M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)						SEM : I				
Course Name: Applied Statistics & Exploratory Data Analytics						Course Code: PCC-ITME101				
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)	Practical/Oral (25)		Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	ESE	OR/ PR	TW		
3	-	-	3	3	25	75	-	--	100	
ISE: In-Semester Examination - Paper Duration – 1.5 Hours ESE: End Semester Examination - Paper Duration - 3 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of Tutorial (40%) and Attendance/Learning Attitude (20%)										
Prerequisite: Basics of probability RBT: Revised Bloom's Taxonomy										

Course Objective:

1. To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. To study various sampling and classification problems

Course Outcomes: After completion of course, students should be able to

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the basic notions of discrete and continuous probability.	Understand(U), Apply(A), Evaluate(E)
2	Understand the methods of statistical inference, and the role that sampling distributions play in those methods.	Understand(U), Apply (A), Create(C)
3	Perform correct and meaningful statistical analyses of simple to moderate complexity.	Understand(U), Apply (A), Create(C)

Detailed syllabus:

Module No.	Detailed Content	Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains	**07**	Apply(A)
2	Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood**,**	**07**	Apply(A)
3	Statistical inference**,** Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** The problem of over fitting model assessment.	**07**	Analyze (AN)
4	Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems	**10**	Evaluate (E)
5	**Computer science and engineering applications** Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.	**10**	Apply (A)
6	Recent Trends in various distribution functions in mathematical field of computer Science for varying fields like bioinformatics, soft computing, and computer vision.	**04**	Apply (A)

References:

1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
4. Alan Tucker, Applied Combinatory, Wiley

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)								**SEM :** I		
Course Name : Machine Learning								**Course Code :** PCC-ITME102		
Contact Hours Per Week : 03								**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**					
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**					
Hours Per Week					**Theory (100)**		**Practical/ Oral (25)**	**Term Work (25)**	**Total**	
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**		
3	-	-	3	3	25	75	-	-	**100**	
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**										
Prerequisite: Algorithms, DBMS										

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To develop skills of using recent machine learning software for solving practical problems.
3. To gain experience of doing independent study and research.
4. Recognize the characteristics of machine learning that make it useful to real-world problems.

Course Outcomes: After completion of course, students should be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Demonstrate ability to apply knowledge of** different machine learning techniques like Decision Trees, ANNs/RNN/CNN, Baysian analysis, HMMs, KNNs, K-means, regression algorithm, clustering algorithms etc.	Understand(U), Apply(A), Evaluate(E)
2	Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised. Use the characterization to appropriately chose a technique based on the data available and the characteristic of the problem.	Understand(U), Apply (A), Create(C)
3	Effectively use machine learning toolboxes.	Understand(U), Apply (A), Create(C)
4	Conceptually, understand and develop ability to apply techniques in inductive, conceptual, analytical and reinforcement learning.	Apply (A), Analyze (AN), Create(C)
5	Develop ability to model a given real-world problem and arrive at possible method/solution.	Apply (A), Analyze (AN), Create(C)

Detailed syllabus:

Module	Detailed Content	Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Machine Learning definition, Components of a learning, Different Types of Learning,Concept Learning Task, Concept learning as search, Inductive Learning Bias, FIND-S and Candidate-Elimination algorithm Decision Trees, Basic decision trees learning algorithm, inductive bias in decision tree learning, overfitting	**08**	Understand(U) , Apply (A), Evaluate(E)
2	Linear Regression and error terms, Artificial Neural Networks, Perceptron, Multilayer networks and Backpropagation algorithm, Methods to avoid overfitting, regularization etc, Introduction to Deep Neural networks, Recurrent Neural Networks (RNNs), LSTM and Convolutional Neural Networks (CNNs)	**08**	Understand(U) , Apply (A)
3	Evaluating Hypotheses, Basics of sampling theory, comparing learning algorithms Bayesian learning and Bayesian networks, Gibbs algorithm, EM algorithm, Naive Bayes classifier, Baysian Belief Networks, Hidden Markov Model,	**08**	Understand(U) , Apply(A), Evaluate(E)
4	Instance based learning, K-Nearest-Neighbor, Locally weighted linear Regression, Logistic Regression, SVM , SVM, Multiclass & Ordinal Classification , Kernel Methods	**08**	Understand(U) , Apply (A)
5	Clustering, Generative Models, Mixture Models , Hierarchical Clustering, Model Based Clustering, K-means algorithm and complexity, Adaptive Hierarchical Clustering, Gaussian mixture model.	**08**	Apply (A), Create(C)
6	Genetic Algorithms and genetic programming Introduction to Analytical Learning, Combining Inductive and Analytical learning, Reinforcement learning. Ensemble of Machine Learning models, Boosting, Bagging, Stacking	**05**	Apply (A), Create(C)

References:

1. Mitchell Tom, Machine Learning. McGraw Hill, 1997-99.
2. Ethem Alpaydin, Introduction to Machine Learning, PHI, 2004
3. Chris Bishop, Pattern Recognition and Machine Learning, Springer, 2010
4. Course material available on Swayam platform and NPTEL, for the course on Introduction to Machine Learning, conducted by Prof. Sudeshna Sarkar, IIT Kharagpur.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining,Inference,and Prediction, Springer, 2001.
6. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern classification, Wiley, New York, 2001.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM :** I		
Course Name : Ethical Hacking and Digital Forensics							**Course Code :** PEC-ITME1011		
Contact Hours Per Week : 03							**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Computer Networks, Cryptography & Network Security									

Course Objective:

1. To understand computer forensic technology
2. To identify types of computer forensic systems
3. To explore the procedures for identification, preservation, and extraction of digital evidence
4. To explore the electronic evidence, identification of forensic data.
5. To learn how to investigate attacks on mobile platforms.
6. To explore various hacking techniques.

Course Outcomes: After completion of course Students should be able to

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the computer forensic technology.	Understand(U), Apply(A), Evaluate(E)
2	To discuss the types of computer forensics systems.	Understand(U), Apply (A), Create(C)
3	Understand the process of collection, analysis and recovery of the digital evidence	Understand(U), Apply (A), Create(C)
4	Understand the process of computer analysis.	Understand(U), Apply (A), Create(C)
5	Identify various security aspects with respect to mobile technology.	Understand(U), Apply (A), Create(C)
6	Understand various hacking tools and techniques.	Understand(U), Apply (A), Create(C)

Detailed Syllabus:

Module	Detailed Content	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Overview of computer Forensics Technology : Introduction to computer forensics, use of forensics in law enforcement, employment proceedings, computer Forensics services. Types of computer Forensics Technology- Military, law, spyware and Adware, Biometrics security systems **Self-learning Topics:** Relevant law to combat computer crime –Information Technology Act	7	Remember (R)
2	Foot Printing & Social Engineering: Information gathering Methodologies, Competitive Intelligence,DNS Enumerations, Social Engineering attacks. Types of Computer Forensics systems: Internet security, IDS, Firewall, Public key. **Self-learning Topics:** Types of IDS and Firewall	7	Analyze (AN)
3	Incident and Incident Response and Storage: Introduction to Incident, Incident Response Methodology, Steps, Activities in Initial Response Phase after detection of an incident. Initial Response and Forensic Duplication: Initial Response & Volatile Data Collection from Windows system. Initial Response & Volatile Data Collection from Unix system, Forensic Duplication: Forensic duplication as Admissible Evidence, Forensic Duplication Tool Requirements. Digital Forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential, Device handling: seizure issues, device identification, networked devices and contamination. **Self-learning Topics:** dd, WinHex, Helix3Pro	8	Analyze (AN)
4	Network Forensics: Collecting Network Based Evidence, Investigating Routers, Network protocols, Email Tracing, Internet Fraud. **Self-learning Topics:** tcpdump, snort	10	Apply (A), Analyze (AN)
5	Mobile Phone Forensics: Crime and mobile phones, evidence, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems. **Self-learning Topics:** Wireshark, Autopsy, SIFT.	8	Apply (A), Analyze (AN)
6	Scanning & Enumeration: Port Scanning, Network Scanning, Vulnerability, Scanning, NMAP, Scanning tool, OS Fingerprinting, Enumeration. System Hacking: Password cracking techniques, Key loggers, Escalating privileges, Hiding Files, Steganography Technologies, Countermeasures. Sniffers & SQL Injection: Active and passive sniffing, ARP Poisoning, Session Hijacking, DNS Spoofing, Conduct SQL Injection attack, Countermeasures. **Self-learning Topics**: IP Spoofing, Buffer Overflow, Password attacks.	5	Apply (A), Analyze (AN)

