SCHOOL OF ENGINEERING AND TECHNOLOGY
Master of Technology- Computer Science and Engineering

Programme Code: SET0130
Duration- 2 Years Full Time

PROGRAM STRUCTURE
AND
CURRICULUM & SCHEME OF EXAMINATION
2019-20

Programme and Course Structure

School of Engineering & Technology

M.Tech

1.1Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

- Transformative educational experience.
- Enrichment by educational initiatives that encourage global outlook.
- Develop research, support disruptive innovations and accelerate entrepreneurship. Seeking beyond boundaries**.**

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.2 Vision and Mission of the SET

Vision of the SET

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship

Mission of the SET

M1: To impart quality education with strong industry & academic connectivity in the expanding fields of Engineering and Technology in a conductive and enriching learning environment.

M2: To product technocrats equipped with technical & soft skills and experiential learning required to stay current with the modern tools in emerging technologies to fulfill professional responsibilities and uphold ethical values.

M3: To inculcate a culture of interdisciplinary research, innovation and entrepreneurship to provide sustainable solutions to meet the growing challenges and societal needs.

M4: To foster collaborative learning and to play adaptive leadership role in professional career and pursuit of higher education through effective mentoring and counselling.

1.2 Vision and Mission of the Department

Vision of the Department

To be known and recognized as the fountainhead of excellence in technical knowledge and research in computer science and engineering, and draw to it the students and scholars across nations.

Mission of the Department

M1: To facilitate and foster the academia industry collaboration to enhance entrepreneurship skills and acquaintance with corporate culture.

M2: To strengthen core competences of students to be successful, ethical, effective problem solver in Computer Science & Engineering through analytical learning

M3: To promote research based activities in emerging areas of technology convergence.

M4: To induce moral values and spirit of social commitment.

1.3 Programme Educational Objectives (PEO)

1.3.1 Writing Programme Educational Objectives (PEO)

The Educational Objectives of UG Program in Computer Science Engineering are:

PEO1: The Graduate will ensconce himself/herself as effective professionals by solving real life problems using exploratory and analytical skills along with the knowledge acquired in the field of Computer Science and Engineering.

PEO2: The Graduate will demonstrate his/her ability to accustom to rapidly changing environment in advanced areas of Computer Science and scale new height in their profession through lifelong learning.

PEO3: The Graduate will have the ability to work and communicate effectively as a team member or leader to complete the task with minimal resources, meeting deadlines.

PEO4: The Graduate will embrace professional code of ethics in the profession while deliberately being part of projects which contributes to the society at large without disturbing the ecological balance.

Methods of Forming PEO's

STEP1: The needs of the Nation and society are identified through scientific publications, industry interaction and media.

STEP2: Taking the above into consideration, the PEOs are established by the coordination Committee of the department.

STEP3: The PEOs are communicated to the alumni and their suggestions are obtained.

STEP4: The PEOs are communicated to all the faculty members of the department and their feedback is obtained.

STEP5: The PEOs are then put to the Board of Studies of the department for final approval.

1.3.2 Map PEOs with School Mission Statements:

PEO Statements	School Mission 1	School Mission 2	School Mission 3	School Mission 4
PEO1:	**3**	**3**	**2**	**2**
PEO2:	**2**	**3**	**2**	**1**
PEO3:	**2**	**2**	**2**	**3**
PEO4:	**2**	**1**	**3**	**1**

Enter correlation levels 1, 2, or 3 as defined below:

1. **Slight (Low)** **2. Moderate (Medium)** **3. Substantial (High)**

If there is no correlation, put "-"

1.3.2.1 Map PEOs with Department Mission Statements:

PEO Statements	Department Mission 1	Department Mission 2	Department Mission 3	Department Mission 4
PEO1:	**2**	**3**	**2**	**1**
PEO2:	**1**	**3**	**3**	**1**
PEO3:	**3**	**2**	**1**	**1**
PEO4:	**1**	**2**	**2**	**3**
PEO5:	**2**	**3**	**2**	**1**

Enter correlation levels 1, 2, or 3 as defined below:

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

If there is no correlation, put "-"

1.3.3 Program Outcomes (PO's)

PO1: Communication-Students will be able to communicate in written and oral forms in such a way as to demonstrate their ability to present information clearly, logically, and critically.

PO2: Mathematics and Theory-Students will be able to apply mathematical and computing theoretical concepts in solution of common computing applications, such as computing the order of an algorithm.

PO3: Programming-Students will be able to complete successfully be able to program small-to-mid-size programs on their own. Sufficient programming skills will require use of good practice, e.g., good variable names, good use of computational units, appropriate commenting strategies.

PO4: Systems Design and Engineering-Students will be able to use appropriately system design notations and apply system design engineering process in order to design, plan, and implement software systems

PO5: Depth of Knowledge-In a self-selected area of depth in Computing, students will demonstrate a depth of knowledge appropriate to graduate study and/or lifelong learning in that area. Students should be able to read for understanding materials in that area beyond those assigned in coursework.

PO6: Preparation for Career-Students will be prepared for a career in an information technology-oriented business or industry, or for graduate study in computer science or other scientific or technical fields.

PSO1: Effectively communicating computing concepts and solutions to bridge the gap between computing industry experts and business leaders to create and initiate innovation

PSO2: Effectively utilizing their knowledge of computing principles and mathematical theory to develop sustainable solutions to current and future computing problems.

PSO3: Exhibiting their computing expertise within the computing community through corporate leadership, entrepreneurship, and/or advanced graduate study

PSO4: Developing and implementing solution based systems and/or processes that address issues and/or improve existing systems within in a computing based industry.

1.3.4 Mapping of Program Outcome Vs Program Educational Objectives

Mapping	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	2	3	2	3	3
PO2	2	3	3	3	2
PO3	3	2	3	3	3
PO4	2	1	3	1	3
PO5	2	3	3	2	1
PO6	2	2	2	3	2

1. Slight (Low) **2. Moderate (Medium)** **3. Substantial (High)**

School of Engineering and Technology							
M. Tech. (CSE) Software Engg.							
Batch: 2019 Onwards						TERM: I (Spring-II)	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1	CSE 611	Analysis and Design of Algorithms	3	1	0	4	
2	CSE 613	Mathematical and Statistical Techniques in Computer Science	3	1	0	4	
3		Departmental Elective-1	3	0	0	3	
	CSE 612	Object Oriented Software Engineering					
		Software Architecture and Design Pattern.					
4		Departmental Elective-2					
	CSE 642	Soft Computing Techniques	3	0	0	3	
5		Departmental Elective-3	3	0	0	3	
	CSE 643	Software Requirement and Estimation					
		Software Quality Metrics and Testing					
Practical/Viva-Voce/Jury							
1	CSP 611	Analysis and Design of Algorithms Lab	0	0	2	1	
2		Departmental Elective-1	0	0	2	1	
	CSP 612	Object Oriented Software Engineering Lab					
		Software Architecture and Design Pattern Lab					
TOTAL CREDITS						19	

School of Engineering and Technology							
M. Tech. (CSE) Software Engg.							
Batch: 2019 Onwards						TERM: II (Spring-I)	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1	CSE601	Pattern Recognition	3	1	0	4	
2	CSE622	Advanced Data Mining Techniques	3	0	0	3	
4		Departmental Elective-4	3	0	0	3	
	CSE644	Agile Based Software Engineering					
		Secure Software Engineering					
5		Departmental Elective-5	2	0	0	2	
		Recent Advances in Software Engineering.					
6		Departmental Elective-6	3	0	0	3	
	CSE635	Software Reliability Engineering					
	CSE621	Web Engineering					
7		Departmental Elective-7	3	0	0	3	
		Component Based Software Engineering					
Practical/Viva-Voce/Jury							
1	CSE601	Pattern Recognition	0	0	2	1	
2		Departmental Elective-4	0	0	2	1	
	CSP644	Agile Based Software Engineering					
		Secure Software Engineering					
3		Departmental Elective-5	0	0	2	1	
		Recent Advances in Software Engineering.					
4		Research Methodology	0	0	4	2	
5	CCU101	Community Connect	-	-	-	2	
TOTAL CREDITS						25	

School of Engineering and Technology							
M. Tech. (CSE) Software Engg.							
Batch: 2019 Onwards						TERM: III	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
Practical/Viva-Voce/Jury							
1	CSP681	Seminar	-	-	-	2	
3	CSP691	Dissertation 1	-	-	-	10	
TOTAL CREDITS						12	

School of Engineering and Technology							
M. Tech. (CSE) Software Engg.							
Batch: 2019 Onwards						TERM: IV	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
Practical/Viva-Voce/Jury							
1.	CSP692	Dissertation-II	-	-	-	16	
TOTAL CREDITS						16	

School of Engineering and Technology							
M. Tech. (CSE) Data Science							
Batch: 2019 Onwards						TERM: I (Spring-II)	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1	CSE 611	Analysis and Design of Algorithms	3	1	0	4	
2	CSE 613	Mathematical and Statistical Techniques in Computer Science	3	1	0	4	
3		Departmental Elective-1	3	0	0	3	
	CSE604	Data Acquisition and Production					
		Massive and Graph Analysis					
4		Departmental Elective-2					
	CSE 642	Soft Computing Techniques	3	0	0	3	
5		Departmental Elective-3	3	0	0	3	
	CSE605	Machine Learning					
		Image and Video Analysis					
Practical/Viva-Voce/Jury							
1	CSP 611	Analysis and Design of Algorithms Lab	0	0	2	1	
2		Departmental Elective-1	0	0	2	1	
	CSP604	Data Acquisition and Production					
		Massive and Graph Analysis					
TOTAL CREDITS						19	

School of Engineering and Technology							
M. Tech. (CSE) Data Science							
Batch: 2019 Onwards						TERM: II (Spring-I)	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1	CSE601	Pattern Recognition	3	1	0	4	
2	CSE622	Advanced Data Mining Techniques	3	0	0	3	
4		Departmental Elective-4	3	0	0	3	
		Bioinformatics					
		Health Care and Analytics					
5		Departmental Elective-5	2	0	0	2	
		Advance Web Analytics					
		Internet of Things and its applications.					
6		Departmental Elective-6	3	0	0	3	
	CSE618	Big Data Analytics					
	CSE620	Deep Learning and web					
7		Departmental Elective-7	3	0	0	3	
	CSE608	Natural Language Computing					
Practical/Viva-Voce/Jury							
1	CSE601	Pattern Recognition	0	0	2	1	
2		Departmental Elective-4	0	0	2	1	
		Bioinformatics					
		Health Care and Analytics					
3		Departmental Elective-5	0	0	2	1	
		Advance Web Analytics					
		Internet of Things and its applications.					

