Scheme and Syllabus for M. Tech. in Computer Science and Technology

(Adopted from AICTE Model Curriculum for Postgraduate Degree Courses in Engineering & Technology
January 2018)

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY,

CENTRAL UNIVERSITY OF JAMMU

जम्मू केंद्रीय विश्वविद्यालय

Central University of Jammu

रया- सूचानी ,बागला, जिला सांबा-181143 जम्मू ,जम्मू एवं कश्मीर
Rahya- Suchani (Bagla), District Samba-181143, Jammu (J &K)

No. CUJ/ACAD/CSIT-M-TECH/2017/460

29th October, 2018

NOTIFICATION No. 61/2018

Sub: Course Scheme and Syllabus of 1st **Semester** of M.Tech. in Computer Science and Technology w.e.f. Academic Session **2018-19** – (eg.

Ref: Notification No. CUJ/ACAD/CSIT-M-TECH/2017/06 dated 13.01.2018

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It is hereby notified for the information of all concerned that on the recommendation of the Board of Studies, Department of Computer Science and Information Technology, the Academic Council has approved the following **Course Scheme and Syllabus of 1st semester** of M.Tech. in Computer Science and Technology w.e.f. Academic Session **2018-19**.

Semester - I

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
	Core courses					
PGMTH1C009T	Mathematical Foundations of Computer Science	4	25	25	50	100
PGMTH1C010T	Advanced Data Structures	4	25	25	50	100
PGMTH1C011L	Laboratory – I (Advanced Data Structures)	2	-	-	-	50
PGMTH1C012L	Lab Based on Elective – I	2	-	-	-	50
PGMTH1C013T	Research Methodology and IPR	2	12.5	12.5	25	50
	Elective – 1 Course					
PGMTH1E011T	Machine Learning					
PGMTH1E012T	Wireless Sensor Networks	4	25	25	50	100
PGMTH1E013T	Introduction to Intelligent Systems					
	Elective – II (MOOC Courses)					
PGMTH1E014T	Data Science					
PGMTH1E015T	Distributed Systems	4	25	25	50	100
PGMTH1E016T	Advanced Wireless and Mobile Networks					
PGMTH1E017T	MOOC available on SWAYAM					
	Audit Courses (Non-Credit)					
PGMTH1A001T	English for Research paper writing					
PGMTH1A002T	Disaster Management					
PGMTH1A003T	Sanskrit for Technical Knowledge					
PGMTH1A004T	Value Education					
PGMTH1A005T	Constitution of India	-	-	-	-	
PGMTH1A006T	Pedagogy Studies					
PGMTH1A007T	Stress Management by Yoga					
PGMTH1A008T	Personality Development through Life Enlightenment Skills					
	Total	22	-	-	-	550

Deputy Registrar
(Admin – HR)

Encl: Syllabus of 1st Semester

To:
Head, Department of CS&IT

Copy to:
OSD (Exam)

No. CUJ/ACAD/CSIT-M.TECH./2019/ 102

4th April, 2018

NOTIFICATION No. 24th / 2019

Sub: Course Scheme and Syllabus of 2nd, 3rd and 4th Semester of M. Tech. in Computer Science and Technology – Reg.

Ref: i) Notification No. 04 of 2018 dated 02.01.2018
ii) Notification No. 62 of 2018 dated 29.10.2018

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It is hereby notified for the information of all concerned that on the recommendation of the Board of Studies, Department of Computer Science and Information Technology and Dean, School of Basic & Applied Sciences, the Academic Council has approved the following **Course Scheme and Syllabus of 2nd, 3rd and 4th Semester of M. Tech. in Computer Science and Technology w.e.f. Academic Session as indicated against each semester. The approved course scheme and syllabus are as follows:

Semester – 2nd (Academic Session: 2018-19)