Text Books:

1.Kevin Mandia, chirs Proise, “Incident Response and Computer Forensic”

2.Marjie T Britz, “Computer Forensics and Cyber Crime: An Introduction”, Pearson Education, 2nd Edition

3.Peter Stepheson,”Investigating Computer Crime: A handbook for corporate investigation”

4. Nilakshi Jain, Dhananjay Kalbande, “Digital Forensic: The fascinating world of Digital Evidences” Wiley India Pvt Ltd 2017.

References:

1.Mari E-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett Learning; 2nd Edition, 2014.

2.Majid Yar, “Cybercrime and Society”, SAGE Publications Ltd, Hardcover, 2nd Edition

3.Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer.

4.Handbook of Computer Crime Investigation, edited by Eoghan Casey.

M.E. Semester –I

Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM : I**		
Course Name : Cyber Security & Laws							**Course Code :** PEC-ITME1012		
Contact Hours Per Week : 03							**Credits : 03**		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE : End Semester Examination - Paper Duration - 3 Hours**									
Prerequisite: Computer Networks, Cryptography									

Course Objective:

1. To understand and identify different types cybercrime and cyber law
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

Course Outcomes: After completion of course, students would be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Understand the concept of cybercrime and its effect on outside world	Understand(U), Apply (A), Create(C)
2	Interpret and apply IT law in various legal issues	Understand(U), Apply (A), Create(C)
3	Distinguish different aspects of cyber law	Understand(U), Apply (A), Create(C)
4	Apply Information Security Standards compliance during software design and development	Understand(U), Apply (A), Create(C)

Detailed Content:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Cybercrime:** Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	7	Understand (U), Apply (A), Create(C)
2	**Cyber offenses & Cybercrime:** How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Bot nets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	7	Understand(U), Apply (A), Create(C)
3	**Tools and Methods Used in Cyber line:** Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	9	Understand(U), Apply (A), Create(C)
4	**The Concept of Cyberspace:** E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	10	Understand(U), Apply (A), Create(C)
5	**Indian IT Act.:** Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	7	Understand (U), Apply (A), Create(C)
6	**Information Security Standard compliances:** SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	5	Understand(U), Apply (A), Create(C

References:

1. Nina Godbole, Sunit Belapure, *Cyber Security*, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, *Information Systems Security*, Wiley India, New Delhi
6. Kennetch J. Knapp, *Cyber Security* & Global *Information Assurance* Information Science Publishing.
7. William Stallings, *Cryptography and Network Security*, Pearson Publication
8. Websites for more information is available on :The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in
9. Website for more information,A Compliance Primer for IT professional: https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals- 33538

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="7">ME (Information Technology)</td><td colspan="4">SEM : I</td></tr>
<tr><td colspan="7">Course Name : Cryptography & PKI</td><td colspan="4">Course Code : PEC-ITME 1013</td></tr>
<tr><td colspan="7">Contact Hours Per Week : 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="9">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="9">Prerequisite: Discrete mathematics, Computer Networks</td></tr>
</table>

Course Objectives:

1. Provide knowledge of Cryptography.
2. Provide Knowledge of Symmetric and Asymmetric Algorithms.
3. Give insight on Message Authentication and Hash Functions.
4. Understand the concepts of Digital Signatures and Public Key Infrastructure

Course Outcomes: After completion of course, students would be able to :

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Discuss knowledge & concepts of Cryptography.	Analyze (AN)
2	Implement Symmetric and Asymmetric Algorithms.	Analyze (AN)
3	Develop Message Authentication and Hash Functions	Create (C)
4	Identify the concepts of Digital Signatures and Public Key Infrastructure	Create (C)

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	Cryptography	**Computer Networks OSI layers.** Introduction, Security Trends, Model for Network Security. **Cryptography: Concepts and Techniques:** Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Stegnography, Key Range and Key Size, Possible Types of Attacks	**06**	**L1,L2.L3, L4,**
2	Symmetric Key Algorithms	**Symmetric Key Algorithms:** DES,3DES, AES, IDEA, RC4, RC5, Confidentiality using symmetric encryption.	**08**	**L1,L2.L3, L4**
3	Number Theory & Cryptography	**Introduction to Number Theory:** Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms **Public- Key Cryptography and RSA:** Principles of Public-Key Cryptosystems, RSA, Key Management, Diffie-Helman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.	**08**	**L1,L2.L3, L4,L5**
4	Message Authentication and Hash Functions	**Message Authentication and Hash Functions:** Authentication Requirements, Authentication Functions, MAC, Hash Functions, Security of Hash Functions and MACs, SHA, HMAC	**06**	**L1,L2.L3, L4,L5**
5	Digital Signatures and Public Key Infrastructure	**Digital Signatures and Public Key Infrastructure (PKI):** Digital Signatures, Authentication Protocols, DSS, Authentication Applications: Kerberos, X.509 Authentication Service Digital Certificates, Private Key Management, PKI Trust Models, Public Key Cryptography Standards, Revocation, Directories and PKI, PKIX and Security.	**11**	**L1,L2.L3, L4,L5**
6	Elliptic Curves	**Elliptic Curves:** The Addition Law, Elliptic curve Mod p, Factoring with Elliptic Curves, Elliptic Curve Cryptosystems **Cryptography in Java, .NET and Operating Systems:** Cryptographic Solutions using Java, Cryptographic Solutions using Microsoft .NET Framework, Cryptographic Toolkits, Security and Operating Systems, Database Security.	**06**	**L1,L2.L3, L4,L5,L6**

Text Books:

1. Information Security Principal and Practice: Mark stamp, Wiley
2. Cryptography and security, wiley, Shyamala, harini
3. Stallings, W., "Cryptography and Network Security", Fourth Edition, Pearson
4. Introduction to Cryptography with coding Theory, Pearson,WadenTrappe
5. Forouzan B., "Cryptography and Network Security", Second Edition, Tata McGraw Hill
6. Bernard Menezes, "Network Security and Cryptography", Cengage Learning.
7. Charlie Kaufman, Radia Perlman and mike speciner "Network security, private communication in a public world" , Second Edition, Pearson

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="6">ME (Information Technology)</td><td colspan="4">SEM : I</td></tr>
<tr><td colspan="6">Course Name: Applied Natural Language Programming</td><td colspan="4">Course Code : PEC-ITME1014</td></tr>
<tr><td colspan="6">Contact Hours Per Week: 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2" rowspan="2">Theory (100)</td><td>Practical /Oral (25)</td><td>Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td>PR</td><td>TW</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisite: Fundamental algorithms and techniques in the area of natural language processing (NLP)</td></tr>
</table>