4		Research Methodology	0	0	4	2	
5	CCU101	Community Connect	-	-	-	2	
TOTAL CREDITS						25	

School of Engineering and Technology							
M. Tech. (CSE) Data Science							
Batch: 2019 Onwards						TERM: III	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
Practical/Viva-Voce/Jury							
1	CSP681	Seminar	-	-	-	2	
3	CSP691	Dissertation 1	-	-	-	10	
TOTAL CREDITS						12	

School of Engineering and Technology							
M. Tech. (CSE) Data Science							
Batch: 2019 Onwards						TERM: IV	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
Practical/Viva-Voce/Jury							
1.	CSP692	Dissertation-II	-	-	-	16	
TOTAL CREDITS						16	

School of Engineering and Technology							
M. Tech. (CSE) Networking and Cyber Security							
Batch: 2019 Onwards						TERM: I (Spring-II)	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1	CSE 611	Analysis and Design of Algorithms	3	1	0	4	
2	CSE 613	Mathematical and Statistical Techniques in Computer Science	3	1	0	4	
3		Departmental Elective-1	3	0	0	3	
	CSE630	Advanced Computer Network					
		Vehicular Communication Network					
4		Departmental Elective-2					
	CSE 642	Soft Computing Techniques	3	0	0	3	
5		Departmental Elective-3	3	0	0	3	
		Advanced Mobile computing					
	CSE632	Advanced Network Security					
Practical/Viva-Voce/Jury							
1	CSP 611	Analysis and Design of Algorithms Lab	0	0	2	1	
2		Departmental Elective-1	0	0	2	1	
	CSP630	Advanced Computer Network					
		Vehicular Communication Network					
TOTAL CREDITS						19	

School of Engineering and Technology							
M. Tech. (CSE) Networking and Cyber Security							
Batch: 2019 Onwards						TERM: II (Spring-I)	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1	CSE601	Pattern Recognition	3	1	0	4	
2	CSE622	Advanced Data Mining Techniques	3	0	0	3	
4		Departmental Elective-4	3	0	0	3	
		Wireless Sensor Network					
	CSE616	Intrusion Detection & Prevention					
	CSE606	Cloud Services in Mobile					
		Applications Programming					
5		Departmental Elective-5	2	0	0	2	
		Grid Computing					
		Performance Modeling of Computer Communication network					
6		Departmental Elective-6	3	0	0	3	
		Ad Hoc Wireless Networks					
		Advanced Wireless Communication					
7		Departmental Elective-7	3	0	0	3	
		Malware Analysis, Detection & Prevention					
		Advanced Cryptography					
Practical/Viva-Voce/Jury							
1	CSE601	Pattern Recognition	0	0	2	1	
2		Departmental Elective-4	0	0	2	1	
		Wireless Sensor Network					
	CSP616	Intrusion Detection & Prevention					

	CSP606	Cloud Services in Mobile					
		Applications Programming					
3		Departmental Elective-5	0	0	2	1	
		Grid Computing					
		Performance Modeling of Computer Communication network					
4		Research Methodology	0	0	4	2	
5	CCU101	Community Connect	-	-	-	2	
TOTAL CREDITS						25	

School of Engineering and Technology							
M. Tech. (CSE) Networking and Cyber Security							
Batch: 2019 Onwards						TERM: III	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
Practical/Viva-Voce/Jury							
1	CSP681	Seminar	-	-	-	2	
3	CSP691	Dissertation 1	-	-	-	10	
TOTAL CREDITS						12	

School of Engineering and Technology							
M. Tech. (CSE) Networking and Cyber Security							
Batch: 2019 Onwards						TERM: IV	
S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
Practical/Viva-Voce/Jury							
1.	CSP692	Dissertation-II	-	-	-	16	
TOTAL CREDITS						16	

Course Modules

Analysis and Design of Algorithm

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Data Science		**Semester: I**	
1	Course Code	**CSE 611**	Course Name: **Analysis and Design of Algorithm**
2	Course Title	**Analysis and Design of Algorithm**	
3	Credits	5	
4	Contact Hours (L-T-P)	3-1-2	
	Course Status	PG	
5	Course Objective	The objective of the course is to teach techniques for effective problem solving in computing. The use of different paradigms of problem solving will be used to illustrate efficient ways to solve a given problem. In each case emphasis will be placed on rigorously proving correctness of the algorithm. In addition, the analysis of the algorithm will be used to show the efficiency of the algorithm over the naive techniques.	
6	Course Outcome	1.Understand the fundamentals of Design and Analysis of Algorithms and Distinguish the concept of NPHard and NPComplete Problems. 2.Apply the Concept of Divide and Conquer method to solve real world problems. 3.Demonstrate the Dynamic programming techniques. 4.Apply the Concept of Greedy method to solve the real world problems of backtracking 5. Explain the various mathematical concepts and implement the pattern matching algorithms.	
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Algorithm Design Paradigms- Motivation, Concept of algorithmic efficiency, Run time analysis of algorithms, Growth of Functions, Asymptotic Notations	CO1
	B	Recurrences: Master's Method, Iteration Method & Recursion Tree Method.	CO1
	C	Theory of NP-Completeness: Introduction to Class-P, NP, NP- Hard & NP-Complete with examples, Approximation Algorithms- Vertex Cover and Travelling Salesperson Problem, Turing's Halting Problem.	CO1
	Unit 2	**Divide and conquer**	

	A	Structure & Analysis of divide-and-conquer algorithms: examples-Binary search			CO2
	B	Quick sort, Merge sort, Discrete Fourier Transform and Fast Fourier Transform, Medians and Order Statistics			CO2
	C	i^{th} order statistics, Randomized Algorithms – Randomized Quick Sort, Calculation of value of π.			CO2
	Unit 3	**Dynamic Programming**			
	A	Overview, Difference between dynamic programming and divide and conquer			CO3
	B	Applications and analysis: Matrix Chain Multiplication, 0/1 Knapsack Problem			CO3
	C	All-pairs Shortest path in graphs, Longest Common Sub-sequence, Optimal Binary Search Tree.			CO3
	Unit 4	**Greedy Method**			
	A	Overview of the Greedy paradigm, Fractional Knapsack problem, Minimum spanning Trees			CO4
	B	Single source shortest paths, Task Scheduling Problem, Huffman Coding Algorithm			CO4
	C	Backtracking: Concepts and N-Queens Problem, Branch and Bound: Concepts and Sum of Subsets Problem			CO4
	Unit 5	**Approximation Algorithms**			
	A	Overview, Performance Bounds, Specific Algorithms: Pattern Matching Algorithms: Rabin Karp Algorithm			CO5
	B	Knuth Morris Pratt Algorithm, String Matching with Finite Automata			CO5
	C	Euclid's algorithm, Chinese Reminder Theorem, Greatest Common Divisor.			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Cormen et al, "Introduction of Computer Algorithm", Prentice Hall India.			
	Other References	1. Sahni et al, "Fundamentals of Computer Algorithms", Galgotia Publication. 2. Internet as a Resource for Reference.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Understand the fundamentals of Design and Analysis of Algorithms and Distinguish the concept of NPHard and NPComplete Problems.	
2.	Apply the Concept of Divide and Conquer method to solve real world problems.	
3.	Demonstrate the Dynamic programming techniques.	
4.	Apply the Concept of Greedy method to solve the real world problems of backtracking	
5.	Explain the various mathematical concepts and implement the pattern matching algorithms.	

PO and PSO mapping with level of strength

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	2	2	3	3	2	2	3	4	3	2	3	3	3	3
CO2	4	4	3	3	4	3	2	2	2	2	2	3	2	3	3	3	3
CO3	4	3	4	5	3	4	4	3	2	3	3	2	3	4	3	3	4
CO4	3	4	4	5	3	2	3	3	4	3	3	2	4	3	3	3	3
CO5	2	3	4	4	3	3	4	3	2	3	3	4	3	2	3	4	3

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Data Science		**Semester: I**	
1	Course Code	**CSE 613**	Course Name: **Mathematical and Statistical techniques**
2	Course Title	**Mathematical and Statistical techniques**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	PG	
5	Course Objective	The objective of the course is to teach students the mathematical & statistical techniques that provide sound basis for research and application development in Computer Science.	
6	Course Outcome	By the end of the course, students will be able to: 1. Understand important mathematical and statistical methods that are essential for Computer Science research and application development; 2. Apply mathematical and statistical methods in their research and application development; and 3. Use a mathematical tool such as MATLAB efficiently.	
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction, Computational Errors and their Analysis**	
	A	Accuracy of numbers, Errors and a general error formula, Errors in Numerical Computations and Inverse Problems	
	B	Floating Point Representations of Numbers and operations, Errors in a Series Approximation	
	C	Algebraic & Transcendental Equations: Order of convergence of iterative and bisection methods, Convergence of a Sequence, Iterative methods for system of non-linear equations, Regular Falsi method	
	Unit 2	**Algorithmic Optimization**	
	A	Assumptions for interpolation, errors in polynomial interpolation, finite differences, difference operators and their relationship, Newton's interpolation formula	

	B	Introduction to numerical differentiation, Introduction to numerical integration, Trapezoidal and Simpson's rules,			
	C	Introduction to numerical solution of ordinary differential equations, Euler's method.			
	Unit 3	**Vector Calculus**			
	A	Scalar functions of several variables, Partial derivatives and differentiability, gradient vector, vector fields			
	B	Linear Systems, Orthogonality, Eigenvalues & Eigenvectors: Vector spaces, Linear maps, Systems of linear equations, Orthogonality, orthogonal projections, Eigenvalues & Eigenvectors.			
	C	QR & Singular value decomposition			
	Unit 4	**Spectral Methods**			
	A	Time Series Analysis (Introduction to classical methods),			
	B	Fourier Analysis: Introduction to Fourier and their applications in knowledge discovery & exploratory data analysis.			
	C	Wavelet Analysis: wavelet transform and their applications in knowledge discovery & exploratory data analysis.			
	Unit 5	**Regression analysis, Techniques for statistical quality control, Testing of hypothesis.**			
	A	Curve fitting: Principle of least squares Fitting of $y=aebx$, $y=ax^b$, $y=ab^x$.			
	B	Techniques for statistical quality control,			
	C	Testing of hypothesis.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. MatheusGrasselli and DimitryPelinovsky, "Numerical Mathematics", Jones and Bartlet Publishers, USA. 2. M. Goyal, "Computer Based Numerical & Statistical Techniques", Infinity Science Press, LLC, MA, USA.			
	Other References	1.Lars Elden, "Mattrix Methods in Data Mining and Pattern Recognition", SIAM (Society for Industrial and Applied Mathematics), USA. 2. Internet as a resource for references			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.		
2.		
3.		
4.		
5.		

Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: II**	
1	Course Code	**CSE 601** Course Name: Pattern Recognition	
2	Course Title	Pattern Recognition	
3	Credits	5	
4	Contact Hours (L-T-P)	3-1-2	
	Course Status	PG	
5	Course Objective	The objectives of this course to teach the students various feature extraction techniques and classifiers, so that, they can implement these concepts in real life projects like information retrieval, data mining, document image analysis and recognition, computational linguistics, forensics, biometrics and bioinformatics.	
6	Course Outcomes	After the completion of this course, students will be able to: 1. To Identify/introduce the ideas of existing patterns 2. To implement existing patterns ideas based on data analysis. 3. To conceptualize the working of patterns explorations using computational algorithms 4. To apply performance evaluation methods for pattern recognition 5. To become familiar with feature knowledge that can be extracted from available examples and generalize to form appropriate feature models.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to pattern recognition systems and their design cycle, learning and adaptation.	CO1,CO2
	B	Data sets for pattern recognition, Pre Processing of Input data set, Output analysis	CO1,CO2
	C	Application areas of pattern recognition with case studies in Medical, Defense and Optical Document Recognition	CO1,CO2
	Unit 2	**Mathematical Background**	
	A	Bayes Rule, Expectation, Correlation, Covariance.	CO3, CO4
	B	Review of Linear Algebra, Linear Transformations	CO3,CO4