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
	Core courses					
PGMTH2C007T	Advanced Database Management Systems	4	25	25	50	100
PGMTH2C005L	Lab based on PGMTH2C007T	2	12.5	12.5	25	50
PGMTH2C008T	Advanced Software Design, Development and Testing	4	25	25	50	100
	Elective – III Course (Any One)					
PGMTH2E009T	Network & Cyber Security					
PGMTH2E010T	Big Data Analytics					
PGMTH2E011T	Computing Systems for Robotics	4	25	25	50	100
PGMTH2E012T	Agile Software Development					
PGMTH2E013T	Cloud Computing					
PGMTH2E014T	Modeling Simulation & Optimization					
	Elective – IV (Any One)					
PGMTH2E015T	Computer Vision					
PGMTH2E016T	Soft Computing					
PGMTH2E017T	Data Warehousing and Data Mining	4	25	25	50	100
PGMTH2E018T	Advanced Java Programming					
PGMTH2E019T	Advanced Web Technologies					
PGMTH2E020T	Lab based on Elective – IV	2	12.5	12.5	25	50
	Interdisciplinary Course					
	MOOC course available on SWAYAM	4	-	-	-	100
	Total	24	-	-	-	600

Semester – 3rd (Academic Session: 2019-20)

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
	Core courses					
PGMTH3C008T	Advances in Computer Networks	4	25	25	50	100
PGMTH3C006D	Dissertation – Part I	8	50	50	100	200
	Seminar	2	12.5	12.5	25	50

	Elective – V Course (Any One)					
PGMTH3E008T	Pattern Recognition					
PGMTH3E009T	Internet of Things					
PGMTH3E010T	Parallel Computing					
PGMTH3E011T	Digital Forensics	4	25	25	50	100
PGMTH3E012T	Advances in Operating Systems					
PGMTH3E013T	Android and iOS based Application Development					
						450
	Total	18	-	-		

Semester – 4th (Academic Session: 2019-20)

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
	Core courses					
PGMTH4C002D	Dissertation – Part II	18	75	150	225	450
						450
	Total	18	-	-	-	

Deputy Registrar 4/4/19
(Admin – HR)

Encl:

To:
        Head, Department of CS&IT

Copy to:
        OSD (Exam)

Department of Computer Science and Information Technology

Programme Educational Objectives (PEOs)

We focus on the following objectives to realize our vision.

PEO-1: To gain in-depth knowledge of Computer Science and Technology and acquire capabilities to compete at the global level with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge to conduct research in theoretical, practical, and policy contexts.

PEO-2: Have in-depth knowledge and research skills to professionally practice in a variety of fields including Security, Machine Learning, Internet of Things (IoT), Natural Language Processing, and Ubiquitous Computing.

PEO-3: Acquire professional and intellectual integrity and ethics, learn independently and continuously to upgrade the knowledge and competence with enthusiasm.

Programme Outcomes (POs)

A postgraduate of the Computer Science and Technology Program will demonstrate

PO-1: An ability to independently carry out research and development work to solve practical problems.

PO-2: Ability to write and present a substantial technical report/document.

PO-3: A degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO-4: An ability to use modern computational tools in modeling, simulation, and analysis with effective participation in multi-disciplinary teams and contribute towards achieving the common goals of the team.

PO-5: An ability to work with integrity and ethics in their professional practice having an understanding of responsibility towards society with sustainable development for a lifetime.

COURSE TITLE: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
COURSE No.:

Internal Assessment=25	**Mid-Term Exam.=25**	**End –Term Exam. = 50**
Total Marks= 100		**Credits: 4**
DURATION OF EXAM: 3 HOURS		**Lectures: 4 hours per week**

COURSE OBJECTIVES
- To understand the mathematical fundamentals that is prerequisites for avariety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
- 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.
- To study various sampling and classification problems.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I 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	9
Unit - II Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood	9
Unit -III Statistical inference**,** Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** The problem of overfitting model assessment.	10
Unit - IV Graph Theory: Isomorphism, Planar graphs, graph colouring, hamilton circuits and euler cycles.	10

Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems	
Unit - V **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**

COURSE OUTCOMES
After completion of course, students would be able to:
- To understand the basic notions of discrete and continuous probability.
- To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
- To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

TEXT/REFERENCES BOOKS
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 Combinatorics, Wiley

COURSE TITLE: ADVANCED DATA STRUCTURES   **COURSE No.:**

Internal Assessment=25	**Mid-Term Exam.=25**	**End –Term Exam. = 50**
Total Marks= 100		**Credits: 4**
DURATION OF EXAM: 3 HOURS		**Lectures: 4 hours per week**

COURSE OBJECTIVES

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness

Total Number of Lectures: 48

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **Dictionaries:** Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.	9
Unit - II **Skip Lists**: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of SkipLists, Deterministic Skip Lists.	6
Unit -III **Trees**: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees	9
Unit - IV **Text Processing**: Sting Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	12

Unit - V	12
Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searchinga Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees. **Recent Trends** in Hashing, Trees and various computational geometry methods for efficiently solving the new evolving problem. .	