Course Objective: Course should be able to deliver fundamental and applied knowledge of Natural Language Processing and applying knowledge to implement real time problems in various sectors.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand fundamental concepts and techniques of natural language processing.	L1, L2,L3
2	Apply various text processing and analysis techniques in NLP	L1, L2, L3
3	Analyze the different statistical techniques in NLP	L1, L2, L3, L4
4	Analyze the different word level and sentence level analysis techniques in NLP	L1, L2, L3, L4
5	Understand concepts of transformers in NLP	L1, L2
6	Apply NLP techniques to design real world NLP applications in various sectors	L1, L2,L3

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Natural Language Processing(NLP)** Introduction, Terminologies , Phases, challenges of NLP , Generic Architecture of NLP , Applications of NLP, NLP tools and packages	5	L1, L2,L3
2	**Texts Processing and analysis in Natural Language Processing** Tokenization, Stop word Removal, Stemming , Lemmatization, Positional Encoding, Padding, Masking, Part-Of-Speech tagging , Name Entity Recognition, Word Cloud , Topic modeling, finite state transducers , N-gram language model, Bag of words ,Term Frequency—Inverse Document Frequency(TF-IDF), Text Clustering and Classification	6	L1, L2, L3
3	**Statistical methods of NLP** Finite state transducers, Hidden Markov Model (HMM), Neural Network, Conditional Random Field (CRF), Maximum Entropy, Natural Language Models(RNN, LSTM)	8	L1, L2, L3,L4
4	**Word level and Sentence level Analysis using NLP** Inflectional morphology & Derivational morphology, Regular expression, finite automata, lexemes & their senses, Word Net, Robust Word Sense Disambiguation (WSD)	8	L1, L2, L3,L4
5	**Transformers** Overview of Encoder-Decoder Architecture, Parts of Encoder-Decoder, Preprocessing Overview (Tokenization, Padding, Positional Encoding, Masking), Attention Mechanism, Similarities and Differences of Encoder and Decoder, Applications of Encoder-Only Model (word classification - BERT), Applications of Decoder-Only Model (Chatbot : Chat-GPT), Application of Encoder-Decoder Model (Language Translation)	10	L1, L2,L3,L4
6	**Applications of NLP across the Industries** Applications in Business, Healthcare, Education, Finance, Marketing, Human Resource, Retail and E-Commerce ,Telecom Industries, Cyber Security, Manufacturing and Transportation	8	L1, L2,L3,L4
	Total Hours	**45**	

	Title	Authors	Publisher	Edition	Year
1	Applied Natural Language Processing in the Enterprise	Ankur A. Patel, Ajay , Uppili Arasanipalai	O'Reilly	Second	2021
1	Speech and Language Processing	Daniel Jurafsky, James H. Martin	Prentice Hall	Third Edition	2008
2	Foundations of Statistical Natural Language Processing	Christopher D.Manning and Hinrich Schutze,	MIT Press, 1999	Second Edition	1999
3	Natural Language Processing and Information Retrieval	Siddiqui and Tiwary U.S	, Oxford University Press	--	2008

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="6">ME (Information Technology)</td><td colspan="4">SEM : I</td></tr>
<tr><td colspan="6">Course Name : Conversational AI</td><td colspan="4">PEC-ITME1015</td></tr>
<tr><td colspan="6">Contact Hours Per Week : 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisite: Basics concepts of AI, Machine Learning</td></tr>
</table>

Course Objective:

1. This course is intended primarily for learners with a focus on business and/or technology, and specifically those seeking to better understand what Conversational AI is, where it came from, and how it can benefit their organizations.
2. Although the course does not cover the technical aspects of building Conversational AI, Data Scientists, Machine Learning Engineers, and other technically-inclined learners may still find concepts and best practices introduced in the subject matter to be useful.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Conversational AI and its concept	L1, L2,L3
2	Understanding Machine learning	L1, L2, L3
3	Building different Chatbots	L1, L2, L3, L4
4	Building different Keyboard to Conversations	L1, L2, L3, L4
5	Understanding voice skills	L1, L2
6	Understanding of Voice Conventional Assistant	L1, L2,L3

Detailed Contents:

Module No.	Detailed Content	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction:** What is AI, Introducing AI, AI is the New Electricity, Introduction to AI, Class Survey	8	Understand(U)
2	**Machine Learning:** Intro & Learning Outcomes, Machine Learning Introduction – Machine Learning Introduction, Industry Use Cases, Deep Learning Introduction	7	Understand(U) Apply(A) Analyze(AN)
3	**Concepts of Conversational AI**: Intro & Learning Outcomes, Trot the Bot, Conversational AI Intro Part, Create your First Chatbot in less than 30 Minutes, Voice is the Future	10	Understand(U) Apply(A) Analyze(AN)
4	**Keyboard to Conversations**: Intro to Alexa, Why How an Alexa Skill Works, Interacting With a Skill, How to Create a Skill, Steps to Build a Skill	10	Understand(U) Apply(A)
5	**Voice Design:** Voice Design, Key Concepts, Characteristics, Key Challenges, Best Practices **Building a voice Skill**: Getting Started, Requirements, Create a Skill in Minutes, Steps, Collect Slots turn-by-turn, Adding Memory, Using Alexa Settings API, Finalizing Skills, Certify and Publish Your Skill, Wrapping Up, Interactive Quiz	5	Understand(U) Apply(A) Analyze(AN)
6	**Building First Voice Conventional Assistant**: Intro to Wise Central, Introduction to Build Voice Enabled Experiences with Alexa, Building for Voice with Alexa, Creating a New Skill, Publishing Skills **Building Second Voice Conventional Assistant**: Design for Conversation, Voice Design, Dialog Sketch, Remembering Attributes, Accessing Codes Github	5	Understand(U)

References:

SN	Name of the Book	Name of the Author	Publisher	Edition	Year
1	Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots (Synthesis Lectures on Human Language Technologies)	Michael McTear	Morgan & Claypool Publishers .	2nd Edition	**2020**
2	The Definitive Guide to Conversational AI with Dialogflow and Google Cloud: Build Advanced Enterprise Chatbots, Voice, and Telephony Agents on Google Cloud	Lee Boonstra	Apress, 2021	1st Edition Edition	2021
3	Conversational AI: Chatbots that work	Andrew Freed	Manning	1st Edition Edition	2021

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="7">IT (Information Technology)</td><td colspan="4">SEM : I</td></tr>
<tr><td colspan="7">Course Name : Reinforcement Learning</td><td colspan="4">Course Code : PEC-ITME1016</td></tr>
<tr><td colspan="7">Contact Hours Per Week : 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisite: Derivatives and Understanding Matrix Vector Operations, Notation, Probabilities, Gaussian Distributions, Mean, Standard Deviation, etc.</td></tr>
</table>

Course Objectives:

1. In this course, we will explore how an agent (via interactions with the environment) can learn by trial and error.
2. This is quite different from supervised machine learning and comes close to how humans learn by interactions. Reinforcement Learning (RL) deals with problems that require sequential decision making.
3. This technology will explore the foundations of reinforcement learning. We will study different algorithms for RL and later in the course, we will explore how functional approximation in RL algorithms could be done using neural networks giving rise to deep reinforcement learning.