	C	Decision Theory, ROC Curves, Likelihood Ratio Test, Linear Discriminants, FMI.			CO3,CO4
	Unit 3	**Feature Extraction**			
	A	Introduction, Shape representation Techniques – One dimensional function, polygonal approximation, spatial interrelation.			CO5
	B	Moments, Scale shape methods, Shape transform domains			CO5
	C	Chi-square statistic, Singular value decomposition, Feature Selection for Time Series Data			CO5
	Unit 4	**Classification**			
	A	Applications of Classification techniques, Classification with and without learning.			CO1,CO2,CO3,CO4,CO5
	B	Support Vector Machine, k-Nearest Neighbour Classifier			CO1,CO2,CO3,CO4,CO5
	C	Decision tree, Artificial Neural Network Classifiers- Multilayer Perceptron, Backpropagation algorithms.			CO1,CO2,CO3,CO4,CO5
	Unit 5	**Clustering**			
	A	Clustering Large Datasets, Applications of Clustering, Clustering techniques – K Means			CO1,CO2,CO3,CO4,CO5
	B	Sequential Algorithms, Agglomerative hierarchical clustering,			CO1,CO2,CO3,CO4,CO5
	C	Functional Optimization-Based Clustering, Graph Clustering			CO1,CO2,CO3,CO4,CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Duda and Hart P.E, “Pattern classification and scene analysis”, John Wiley and sons, NY. 2. Fu K.S., Eaglewood cliffs, “Syntactic Pattern recognition and applications”, Prentice Hall, N.J.			
	Other References	1. Earl Gose, Richard Johnsonbaugh, and Steve Jost, “Pattern Recognition and Image Analysis”, PHI Pvt. Ltd., NewDelhi. 2. Rochard O. Duda , Hart P.E, and David G Stork, “Pattern classification” , John Wiley & Sons Inc. 3. Internet as source of Reference.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1	PO1, PO3, PO4,PO5, PSO1
2.	CO2	PO1, PO3, PO4, PO5, PSO1
3.	CO3	PO1, PO5, PSO1, PSO2, PSO4
4.	CO4	PO1, PO5, PSO1, PSO2, PSO4
5.	CO5	PO1, PO3, PO4, PO5, PSO1

PO and PSO mapping with level of strength (3 being the highest) for Pattern Recognition (CSE601)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3	PSO4
CO1	3	1	3	3	1	1	3	1	2	2
CO2	2	2	3	3	2	2	3	2	2	2
CO3	3	3	2	2	3	2	3	3	2	3
CO4	1	3	2	2	3	2	3	3	2	3
CO5	1	2	3	3	1	3	3	2	2	2

1	Course Code	**CSE622**	
2	Course Title	**Advance Data Mining Techniques**	
3	Credits	3	
4	Contact Hours	3-0-0	
5	Course Objective	Learn about the most advance data mining methods to solve real world problems.	
6	Course Outcomes (CO) (Max of 4)	On successful completion of this module students will be able to: 1. Analyze practical and theoretical understanding of data mining and its applications 2. Develop the abilities of critical analysis to data mining techniques of advanced pattern mining, classification and clustering. 3. Explore the concepts of Web and Text Mining 4. Explore the concepts of Big Data analysis	
7	Course Description	This course introduces advanced aspects of data mining, encompassing the principles, to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.	
8	**Course Contents**		CO Mapping
8.01	Unit A	**Data mining Overview and Advanced Pattern Mining**	
8.02	Unit A Topic 1	Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis , outlier analysis	CO1, CO2
8.03	Unit A Topic 2	Advanced pattern mining in multilevel, multidimensional space – mining multilevel associations, mining multidimensional associations	CO1, CO2
8.04	Unit A Topic 3	Mining quantitative association rules, mining rare patterns and negative patterns.	CO1, CO2
8.05	Unit B	**Advance Classification**	
8.06	Unit B Topic 1	Classification by back propagation, support vector machines,	CO1, CO2
8.07	Unit B Topic 2	Classification using frequent patterns	CO1, CO2
8.08	Unit B Topic 3	Other classification methods – genetic algorithms roughest approach, fuzzy set approach;	CO1, CO2
8.09	Unit C	**Advance Clustering**	
8.10	Unit C Topic 1	Density - based methods –DBSCAN, OPTICS, DENCLUE;	CO1,CO2
8.11	Unit C Topic 2	Grid-Based methods – STING, CLIQUE;Exception – maximization algorithm	CO1,CO2
8.12	Unit C Topic 3	Clustering High- Dimensional Data; Clustering Graph and Network Data.	CO1,CO2
8.13	Unit D	**Web and Text Mining**	
8.14	Unit D Topic 1	Introduction to web mining, web content mining, web structure mining, web usage mining	CO1,CO3
8.15	Unit D Topic 2	Text mining –unstructured text, episode rule discovery for texts	CO1,CO3
8.16	Unit D Topic 3	Hierarchy of categories, text clustering.	CO1,CO3
8.17	Unit E	**Big Data**	

8.18	Unit E Topic 1	Introduction to Big Data, challenges of conventional systems, Overview of Hadoop, Hadoop Distributed File System (HDFS)			CO1, CO4
8.19	Unit E Topic 2	Hadoop Map reduce Framework, HBASE			CO1, CO4
8.20	Unit E Topic 3	Interacting HDFS using HIVE, sample programs in HIVE-PIG			CO1, CO4
9					
			Mid-Term Examination	End-Term Examination	
9.1	Attendance	Mandatory	Mandatory	75%	
9.2	Assignment	Yes	--	--	
9.3	Quizzes	Yes	--	--	
9.4	Projects	Yes	--	--	
9.5	Presentations	Yes	--	--	
9.6	Exam	--	Yes	Yes	
9.7	Total Marks	30	30	40	
10	**Reading Content**				
10.1	Text book*	1. Data Mining Concepts and Techniques, Jiawei Hang Micheline Kamber, Jian pei, Morgan Kaufmannn. 2. Bill Franks, "Taming the big data tidal wave: finding opportunities in huge data streams with advanced analytics", John Wiley & Sons, 2012			
10.2	other references	1. Introduction to Data Mining – Pang-Ning Tan, Vipinkumar, Michael Steinbach, Pearson. 2. Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier. 3. Internet as source of reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Analyze practical and theoretical understanding of data mining and its applications	PO1,PO2,PO3,PO4, PO5, PO6
2.	**CO2:** Develop the abilities of critical analysis to data mining techniques of advanced pattern mining, classification and clustering.	PO1,PO2,PO3,PO4, PO5, PO6
3.	**CO3:** Explore the concepts of Web and Text Mining	PO1,PO6
4.	**CO4:** Explore the concepts of Big Data analysis	PO1, PO6

PO and PSO mapping with level of strength for Course Name Advance Data Mining Techniques (Course Code CSE622)

	POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
	CO1	3	3	3	3	--	--	3	2	2	2
	CO2	3	2	3	3	--	--	2	3	2	2
	CO3	3	--	--	--	--	2	3	2	1	2
	CO4	2	--	--	--	--	2	2	2	2	2

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Data Science		**Semester: I**	
1	Course Code		Course Name: **Research Methodology**
2	Course Title	**Research Methodology**	
3	Credits	2	
4	Contact Hours (L-T-P)		
	Course Status	PG	
5	Course Objective	The main purpose of the Research Methods, Data Analysis, and Reporting to Support DoD Security Programs course is to introduce students to quantitative and qualitative methods for conducting meaningful inquiry and research. They will gain an overview of research intent and design, methodology and technique, format and presentation, and data management and analysis informed by commonly used statistical methods	
6	Course Outcomes	On successful completion of this module students will be able to: 1. Developing a hypothesis, a research problem and related questions 2. Framing the problem with the correct research methodology 3. Collecting and using data that accurately addresses the research problem	
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**FUNDAMENTAL OF RESEARCH**	
	A	What is Research? Objectives of Research	
	B	Scientific Research, Research and Theory	
	C	Conceptual and Theoretical Models	
	Unit 2	**Types and Methods of Research**	
	A	Classification of Research, Pure and Applied Research Exploring or Formulative Research	
	B	Descriptive Research, Diagnostic Research/Study, Evaluation Research/ Studies	
	C	Surveys, Case Study ,Field Studies	
	Unit 3	**Literature Review**	
	A	Need for Reviewing Literature, What	

		to Review and for What Purpose			
	B	Literature Search Procedure, Sources of Literature			
	C	Planning of Review work, Note Taking			
	Unit 4	**Problem Definition**			
	A	Selection of a Problem for Research, Formulation of the Selected Problems			
	B	Hypothesis Formation, Measurement			
	C	Research Design/Plan and sampling concept			
	Unit 5	**DATA COLLECTION**			
	A	Methods of data collection Meaning and Importance of Data			
	B	Sources of Data, Use of Secondary Data			
	C	Methods of Collecting Primary Data, Observation Method, Experimentation			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers,			
	Other References	1. An introduction to Research Methodology :Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002., RBSA Publishers., 2. Research Methodology, Sinha, S.C. and Dhiman, A.K., 2002. Ess Ess Publications. 2 volumes			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.		
2.		
3.		
4.		
5.		
6.		

CSE642: Soft Computing Techniques

1	Course Code	**CSE642** Course Name: **Soft Computing Techniques**	
2	Course Title	**Soft Computing Techniques**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective	**Students will try to learn:** 1. To conceptualize the working of human brain using ANN. 2. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems. 3. To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience. 4. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.	
6	Course Outcome	After Successful completion of this course the student will be able to: 1. ***Identify*** basic mathematical/statistical methods used in soft computing. 2. ***Formulate*** learning techniques used in different cases. 3. ***Use*** fuzzy logic inference with emphasis on their use in the design of intelligent or humanistic systems. 4. ***Analyze*** problems involving ambiguities, uncertainties, vagueness and inexactness 5. ***Integrate*** optimization techniques in problems of Engineering and Technology using genetic algorithm. 6. ***Justify*** use of soft computing terminologies in Decision and control system.	
7	Course Description	This course introduces soft computing theories, techniques and tools. Those are frequently required for understanding and developing the exploratory data analysis techniques, and knowledge discovery and intelligent systems.	
8	Outline syllabus		CO Mapping
	Unit 1	**Neural Network**	
	A	History, overview of biological Neuro-system, Mathematical Models of Neurons, architecture, Learning rules, Training rules, Delta, Back Propagation Algorithm.	CO1
	B	Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training	CO1, CO2

		Algorithms-perceptions	
	C	Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.	CO1, CO2
	Unit 2	**Fuzzy Logic**	
	A	Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function,	CO3
	B	Fuzzy rule generation, Operations on Fuzzy Sets: Compliment, Intersections, Unions,	CO1,CO3
	C	Combinations of Operations, Aggregation Operations..	CO3
	Unit 3	**Fuzzy Arithmetic**	
	A	Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	CO1, CO3
	B	Fuzzy Logic: Classical Logic, Multi-valued Logics, Fuzzy Propositions	CO1, CO3
	C	Fuzzy Qualifiers, Linguistic Hedges.	CO1, CO3
	Unit 4	**Uncertainty Based Information**	
	A	Information & Uncertainty, Non-specificity of Fuzzy & Crisp Sets,	CO3, CO4
	B	Fuzziness of Fuzzy Sets.	CO3, CO4
	C	Introduction of Neuro-Fuzzy Systems	CO3, CO4
	Unit 5	**Architecture of Neuro fuzzy Networks**	
	A	Application of Fuzzy Logic: Medicine, Economics etc.	CO3, CO6
	B	Genetic Algorithm: An Overview.	CO5, CO6
	C	GA in problem solving, Implementation of GA.	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE	
		30% / 20% / 50%	
	Text book/s*	1. S.N.Sivanandam, "Principles of Soft Computing", John Wiley-India edition. 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", PHI.	
	Other References	1. Anderson J.A., "An Introduction to Neural Networks", PHI. 2. G.J. Klir and B. Yuan "Fuzzy Sets & Fuzzy Logic", PHI. 3. Internet as a resource for references	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	***Identify*** basic mathematical/statistical methods used in	PO1, PO6, PSO2, PSO3

	soft computing.	
2.	***Formulate*** learning techniques used in different cases.	PO2, PO5, PSO1, PSO2, PSO3
3.	***Use*** fuzzy logic inference with emphasis on their use in the design of intelligent or humanistic systems.	PO3, PO4, PO5, PSO2, PSO3, PSO4
4.	***Analyze*** problems involving ambiguities, uncertainties, vagueness and inexactness	PO4, PO5, PO6, PSO3, PSO4
5.	***Integrate*** optimization techniques in problems of Engineering and Technology using genetic algorithm.	PO3, PO4, PO5, PO6, PSO3, PSO4
6.	***Justify*** use of soft computing terminologies in Decision and control system.	PO4, PO5, PO6, PSO2, PSO3, PSO4

