CO 4. Practice ethics in publication and academic integrity

		No of Hours
Name of the Programme	: Master of Engineering (Artificial Intelligence and Data Science)	

Name of the Programme : Master of Engineering (Artificial Intelligence and Data Science)
Course code : REC-562
Title of the course : Literature Review & Technical Writing for Engineers
Number of credits : 4(3L + 1T)
Effective from AY : 2024-25

Pre-requisites for the Course:	Basics of Technical writing skills.	
Course Objectives:	The course will enable the students to 1. Understand the importance of literature review and writing a review paper. 2. Explain the method to be followed to write a review paper. 3. Classify data for qualitative and quantitative analysis 4. Demonstrate technical writing for conference.	
Content:		**No of Hours**
Unit -1	**Overview on Literature Review**, difference between objectives of literature review and research objectives; types of literature review, qualitative and quantitative reviews, search strategies, primary and secondary sources, database search strategies, field search, root search, complimentary search, meta-analysis	**12 + 4T**
Unit -2	**Database management of literature reviews**, bibliometric analysis, importance of writing a review paper, reply to comments and responses, publication ethics, references, citations, authorship, plagiarism, academic integrity; public domain, open access, current literature.	**11 + 4T**
Unit -3	**Technical writing on a specific research topic**, structure of the paper, abstract, introduction, experimental, simulation, analysis, discussion, inferences, title, acknowledgment, referencing, presentation of tables, figures, graphs, equations; comparison between technical writing for conference papers and journal paper	**11 + 4T**
Unit- 4	**Importance of data in research**, types of data, data collection techniques, Quantitative methods for analysis of data – statistical tools, mathematical modeling, simulation, experimental data, optimization methods; Qualitative data collection, preparing questioners, rating scale, conducting survey, validation of models.	**11 + 3T**
Pedagogy:	Inquiry based learning, Integrative, Reflective Learning, Constructive learning and Collaborative learning	
References/ Readings:	1. Rob Dekkers, Lindsey Casey, Peter Langhorne, 'Making Literature Review Work – Multidisciplinary Guide to Systematic Approaches', Springer Publications, 2022, ISBN:9783030900243. 2. Michael Jay Katz, 'From Research to Manuscript', Springer Publication, 2009, ISBN:9781402094668. 3. Herman Tang, 'Engineering Research-Design, Methods and Publications', John Wiley and Sons, 2021, ISBN:9781119624486. 4. Meikang Qiu, Han Qiu, Yi Zeng, 'Research & Technical Writing for	

	Science and Engineering', Taylor & Francis Publications, 2022, ISBN:9781003139058.
Course Outcomes:	After taking this course, student will be able to: CO 1. Understand the importance of literature review and writing a review paper. CO 2. Explain the method to be followed to write a review paper. CO 3. Classify data for qualitative and quantitative analysis CO 4. Demonstrate technical writing for conference.