Course Outcomes: After completion of course, students would be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Learn how to define RL tasks and the core principals behind the RL, including policies, value functions, deriving Bellman equations	Remember (R), Understand(U)
2	Implement in code common algorithms following code standards and libraries used in RL	Remember (R), Understand(U), Apply(A), Analyze(A)
3	Understand and work with tabular methods to solve classical control problems	Understand(U), Apply(A), Analyze(A)
4	Generative architectures work, in great depth, from GANs to multimodal A.I, understanding every little detail in the process	Understand(U),Apply(A), Analyze(A)

5	In-depth review of the key concepts related to these architecture	Understand(U),Apply(A), Analyze(A)
6	Learn to use industry-leading tools for text, image, audio & video generation	Understand(U),Apply(A), Analyze(A)

Detailed syllabus:

Module No.	Detailed Content	Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Reinforcement Learning:** Introduction: Reinforcement learning, Elements of Reinforcement learning, Early history of Reinforcement Learning, Characteristics of Reinforcement Learning, Limitation & Scope, Tic-Tac -Toe, inside RL Agent, Reinforcement Learning Problems, Agent & Environment, Sequentially Decision Making, Policy	07	Remember (R), Understand(U), Apply(A)
2	**Probability Primer:** Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.	07	Remember (R), Understand(U), Apply(A), Analyze(AN)
3	**Prediction and Control by Dynamic Programing:** Overview of dynamic programing for MDP, definition and formulation of planning in MDPs, Principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.	07	Remember (R), Understand(U), Apply(A),
4	**Monte Carlo Methods for Model Free Prediction and Control:** Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.	10	Remember (R), Understand(U), Apply(A), Analyze(AN)
5	**TD Methods:** Introduction, Definition and types, Limitations, Various phases of modeling, Monte Carlo method, Applications, advantages and limitations of simulation	10	Remember (R), Understand(U), Apply(A)
6	**Function Approximation Methods:** Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, Afterstates, Control with function approximation, Least squares, Experience replay in deep Q-Networks	04	Remember (R), Understand(U), Apply(A), Analyze(AN), Evaluate (E)

References:

SN	Name of the Book	Name of the Author	Publisher	Edition	Year
1	Reinforcement Learning: An Introduction	Richard S. Sutton and Andrew G. Barto	MIT Press, 2020.	2nd Edition	2020
2	Reinforcement Learning and Optimal Control	Dimitri P. Bertsekas	Athena Scientific, 2019.	1st Edition Edition	2019
3	Reinforcement Learning: A Survey	Leslie Pack Kael bling, Michael L. Littman and Andrew W. Moore	Journal of Artificial Intelligenc e Research	4th Volume	1996
4	Reinforcement Learning: An Introduction	K. Deb	Prentice-Hall of India Pvt. Ltd., New Delhi	2003 Edition	2003

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM :** I		
Course Name : Advance Web Technologies							**Course Code :** PEC-ITME1017		
Contact Hours Per Week : 03							**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours**									
ESE : End Semester Examination - Paper Duration - **3 Hours**									

Course objectives: To understand the details of web programming

Course outcomes: After completion of course, students would be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	To understand the concepts of Web Technology Basics & HTML 5.0	Apply(A)
2	To apply the ideas of Responsive web design with HTML5 and CSS3, Web Services	Analyze (AN)
3	To understand & apply the importance of Rich Internet Application (RIA)	Analyze (AN)
4	To apply & analyse the concepts of Web Analytics 2.0	Analyze(AN)
5	To apply & analyse the importance of Web 3.0 and Semantic Web	Evaluate (E)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Web Technology Basics & HTML 5.0: **Introduction to web technologies**: Web system architecture- 1,2,3 and n tier architecture, URL, domain name system, overview of HTTP and FTP, Cross browser compatibility issues, W3C Validators **Web Site Design Issues**: Planning a Web Site –Objective and Goals, Audience, Organizing contents. **Publishing of Web Site**. **Function of Web Server** **Basic HTML**: Formatting and fonts, Anchors, images, lists, tables, frames and forms. XML basics. **HTML 5:** Fundamental Syntax and Semantics, Progressive Markup and Techniques, Forms, Native Audio and Video, Micro data and Custom data, Accessibility, Geo-location, Canvas.	7	Apply(A)
2	Responsive web design with HTML5 and CSS3: **Introduction to CSS**: Evolution of CSS, Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document, Defining Inheritance in CSS **CSS3 and Responsive Web Design.** **CSS3:** Selectors, Typography and color Modes Stunning Aesthetics with CSS3, CSS3 Transitions, Transformations and Animations, Conquer Forms HTML5 and CSS3	7	Apply(A)
3	Web Services: **Web Services:** Web services, Evolution and differences with Distributed computing, XML, WSDL, SOAP, UDDI, Transactions, Business Process Execution Language for Web Services, WS-Security and the Web services security specifications, WS-Reliable Messaging, WS-Policy, WS- Attachments. REST-ful web services, Resource Oriented Architecture, Comparison of REST, SOA, SOAP	10	Apply(A)
4	Rich Internet Application (RIA): **Introduction to Ajax:** Ajax Design Basics, JavaScript, Blogs, Wikis, RSS feeds **Working with JavaScript Object Notation (JSON):** Create Data in JSON Format, JSON parser, Implement JSON on the Server Side, Implementing Security and Accessibility in AJAX **Applications:** Secure AJAX Applications, Accessible Rich Internet Applications, **Developing RIA using AJAX techniques:** CSS, HTML, DOM, XMLHTTPRequest, JavaScript, PHP, AJAX as REST Client **Open Source Frameworks and CMS for RIA:** Django, Drupal, Joomla introduction and comparison.	8	Analyze (AN)

5	Web Analytics 2.0: Introduction to Web Analytics 2.0, State of the Analytics Union, State of the Industry, Rethinking Web Analytics: Meet Web Analytics 2.0, Optimal Strategy for Choosing Your Web Analytics Soul Mate. The Awesome World of Clickstream Analysis: Metrics. The Key to Glory: Measuring Success. Failing Faster: Unleashing the Power of Testing and Experimentation.	7	Analyze (AN)
6	**Web 3.0 and Semantic Web**: Challenges, Components, Semantic Web Stack: RDF, RDF Schema (RDFS), Simple, Knowledge Organization System (SKOS), SPARQL as RDF, query language, N-Triples as a format for storing and transmitting data, Turtle (Terse RDF Triple Language), Web Ontology Language (OWL) a family of knowledge, representation languages, Rule Interchange Format (RIF), a framework of web rule language dialects supporting rule, interchange on the Web.	6	Apply(A)

Reference Books:

Text Books:

1. HTML 5 Black Book: Kogent Learning solutions
2. Tim O'Reilly, What is Web 2.0? : Design Patterns and Business Models for the Next Generation of Software, O'REILLY
3. John Davies, Rudi Studer, and Paul Warren John , "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley & Son'
4. Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity, Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity
5. Avinash Kaushik, ISBN: 978-0-470-52939-3, wiley publication.

References:

1. Grigoris Antoniou and Frank van Harmelen,. A Semantic Web Primer: MIT Press,2004, ISBN 0-262- 01210-3
2. Deane Brker, Web Content Management: Systems, Features, and Best Practices, O'Reilly & Associates incorporated, 2016
3. John Domingue, Dieter Fensel, Handbook of Semantic Web Technologies, Springer Reference
4. Liyang Yu, a Developer's Guide to the Semantic Web, Second Edition, Springer
5. An introduction to RDF and Jena RDF API, www.jena.apache.org/tutorials/rdf_api.html.