COURSE OUTCOMES
After completion of course, students would be able to:
- Understand the implementation of symbol table using hashing techniques.
- Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

TEXT/REFERENCES BOOKS
1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002

COURSE TITLE: WIRELESS SENSOR NETWORKS   COURSE No.:
Internal Assessment=25   Mid-Term Exam.=25   End –Term Exam. = 50
Total Marks= 100   Credits: 4
DURATION OF EXAM: 3 HOURS   Lectures: 4 hours per week

COURSE OBJECTIVES
- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **Introduction to Wireless Sensor Networks:** Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors **Network Architecture:** Traditional layered stack, Cross-layer designs, Sensor Network Architecture **Hardware Platforms:** Motes, Hardware parameters	10
Unit - II **Introduction to ns-3: I**ntroduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.	9
Unit -III **Medium Access Control Protocol design:** Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled **Introduction to Markov Chain:** Discrete time Markov Chain definition, properties, classification and analysis **MAC Protocol Analysis:** Asynchronous duty-cycled. X-MAC Analysis	10

(Markov Chain)	
Unit - IV **Security**: Possible attacks, countermeasures, SPINS, Static and dynamic key Distribution	9
Unit - V **Routing protocols:** Introduction, MANET protocols **Routing protocols for WSN**: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast **Opportunistic Routing Analysis**: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks. Recent development in WSN standards, software applications.	10

COURSE OUTCOMES
After completion of course, students would be able to:
- Describe and explain radio standards and communication protocols for wireless sensor networks.
- Explain the function of the node architecture and use of sensors for various applications.
- Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

TEXT/REFERENCES BOOKS
3. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", Wiley 2010
4. KazemSohraby, Daniel Minoli and TaiebZnati, "wireless sensor networks -Technology, Protocols, and Applications", Wiley Interscience 2007
5. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer 2010

COURSE TITLE: DISTRIBUTED SYSTEMS   COURSE No.:
Internal Assessment=25   Mid-Term Exam=25   End –Term Exam. = 50
Total Marks= 100   Credits: 4
DURATION OF EXAM: 3 HOURS   Lectures: 4 hours per week

COURSE OBJECTIVES

- To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **INTRODUCTION** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts **DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE** Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues	10
Unit - II **DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic Integrity Control **QUERY PROCESSING ISSUES** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	10
Unit -III **DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms	10

TRANSACTION MANAGEMENT The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models **CONCURRENCY CONTROL** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management	
Unit - IV **RELIABILITY** Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols, Mobile Databases , Multi-databases	**9**
Unit - V **PARALLEL DATABASE SYSTEMS** Parallel architectures; parallel query processing and optimization; load balancing, Distributed Object Management.	**9**

COURSE OUTCOMES
After completion of course, students would be able to:
- Design trends in distributed systems.
- Apply network virtualization.
- Apply remote method invocation and objects.

TEXT/REFERENCES BOOKS
1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

COURSE TITLE: ADVANCED WIRELESS AND MOBILE NETWORKS COURSE No.:

Internal Assessment=25	**Mid-Term Exam.=25**	**End –Term Exam. = 50**
Total Marks= 100		**Credits: 4**
DURATION OF EXAM: 3 HOURS		**Lectures: 4 hours per week**

COURSE OBJECTIVES
- The students should get familiar with the wireless/mobile market and the future needs and challenges.
- To get familiar with key concepts of wireless networks, standards, technologies and their basic operations
- To learn how to design and analyse various medium access
- To learn how to evaluate MAC and network protocols using network simulation software tools.
- The students should get familiar with the wireless/mobile market and the future needs and challenges.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **INTRODUCTION:** Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc. **WIRELESS LOCAL AREA NETWORKS:** IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues	10
Unit - II **WIRELESS CELLULAR NETWORKS:** 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving	10

coverage and capacity in cellular systems, Spread spectrum Technologies.	
Unit -III	10
WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview **WIRELESS SENSOR NETWORKS** Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.	
Unit - IV	9
WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors,. **ADVANCED TOPICS** IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks	
Unit - V	9
SECURITY Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.	