PO and PSO mapping with level of strength for Course Name: Soft Computing Techniques (Course Code CSE642)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	1	3	2	2	2	3	2	3	3	2
CO2	2	3	2	2	3	2	3	3	3	2
CO3	1	2	3	3	3	2	2	3	3	3
CO4	1	2	2	3	3	3	2	2	3	3
CO5	1	2	3	3	3	3	2	2	3	3
CO6	2	2	3	3	3	3	2	3	3	3

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2022**	
Branch: SE		**Semester: I**	
1	Course Code	**CSE612**	Course Name: Object Oriented Software Engineering
2	Course Title	Object Oriented Software Engineering	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	PG	
5	Course Objective	This objective of this course is to give students an understanding of the object-oriented programming paradigm in the context of developing software that is well specified, designed and tested. Students will be exposed to a variety of notations at different stages of the development process.	
6	Course Outcomes	Students will be able to: CO1. Identify and define the principles of object-oriented software engineering, from analysis through testing CO2. Describe how to produce detailed object models and designs from system requirements CO3. Analyze the system design for development of an object oriented software CO4. Apply object oriented paradigm in software designing. CO5. Evaluate and integrate the testing techniques using various test cases.	
7	Course Description	The objective of this course is to provide fundamental knowledge of object-oriented software engineering, and make student aware of best object-oriented software engineering practices, and contemporary software engineering tools.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Software Engineering Concepts, Software Engineering Development Activities, Software Life Cycle Models	CO1
	B	An Overview of UML, Modeling Concepts, Basic Building Blocks of UML, View into UML, A Conceptual Model of UML, Basic Structural Modelling, UML Diagrams.	CO1, CO2
	C	Requirement Elicitation Concepts and	CO1

		Activities, Documenting Requirement Elicitation	
	Unit 2	**Analysis**	
	A	An overview of Analysis, Analysis Concepts	CO2
	B	Analysis Activities: From Use Case to Objects	CO2
	C	Documenting Analysis	CO2
	Unit 3	**System Design**	
	A	An overview of System Design, System Design Concepts	CO3
	B	System Design Activities: From Objects to Subsystems	CO3
	C	UML Deployment Diagrams, System Design Activities: Addressing Design Goals, Documenting System Design	CO3
	Unit 4	**Object Design**	
	A	Object Design: Reuse Concepts	CO4
	B	Object Design: Interface Specification Concepts	CO4
	C	Documenting Reuse & Object Design	CO4
	Unit 5	**Testing Object Oriented Systems**	
	A	Testing Concepts: Faults, Erroneous States, and Failures, Test Cases, Test Stubs and Drivers	CO5
	B	Testing Activities: Component Inspection, Usability Testing, Unit Testing, Integration Testing, System Testing	CO5
	C	Managing Testing	CO5
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE	
		30% / 20% / 50%	
	Text book/s*	**1. Bernd Bruegge and Allen H. Dutoit**,"Object oriented Software Engineering, using UML, and Pattern Java" Pearson (2nd Edition). 2. George Wilkie, "Object oriented Software Engineering", Addison-Wesley.	
	Other References	1. Ivar Jacobson "Object Oriented Software Engineering: A Use Case Driven Approach", Addison-Wesley. 2. Grady Booch "Object-Oriented Analysis and Design with Applications", Addison-Wesley Professional.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Identify and define the principles of object-oriented software engineering, from analysis through testing	PO1,PO2, PO3, PSO1,PSO2,PSO3,PSO4
2.	CO2. Describe how to produce detailed object models and designs from system requirements	PO1,PO2,PO3, PSO1,PSO2,PSO3,PSO4
3.	CO3. Analyze the system design for development of an object oriented software	PO1,PO2,PO3,PO4 PSO1,PSO2,PSO3,PSO4
4.	CO4. Apply object oriented paradigm in software designing.	PO1,PO2,PO3, PO4, PO5,PO6 PSO1,PSO2,PSO3,PSO4
5.	CO5. Evaluate and integrate the testing techniques using various test cases.	PO2,PO3,PO4,PO5, PO6 PSO1,PSO2,PSO3,PSO4

PO and PSO mapping with level of strength for Course Name Object Oriented Software Engineering (Course Code CSE612)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	-	-	-	3	2	2	1
CO2	3	2	3	-	-	-	3	2	2	1
CO3	3	2	3	1	-	-	2	3	2	1
CO4	3	2	3	3	2	1	3	2	1	2
CO5	1	2	3	2	2	3	2	2	2	3

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2022**	
Branch: SE		**Semester: II**	
1	Course Code	**CSE**	Course Name: Software Reliability Engineering
2	Course Title	Software Reliability Engineering	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective	This course will look at professional techniques for understanding, assessing and applying the software reliability models in software development systems	
6	Course Outcomes	Students will be able to: CO1. Identify importance of Reliability CO2. To apply Software Reliability Growth Models in Software Development CO3. To emphasize the Application of Software Reliability Models CO4. Apply concepts and development procedures. CO5. Evaluate and integrate the testing techniques for reliability measurement.	
7	Course Description	The course is a step by step introduction of software reliability engineering and software reliability process. The course includes introduction to the software reliability process, defining necessary reliability, developing operational profiles and executing test.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Need and Concepts of Software Reliability, Failure and Faults – Prevention, Removal, Tolerance, Forecast	CO1
	B	Dependability Concept – Failure Behaviour, Characteristics, Maintenance Policy	CO1
	C	Reliability and Availability Modelling, Reliability Evaluation	CO1
	Unit 2	**Software reliability model**	
	A	Introduction -Historical Perspective and Implementation, classification, limitations and issues	CO1, CO2
	B	Exponential Failure Models – Jelinski-moranda model, Poisson, Musa, Exponential models, Weibull Model, Musa-okumoto	CO2

		Model			
	C	Bayseian Model – Littlewood verral Model, Phase Based Model			CO2
	Unit 3	**Prediction analysis**			
	A	Model Disagreement and Inaccuracy – Short & Long Term Prediction, Model Accuracy			CO3
	B	Analyzing Predictive Accuracy – Outcomes,PLR, U & Y Plot, Errors and Inaccuracy			CO3
	C	Recalibration – Detecting Bias, Techniques, Power of Recalibration, Limitations in Present Techniques, Improvements.			CO3
	Unit 4	**The operational profile**			
	A	Concepts and Development Procedures – Customer Type, User Type, System Mode			CO4
	B	Functional and Operational Profile, Test Selection -Selecting Operations, Regression Test, Special Issues – Indirect Input Variables			CO4
	C	Updating, Distributed system, CASE STUDY (Application of DEFINITY & FASTAR), Power Quality Resource System			CO4
	Unit 5	**Testing for reliability measurement**			
	A	Software Testing – Types, White and Black Box, Operational Profiles – Difficulties, Estimating Reliability			CO5
	B	Time/Structure based software reliability – Assumptions, Testing methods, Limits			CO5
	C	Starvation , Coverage, Filtering, Microscopic Model of Software Risk			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. John D. Musa, “Software Reliability Engineering”,Tata McGraw Hill, 1999			
	Other References	1. Patric D. T.O connor, “Practical Reliability Engineering”, 4th Edition, John Wesley & sons, 2003. 2. Michael Lyu, “Handbook of Software Reliability Engineering”, IEEE Computer Society Press, ISBN: 0-07-039400-8, 1996			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Identify importance of Reliability	PO1,PO2, PO3, PSO1, PSO2, PSO3,PSO4
2.	CO2. To apply Software Reliability Growth Models in Software Development	PO1,PO2,PO3, PSO1, PSO2, PSO3,PSO4
3.	CO3. To emphasize the Application of Software Reliability Models	PO1,PO2,PO3,PO4 PSO1, PSO2,PSO3,PSO4
4.	CO4. Apply concepts and development procedures.	PO1,PO2,PO3, PO4, PO5,PO6 PSO1,PSO2,PSO3,PSO4
5.	CO5. Evaluate and integrate the testing techniques for reliability measurement.	PO2,PO3,PO4,PO5, PO6 PSO1,PSO2,PSO3,PSO4

PO and PSO mapping with level of strength for Course Name Software Reliability Engineering (Course Code CSE)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	2	2	2	2
CO2	2	2	3	-	-	-	3	2	2	1
CO3	2	2	2	1	-	-	2	3	2	1
CO4	3	2	3	3	2	1	3	2	1	3
CO5	1	2	2	2	2	3	2	1	2	3

1	Course Code	CSE644
2	Course Title	Agile Software Engineering
3	Credits	4
4	Contact Hours	(3-0-2)
5	Course Description	This course will address what agile methods are and how they are implemented. A variety of agile methods will be described, but the focus will be on Scrum and Extreme Programming. The course will conclude with a discussion of some of the issues facing organizations adopting agile methods.
5	Course Objective	This course will provide the understanding of what Agility means, when and why to employ Agile development, the pitfalls, issues and common mistakes to watch out for, and will cover key methodologies including Scrum and XP.
6	Course Outcomes (CO)	On successful completion of this module students will have ability to: 1. Demonstrate the ability to participate effectively in agile practices/process for software development. 2. Apply Scrum &XP. 3. Analyze best and effective Agile Development model required for Software Project Development. 4. Compare agile software development to traditional software development models. 5. Experiment the practice of feature testing, integration testing, TDD and BDD testing methods
7	Prerequisite	Software Engineering
Course Contents		
Unit 1	Agile Fundamentals Time taken:7 hours	
Overview of traditional software life cycle models. Problems with the waterfall. Rapid software development. Introduction to Agile. History of Agile: More or less a process? Necessity & requirement of Agility in software development. Agile Manifesto & Principles. Benefits, characteristics and Challenges of Agile methodology. Suitability of Agile Methods: When to Use Agile and When NOT to? Agile misconceptions, Agile hype, Applications of Agile Software development. Agile Lifecycle. Concept of Agile Alliance.		
Unit 2	Agile development Time taken:8 hours	
Iterative development Process, Risk-Driven and Client-Driven iterative planning, Time boxed iterative development. Incremental development, Software prototyping: Process, benefits, throw-away prototypes. Conflicting objectives of Incremental development and throw-away prototypes. Evolutionary and adaptive development. Classification of different Agile Methods.		
Unit 3	Scrum Time taken:9 hours	

SCRUM Roots, Philosophy behind Scrum, Scrum overview, Key Features, Scrum Values, Scrum Lifecycle, Scrum Events-Sprint, Sprint Planning, Daily Scrum, Sprint Review, Sprint Retrospective, Scrum Meetings, Strengths and Weaknesses, Characteristics, Pros and cons, Tools and Techniques, Scrum artifacts, Scrum practices, Work products, Roles, Responsibilities, Common mistakes and misunderstandings, Adoption strategies.				
Unit-4	XP(Extreme Programming) Time taken:9 hours			
Method overview , Core values of XP, XP practices, XP Lifecycle, XP and agile principles, Work products, Roles and Responsilities, Strengths and Weaknesses, Characteristics, Pros and cons, Tools and Techniques, Common mistakes and misunderstandings, Adoption strategies, Scrum vs. XP, Testing in XP, Pair Programming.				
Unit-5	Agile testing Time taken:7 hours			
Concept of agile testing, Roles and activities on an Agile Team, Traditional vs. Agile testing, Concept of Whole-Team Approach. Role of Tester in Agile Team, Ten Principles for Agile testers, Six concrete practices for testing on agile teams. Organizational and cultural challenges affect tester's role on agile team. Agile testing methods-TDD, ATDD, BDD, Exploratory. Agile Testing Lifecycle, Test Plan for Agile. Agile testing Quadrants.				
	Course Evaluation			
		Continuous Assessment		
9.11	Attendance	Mandatory (75%)		
9.12	Assignment	Three best out of 4 assignments: 20 marks		
9.13	Quizzes	Two quizzes: 10 marks		
9.14	Projects	--		
9.15	Presentations	As per instructor's choice		
9.16	Exam	--		
10	Reading Content		Mid-Term Examination	End-Term Examination
9.1	Text book*	1. Agile Testing: A Practical Guide for Testers and Agile Teams 2. Agile and Iterative Development: A Manager's Guide By Craig Larman	Mandatory	75%
9.2	References	• Succeeding with Agile: Software Development Using Scrum • Agile Software Engineering By Orit Hazzan, Yael Dubinsky. • Internet resources	--	--