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM :** I		
Course Name : Web Application Security							**Course Code :** PEC-ITME1018		
Contact Hours Per Week : 03							**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week:					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Web Applications concepts, Web Security									

Course Objective:

1. To reveal the underlying in web application.
2. To understand the browser security principles.
3. To understand web applications vulnerabilities.
4. To understand web application mitigations.
5. To identify and aid in fixing any security vulnerabilities during the web development process.
6. To understand the security principles in developing a reliable web application.

Course Outcomes: After completion of course, students would be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	To understand the security principles in developing a reliable web application	Apply (A)
2	Identify the various types of security issues in web browser.	Understand (U)
3	Identify the various types of threats in developing a web application.	Create (C)
4	Identify the various types of mitigation measures of web applications.	Apply(A)
5	Apply the security principles in developing a reliable web application.	Apply(A)
6	Use industry standard tools for web application security.	Analyze(AN)

Detailed Syllabus:

Module No.	Detailed Content	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1.	Web Application Security Fundamentals: Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classifying and Prioritizing Threads **Self-learning Topics:** Cookies, Access Control.	7	Remember(R) Understand(U)
2.	Browser Security Principles: Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS,- HTML Injection **Self-learning Topics:** HTTPS, HTTP Proxies	8	Apply (A) Analyze (AN)
3.	Web Application Vulnerabilities: Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery **Self-learning Topics:** SSH Tunneling Cleaning traces ,Cleaning the event log Advanced phishing attacks	10	Analyze (AN) Evaluate (E)
4.	Web Application Mitigations: HTTP request, HTTP response, rendering and events , html image tags, image tag security, issue, java script on error , Javascript timing , port scanning , remote scripting , running remotecode, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation **Self-learning Topics:** Nikto, OWASP ZAP	8	Apply (A) Analyze (AN)
5.	Secure Website Design: Secure website design: Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management, Sen- sitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Manage- ment, Auditing and Logging, Design Guidelines, Forms and validity, Technical implementation **Self-learning Topics:** Wapiti**,** SQL Map	7	Evaluate (E) Create (C)
6.	Cutting Edge Web Application Security: Clickjacking - DNS rebinding - Flash security - Java applet security - Single-sign- on solution and security - IPv6 impact on web security **Self-learning Topics:** https://owasp.org/www-community/Free_for_Open_Source_Application_Security_Tools	5	Understand(U)

Text Books:

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Profe ssional, 2011.

2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

References:

1. OReilly Web Security Privacy and Commerce 2nd Edition 2011

2. Professional Pen Testing for Web application, Andres andreu, wrox press

3. Carlos Serrao, Vicente Aguilera, Fabio Cerullo,"Web Application Security" Springer; 1st Edition

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="7">ME (Information Technology)</td><td colspan="3">SEM : I</td></tr>
<tr><td colspan="7">Course Name: ICT Security for Social Cause</td><td colspan="3">Course Code : PEC-ITME1021</td></tr>
<tr><td colspan="7">Contact Hours Per Week : 03</td><td colspan="3">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td></td><td></td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisite: Computer networks, Network security concepts</td></tr>
</table>

Course Objectives:

1. To appreciate various theoretical and disciplinary perspectives towards developing ICT system for development of society.
2. To illustrate different ways by which information can be communicated.
3. To demonstrate an understanding for acquiring data securely for developing an ICT system.
4. To illustrate data storage techniques and formulate knowledge from the raw data.
5. To formulate policies and strategies for ICT system.
6. To design various application using ICT.

Course Outcomes: After completion of course, students should be able to:

S.No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To identify opportunities and challenges for developing ICT systems.	Analyze (AN)
2	To identify and access the ways by which information can be communicated.	Analyze (AN) Evaluate (E)
3	To identify methods of capturing data securely for developing an ICT system.	Create (C)
4	To store and analyze the data captured and generate knowledge from the raw data.	Analyze (AN) Evaluate (E)
5	To devise policies and strategies for ICT system.	Analyze (AN) Evaluate (E)
6	To design various application using ICT,	Analyze (AN)

		Evaluate (E)

Detailed syllabus:

Module	Detailed Content	Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Review of ICT history and growth, importance of ICT in societal, development identifying opportunities for using ICT, learning from failures Drivers and barriers for ICT development ICT in developing countries – opportunities for developments and challenges Creating an ICT – handling text, data and media. **Self-learning Topics**: Application of ICT	**07**	Analyze (AN)
2	**Communication Techniques in ICT** : Radio and TV Techniques, Mobile Techniques – CDMA, Mobile wireless WiMAX, Advanced wireless technologies, Bluetooth Satellite Techniques – architecture AND working principles GPS/GPRS Cloud computing –Introduction, cloud services, Cloud service providers, collaborative techniques like sharing ideas through blogs, forums, online communities etc safe transmission of data **Self-learning Topics:** Study different ICT techniques	**07**	Evaluate (E)
3	**Data acquisition in ICT** : Recognition systems RFID,OMR Location recognition Data acquisition process for MEMS devices Sensors – Programming, communication with cloud. Acquiring data from internet and social media. Formation of social groups and interaction analysis Facebook, Twitter, Blogs, Forums, mailing lists etc controlling access to confidential information **Self-learning Topics:** Case study on data acquisition in ICT	**06**	Apply (A)
4	**Data and Knowledge Management in ICT:** Data storage and management content management system identity management Knowledge elicitation Knowledge representation and visualization techniques Knowledge Engineering Methodology Auditing knowledge management Data storage and disposal of data Linking knowledge management to business performance	**09**	Apply (A)

	Self-learning Topics: case study on Data and Knowledge Management in ICT		
5	**Defining policies for administering ICT:** ICT policies and e-Strategies, approach to ICT policy formulation and e-Strategy development, e-Readiness assessment, identifying priority areas and developing action plans. National Policy on ICT in India. **Self-learning Topics:** study ICT policy	**09**	Apply (A)
6	**ICT applications:** Study of ICT applications in various domains such as Agriculture, Healthcare, Education, social studies, Finance, Law, life science. **Self-learning Topics:** Study of ICT applicationsin different area.	**07**	Evaluate (E)

References /Text Books:

1.Lechman, E. (2015). ICT Diffusion in Developing Countries: Towards a New Concept of Technological Takeoff. Germany: Springer International Publishing.,

2.Affordability Issues Surrounding the Use of ICT for Development and Poverty Reduction. (2018). United States: IGI Global.

3.Koh, S. C. L., Maguire, S. (2009). Information and Communication Technologies Management in Turbulent Business Environments. United Kingdom: Information Science Reference.,

4.The Development Dimension ICTs for Development: Improving Policy Coherence. (2010). Ukraine: OECD Publishing.,

5.Gorica, K., Kordha Tolica, E., Sevrani, K. (2015). Information Society Development Through ICT Market Strategies: Albania Versus Other Developing Countries. Germany: Springer International Publishing.

6.ICT Futures :Delivering Pervasive Realtime And Secure Services Edited By Paul Warren , John Davies, David Brown , Wiley Publication

7.ICT Policy Formulation and e-Strategy Development Strategy Development - A Comprehensive Guidebook by Richard Labelle, Asia-Pacific Development Information Programme

Online References:
1. BLI-224: ICT Fundamentals - https://onlinecourses.swayam2.ac.in/nou22_lb08/preview

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="5">ME (Information Technology)</td><td colspan="4">SEM : I</td></tr>
<tr><td colspan="5">Course Name : Security & Risk Management</td><td colspan="4">Course Code : PEC-ITME1022</td></tr>
<tr><td colspan="5">Contact Hours Per Week : 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="4">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="4">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="9">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="9">Prerequisite: Computer networks, Cryptography & Network Security Concepts.</td></tr>
</table>

Course Objectives:

1. Gain knowledge about security risk assessment and different risk mitigation/management strategies.

2. Have a good understanding of how a risk management cycle operates. Allow participants to calculate the level of risks and make tangible decisions based on the risk analysis.