COURSE OUTCOMES
After completion of course, students would be able to:
- Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
- Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
- Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
- Design wireless networks exploring trade-offs between wire line and wireless links.
- Develop mobile applications to solve some of the real world problems.

TEXT/REFERENCES BOOKS
1. Schiller J., Mobile Communications, Addison Wesley 2000
2. Stallings W., Wireless Communications and Networks, Pearson Education 2005
3. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
4. Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000
5. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

COURSE TITLE: MACHINE LEARNING   **COURSE No.:**

Internal Assessment=25	**Mid-Term Exam.=25**	**End –Term Exam. = 50**
Total Marks= 100		**Credits: 4**
DURATION OF EXAM: 3 HOURS		**Lectures: 4 hours per week**

COURSE OBJECTIVES
- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **Supervised Learning (Regression/Classification)** - Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes. - Linear models: Linear Regression, Logistic Regression, Generalized Linear Models. - Support Vector Machines, Nonlinearity and Kernel Methods - Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	10
Unit - II **Unsupervised Learning** - Clustering: K-means/Kernel K-means - Dimensionality Reduction: PCA and kernel PCA - Matrix Factorization and Matrix Completion - Generative Models (mixture models and latent factor models)	7
Unit -III Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6
Unit - IV	11

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning. Introduction to Bayesian Learning and Inference. Scalable Machine Learning (Online and Distributed Learning).	
Unit - V A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications	**12**

COURSE OUTCOMES
After completion of course, students would be able to:
- To mathematically analyse various machine learning approaches and paradigms.
- Extract features that can be used for a particular machine learning approach in various IOT applications.
- To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.

TEXT/REFERENCES BOOKS
1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

COURSE TITLE: INTRODUCTION TO INTELLIGENT SYSTEMS   COURSE No.:

Internal Assessment=25	**Mid-Term Exam=25**	**End –Term Exam = 50**
Total Marks= 100		**Credits: 4**
DURATION OF EXAM: 3 HOURS		**Lectures: 4 hours per week**

COURSE OBJECTIVES
- The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.
- It explores the essential theory behind methodologies for learning from experience and following problem solving strategies found in nature.

Total Number of Lectures: 43

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **Biological foundations to intelligent systems I:** Artificial neural networks, Back propagation networks, Radial basis function networks, and recurrent networks.	9
Unit – II **Biological foundations to intelligent systems II:** Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.	6
Unit –III **Search Methods** Basic concepts of graph and tree search. **Three simple search methods:** breadth-first search, depth-first search, iterative deepening search. **Heuristic search methods:** best-first search, admissible evaluation functions, hill climbing search. Optimization and search such as stochastic annealing and genetic algorithm.	7
Unit – IV **Knowledge representation and logical inference:** Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of	9

Blackboard architectures.	
Unit – V **Reasoning under uncertainty and Learning Techniques** on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning. **Recent trends** in Fuzzy logic, Knowledge Representation.	**12**

COURSE OUTCOMES

After completion of course, students would be able to:
- Able to Demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyze and compare the relative merits of a variety of AI problem solving techniques.

TEXT/REFERENCES BOOKS
1. Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.
2. Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice Hall, 3rd edition.

COURSE TITLE: DATA SCIENCE	**COURSE No.:**	
Internal Assessment=25	**Mid-Term Exam.=25**	**End –Term Exam. = 50**
Total Marks= 100		**Credits: 4**
DURATION OF EXAM: 3 HOURS		**Lectures: 4 hours per week**

COURSE OBJECTIVES

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
- Produce Python code to statistically analyze a dataset;
- Critically evaluate data visualizations based on their design and use for communicating stories from data;

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.	6
Unit - II Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources	7
Unit -III Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance,Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.	10
Unit - IV Data visualisation: Introduction, Types of data visualisation, various	15

visualization techniques, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings. Technologies for visualisation	
Unit - V Applications of Data Science, Recent trends in various data collection and analysis techniques, application development methods of used in data science. Bokeh (Python) .	**10**

COURSE OUTCOMES

After completion of course, students would be able to:

• Explain how data is collected, managed and stored for data science;

• Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;

• Implement data collection and management scripts using MongoDB

TEXT/REFERENCES BOOKS

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.