Program Outcomes of M. Tech-CSE (The Program Outcomes defined for the program are aligned with the Graduate Attributes of NBA as shown)
CO-PO MAPPING (CSE644)

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1		2	3	2			
CO2	2	2	1	2	3		2	1	1	1
CO3		3	2		3		2	1		
CO4	2	2	1		2	3	2			2
CO5	3	3	3	4	1		2		1	

Mapping level 1-Low
Mapping level 2-Moderate
Mapping level 3-High

1	Course Code	**CSE621**
2	Course Title	**Web Engineering**
3	Credits	3
4	Contact Hours	3-0-0
5	Course Objective	This course aims to introduce the methods and techniques used in Web-based system development. In contrast to traditional Software Engineering efforts, Web Engineering methods and techniques must incorporate unique aspects of the problem domain such as: document oriented delivery, fine-grained lifecycles, user-centric development, client-server legacy system integration and diverse end user skill levels.
6	Course Outcomes (CO) (Max of 4)	On successful completion of this module students will be able to: 1. Develop a web application using server side programming languages and components. 2. Apply the web engineering methodologies for Web application development 3. Develop a component based web solution and use UML diagrams to describe such a solution. 4. Identify and discuss the security risk of a Web application.
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction:**
8.02	Unit A Topic 1	History of internet and WWW, different web generations, Web 2.0 personal, distributed and client server computing, Hardware trends.
8.03	Unit A Topic 2	Web Servers, HTTP Transactions, Multitier application architecture, client side versus server scripting
8.04	Unit A Topic 3	Browsing: URL, Homepage, document management, cookies, plug-in, online & offline Browsing.
8.05	Unit B	**Mark-up Languages:**
8.06	Unit B Topic 1	HTML : Basic layout of HTML (Head Section: title, base, link, meta. Body Section: Text formatting and alignment, fonts, colors, ordered and unordered lists, links, images, sounds, video, background, tables, forms, frames)
8.07	Unit B Topic 2	XHTML: Introduction, editing XHTML and XML, W3C, headers, linking images, DTD objectives, special characters, unsorted,nested and ordered lists, XHTML tables, forms, internal linking, meta elements. DHTML:Cascading style sheet, inline styles, embedded style, linking external style sheets, positioning elements, user style sheets, document object model.
8.08	Unit B Topic 3	XML data, XML namespaces, DTD and schemas ,XML variables, DOM methods, simple API for XML, web services, application of XML.
8.09	Unit C	**Web Development using Scripting Language:**

8.10	Unit C Topic 1	JavaScripts: Introduction to scripting, user input/output, memory concepts, arithmetic, decision making, control statement, functions, arrays, objects.
8.11	Unit C Topic 2	Program modules in JavaScript, function definitions, scope rules, global functions, recursion, arrays, references and reference parameters, passing arrays to functions, objects in javascript, using cookies, using JSON to represent objects.
8.12	Unit C Topic 3	Active Server Pages (ASP): How ASP works, ASP objects, file system, objects, ActiveX components
8.13	Unit D	**Document Object Model:**
8.14	Unit D Topic 1	Introduction, modelling a document, DOM nodes and trees, Traversing and modifying a DOM tree
8.15	Unit D Topic 2	DOM collections, Dynamic styles, summary of DOM objects and Collections
8.16	Unit D Topic 3	Registering event handlers, on load, on mouse move, the event object, this, on mouse over, on mouse-out, on focus, on blur, on submit, on reset, event bubbling, more events
8.17	Unit E	**AJAX:**
	Unit E Topic 1	Introduction, traditional web applications versus AJAX applications, rich internet applications with AJAX, Raw AJAX example using XMLHTTP Request. Using XML and DOM
	Unit E Topic 2	PHP: Introduction, Basics, string processing and regular expressions, form processing and business logic
	Unit E Topic 3	Connecting to database, using cookies, dynamic content, operator precedence.

9	**Course Evaluation**			
		Continuous Assessment	Mid-Term Examination	End-Term Examination
9.11	Attendance	Mandatory	Mandatory	75%
9.12	Assignment	10 assignments, no weight	--	--
9.13	Quizzes	7 best quizzes (based on assignments); 20 marks	--	--
9.14	Projects	--	--	--
9.15	Presentations	--	--	--
9.16	Exam	--	Yes	Yes
9.17	Total Marks	30	20	50

10	**Reading Content**	
9.1	Text book*	1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th edition, Prentice Hall, 2009
9.2	other references	1. Chuck Musciano & Bill Kennedy, HTML & XHTML

		[SPD] 2. Jesse Feiler, Managing the Web Based Enterprise [Morgan Kaufmann] 3. Internet as source of Reference.

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Develop a web application using server side programming languages and components.	PO1:Students will learn the conceptual skills on Web Tools . PO3:Sufficient programming skills will require use of good practice, e.g., good variable names, good use of computational units, appropriate commenting strategies. **PO3:** Effectively utilizing their knowledge of computing principles and mathematical theory to develop sustainable solutions to current and future computing problems. **PO4:** Exhibiting their computing expertise within the computing community through corporate leadership, entrepreneurship, and/or advanced graduate study **PO5:** Developing and implementing solution based systems and/or processes that address issues and/or improve existing systems within in a computing based industry.
2.	Apply the web engineering methodologies for Web application development	**PO2:** Systems Design and Engineering-Students will be able to use appropriately system design notations and apply system design engineering process in order to design, plan, and implement software systems
3.	Develop a component based web solution and use UML diagrams to describe such a solution.	PO3: Students will be able to complete successfully be able to program small-to-mid-size programs on their own.
4.	Identify and discuss the security risk of a Web application.	PO4: Preparation for Career-Students will be prepared for a career in an information technology-oriented business or industry, or for graduate study in computer science or other scientific or technical fields
5.	To strategize future scope on Web Engineering Tools & Techniques	PSO1: Effectively communicating computing concepts and solutions to bridge the gap between computing industry experts and business leaders to create and initiate innovation. **PSO2:** Effectively utilizing their knowledge of computing principles and mathematical theory to develop sustainable solutions to current and future computing problems. **PSO3:** Exhibiting their computing expertise within the computing community through corporate leadership, entrepreneurship, and/or advanced graduate study

		PSO4: Developing and implementing solution based systems and/or processes that address issues and/or improve existing systems within in a computing based industry.

PO and PSO mapping with level of strength for Course Name Web Engineering (Course Code CSE621)

DE 1: Machine Learning

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Data Science		**Semester: I**	
1	Course Code	CSE605 | Course Name- Machine Learning	
2	Course Title	Machine Learning	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective	This course provides an introduction to machine learning and statistical pattern recognition in a way to solve the problem in real-time	
6	Course Outcomes	After completion of this course, student will be able to:- 1. Understand learning problems and Identify fundamental problems in machine learning. 2. Conceptualize various algorithms for machine learning. 3. Select and Apply appropriate tools for developing solutions for real world problems using machine learning algorithms. 4. Create and Evaluate hypothesis for problems and to implement solutions for them.	
7	Course Description	Introduction and concept of learning task, Decision Tree and Artificial Neural Networks, Evaluating hypothesis and Bayesian learning, Computational Learning Theory and Instance Based Learning , Genetic Algorithms and Reinforcement Learning	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Well defined learning problems, Designing a Learning System, Issues in Machine Learning	CO1
	B	The Concept Learning Task - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithms, Candidate elimination algorithm, Inductive bias	CO1
	C	Decision Tree Learning - Decision tree learning algorithm, Issues in Decision tree learning	CO1
	Unit 2	**Artificial Neural Networks**	
	A	Perceptrons, Gradient descent and the Delta rule	CO2, CO3
	B	Adaline, Multilayer networks	CO2, CO3
	C	Derivation of backpropagation rule Backpropagation Algorithm Convergence	CO2, CO3
	Unit 3	**Hypotheses**	
	A	Evaluating Hypotheses – Estimating Hypotheses Accuracy, Basics of sampling Theory	CO3, CO4
	B	Comparing Learning Algorithms	CO3, CO4

	C	Bayesian Learning – Bayes theorem, Naïve Bayes classifier, Bayesian belief networks			CO3, CO4
	Unit 4	**Computational Learning Theory**			
	A	Sample Complexity for Finite Hypothesis spaces			CO2, CO3, CO4
	B	Sample Complexity for Infinite Hypothesis space Instance-Based Learning			CO2, CO3, CO4
	C	k-Nearest Neighbor Learning, Locally Weighted Regression, Radial basis function networks			CO2, CO3
	Unit 5	**Genetic Algorithms**			
	A	An illustrative example, Hypothesis space search, Genetic Programming			CO2, CO3, CO4
	B	Models of Evolution and Learning Learning first order rules-sequential covering algorithms-General to specific beam search-FOIL			CO2, CO3
	C	Reinforcement Learning - The Learning Task, Q Learning			CO2, CO3
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Tom. M. Mitchell, Machine Learning, McGraw Hill International Edition			
	Other References	1. Ethern Alpaydin, Introduction to Machine Learning. Eastern Economy Edition, Prentice Hall of India 2.Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1	PO1, PO5, PSO1
2.	CO2	PO2, PO5, PSO1, PSO2
3.	CO3	PO2, PO3, PSO2, PSO4
4.	CO4	PO2, PO3, PSO2, PSO4, PSO3

PO and PSO mapping with level of strength for Machine Learning

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	2	3	2	3	2	1	1
CO2	1	3	1	2	3	1	3	3	1	2
CO3	1	3	3	2	1	1	2	3	1	3
CO4	1	3	3	2	1	1	1	3	2	3

CSE608: Natural Language Computing

1	Course Code	**CSE608** Course Name: **Natural Language Computing**	
2	Course Title	**Natural Language Computing**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective	This course presents an introduction to natural language computing in applications such as information retrieval and extraction, intelligent web searching, speech recognition, and machine translation. These applications will involve various statistical and machine learning techniques.	
6	Course Outcome	After the completion of this course, students will be able to: CO-1. ***Identify*** Linguistic phenomena and an ability to model them with formal grammars**.** CO-2. ***Illustrate*** proper experimental methodology for training and evaluating empirical NLP systems. CO-3. ***Use*** probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods. CO-4. ***Compare*** algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics. CO-5. ***Integrate*** knowledge representation, inference, and relations to the artificial intelligence. CO-6. ***Support*** Machine Translation techniques in intelligent systems.	
7	Course Description	This course introduces natural language computing theories, techniques and tools. Those are frequently required for understanding and developing the exploratory data analysis techniques, and knowledge discovery and intelligent systems.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Definition, History, Applications, Goals.	CO1
	B	Regular expressions and Automata,	CO1, CO2
	C	Morphology and Finite State Transducers.	CO1, CO2
	Unit 2	N-grams:	
	A	Introduction, Simple (Unsmoothed) N-Grams,	CO2
	B	Smoothing: Add-one smoothing, Witten-Bell Discounting,	CO2,CO3
	C	Good-Turing Discounting, Back off, Deleted	CO2, CO3