COURSE OUTCOMES: After completion of course, students would be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Assessing Network Vulnerabilities	L1, L2, L3,
2	Understand Principles of Security	L1, L2, L3, L4
3	Assess Risk Assessment: Laws	L1, L2, L3, L4
4	Understand Risk Assessment Methodologies	L1, L2, L3, L4
5	Perform the Assessment and Remote Maintenance	L1, L2, L3, L4
6	Prepare Report and Post Assessment Activists	L1, L2, L3, L4, L5

Detailed contents:

Sr. No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to assessing Network Vulnerabilities: type and procedure of network vulnerability assessment	8	Remember(R), Understand(U)
2	Principles of Security: Information Classification, Policy framework, role based security in an organization	8	Understand(U), Apply(A) Apply(A), Analyze(AN)
3	Risk Assessment: Laws, Mandates and Regulations, Risk assessment best practices, Risk assessment best practice.	7	Understand(U), Apply(A) Understand(U), Apply(A), Analyze(AN)
4	Risk Assessment Methodologies: Defense –in depth approach, risk analysis, Asset valuation approach, Quantitative and Qualitative risk-assessment approaches. Scoping the project, Understanding the attacker.	8	Understand(U), Apply(A), Analyze(AN) Understand(U), Apply(A)
5	Performing the Assessment: Vulnerability scan and Exploitation: Internet Host and network enumeration, IP network Scanning, Assessing Remote Information Services, Assessing Web servers, Assessing Web Applications, Assessing Remote Maintenance Services, Assessing Database services, Assessing Windows Networking Services, Assessing Email services.	9	Apply(A), Analyze(AN) Understand(U), Apply(A)
6	Open source tools used for Assessment and Evaluation, and exploitation framework	5	Understand(U), Apply(A), Analyze(AN)
7	Final Report Preparation and Post Assessment Activists		

Reference books:

1. Network Security assessment, Chris McNab, O'reilly
2. Inside Network Security Assessment, Michael Gregg, Pearson
3. Security in Computing, fourth Edition, Charles Pfleeger, Pearson
4. The Security Risk Assessment Handbook: Douglas LanDoll, Auerbach Publication.
5. Nina Godbole, "Information Systems Security", Wiley
6. Cyber Security: Sunit Belapur, Wiley
7. Whitman & Mattord. Management of Information Security. Thomson Course Technology (2004). ISBN: 0-619-21515-1

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="7">ME (Information Technology)</td><td colspan="4">SEM : I</td></tr>
<tr><td colspan="7">Course Name : Network Security</td><td colspan="4">Course Code : PEC-ITME1023</td></tr>
<tr><td colspan="7">Contact Hours Per Week : 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/ Oral (25)</td><td>Term Work (25)</td><td rowspan="2">Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisite: Basic knowledge of Computer Networks, Cryptography</td></tr>
</table>

Course Objectives:

1. To learn the basics of security and various types of security issues.
2. To study different cryptography techniques available and various security attacks..
3. Explore network security and how they are implemented in real world.
4. To get an insight of various issues of Web security and biometric authentication.

COURSE OUTCOMES: After completion of course, students would be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To have an understanding of basics of security and issues related to it.	Understand (U)
2	Understanding of biometric techniques available and how they are used in today's world.	Understand (U)
3	Security issues in web and how to tackle them.	Analyze(AN)
4	Learn mechanisms for transport and network security	Understand (U)
5	Security at various levels	Understand (U)
6	Firewalls & IDS	Analyze(AN)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Security Problem in TCP/IP Protocol Suite:** Identification of Security issues in Ethernet, ARP, IP, TCP, Application and Routing protocols.	8	Analyze (AN)
2	**Security Models:** Military and civil security, vulnerability and threat models, End-end security (COMSEC), link encryption (TRANSEC), compartments. Privacy. Authentication. Denial of service. Nonrepudiation. Issues in multi-level secure systems. Internet security models: IPv4/IPv6 encapsulation header	8	Analyze (AN) Evaluate (E)
3	**Security at Network Layer** Routing algorithm vulnerabilities: route and sequence number spoofing, instability and resonance effects. Information hiding: DMZ networks, route aggregation and segregation ICMP redirect hazard: denial of service. ARP hazard: phantom sources, ARP explosions and slow links. Defending against Chernobyl packets and meltdown. Fragmentation vulnerabilities and remedies: (ICMP Echo overrun) **IPSec:**IP Security Overview, IP Security Architecture, Security Associations, Security Association Database, Security Policy Database, Tunnel and Transport mode, AH and ESP, IP and IPv6, Encapsulating Security Payload, Internet Key Exchange	9	Analyze (AN)
4	**Security at Transport Layer: SSL and TLS** Secure network infrastructure services: DNS, NTP, SNMP, SSL Architecture, SSL/TLS Basic Protocol, SSL Message Formats, Session Resumption, Computing the keys, Client Authentication, PKI as deployed bySSL, Version Numbers, Negotiating Cipher Suites, Negotiating Compression Methods, Exportability, Encoding, Mobile systems: Address Export and re-use. Session key management: Blind-key cryptosystems (NTP).	7	Analyze (AN)
5	**Security at Application Layer: PGP, S/MIMIE** E-mail security, PGP, PEM, S/MIME, Secure binding of multimedia streams, Secure RTP. Secure RSVP. **Firewalls and IDS** Firewalls: Network partitioning, firewall platforms, partitioning models and methods, Secure SNMP, Secure routing interoperability: virtual networks (DARTnet/CAIRN). Transparent and opaque network services. Source masking and hidden channels. IDS, Honeypots, Honey nets,	8	Apply (A) Analyze (AN)
6	**Wireless Network Security:** Introduction, How wifi works, WEP, Technique of hacking wireless network, countermeasure. **Network Packet analysis**: Packet analysis and Packet sniffing in Hub and Switched environment, Analysis of packet for security i.e Sync Scan, OS Fingerprinting. NOS Security issues: Windows and Linux environment	5	Evaluate (E) Create (C)

References:

1. Stallings, W., "Cryptography and Network Security: Theory and Practice", Second Edition, John Wiley

2. "Charles P. Pfleeger "Security in computing", Pearson Education

3. Stalling W., " Network Security Essentials", Pearson

4. Garfinkel S., Spafford G., "Practical Unix and Internet Security", O'Reilly

5. Blacharski D., "Network Security in a Mixed Environment"

6. Practical Packet Analysis: Using Wireshark to Solve Real-Word Network problems by Chris Sanders

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM :** I		
Course Name: Computer Vision & Image Processing							**Course Code :** PEC-ITME1024		
Contact Hours Per Week : 03							**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/ Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Basic level of expertise in programming and mathematics									

COURSE OBJECTIVE: The course should be able to introduce the computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving

COURSE OUTCOMES: After completion of course, students would be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Understand fundamentals of Digital image processing	L1, L2, L3,
2	Study and apply Image enhancement techniques	L1, L2, L3, L4
3	Apply morphological techniques on images	L1, L2, L3, L4
4	Apply segmentation techniques on images	L1, L2, L3, L4
5	Understand various area extraction and region analysis Techniques	L1, L2, L3, L4
6	Apply various compression techniques on images	L1, L2, L3, L4, L5

Detailed syllabus:

Sr. No.	Detailed Content	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Digital Image Fundamentals:** Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization, Representation of Digital Image, Connectivity Image File Formats: BMP, TIFF and JPEG.	8	Evaluate (E)
2	**Image Enhancement in Spatial Domain:** Gray Level Transformations, Zero Memory Point Operations, Histogram Processing, Histogram equalization. Neighborhood Processing, Spatial Filtering, Smoothing and Sharpening Filters, Median Filter.	8	Apply(A)
	Recognition Methodology and Morphological Image Processing: **Recognition Methodology**: Conditioning, Labeling, Grouping, Extracting, Matching **Morphological Image Processing**: Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on grayscale images, Thinning, Thickening, Region growing, region shrinking.	9	Analyze (AN)
4	**Binary Machine Vision:** Thresholding, Segmentation, connected component labeling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation	6	Analyze (AN)
5	**Area Extraction and Region Analysis:** **Area Extraction:** Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting). **Region Analysis:** Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.	9	Apply(A)
6	**Image Compression:** Introduction, Redundancy, Fidelity Criteria, Lossless Compression Techniques: Run Length Coding, Arithmetic Coding, Huffman Coding, Differential PCM Lossy Compression Techniques: Improved Gray Scale , Quantization, Vector Quantization	5	Evaluate (E)

References:

SN	Title	Authors	Publisher	Edition	Year
1	Computer Vision: A Modern Approach	David Forsyth, Jean Ponce	Pearson Education India	Second	2015
2	Image Processing, Analysis, and Machine Vision	Milan Sonka, Vaclav Hlavac, Roger Boyle	Cengage India Private Limited	Fourth	2017
3	Fundamentals of Digital Images Processing	Anil K. Jain	Pearson Education India	Fourth	2015
4	Digital Image Processing	Rafael C. Gonza Lez, Richard E. Woods	Pearson Education India	Fourth	2018

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM :** I		
Course Name : Robotic Process & Automation							**Course Code :** PEC-ITME1025		
Contact Hours Per Week : 03							**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**									

Pre-requisite: Programming Languages , Software process

Course Objective:

1. The course intends to deliver the fundamentals concepts of robotic process automation and the use of UiPath tool for process automation in detail.
2. It also focus on the development of bots and its deployment.

Course Outcomes: After completion of course, students would be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Understand and analyze business functionalities in Robotics Process Automation	Analyze (AN)
2	Analyze various tool software bots development	Evaluate (E)
3	Understand and apply variable and data manipulation using tool	Apply (A)
4	Implementing recorder and scraping utility for robotic process automation	Apply (A)
5	Perform exception handling and error reporting for RPA	Create (C)
6	Understand the steps involve for publishing the bots for automation	Understand, Apply(U, A)

Detailed syllabus:

Detailed Content	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
Introduction: Robotic process automation need, benefits , component of RPA , databases ,API Programming interface, Artificial Intelligence , Cognitive Automations , Agile , Scrum, Kanban and waterfall. Natural language processing and RPA	7	Analyze (AN)
UiPath for RPA: Introduction, Installation and activation, Interfaces, Different types of workflows, Creating-a-basic-workflow, Debugging, Managing packages, Reusing Library, Installing-the-extension-for-UiPath-studio, Source control, Activities guide, Workflow, Control Flow, Sequences, Flowcharts, State Machines, Control Flows, The-assign-activity, The-delay-activity, The-do-while-activity, The-if-activity, The-switch-activity, The-while-activity, The-for-each-activity, The-break-activity	8	Evaluate (E)
Variable , Datatable and Recording for RPA Managing-variables, Naming-best-practices, The-variables-panel, Generic-value-variables, Text-variables, True-or-false-variables, Number-variables, Array-variables, Date-and-time-variables, Data-table-variables, Managing-arguments, Using-arguments, Data Manipulations, Data table , Excel Automation,	9	Analyze (AN)
Recording and Scraping: Recording Introduction, Recording Types- Automatic Recording, Manual Recording **Scraping :** UI Elements, Output-or-screen-scraping-methods, Examples-of-using-output-or-screen-scraping-methods, About-web-scraping, Example-of-using-web-scraping, data scraping	9	Analyze (AN) Apply (A)
Exception Handling , Debugging and Logging Exception Handling: Unavailability of UI element , Handling runtime exceptions, Logging and taking screenshot, Debugging techniques, Collecting crush dumps, Error reporting	7	Analyze (AN) Create (C)
Deploy and Marinating Bots publishing using utility: How to publish a workflow in UiPath, Writing editing publish package to .jsonfile. Overview of Orchestration Server- Queues, assets, process, developing a process. Using Orchestration server to control bots. Publish and managing update	5	Evaluate (E)

References:

S. No.	Title	Authors	Publisher	Edition	Year
1.	Learning Robotic Process Automation Create software robots and automate business process with the leading RPA tool	Alok Mani Tripathi	Packt	1st	2018
4.	Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere	Nandan Mullakara , Arun Kumar Asokan	Packt	1st	2020
3.	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems 1st ed. Edition	Tom Taulli	Apress	1st	2020

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM :** I		
Course Name : Advanced Soft Computing							**Course Code :** PEC-ITME1026		
Contact Hours Per Week : 03							**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Algorithm, Programming skills in C, C++, or Java, MATLAB, Python etc.									

COURSE OBJECTIVE:

1. To inculcate interdisciplinary engineering skills this course will cover fundamental concepts used in soft computing.
2. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA).
3. Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.
4. In summary, this course will provide exposure to theory as well as practical systems and software used in soft computing.

COURSE OUTCOMES: After completion of course, students would be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	List the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms.	L1,L2
2	Explain the concepts and meta-cognitive of soft computing.	L1,L2
3	Apply Soft computing techniques the solve character recognition, pattern Classification, regression and similar problems.	L1,L2,L3
4	Outline facts to identify process/procedures to handle real world problems using soft computing.	L1,L2,L3,L4,L5,L6
5	Evaluate various techniques of soft computing to defend the best working solutions	L1,L2,L3,L4,L5,L6
6	Design hybrid system to revise the principles of soft computing	L1,L2,L3,L4,L5,L6

	in various applications.	

Detailed syllabus:

Sr. No.	Detailed Content	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.	5	Remember (R), Understand (U)
2	Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification	7	Remember (R), Understand (U), Apply (A)
3	Neural network I: Artificial Neural Networks: An Introduction, Supervised Learning: Introduction and how brain works, Neuron as a simple computing element, The perceptron, Backpropagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, accelerated learning in multilayer perceptron, The Hopfield network, Bidirectional associative memories (BAM), RBF Neural Network.	9	Remember (R), Understand (U), Apply (A)
4	**Neural Network II:** Unsupervised Learning: Hebbian Learning, Generalized Hebbian learning algorithm, Competitive learning, Self-Organizing Computational Maps: Kohonen Network. Building blocks of Adaptive Resonance, Substrate of resonance, Structural details of the resonance Model, Adaptive Resonance Theory I, Adaptive Resonance Theory II. Special Networks: Simulated Annealing Network, Boltzmann Machine, Gaussian Machine, Cauchy Machine.	10	Remember (R), Understand (U), Apply (A), Analyze(AN)
5	**Genetic Algorithms:** Traditional Optimization and search techniques, Genetic algorithm and search space, History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Nature inspired Algorithms : Particle Swarm Algorithm and Ant Colony Algorithm.	9	Remember (R), Understand (U), Apply (A),
6	**Hybrid Computing:** Introduction, Neuro-Fuzzy Hybrid Systems, Adaptive Neuro-Fuzzy Inference System (ANIFS): Introduction, ANFS Architecture, Hybrid Algorithm, ANFIS as a Universal Approximator, Simulation Examples: Two-input Sinc Function and Three Input Nonlinear Function Genetic Neuro-Hybrid Systems: Properties of Genetic Neuro-Hybrid Systems, genetic Algorithm based Back-propagation Network, Advantages of Neuro-Genetic Hybrids, Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid	5	Remember (R), Understand (U), Apply (A), Analyze(AN)

	Systems Genetic Fuzzy Rule based Systems, Advantages of Genetic Fuzzy Hybrids.		