2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press

COURSE TITLE: RESEARCH METHODOLOGY AND IPR   COURSE No.:
Internal Assessment=12.5   Mid-Term Exam=12.5   End –Term Exam= 25
Total Marks= 50   Credits: 2
DURATION OF EXAM: 2 HOURS   Lectures: 2 hours per week

COURSE OBJECTIVES
- Understand research problem formulation.
- Analyze research related information.
- Follow research ethics.
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Total Number of Lectures: 25

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I	**11**
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.	
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	
Effective literature studies approaches, analysis, Plagiarism, Research ethics.	
Effective technical writing, how to write report, Paper	
Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	
Unit - II	**7**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.	
International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	
Unit -III	**7**
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	

TEXT/REFERENCES BOOKS

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners".
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course: M.Tech. (Computer Science & Technology)
Semester: III
(Syllabus for the examination to be held in November/December 2018)

COURSE TITLE: VALUE EDUCATION   **COURSE No.:**
Internal Assessment=12.5   **Mid-Term Exam.=12.5**   **End –Term Exam. = 25**
Total Marks= 50   **Credits: 0**
DURATION OF EXAM: 2 HOURS   **Lectures: 2 hours per week**

COURSE OBJECTIVES
   1. Understand value of education and self- development.
   2. Imbibe good values in students.
   3. Let the students should know about the importance of character.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I • Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. • Moral and non- moral valuation. Standards and principles. • Value judgements	4
Unit - II • Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, • Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism. Love for nature, Discipline	6
Unit -III • Personality and Behaviour Development - Soul and Scientific attitude, Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	6
Unit - IV	6

• Character and Competence –Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Non-violence, Humility, Role of Women. • All religions and same message. • Mind your Mind, Self-control. • Honesty, Studying effectively	

COURSE OUTCOMES
After completion of course, students would be able to:
1. Knowledge of self-development.
2. Learn the importance of Human values.
3. Developing the overall personality.

TEXT/REFERENCES BOOKS
1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

COURSE TITLE: PEDAGOGY STUDIES   **COURSE No.:**
Internal Assessment=12.5   **Mid-Term Exam.=12.5**   **End –Term Exam. = 25**
Total Marks= 50   **Credits: 0**
DURATION OF EXAM: 2 HOURS   **Lectures: 2 hours per week**

COURSE OBJECTIVES
1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I ☐ **Introduction and Methodology:** • Aims and rationale, Policy background, Conceptual framework and terminology • Theories of learning, Curriculum, Teacher education. • Conceptual framework, Research questions**.** • Overview of methodology and Searching. • Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. • Curriculum, Teacher education.	6
Unit -II • Evidence on the effectiveness of pedagogical practices • Methodology for the in depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? • Theory of change. • Strength and nature of the body of evidence for effective pedagogical practices. • Pedagogic theory and pedagogical approaches. • Teachers' attitudes and beliefs and Pedagogic strategies.	4
Unit - III • Professional development: alignment with classroom practices and follow-up support • Peer support	6

• Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes **Research gaps and future directions** • Research design • Contexts	

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

1. What pedagogical practices are being used by teachers in formal and informal classrooms in Developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions,   and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

TEXT/REFERENCES BOOKS

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
1. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
2. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education   research project (MUSTER) country report 1. London: DFID.
3. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
4. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
5. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE TITLE: CONSTITUTION OF INDIA   **COURSE No.:**
Internal Assessment=12.5   **Mid-Term Exam.=12.5**   **End –Term Exam. = 25**
Total Marks= 50   **Credits: 0**
DURATION OF EXAM: 2 HOURS   **Lectures: 2 hours per week**

COURSE OBJECTIVES
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I	
• **History of Making of the Indian Constitution:** History • Drafting Committee, (Composition & Working) • **Philosophy of the Indian Constitution:** Preamble Salient Features **Contours of Constitutional Rights & Duties:** • Fundamental Rights • Right to Equality • Right to Freedom • Right against Exploitation • Right to Freedom of Religion • Cultural and Educational Rights • Right to Constitutional Remedies • Directive Principles of State Policy • Fundamental Duties.	**12**
Unit - II **Organs of Governance:** • Parliament • Composition • Qualifications and Disqualifications • Powers and Functions	**4**

• Executive • President • Governor • Council of Ministers • Judiciary, Appointment and Transfer of Judges, Qualifications • Powers and Functions	
Unit - III **Local Administration:** • District's Administration head: Role and Importance, • Municipalities: Introduction, Mayor and role of Elected Representative, • CEO of Municipal Corporation. • Pachayati raj: Introduction, PRI: ZilaPachayat. • Elected officials and their roles, CEO ZilaPachayat: Position and role. • Block level: Organizational Hierarchy (Different departments), • Village level: Role of Elected and Appointed officials, • Importance of grass root democracy **Election Commission:** • Election Commission: Role and Functioning. • Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women.	**8**

COURSE OUTCOMES
After completion of course, students would be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

TEXT/REFERENCES BOOKS
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

COURSE TITLE: STRESS MANAGEMENT BY YOGA   COURSE No.:
Internal Assessment=12.5   Mid-Term Exam. =12.5   End –Term Exam. = 25
Total Marks= 50   Credits: 2
DURATION OF EXAM: 2 HOURS   Lectures: 2 hours per week

COURSE OBJECTIVES
- To achieve overall health of body and mind.
- To overcome stress.

Total Number of Lectures: 24

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **Definitions of Eight parts of yog** (Ashtanga)	**8**
Unit - II **Yam and Niyam** Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	**8**
Unit –III **Asan and Pranayam** i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayama	**8**

COURSE OUTCOMES
After completion of course, students would be able to:
- Develop healthy mind in a healthy body thus improving social health also.
- Improve efficiency.

TEXT/REFERENCES BOOKS
1. "Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

COURSE TITLE: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS   **COURSE No.:**
Internal Assessment=12.5   **Mid-Term Exam. =12.5**   **End –Term Exam. = 25**
Total Marks= 50   **Credits: 2**
DURATION OF EXAM: 2 HOURS   **Lectures: 2 hours per week**

COURSE OBJECTIVES
- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination.
- To awaken wisdom in students.

Total Number of Lectures: 24

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **Neetisatakam-Holistic development of personality** Verses- 19,20,21,22 (wisdom),Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's)	**8**
Unit - II **Approach to day to day work and duties.** Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	**8**
Unit –III **Statements of basic knowledge.** **Shrimad BhagwadGeeta:** Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. **Shrimad BhagwadGeeta:** Chapter2-Verses 17, Chapter 3-Verses 36,37,42,Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63	**8**

COURSE OUTCOMES

After completion of course, students would be able to:

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students.

TEXT/REFERENCES BOOKS

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
3. Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE TITLE: ENGLISH FOR RESEARCH PAPER WRITING   **COURSE No.:**
Internal Assessment=12.5   **Mid-Term Exam.=12.5**   **End –Term Exam. = 25**
Total Marks= 50
DURATION OF EXAM: 2 HOURS   **Lectures: 2 hours per week**

COURSE OBJECTIVES

Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness,useful phrases	5
Unit - II Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction. Review of the Literature, Methods	7
Unit -III Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. how to ensure paper is as good as it could possibly be the first- time submission	12

TEXT/REFERENCES BOOKS

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) 2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course: M.Tech. (Computer Science & Technology)
Semester: I
(Syllabus for the examination to be held in November/December 2018)
AUDIT COURSE 1 & 2

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COURSE TITLE: DISASTER MANAGEMENT   **COURSE No.:**
Internal Assessment=12.5   **Mid-Term Exam.=12.5**   **End –Term Exam. = 25**
Total Marks= 50
DURATION OF EXAM: 2 HOURS   **Lectures: 2 hours per week**

COURSE OBJECTIVES

Students will be able to:

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I **Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude **Repercussions Of Disasters And Hazards:** Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	8

Unit -II **Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics **Disaster Preparedness And Management Preparedness:** Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	**8**
Unit - III **Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global CoOperation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival **Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India. submission	**8**

TEXT/REFERENCES BOOKS
1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

COURSE TITLE: SANSKRIT FOR TECHNICAL KNOWLEDGE   **COURSE No.:**
Internal Assessment=12.5   Mid-Term Exam.=12.5   End –Term Exam. = 25
Total Marks= 50
DURATION OF EXAM: 2 HOURS   Lectures: 2 hours per week

COURSE OBJECTIVES

Students will be able to:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects
- enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit - I • Alphabets in Sanskrit, • Past/Present/Future Tense, • Simple Sentences	**8**
Unit - II • Order • Introduction of roots • Technical information about Sanskrit Literature	**8**
Unit -III • Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	**8**

COURSE OUTCOMES
Students will be able to:

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

TEXT/REFERENCES BOOKS

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.