		Interpolation. Entropy	
	Unit 3	HMM	
	A	Overview	CO3
	B	Viterbi Algorithm	CO3, CO4
	C	Syntax: Word Classes and Part-of Speech Tagging, Context Free Grammars for English, Parsing with Context-Free Grammars.	CO3, CO4
	Unit 4	Classification	
	A	Word Sense Disambiguation: Selection Restriction Based Disambiguation,	CO3, CO4
	B	Robust WSD: Machine Learning, Supervised Learning Approaches,	CO4, CO5
	C	Bootstrapping Approaches, Unsupervised Methods, Dictionary Based Approaches.	CO4, CO5
	Unit 5	Machine Translation:	
	A	Introduction, Language Similarities and Differences,	CO5, CO6
	B	Approaches, in machine translation system design.	CO5, CO6
	C	Steps involved in machine translation system design.	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE 30% / 20% / 50%	
	Text book/s*	1) Jurafsky, D. & J. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing Computational Linguistics, and Speech Recognition" Prentice Hall. 2) Grosz, B.J., Sparck Jones, K. & Webber, B.L. (eds) "Readings in natural language processing", Los Altos, CA. Morgan Kaufmann.	
	Other References	3) Allen, J., "Natural Language Understanding", Redwood City, Benjamin/Cummings. 4) Bharti, Akshar, Chaitanya Vineet, Sangal Rajeev, "Natural Language Processing", Prentice Hall. 5) Internet as source of Reference.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)

1.	***Identify*** Linguistic phenomena and an ability to model them with formal grammars**.**	PO1,PO5,PSO1
2.	***Illustrate*** proper experimental methodology for training and evaluating empirical NLP systems.	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2, PSO4
3.	***Use*** probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.	PO1, PO3, PO4, PSO2, PSO4
4.	***Compare*** algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.	PO1, PO3, PO4, PSO2, PSO4
5.	***Integrate*** knowledge representation, inference, and relations to the artificial intelligence.	PO4, PO5, PSO2, PSO3
6.	***Support*** Machine Translation techniques in intelligent systems.	PO1, PO4, PO5, PO6, PSO3

PO and PSO mapping with level of strength for Course Name: Natural Language Computing (Course Code CSE608)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	2	3	2	3	2	1	2
CO2	3	3	3	3	3	2	3	3	1	3
CO3	3	2	3	3	2	2	2	3	1	3
CO4	3	2	3	3	2	2	2	3	1	3
CO5	1	1	2	3	3	2	2	3	3	2
CO6	3	2	2	3	3	3	2	2	3	2

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Data Science		**Semester: I**	
1	Course Code	**CSE604**	Course Name: Data Acquisition and Production
2	Course Title	Data Acquisition and Production	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	PG	
5	Course Objective	1. To explore the fundamental concept of data processing, extraction, cleaning, annotation, integration 2. To understand various information visualization techniques. 3. To understand data productization techniques	
6	Course Outcomes	Students will be able to: CO1. Identify importance of OLAP and OLTP CO2. To apply data aggregation operators to reach knowledge discovery CO3. To emphasize the data visualization techniques in data science CO4. Apply data analysis techniques. CO5. Evaluate and integrate the IOT measures in data science	
7	Course Description	Major topics covered in this subjects are data acquisition process, managing data, Graphical representation of data, Data Aggregation, Group Operations ,Timeseries , Visualization of data, Data Productization IoT, and Virtualization on Embedded Boards IoT.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Data Warehouse- OLTP and OLAP concepts- Introduction to Data Mining- Data Objects and Attribute Types- Basic Statistical Descriptions of Data Exploratory	CO1
	B	Data analysis- Measuring Data Similarity and Dissimilarity- Graphical representation of data. Introduction to Data Acquisition – Applications –Process- Data Extraction-	CO1
	C	Data Cleaning and Annotation- Data Integration –Data Reduction, Data Transformation, Data Discretization and Concept Hierarchy Generation	CO1
	Unit 2	**Data Aggregation**	
	A	Group Operations ,Time series , Group By Mechanics – Data Aggregation – Group wise Operations and Transformations	CO2
	B	Pivot Tables and Cross Tabulations – Date and Time Date Type	CO2

		tools			
	C	Time Series Basics – Data Ranges, Frequencies and Shifting.			CO2
	Unit 3	**Visualization**			
	A	Terminology- Basic Charts and Plots- Multivariate Data Visualization- Data Visualization Techniques– Pixel-Oriented Visualization Techniques-			CO3
	B	Geometric Projection Visualization Techniques- Icon-Based Visualization Techniques- Hierarchical Visualization Techniques- Visualizing Complex Data and Relations- Data Visualization Tools			CO3
	C	Rank Analysis Tools- Trend Analysis Tools Multivariate Analysis Tools- Distribution Analysis Tools- Correlation Analysis Tools Geographical Analysis Tools.			CO3
	Unit 4	**Data Productization**			
	A	IoT Overview- IoT Design methodology- Semantic Web Infrastructure Intelligence Applications			CO4
	B	Programming Framework for IoT- Distributed Data Analysis for IoT			CO4
	C	Security and Privacy in IoT- Applied IoT- Cloud Based Smart Facilities Management			CO4
	Unit 5	**Embedded Boards**			
	A	Virtualization on Embedded Boards IoT- Stream Processing in IoT			CO5
	B	Internet of Vehicles and Applications			CO5
	C	Case study on Data Acquisition using Dashboards, Android and iOSapps			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Han, Jiawei, Jian Pei, and Micheline Kamber, “Data mining: concepts and techniques”,3rd Edition,Elsevier,2011.			
	Other References	1. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education,2012. 2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things -A hands-on approach”, UniversitiesPress,2015. 3. Manoel Carlos Ramon, “Intel Galileo and Intel Galileo Gen 2: API Features and ArduinoProjectsforLinuxProgrammers”,Apress,2014. 4. KarlPover,“LearningQlikviewDataVisualization”,Packt,2013. 5. Rajkumar Buyya, Amir Vahid Dastjerdi, “Internet of Things: Principles and Paradigms”,Elsevier,2016.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Identify importance of OLAP and OLTP	PO1,PO2, PO3, PSO1, PSO2, PSO3,PSO4
2.	CO2. To apply data aggregation operators to reach knowledge discovery	PO1,PO2,PO3, PSO1, PSO2, PSO3,PSO4
3.	CO3. To emphasize the data visualization techniques in data science	PO1,PO2,PO3,PO4 PSO1, PSO2,PSO3,PSO4
4.	CO4. Apply data analysis techniques.	PO1,PO2,PO3, PO4, PO5,PO6 PSO1,PSO2,PSO3,PSO4
5.	CO5. Evaluate and integrate the IOT measures in data science	PO2,PO3,PO4,PO5, PO6 PSO1,PSO2,PSO3,PSO4

PO and PSO mapping with level of strength for Course Name Data Acquisition and Production (Course Code CSE604)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	2	2	2	2
CO2	2	2	3	-	-	-	3	2	2	1
CO3	2	2	2	1	-	-	2	3	2	1
CO4	3	2	3	3	2	1	3	2	1	3
CO5	1	2	2	2	2	3	2	1	2	3

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Data Science		**Semester: II**	
1	Course Code		Course Name- **Bioinformatics**
2	Course Title	**Bioinformatics**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective		
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Fundamental of Bioinformatics**	
	A	Introduction to Bioinformatics: philosophical, directional and application oriented background of Bioinformatics.	
	B	Basic Biology: Prokaryotes and Eukaryotes, Yeast and People, Evolutionary time and relatedness.	
	C	Living parts: Tissues, cells, compartments and organelles, Central dogma of molecular biology, Concept of DNA, RNA, Protein and metabolic pathway.	
	Unit 2	**Biological databanks**	
	A	NCBI data model, GenBank sequence database.	
	B	Structural database, biodiversity information, virology information database, Chemoinformatics databases.	
	C	Protein databases-PIR, SWISSPROT, TrEMBL, Prosite, PRINTS.	
	Unit 3	**Sequence Analysis**	
	A	Methods of sequence alignment. Pair wise alignment- Global, local, dot plot and its applications.	
	B	Words method of alignment- FASTA and its variations, BLAST- Filtered and gapped BLAST, PSIBLAST.	
	C	Multiple sequence alignment- methods and Tools for MSA, Application of multiple alignments, Viewing and editing of MSA	
	Unit 4	**Molecular phylogeny**	
	A	Concepts of trees- Distance matrix methods.	
	B	Character based methods. maximum Parsimony, maximum likelihood methods	

	C	Solving UPGMA, NJ and small parsimony problems			
	Unit 5	**Applications**			
	A	Application of graph theory in Biology: Biochemical Pathway			
	B	Protein-protein interaction network, Regulatory network and their analysis.			
	C	Bioinformatics in pharmaceutical industry: informatics & drug- discovery			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Attwood T K, D J Parry-Smith, "Introduction to Bioinformatics", Pearson Education, 2005. 2. David W Mount, "Bioinformatics: Sequence and genome analysis", Cold spring harbor laboratory press, 2nd edition, 2004. 3. Des Higgins and Willie Taylor, "Bioinformatics Sequence, Structures and Databanks", Oxford University Press, USA, 2000.			
	Other References	1. Arun Jagota, "Data Analysis and Classification for Bioinformatics", Pine Press, 2001. 2. David Edwards, Jason Eric Stajich, David Hansen, "Bioinformatics: Tools and Applications", Springer, 2009. 3. Internet as a Resource for Reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.		
2.		
3.		
4.		

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: I**	
1	Course Code	**CSE630** Course Name: **Advanced Computer Network**	
2	Course Title	**Advanced Computer Network**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	PG	
5	Course Objective	This course will describe, design and implement various network protocols with the concept of layered approach of OSI and TCP/IP model.	
6	Course Outcome	CO1: Enumerate the layers of the OSI model and TCP/IP and classifying the function(s) of each layer and understanding IEEE 802.11 AND IEEE 802.3 CO2: Understand and building the skills of IP Addressing and Routing with Internet Routing Protocols and summarizing Mobility Issues and Mobile IP CO3: Familiarity with the protocols of computer networks LIKE UDP and TCP and SCTP, and executing those concepts in real time network design and implementation of voice over IP. CO4: Have an understanding of the issues surrounding congestion control, flow control and working knowledge of Quality of Service parameters. CO5: Interpreting and attributing security issues and encryption schemes	
7	Course Description	This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks via introduction to wired and wireless networks using the standard OSI reference model as a framework. Students will be exposed to the Transport Layer protocol suite and network tools and programming; along with Traffic Control and Quality of Service attributes and Traffic Management & Security measures.	
8	Outline syllabus		CO Mapping
	Unit 1	**Overview of Wired and Wireless Data Networks**	
	A	Review of Layered Network Architecture, ISO-OSI and TCP/IP Network Model Datagram Networks and Virtual Circuit	CO1

		Networks, Point to Point and Point to Multipoint Networks Layer 2 Switches			
	B	IEEE 802.3U(Fast Ethernet) and IEEE 802.3Z(Gigabit Ethernet)Virtual LAN			CO1
	C	Wireless LAN: IEEE 802.11, Bluetooth Broadband Wireless LAN : 802.16, WIMAX			CO1
	Unit 2	**Internetworking**			
	A	Review of IP Addressing and Routing Internet Architecture :Layers 3 Switch, Edge Router and Core Router Overview of Control Plane, Data Plane ,Management Plane			CO2
	B	Internet Routing Protocols**:** OSPF, BGP Broadcast and Multicast Routing**:** Flooding, Reverse Path Forwarding, Pruning, Core based trees, PIM			CO2
	C	Mobility Issues and Mobile IP			CO2
	Unit 3	**Transport Layer Protocols**			
	A	Process to Process Delivery, Review of UDP, TCP			CO3
	B	SCTP Protocol**:** Services, Features, Packet Format, Association, Error Control Wireless TCP and RTP, RTCP			CO3
	C	Real Time Application: Voice and Video over IP.			CO3
	Unit 4	**Traffic Control and Quality of Service**			
	A	Flow Control**:** Flow Model, Open Loop: Rate Control, LBAP, Closed Loop: Window scheme, TCP and SCTP Flow Control			CO4
	B	Congestion Control**:** Congestion Control in packet networks, ECN and RED Algorithm, TCP and SCTP Congestion Control			CO4
	C	Quality of Service: IP Traffic Models, Classes and Subclasses, Scheduling: GPS, WRR, DRR, WFQ, PGPS, VC.			CO4
	Unit 5	**Traffic Management & Security**			
	A	Traffic Management Framework**:** Scheduling, Renegotiation, Signaling, Admission Control, Capacity Planning			CO5
	B	Security Issues, Symmetric Encryption: DES , TripleDES ,Modes, AES			CO5
	C	Public Key Encryption: RSA , Diffie Hellman, Elliptic Curve, Hashing :MDS , SHA-1 , DSA Protocols: Kerberos,SSL/TLS, IPSec			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	

		30%	20%	50%	
	Text book/s*	1. Srinivasan Keshav" An Engineering Approach To Computer Networking ",Pearson 2. A. Tanenenbaum, " Computer Network",PHI			
	Other References	1. W. Richard Stevens "TCP/IP ILLustrated "-Vol1 Pearson 2. W. Stallings, " Wireless Communication and Networks" Pearson 3. Internet as source of Reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Enumerate the layers of the OSI model and TCP/IP and classifying the function(s) of each layer and understanding IEEE 802.11 AND IEEE 802.3	PO1,PO2, PO3, PSO1, PSO2, PSO3,PSO4
2.	CO2: Understand and building the skills of IP Addressing and Routing with Internet Routing Protocols and summarizing Mobility Issues and Mobile IP	PO1,PO2,PO3, PSO1, PSO2, PSO3,PSO4
3.	CO3: Familiarity with the protocols of computer networks LIKE UDP and TCP and SCTP, and executing those concepts in real time network design and implementation of voice over IP.	PO1,PO2,PO3,PO4 PSO1, PSO2,PSO3,PSO4
4.	CO4: Have an understanding of the issues surrounding congestion control, flow control and working knowledge of Quality of Service parameters.	PO1,PO2,PO3, PO4, PO5,PO6 PSO1,PSO2,PSO3,PSO4
5.	CO5: Interpreting and attributing security issues and encryption schemes	PO2,PO3,PO4,PO5, PO6 PSO1,PSO2,PSO3,PSO4

PO and PSO mapping with level of strength for Course Name Advanced Computer Network (Course Code CSE630)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	2	2	2	2
CO2	2	2	3	-	-	-	3	2	2	1
CO3	2	2	2	1	-	-	2	3	2	1
CO4	3	2	3	3	2	1	3	2	1	3
CO5	1	2	2	2	2	3	2	1	2	3

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: I**	
1	Course Code	**CSE 632**	Course Name**: Advanced Network Security**
2	Course Title	**Advanced Network Security**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective	1. Gain knowledge about key security requirements of networks, symmetric and asymmetric ciphers and Cryptographic Data Integrity Algorithms. 2. Provide a practical survey of both the principles and practice of cryptography and network security. Understand the fundamentals of OSI, Encryption techniques, network access control and cloud security . 3. Understand the principles of transport level security, wireless network security, electronic mail security and IP security, use of attack surfaces and attack trees and cryptography standards.	
6	Course Outcomes	On successful completion of this module students will be able to: • CO1: Understand the key security requirements of confidentiality, integrity, and availability, security architecture for OSI, categories of computer and network assets, fundamental security design principles, and cryptography standards • CO2: Gain knowledge of symmetric and asymmetric ciphers, classical encryption techniques, block ciphers and data encryption standard, and public key cryptography. • CO3: Acquire understanding of cryptographic data integrity algorithms, cryptographic, hash function, message authentication codes, digital signatures and user authentication. • CO4: Understand network access control and cloud security, transport level security, wireless network security, electronic mail security and IP security.	
7	Course Description	This course will provide a survey of both the principles and practice of cryptography and network security. It covers the basic issues to be addressed by a network security capability, and explored by providing a tutorial and survey of cryptography and network security technology.	
8	Outline syllabus		CO Mapping
	Unit 1	**Basic Concept of Network Security**	

	A	Network Security Model, OSI Security Architecture, Goals of network security and standards.			CO1, CO2
	B	Basic concepts of cryptography			CO1, CO2
	C	Introduction to IT-Security in Open system, threats to security, security requirements and how it works.			CO1, CO2,CO3
	Unit 2	**Network Security Threats and Issues**			
	A	Protocol Vulnerabilities: DoS and DDoS, SYN Flooding, Session Hijacking, ARP Spoofing, Attack on DNS.			CO1, CO2,CO4
	B	Wireless LAN: Frame spoofing, Violating MAC; Software Vulnerabilities: Phishing Attack, Buffer Overflow, Cross-site Scripting			CO1, CO2,CO4
	C	SQL Injection; Virus, Worm, Malware, Botnets; Eavesdropping, Password Snooping and IP Masquerade			CO1, CO2,CO4
	Unit 3	**Security at Network Level**			
	A	Authentication: password-based, certificate-based, Centralized; Kerbos, Biometrics., SSL.			CO1,CO2,CO3
	B	IP Security, IKE, Virtual Private Network.			CO1,CO2,CO3
	C	Open SSL, Wireless LAN Security: WEP, TKIP, CCMP.			CO4,CO2
	Unit 4	**Firewall Introduction to ACL**			
	A	Introduction to Firewall, Firewall Functionalities, Types of Firewalls.			CO1,CO2,CO3
	B	Packet Filtering, Reverse Proxy, Stateful Firewalls, limitation of Stateful FireWalls.			CO1,CO2,CO3
	C	Application Firewalls, Circuit Firewalls, CHECK Point, CISCO PIX, CISCO firewalls case study.			CO1,CO2,CO3
	Unit 5	**Security and Network Applications**			
	A	Electronic Payment: Payment types, SET, Chip Card Transaction.			CO2,CO3,CO4
	B	Mobile Payments; Electronic Mail Security, Web Security: SSL and TLS			CO1,CO3,CO4
	C	Web Service Security: Token Type, XML Encryption, XML Signatures, SAML; Intrusion detection and prevention systems; honey pots.			CO2,CO3,CO4
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Bernard Menezes, “Network Security and Cryptography”,Cengage Learning.			
	Other References	1. Raymond R. Panko,“Corporate Computer and Network Security”,			

		Pearson Education. 2. Willam Stallings, "Cryptography and Network Security", Pearson Education. 3. Internet as a resource for references

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the key security requirements of confidentiality, integrity, and availability, security architecture for OSI, categories of computer and network assets, fundamental security design principles, and cryptography standards	PO2, PO03, PO5,PO6, PSO1, PSO02
2.	CO2: Gain knowledge of symmetric and asymmetric ciphers, classical encryption techniques, block ciphers and data encryption standard, and public key cryptography.	PO2, PO3, PO5, PSO2, PSO03
3.	CO3: Acquire understanding of cryptographic data integrity algorithms, cryptographic, hash function, message authentication codes, digital signatures and user authentication.	PO2,PO3,PO5,PO6, PSO2, PSO04
4.	CO4: Understand network access control and cloud security, transport level security, wireless network security, electronic mail security and IP security.	PO2, PO3, PO5, PSO3, PSO04

PO and PSO mapping with level of strength for Course Name Advanced Network Security (Course Code CSE-632)

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
	CO1	-	2	3	-	2	3	3	3	2	1
	CO2	-	3	3	-	3	3	2	3	2	1
	CO3	-	3	3	-	3	2	3	3	1	1
	CO4	-	2	2	-	3	3	2	3	2	1

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: I**	
1	Course Code		Course Name**: Advanced Mobile Computing**
2	Course Title	**Advanced Mobile Computing**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective		
6	Course Outcomes		
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Basic Concepts, Principle of Cellular Communication	
	B	Overview of 1G, 2G, 2.3G, 3G and 4G, GSM and CDMA	
	C	Architecture, Mobile Agent: Mobile Objects and Agents, Mobile program, Mobile Agent issues.	
	Unit 2	**Routing in Base Station Subsystem**	
	A	Directory look up, mail box, routing data to mobile, routing table update, permanent and temporary address schemes.	
	B	Home domain directory, location directory, Routing: TCP/IP and other protocols, Ad-hoc networking protocols, Mobile Ipv4 and Ipv6.	
	C	Mobile Internetworking Architecture, Internet Mobility issues, Route optimization, Wireless TCP, GPRS services, IP over CDMA.	
	Unit 3	**Channel Allocation**	
	A	Basic Strategies, congestion control.	
	B	Static and Dynamic routing	
	C	concept of Channel Borrowing.Wireless ATM: Channel borrowing.	
	Unit 4	**Mobile Computing**	

	A	Database requirements, computing within a building, within a city and outside city.			
	B	Mobility:Mobility Management			
	C	Mobile Devices: PDA, Mobile OS			
	Unit 5	**Proxy Servers and Applications**			
	A	Wireless Internet, remote data access, Global Positioning, Document Tracing, Health Care.			
	B	Warehouse, Automated Vending, Future directions in mobile networks			
	C	A survey of recent work from publications including some case studies on Ad hoc networks.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Richard Wheeler, "Mobility: processes, computers and Agents", Pearson 2. Charles Perkins, "Mobile IP: Design principle and practices", Pearson			
	Other References	1. Stojmenovic and Cacute,"Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028 2. Internet as a resource for references			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
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School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: I**	
1	Course Code		Course Name: **Vehicular Communication Network**
2	Course Title	**Vehicular Communication**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	PG	
5	Course Objective		
6	Course Outcomes		
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Vehicular Ad Hoc Networks (VANETs)**	
	A	Traffic Monitoring, Causes of congestion, Traffic Monitoring Data, Common Applications of Traffic Data	
	B	Commonly used sensor technology, Detection methods, Vehicular Applications	
	C	Safety related vehicular applications, use of Infrastructure in VANETs.	
	Unit 2	**Models for Traffic flow and Vehicle Motion**	
	A	Models for Longitudinal Vehicle Movement, Lane changes situations	
	B	Simulating Vehicle-toVehicle	
	C	Infrastructure-to-Vehicle Communication.	
	Unit 3	**Networking Issues**	
	A	Routing in MANET, Applicability of MANET.	
	B	Routing to Vehicular Environment	
	C	Routing protocols for VANET	
	Unit 4	**Delay-Tolerant Networks in VANETs**	
	A	Deterministic/Stochastic Delay-	

		Tolerant Routing			
	B	Vehicle Traffic Model, Vehicle-Roadside Data Access			
	C	Data Dissemination in VANETs **.**			
	Unit 5	**Localization in Vehicular Ad-Hoc Networks**			
	A	Localization-Aware VANET applications, Localization Techniques for VANETs			
	B	Data Fusion in VANET Localization Systems			
	C	Vehicular Network Simulators.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Stephan Olariu, Michele C. Weigle, "Vehicular Networks from Theory to Practice", CRC Press. 2. Hassnaa Moustafa and Yan Zhang, "Vehicular Networks: Techniques, Standards and Applications," Auerbach Publications, 2009			
	Other References	1. C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols," Prentice Hall, 2004. 2. Internet as a resource for references			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
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School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: II**	
1	Course Code		Course Name: **Ad Hoc Wireless Networks**
2	Course Title	**Ad Hoc Wireless Networks**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective		
6	Course Outcomes		
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	**Cellular and AdHoc Wireless Networks,Applications of AdHoc Wireless Networks**	
	B	Issues in Ad-Hoc Wireless Networks-Medium Access scheme, security,	
	C	Energy Management, Deployment considerations	
	Unit 2	**MAC Protocols**	
	A	Introduction to Mac, Issues in Designing a MAC Protocol for Ad HOC Wireless Networks	
	B	Classifications of MAC protocols-Contention based protocols, Contention based protocols with reservation mechanisms, Contention based MAC protocols with scheduling Mechanisms	
	C	Other MAC protocols- Multi Channel MAC protocol, Power Control MAC protocol for Ad Hoc Networks	
	Unit 3	**Routing Protocol**	
	A	Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks-Mobility, Hidden and Exposed terminal Problems, Characteristics of an Ideal Routing Protocol for Ad Hoc Wireless Networks	
	B	Classifications of Routing Protocols-Based on Routing Information, Routing Topology,	

		Utilization of Specific resources, Hierarchical Routing Protocol, Power aware Routing Protocol			
	C	Multicast Routing-Introduction, Issues in Multicast Routing Protocols, classification: Tree Based Multicast Routing protocol, Mesh Based Multicast Routing protocol			
	Unit 4	**Ad Hoc Transport Layer Protocols**			
	A	Ad hoc transport layer Issues, Design Goals and Classification of Transport layer Protocol			
	B	TCP over AdHoc Wireless Networks-Feedback Based TCP,TCP with Explicit Link Failure Notification			
	C	TCP-BuS,AdHoc TCP ans Split TCP.			
	Unit 5	**Wireless sensor networks**			
	A	Introduction-Applications of Sensor Networks,Comparison with AdHoc Wireless Networks , Issues and challenges in Designing a Sensor Network,Sensor Network Architecture-Layered Architecture, Clustered Architecture			
	B	Mac Protocols for Sensor Networks-Self Organizing MAC for Sensor Networks and Eavesdrop and register, Carrier Sense Multiple Access based MAC			
	C	Issues in WSN Routing-Energy Efficient Design, Synchronization, Issues in WSN Routing- Transport layer Issues, Security and Real Time Communication. Localization- Indoor and Sensor Network Localization, QoS in WSN-Coverage, Exposure			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. C.Siva Ram Murthy and B.Smanoj, " Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education			
	Other References	1. Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers 2. C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education 3. Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly 4. Internet as Source of Reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
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School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: II**	
1	Course Code		Course Name: **Advanced Wireless Communication**
2	Course Title	**Advanced Wireless Communication**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PG	
5	Course Objective		
6	Course Outcomes		
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Radio Propagation Over Wireless Channel**	
	A	Mobile radio communication fundamentals, fundamental of wireless communication	
	B	Bandwidth concept, type of signals, quantization, channel coding, equalization, large scale path loss: propagation models, reflection	
	C	Diffraction and scattering. Small scale multi path propagation, multi path effect/ fading in land mobile system.	
	Unit 2	**Wideband Modulation Techniques**	
	A	Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS)	
	B	Frequency hopped spread spectrum (FH-SS), OFDM (Multi carrier Modulation)	
	C	Introduction to multiple Access: time division multiple access (TDMA), space division multiple access (SDMA), code division multiple access (CDMA) and frequency division multiple access (FDMA).	

	Unit 3	**Broadcast Networks**			
	A	Introduction to Broadcast Systems, DAB			
	B	Mondiale(DRM), HD Radio Technology			
	C	Digital Radio Digital Video broadcasting(DVB), Direct to home(DTH)			
	Unit 4	**Infrastructure-Based/Cellular Networks**			
	A	Introduction to Mobile Networks, GSM System, GPRS, EDGE, and CDMA			
	B	Based standard, IMT-2000, WLL, Mobile Satellite Communication			
	C	3G and 4G, Cognitive Radio Network (5G).			
	Unit 5	**Ad Hoc Network, Wlan and WMAN**			
	A	Introduction, Bluetooth, Wi-Fi Standard, WiMAX Standard			
	B	Wireless Sensor Networks			
	C	IEEE 802.15.4 and Zigbee, Ultra-wideband(UWB), IEEE 802.20			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Upena Dalal, “Wireless Communication”, Oxford Higher Education.			
	Other References	1. Willium C. Y. Lee, “Mobile communication Design and fundamentals” 2. D. R. KamiloFehar, “Wireless digital communication” 3. Internet as a resource for references			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
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School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: II**	
1	Course Code		Course Name: **Wireless Sensor Network**
2	Course Title	**Wireless Sensor Network**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	PG	
5	Course Objective	This course provides a broad coverage of challenges and latest research results related to the design and management of wireless sensor networks	
6	Course Outcomes	On successful completion of this module students will be able to: 1. Architect sensor networks for various application setups 2. Assess coverage and conduct node deployment planning 3. Devise appropriate data dissemination protocols and model links cost 4. Determine suitable medium access protocols	
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction: Hardware, Architecture & Application**	
	A	Introduction: Ad Hoc Wireless Networks, Issues in Ad-Hoc Wireless Networks, Sensor networks as ad hoc networks, Comparison with Ad Hoc Wireless Networks	
	B	Issues and challenges in Designing a Sensor Network, Applications of Sensor Networks	
	C	Sensor Network Architecture-Layered Architecture, Clustered Architecture, Network architecture – Sensor network scenarios – types of sources and sinks – single hop Vs multi hop-multiple sources and sinks – mobility	
	Unit 2	**Hardware & Software components**	
	A	Hardware components – sensor node overview – controller- memory -communication device - sensors and actuators – power supply of sensor nodes	

	B	Energy consumption of sensor nodes, operation states with different power consumption , microcontroller energy consumption memory, Radio transceivers computation and communication power consumption.	
	C	OS, Embedded OS, programming paradigms ,protocol stack ,energy and power management, TinyOS and nesC, Gateway ,Need ,WSN to internet ,Internet to WSN ,WSN tunneling	
	Unit 3	Communication protocols	
	A	Physical layer and transceiver design in WSN energy usage profile –choice of modulation scheme, dynamic modulation scaling – antenna.	
	B	MAC protocols - Low duty cycle protocols and wake up concepts : S-MAC, Mediation device protocol, Wakeup radio concepts	
	C	Naming and addressing – Address and name management in WSN, Assignment of MAC addresses – distributed assignment of network wide addresses	
	Unit 4	**Topology & Routing**	
	A	Routing protocols – Energy efficient – overview – unicast protocols, multipath unicast routing, Geographic routing – position based routing – geocasting	
	B	**Topology control –controlling topology in flat networks –power control, Clustering – hierarchical networks by clustering – clusters - connecting clusters – rotating cluster heads, Multihop clusters – multilayer of clustering – passive clustering**	
	C	**Time synchronization: need – properties – protocol – LTS – TPSN – RBS – HRTS, clocks and communication delays – interval methods – reference broadcasts**	
	Unit 5	Localization – services & task control	
	A	**Localization and positioning – properties – approaches – alteration problem – Single Hop localization, positioning in multihop**	

		environment			
	B	**Localization services – Ranging techniques – range based localization algorithms – location services**			
	C	Sensor tasking and control – Task driven sensing – roles of sensor nodes and utilities – information based sensor tasking, Sensor tasking and control – joint routing and information aggregation			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1- "Protocols and Architectures for Wireless Sensor Networks", Holger Karl, Andreas Willig, *Wiley, ISBN:* 0-470-09510-5			
	Other References	1. "Wireless Sensor Networks", Cauligi S. Raghavendra, Krishna Sivalingam, Taieb M. Znati, *Springer, ISBN:* 1-4020-7883-8 2. Internet as a resource for references			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
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School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: II**	
1	Course Code		Course Name: **Grid Computing**
2	Course Title	**Grid Computing**	
3	Credits	3	
4	Contact Hours (L-T-P)	2-0-2	
	Course Status	PG	
5	Course Objective		
6	Course Outcomes		
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Definition of Grid, history and evolution of Grid Computing, Virtual Organizations	
	B	Computational Grid projects around the world, Grid challenges, Grid organizations, Service	
	C	Oriented Architecture (SOA), Issues in Management of Grid Models.	
	Unit 2	**Architecture**	
	A	Components of Layered Grid Architecture, Open Grid Services.	
	B	Architecture (OGSA), Grid architecture models	
	C	Grid Resource Information Service (GRIS). Resource infrastructure.	
	Unit 3	**Grid Middleware**	
	A	Globus: Overview, resource specification language.	
	B	information services, Globus Resource Allocation Manager (GRAM).	
	C	Grid FTP protocol.	
	Unit 4	**Resource Management and**	

		Scheduling			
	A	Grid Scheduling and Resource Management, Scheduling Paradigms,			
	B	Working principles of Scheduling, A Review of Condor.			
	C	SGE, PBS and LSF-Grid Scheduling with QoS.			
	Unit 5	**Grid Portals and Security**			
	A	Functionality and underlying infrastructure for sample general and application specific portals.			
	B	Grid security demands and solutions.			
	C	**Case Studies**: Recent version of Globus Toolkit- Architecture, Components and Features.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Foster, I. and Kesselman, C. (eds.). The Grid: Blueprint for a New Computing Infrastructure. Morgan Kaufmann Publishers, (1999).			
	Other References	1. Luis Ferreira et al., Grid Computing in Research and Education, ibm.com/redbooks, (September 203). 2. Maozhen Li, Mark Baker, "The Grid Core Technologies", John Wiley & Sons, (2005). 3. Internet as a resource for references			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
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School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Computer Network		**Semester: II**	
1	Course Code		Course Name: **Performance Modeling of Computer Communication Network**
2	Course Title	**Performance Modeling of Computer Communication Network**	
3	Credits	3	
4	Contact Hours (L-T-P)	2-0-2	
	Course Status	PG	
5	Course Objective		
6	Course Outcomes		
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to probability theory**	
	A	sample points, events probability, random variable	
	B	Expectation and other moments, stochastic process	
	C	exponential distribution and poisson process, markov chains	
	Unit 2	**Performance Modelling**	
	A	system, model and modelling, classification of models	
	B	performance models, simulation models	
	C	Analytical models	
	Unit 3	**Single server queueing model**	
	A	M|M|1 Queueing models	
	B	M|G|1-FCFS Queuing Models, G|M|1-FCFS and G|G|1-FCFS Queueing Models	
	C	PH|PH|1 Queueing Models, Polling Models	
	Unit 4	**Queueing Network Model**	
	A	Open Queuing Networks, Closed	

		Queueing Networks			
	B	BCMP Queueing Networks			
	C	Hierarchical Queueing Networks			
	Unit 5	**Stochastic Petri Models**			
	A	Stochastic Petri Nets, Numerical Solution of Markov Chains			
	B	Stochastic Petri Net application, infinite-state SPN			
	C	Simulation methodology and statistics			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1.Performance of Computer Communication Systems: A Model-Based Approach, Boudewijn R. Haverkort, 1998 John Wiley & Sons, Ltd			
	Other References	1. Performance Models and Risk Management in Communications Systems Gülpınar, Nalân, Harrison, Peter G., Rustem, Berc (Eds. 2. Performance Modelling of Communication Networks and Computer Architectures : Peter G. Harrison , Naresh M. Patel 3. Internet as source of reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
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