References:

Sr	Title	Authors	Publisher	Edition	Year
1	Principles of Soft Computing, Wiley India, 2007	S.N. Sivanandan and S.N. Deepa	Wiley India	Second	2007
2	Neuro-Fuzzy and Soft Computing, A Computational Approach to Learning and Machine Intelligence	J.-S. R. Jang, C. –T. Sun, E. Mizutani,	PHI Learning Private Limited	First	2014
3	Genetic Algorithms, in search, optimization and Machine Learning	David E. Goldberg	Pearson	First	1989

M.E. Semester –I
Choice Based Credit Grading Scheme (CBCGS 2023)

<table>
<tr><td colspan="5">ME (Information Technology)</td><td colspan="4">SEM : I</td></tr>
<tr><td colspan="5">Course Name : Web X.0</td><td colspan="4">Course Code : PEC-ITME1027</td></tr>
<tr><td colspan="5">Contact Hours Per Week : 03</td><td colspan="4">Credits : 03</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="4">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="4">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral (25)</td><td>Term Work (25)</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE : End Semester Examination - Paper Duration - 3 Hours</td></tr>
<tr><td colspan="10">Prerequisite: Web Engineering Concepts</td></tr>
</table>

Course Objective:

1. To understand the digital evolution of web technology.
2. To learn Type Script and understand how to use it in web applications.
3. To learn the fundamentals of Node.js.
4. To make Node.js applications using the express framework.
5. To enable the use of AngularJS to create web applications that depend on the Model-View-
6. Controller Architecture.
7. To gain expertise in a leading document-oriented NoSQL database, designed for speed, scalability, and developer agility using MongoDB and Mongoose.

Course Outcomes: After completion of course, students would be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the basic concepts related to web analytics and semantic web.	Understand(U)
2	Understand how Type Script can help you eliminate bugs in your code and enable you to scale your code.	Understand(U) Apply(A)
3	Develop back-end applications using Node.js.	Understand(U) Apply(A)
4	Construct web based Node.js applications using Express.	Understand(U) Apply(A)

5	Understand Angular Js framework and build dynamic, responsive single-page web applications.	Understand(U) Apply(A)
6	Apply MongoDB for frontend and backend connectivity using Mongoose and REST API.	Understand(U) Apply(A)

Detailed Syllabus:

Sr. No	Detailed Content	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to WebX.0: Evolution of WebX.0; **Web Analytics 2.0**: Introduction to Web Analytics, Web Analytics 2.0, Clickstream Analysis, Strategy to choose your web analytics tool, Measuring the success of a website; Web3.0 and Semantic Web: Characteristics of Semantic Web, Components of Semantic Web, Semantic Web Stack, N-Triples and Turtle, Ontology, RDF and SPARQL **Self-learning Topics**: Semantic Web Vs AI, SPARQL Vs SQL.	**7**	Understand(U)
2	TypeScript: Overview, TypeScript Internal Architecture, TypeScript Environment Setup, TypeScript Types, variables and operators, Decision Making and loops, TypeScript Functions, TypeScript Classes and Objects, TypeScript Inheritance and Modules **Self-learning Topics**: Javascript Vs TypeScript	**7**	Understand(U) Apply(A)
3	Node.js: Introducing the Node.js-to-Angular Stack (MEAN Stack), Environment setup for Node.js , First app, Asynchronous programming, Callback concept, Event loops, REPL, NPM, Event emitter, Buffers, Streams, Networking module, File system, Web module. **Self-learning Topics:** Node.js with MongoDB.	**8**	Understand(U) Apply(A)
4	**Express:** Introduction to Express ,Installing Express, Creating First Express application, The application, request, and response objects, Configuring Routes, Understanding Middleware, cookies, Session, Authentication **Self-learning Topics:** Express Js Templates	**7**	Understand(U) Apply(A)
5	Overview of AngularJS, Need of AngularJS in real websites, AngularJS modules, AngularJS built-in directives, AngularJS custom directives, AngularJS, expressions, AngularJS Data Binding, AngularJS filters, AngularJS controllers, AngularJS scope, AngularJS dependency injection, AngularJS Services, Form Validation, Routing. **Self-learning Topics:** MVC model, DOM model.	**6**	Understand(U) Apply(A) Analyze(AN)
6	**MongoDB**: Understanding MongoDB, MongoDB Data Types, Administering User Accounts, Configuring Access Control, Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Accessing and Manipulating Databases, Manipulating MongoDB Documents from Node.js, Accessing MongoDB from Node.js, Using Mongoose for Structured Schema and Validation.	**10**	Understand(U) Apply(A) Analyze(AN)

	Mongoose: Installation and connecting to MongoDB, understanding and extending Mongoose Schema, Define custom model methods and validation, Mongoose Middleware and DBRef. **REST API**: Examining the rules of REST APIs, Evaluating API patterns, Handling typical CRUD functions (Create, Read, Update, Delete), Using Express and Mongoose to interact with MongoDB, Testing API endpoints. **Self-learning Topics**: MongoDB vs SQL Databases		

Text books and References:

1. Boris Cherny, "Programming TypeScript- Making Your Javascript Application Scale", O'Reilly Media Inc.

2. Amos Q. Haviv, "MEAN Web Development" , PACKT Publishing
3. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development:The definitive guide to using the MEAN stack to build web applications", 2nd Edition, Addison-Wesley Professional
4. Adam Bretz and Colin J. Ihrig, "Full Stack JavaScript Development with MEAN", SitePoint.
5. Dr. Deven Shah, "Advanced Internet Programming", StarEdu Solutions. References:
6. Simon Holmes Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Manning Publications.
7. Yakov Fain and Anton Moiseev, "TypeScript Quickly", Manning Publications.

M.E. Semester –I

Choice Based Credit Grading Scheme (CBCGS 2023)

ME (Information Technology)							**SEM :** I		
Course Name : Web Analytics and Intelligence							**Course Code :** PEC-ITME1028		
Contact Hours Per Week : 03							**Credits** : 03		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: Fundamentals of Web Analytics									

Course Objective:To explore use of social network analysis to understand growing connectivity and complexity in the world ranging from small groups to WWW.

Detailed syllabus:

Sr. No.	**Detailed Content**	**Hrs.**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	**Introduction:** Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, On site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations. **Data Collection:** Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.	4	Understand(U), Evaluate(E)
2	**Qualitative Analysis:** Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys. **Web Analytic fundamentals**: Capturing data: Web logs or	10	Understand(U), Create (C)

	JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding click stream data quality, Identifying unique page definition, Using cookies, Link coding issues		
3	**Web Metrics:** Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non e-commerce sites): Improving bounce rates, Optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI.	10	Understand(U), Create (C) Evaluate (E)
4	**Relevant Technologies:** Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files & Cookies, Web Bugs.	10	Understand(U), Evaluate (E) Apply(A)
5	**Web Analytics 2.0**:Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.	7	Understand(U), Evaluate (E)
6	**Google Analytics:** Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.	4	Understand(U),

References:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed.

2. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. 1st ed.

3. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons