Dr. Babasaheb Ambedkar Marathwada University

Aurangabad

Department of Computer Science & Information Technology

Reaccredited with 'A' Grade

Curriculum Book

M.Tech. Computer Science & Engineering

2018-2019

Outcome Based Education Curriculum

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

Syllabus Book of

M. Tech (Computer Science Engineering)

w.e.f. ACADEMIC YEAR JUNE, 2018-19

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Department of Computer Science and Information Technology

OBE

M. Tech (Computer Science Engineering)

(2018-2019)

SCHEME FOR CHOICE BASED CREDIT SYSTEM (CBCS)

w.e.f. JUNE, 2018 (ACADEMIC YEAR, 2018-19)

Index

M.Tech (Computer Science Engineering) 2018-19

Sr. No.	Contents	Page No.
1	About the revised syllabus	4
2	About Admission Procedure	4
3	Credit Based System	7
4	Course Structure	11
5	Detailed Syllabus 1. Semester I 2. Semester II 3. Elective-I 4. Elective-II	19

About the Revised Syllabus

- This version came into effect in June 2016. There have been many advancements in Computer Science and Information Technology and consequent changes in needs of society, industry in respect in which the syllabus was required to be updated.
- This document present the revised version of M. Tech. Computer Science and Engineering syllabus which becomes effective for teaching with immediate effect. It is designed to facilitate students in the development of concept based approach for problem solving using CSE as a tool. The self-learning approach is built in the syllabus thereby training the candidate to update themselves on the changing technologies in their area of work. The outstanding syllabus has been designed to produce junior programmers, EDP Assistants, web designers, etc. equipped with latest knowledge and skills.

About Admission Procedure:

Department of Computer Science and Information Technology adopted a credit- based system under the Academic Flexibility Program of the University from the academic year 2011- 12.

It is a flexible, cafeteria- type learning system with an inbuilt horizontal mobility for students to all desire units of education in the Department/Departments with provision for even inter Departmental mobility for students. CBCS operates on modular pattern based on module/units called "credits", wherein 'credit' defines the quantum of contents/syllabus prepared for a course/paper and determines the minimum number of teaching- learning hours required

OBE & CBCS permits students to:

- Learn at their own pace,
- Choose electives from a wide range of elective courses offered by the department,
- Undergo additional/value added courses and acquire more than the required number of credits, depending upon the learner aptitude,
- Adopt an interdisciplinary approach in learning,
- Make best use of the expertise of faculty across the Department, beside the particular department faculty

- Acquire knowledge, skill and attitude of learning outcomes through participatory teaching and learning and continuous evaluation process

This provides the flexibility to make the system more responsive to the changing needs of our students, the professionals and society. The credit- based system also facilitates the transfer of credits.

Admission/ Promotion in M. Tech. Computer Science and Engineering

Program: M. Tech. Computer Science and Engineering

Duration: (Four Semesters means Two Academic Years)

Intake: 30

Eligibility: B.E/B. Tech. in Computer Science and Engineering/IT.

Program Outcomes:

The overall objective of this course is to cater the need of computational field. The content of this course is according to the current trends of research in Computer Science and requirements of industry expectations. Some courses of this program are exclusively designed towards development of analytical, presentation and personality development skills among the students, through which the students get prepared and trend for building their carrier in computer science and its related applied technology, research and development.

In line with Outcome based education the program specific outcomes for M. Tech. Computer Science programs are as follows

- To be fundamentally strong at core subjects of computer science.
- An ability to apply programming and computational skills for industrial solutions.
- Realizes the importance of lifelong learning and continuous professional development.
- Broad understanding of latest technological trends.
- An ability to identify opportunities for establishing an enterprise for immediate Employment.
- Ability to understand and apply fundamental research concepts.
- An ability to use efficient soft skills for professional development.
- To be rational in professional ethics and attitude.
- Able to use current tools and technologies to cater multidisciplinary needs.
- An ability to indulge in lifelong learning for professional development.
- Ability to sustain in the areas of Data Science and Analytics.

Fees

Sr. No.	Fees Head	First Semester				Second Semester			
		Open	SC/ ST	OBC /VJ /NT /SBC	Sponsored	Open	SC/ST	OBC/VJ/ NT/SBC	Sponsored
1	Admission Fees	50	50	50	50	50	50	50	50
2	Tuition Fees	18000	00	7500	18000	18000	00	7500	23000
3	Laboratory Fees	5000	00	5000	5000	5000	00	5000	5000
4	Other Fees	2000	00	2000	2000	2000	00	2000	2000
5	Eligibility Fees	100	100	100	00	00	00	00	00
		25150	150	14650	30150	25050	50	14550	30050

***Fees likely to be modified as per the university rule and regulation from time to time and will be applicable to the concern students.**

Admission to the M. Tech. Computer Science course in the department will be done on the performance of GATE score and on their performance in the qualifying graduate level examination.

The student will apply on the application form of the University provided with the prospectus/e-prospectus. Once the student is admitted to the concern department/ course, he/she will be

promoted to next semester with full carryon; subject to the registration of student in every consecutive semester. Dropout student will be allowed to register for respective semester as and when the concerned courses are offered by the department, subject to the condition that his/her tenure should not exceed more than twice the duration of course from the date of first registration at parent department. The admission of concern student will be automatically get cancelled if he/she fails to complete the course in maximum period (Four years/Eight semesters)

Credits and Degrees

i) A candidate who has successfully completed all the core courses, Elective/ Specialized courses and, seminars and project prescribed and or optional service courses approved by the University for the program with prescribed CGPA shall be eligible to receive the degree.

ii) One Credit shall mean one teaching period of one hour per week for one semester (of 15 weeks) for theory courses and two practical/laboratory/field/demonstration hours/ week for one semester.

iii) Every student will have to complete at least 100 credits to obtain the master's degree of M. Tech.

Computer Science M. Tech. (Post graduate degree) out of which 96 credits should be from this Department and four or eight credits of service courses from this or other Department. However the Department can design the curriculum of more credits and it will be compulsory for the students of this Department to complete the credits accordingly

Courses

i) Core Course: A core course is a course that a student admitted to M. Tech. Computer Science program must successfully completed to receive the degree. Normally no theory course shall have more than 4 credits.

ii) Elective Course: Means optional course from the basic subject or specialization. The elective course defined specialization that student want to perceive. The horizontal learning path is to be followed by the student for selection of elective course. Department may offer more than one specialization depending availability of resources.

iii) Attendance: Students must have 75% of attendance in each Core and Elective course for appearing the examination. However student having 65% attendance with medical certificate may apply to the H.O.D. for commendation of attendance.

Departmental Committee:

Every P.G. program of the University/College shall be monitored by a committee constituted for this purpose by the Department. The Committee shall consist of H.O.D. as a Chairman and some/all the teachers of the Department as its members.

Results Grievances Redressal Committee:

The department shall form a Grievance Redressal Committee for each course with the Course Teacher and the HOD. This Committee shall solve all grievances relating to the Assessment of the students.

Awards of Grades

Grade Scale As per regulation 1977 and 1978 for MTech. Examination

Sr. No.	Equivalent Percentile	Equivalent Percentile	Equivalent percentage	Grade points	Grade	Grade description	Passed Division
1	90.00- 100	45.00- 50.00	90.00-100.00	9.00- 10	O	Outstanding	**Passed with Distinction**
2	80.00- 89.99	40..00- 44.99	80.00- 89.99	8.00- 8.99	A++	Excellent	
3	70.00- 79.99	35.00- 39.99	70.00- 79.99	7.00- 7.99	A+	Exceptional	
4	60.00- 69.99	30.00- 34.99	60.00-69.99	6.00- 6.99	A	Very good	**Passed with First Division**
5	55.00- 59.99	27.50- 29.99	55.00- 59.99	5.50- 5.99	B+	Good	**Passed with Second Division**
6	50.00- 54.99	27.00- 27.49	54.00- 54.99	5.00- 5.49	B	Fair	
7	45.00- 49.99	26.50- 26.99	52.50- 53.99	4.50- 4.99	C+	Average	
8	40.01- 44.99	25.01-26.49	50.01-52.50	4.01- 4.49	C	Below average	
9	40	25	50	4.00	D	Pass	
10	< 40	< 25	< 50	0.00	F	Fail	**Fail**

Computation of SGPA (Semester grade point average) &CGPA (Cumulative grade point average)

The computation of SGPA & CGPA, will be as below:

a) **Semester Grade Point Average (SGPA)** is the weighted average of points obtained by a student in a semester and will be computed as follows:

$$SGPA = \frac{Sum(CourseCredit * Number\ of\ Points\ in\ concern\ gained\ by\ student)}{Sum(CourseCredits)}$$

The Semester Grade Point Average (SGPA) for all the four semesters will be mentioned at the end

of every semester.

b) **The Cumulative Grade Point Average (CGPA)** will be used to describe the overall performance of a student in all semesters of the course and will be computed as under:

$$CGPA = \frac{Sum(All\ Four\ Semester\ Credits\ gained\ by\ th\ e\ student)}{Sum(Credits\ of\ All\ Semesters)}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Evaluation method:

Each theory course will be of 100 Marks and be divided in to internal examination (Sessional) of 20 Marks and Semester end examination of 80 Marks. (20+80 = 100 Marks). Each Practical course will be of 50 marks. Research project / Internship / field projects if any, will be of 100 marks.

a. Internal Evaluation Method

There shall be two mid semester examinations, first based on 40 percent syllabus taught and second based on 60 percent syllabus taught. The setting of the question papers and the assessment will be done by the concerned teacher who has taught the syllabus. Average score obtained out of two mid semester examinations will be considered for the preparation of final sessional marks/grade.

b. Term end examination and evaluation

i. Semester end examination time table will be declared by the departmental committee and accordingly the concern course teacher will have to set question paper, conduct theory examination, practical examination with external expert, evaluate, satisfy the objection / query of the student (if any) and submit the result to DC.

ii. The semester end examination theory question paper will have two parts (20+60 = 80

Marks)

iii. Template of question paper is designed in light of Outcome based education method and determines the attainment level of students. The pattern of question paper is as below

   a. Q1 will be based on (fill in the blanks/ multiple choice questions/ match columns / state true or false / answer in one sentence) as compulsory questions and it should cover entire syllabus and carries 20 Marks.
   b. Student will require to solve any five questions from Q2 to Q8 where Q2 of type comprehension, Q3 and Q4 are application oriented, Q5 based on analysis, Q6 will be on synthesis, Q7 checks evaluation ability of student, and Q8 on Comprehension ability.

iv. Semester end Practical examinations will be of 50 marks each and students will be examined by one external and one internal examiner. Seminar and Project work (if any) will be evaluated by the external examiners along with guide.

v. At the end of each semester the Committee of Department shall assign grade points and grades to the students.

vi. The Committee of Department shall prepare the copies of the result sheet in duplicate. Every student shall have the right to scrutinize answer scripts of Mid semester/Term end semester examinations and seek clarifications from the teacher regarding evaluation of the scripts immediately thereafter or within 3 days of receiving the evaluated scripts.

vii. The Head of the department shall display the grade points and grades for the notice of students. The head of the department shall send all records of evaluation for Safekeeping to the Controller of Examinations as soon as all the formalities are over.

Grade Card

The University shall issue at the beginning of each semester a grade card for the student, containing the Grades obtained by the student in the previous semester and his Semester Grade Point Average (SGPA).

The grade card shall list:

(a) The title of the courses along with code taken by the student

(b) The credits associated with the course,

(c) The grade and grade points secured by the student,

(d) The total credits earned by the student in that semester.

(e) The SGPA of the student,

(f) The total credits earned by the students till that semester and

(g) The CGPA of the student (At the end of the IV Semester).

Cumulative Grade Card

At the end of the IV semester, the University shall issue Cumulative Grade Card to the Students showing details of Grades obtained by the student in each subject in all semesters along with CG PA and total credits earned.

M. Tech. (Revised Course Structure-2018)

Semester I

Sr. No.	Subject Code	Subjects	Teaching Scheme (Hours/Week)				Examination Scheme (Credits)				Min Marks	Max Marks
			L	T	P	Total	Th	TW	Practical	Total		
01	MTTR401	**Program Core I** Mathematical foundations of Computer Science	4	--	--	4	4	--	--	4	40	100
02	MTTR402	**Program Core II** Advanced Data Structures	4	--	--	4	4	--	--	4	40	100
03	MTPR201	Practical Based on MTTR402	--	--	4	4	--	--	2	2	20	50
04		Program Elective I	4	--	--	4	4	--	--	4	40	100
05		Practical Based on Elective-I	--	--	4	4	--	--	2	2	20	50
06		Program Elective II	4	--	--	4	4	--	--	4	40	100
07		Practical Based on Elective-II	--	--	4	4	--	--	2	2	20	50
08	MTTR286	Research Methodology and IPR	2	--	--	2	2	--	--	2	20	50
09		Audit Course	2	--	--	2	2	--	--	2	20	50
Total of First semester			**20**	**--**	**12**	**32**	**20**		**6**	**26**	**260**	**650**

Elective I:

Subject Code	Subjects	Min Marks	Max Marks		Subject Code	Subjects	Min Marks	Max Marks
MTTR421	**Machine Learning**	40	**100**		MTTR423	**Introduction to Intelligent Systems**	40	**100**
MTPR202	Practical Based on MTTR421	20	**50**		MTPR204	Practical Based on MTTR423	20	**50**
MTTR422	**Wireless Sensor Networks**	40	**100**					
MTPR203	Practical Based on MTTR422	20	**50**					

Elective II:

Subject Code	Subjects	Min Marks	Max Marks		Subject Code	Subjects	Min Marks	Max Marks
MTTR431	**Data Science**	40	**100**		MTTR433	**Advanced Wireless and Mobile Networks**	40	**100**
MTPR205	Practical Based on MTTR431	20	**50**		MTPR207	Practical Based on MTTR433	20	**50**
MTTR432	**Distributed Systems**	40	**100**		MTTR434	**Remote Sensing**	40	**100**
MTPR206	Practical Based on MTTR432	20	**50**		MTPR208	Practical Based on MTTR434	20	**50**

Semester II

Sr. No.	Subject Code	Subjects	Teaching Scheme (Hours/Week)				Examination Scheme (Credits)				Min Marks	Max Marks
			L	T	P	Total	Th	TW	Practical	Total		
10	MTTR403	**Program Core III** Advance Algorithms	4	--	--	4	4	--	--	4	40	100
11	MTTR404	**Program Core IV** Soft Computing	4	--	--	4	4	--	--	4	40	100
12	MTPR209	Practical Based on MTTR432	--	--	4	4	--	--	2	2	20	50
13		Program Elective III	4	--	--	4	4	--	--	4	40	100
14		Practical Based on Elective-III	--	--	4	4	--	--	2	2	20	50
15		Program Elective IV	4	--	--	4	4	--	--	4	40	100
16		Practical Based on Elective-IV	--	--	4	4	--	--	2	2	20	50
17		Audit Course	2	--	--	2	2	--	--	2	20	50
18	MTPR216	Mini Project with Seminar	--	--	2	2	--	--	2	2	20	50
Total of Second semester			**18**		**16**	**34**	**18**		**8**	**26**	**260**	**650**

Elective III:

Subject Code	Subjects	Min Marks	Max Marks		Subject Code	Subjects	Min Marks	Max Marks
MTTR441	**Data Preparation and Analysis**	40	**100**		MTTR442	**Knowledge Discovery**	40	**100**
MTPR210	Practical Based on MTTR441	20	**50**		MTPR212	Practical Based on MTTR442	20	**50**
MTTR442	**Computer Vision**	40	**100**					
MTPR211	Practical Based on MTTR442	20	**50**					

Elective IV:

Subject Code	Subjects	Min Marks	Max Marks		Subject Code	Subjects	Min Marks	Max Marks
MTTR451	**Human and Computer Interaction**	40	**100**		MTTR453	**Secure Software Design & Enterprise Computing**	40	**100**
MTPR213	Practical Based on MTTR451	20	**50**		MTPR215	Practical Based on MTTR453	20	**50**
MTTR452	**Geographic Information System (GIS)**	40	**100**					
MTPR214	Practical Based on MTTR452	20	**50**					

Audit Course:

Subject Code	Subjects	Min Marks	Max Marks		Subject Code	Subjects	Min Marks	Max Marks
MTTR291	English for Research Paper Writing	20	**50**		MTTR294	Constitution of India	20	**50**
MTTR292	Disaster Management	20	**50**		MTTR295	Pedagogy Studies	20	**50**
MTTR293	Value Education	20	**50**					

Updated Syllabus 2018-19

Semester – I

1. Mathematical Foundation of Computer Science

Course Code	MTTR401	Course Title	Mathematical Foundation of Computer Science
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Discrete Mathematics

Course Objectives

1] To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

2] To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.

3] To study various sampling and classification problems.

Course Outline:

Unit 1: Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains.

Unit 2: Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.

Unit 3: Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

Unit 4: Graph Theory: Isomorphism, Planar graphs, graph colouring, hamilton circuits and euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

Unit 5:Computer science and engineering applications Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

Unit 6: Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatic, soft computing, and computer vision.

References

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

Lab Exercise:

There should be minimum 10 lab assignment on the topics discussed in the course.

Course Outcomes:

After completion of course, students would be able to:

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

2. Advanced Data Structures:

Course Code	MTTR402	Course Title	Advanced Data Structure
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites:

UG level course in Data Structures.

Course Objectives

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

Course Outline:

Unit 1

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.

Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Unit 2:

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

Unit 3

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees.

Unit 4

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Unit 5

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

Unit 6:

Recent Trands in Hashing, Trees, and various computational geometry methods for effeciently solving the new evolving problem

References:

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

Lab Exercise:

There should be minimum 10 lab assignment on the topics discussed in the course.

Course Outcomes:

After completion of course, students would be able to:

1. Understand the implementation of symbol table using hashing techniques.
2. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3. Develop algorithms for text processing applications.
4. Identify suitable data structures and develop algorithms for computational geometry problems.

Elective I:

1. Machine learning

Course Code	MTTR421	Course Title	Machine Learning
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites:

An upper-level undergraduate course(s) in algorithms and data structures, a basic course on probability and statistics, basic understanding of linear algebra and basic of neural networks

Course Objectives

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

Course Outline:

Unit 1: Supervised Learning (Regression/Classification)

- Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes
- Linear models: Linear Regression, Logistic Regression, Generalized Linear Models
- Support Vector Machines, Nonlinearity and Kernel Methods

Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

Unit 2: Unsupervised Learning

- Clustering: K-means/Kernel K-means
- Dimensionality Reduction: PCA and kernel PCA
- Matrix Factorization and Matrix Completion

Generative Models (mixture models and latent factor models)

Unit 3

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, and Random Forests).

Unit 4

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

Unit 5

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

Unit 6:

Recent trends in various learning techniques of machine learning and classification
Methods for IOT applications. Various models for IOT applications.

References:

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

Lab Exercise:

There should be minimum 10 lab assignment on the topics discussed in the course.

Course Outcomes:

After completion of course, students would be able to:

- Extract features that can be used for a particular machine learning approach in various IOT applications.
- To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
- To mathematically analyze various machine learning approaches and paradigms.

2. Wireless Sensor Networks

Course Code	MTTR422	Course Title	Wireless Sensor Networks
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Wireless Communication

Course Objectives

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost.
3. Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks.

Course Outline:

Unit 1:

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors

- **Network Architecture:** Traditional layered stack, Cross-layer designs, Sensor Network Architecture
- **Hardware Platforms:** Motes, Hardware parameters.

Unit 2:

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.

Unit 3:

Medium Access Control Protocol design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled

Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis

MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC Analysis
(Markov Chain).

Unit 4:

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key Distribution.

Unit 5:

Routing protocols: Introduction, MANET protocols

Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast

Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain)

Advanced topics in wireless sensor networks.

Unit 6:

ADVANCED TOPICS

Recent development in WSN standards, software applications

References:

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

Lab Exercise:

There should be minimum 10 lab assignment on the topics discussed in the course.

Course Outcomes:

After completion of course, students would be able to:

- Describe and explain radio standards and communication protocols for wireless sensor networks.
- Explain the function of the node architecture and use of sensors for various applications.
- Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

3. Introduction to Intelligent Systems

Course Code	MTTR423	Course Title	Introduction to Intelligent Systems
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Data Structures and Data Management or Data Structures

Course Objectives

The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

Course Outline:

Unit 1:

Biological foundations to intelligent systems I: Artificial neural networks, Back propagation networks, Radial basis function networks, and recurrent networks.

Unit 2:

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

Unit 3:

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hillclimbing search. Optimisation and search such as stochastic annealing and genetic algorithm.

Unit 4:

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

Unit 5:

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

Unit 6:

Recent trends in Fuzzy logic, Knowledge Representation

References:

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

Course Outcomes:

After completion of course, students would be able to:

- Able to Demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyse and compare the relative merits of a variety of AI problem solving techniques.

Elective: II

1. Data Science

Course Code	MTTR431	Course Title	Data Science
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Data Structures and Data Management or Data Structures

Course Objectives

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

Course Outline:

Unit 1:

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Unit 2:

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

Unit 3:

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance,Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Unit 4:

Data visualisation: Introduction, Types of data visualisation, Data for visualisation:Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Unit 5:

Applications of Data Science,Technologies for visualisation, Bokeh (Python)7

Unit 6:

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science

References:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Lab Exercise:

There should be minimum 10 lab assignment on the topics discussed in the course.

Course Outcomes:

After completion of course, students would be able to:

- Explain how data is collected, managed and stored for data science;
- Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
- Implement data collection and management scripts using MongoDB

2. Distributed Systems

Course Code	MTTR432	Course Title	Distributed Systems
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Database Management Systems

Course Objectives

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

Course Outline:

Unit 1:

INTRODUCTION

Distributed data processing; what is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE

Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

Unit 2:

DISTRIBUTED DATABASE DESIGN

Alternative design strategies; Distributed design issues; Fragmentation; Data allocation

SEMANTICS DATA CONTROL

View management; Data security; Semantic Integrity Control

QUERY PROCESSING ISSUES

Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

Unit 3:

DISTRIBUTED QUERY OPTIMIZATION

Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms

TRANSACTION MANAGEMENT

The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models

CONCURRENCY CONTROL

Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

Unit 4:

RELIABILITY

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

Unit 5:

PARALLEL DATABASE SYSTEMS

Parallel architectures; parallel query processing and optimization; load balancing

Unit 6:

ADVANCED TOPICS

Mobile Databases, Distributed Object Management, Multi-databases

References:

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

Course Outcomes:

After completion of course, students would be able to:

- Design trends in distributed systems.
- Apply network virtualization.
- Apply remote method invocation and objects.

3. Advanced Wireless and Mobile Network

Course Code	MTTR433	Course Title	Advanced Wireless and Mobile Networks
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Computer Networks

Course Objectives

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

The students should get familiar with the wireless/mobile market and the future needs and challenges.

Course Outline:

Unit 1:

INTRODUCTION:

Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

WIRELESS LOCAL AREA NETWORKS:

IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node &

Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues

Unit 2:

WIRELESS CELLULAR NETWORKS:

1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

Unit 3:

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview

WIRELESS SENSOR NETWORKS

Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

Unit 4:

WIRELESS PANs

Bluetooth AND Zigbee, Introduction to Wireless Sensors.

Unit 5:

SECURITY

Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

Unit 6:

ADVANCED TOPICS

IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks

References:

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

Course Outcomes:

After completion of course, students would be able to:

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

4. Remote sensing

Course Code	MTTR434	Course Title	Remote Sensing
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: The students are required to know the theoretical and practical knowledge of Digital Image Processing, Digital Signal Processing and Pattern Recognition.

Course Objectives

Introducing technical issues behind the remotely sensed image acquisition and utilization with airborne and satellite images. Analyzing and studying various formats and interpretation of images with software tools. Understanding thoroughly the techniques which help in experimentation of remote sensed images for studying environmental monitoring, biological, geological, hydrological, Agricultural and oceanographic as well as human activities are emphasized.

Course Outline:

Unit 1: Introduction

Inroduction, Definition and Objectives, Historical Background, International Space Law, Sources of Information on Remote Sensing, Advantages of Space-Based Observations, Remote Sensing System Characteristics.

Unit 2: Remote Sensing Sensor and Data Models

Fundamentals of Remote Sensing Sensors, the Electromagnetic Spectrum, Terms and Units of Measurement, Spectral Signatures, Overall Sensor Model, Resolutions, Spatial Response, Spectral Response, Geometric Distortion, Univariate and Multivariate Image Statistics, Noise Models, Spatial Statistics, Topographic and sensor effects.

Unit 3: Spectral-Spatial Transforms and Preprocessing

Spectral Transform: Feature Space, Multispectral Ratios, Principal Components, Contrast Enhancement. Spatial Transform: An Image Model for Spatial Filtering, Convolution Filters, Fourier Transforms, Scale-Space Transform. Preprocessing: Distortion Correction, Noise Reduction and Radiometric Correction.

Unit 4: Registration, Visual Interpretation and Digital Image Processing

Registration: Registration, Automated GCP location, Orthorectification, Multi-Image Fusion. Visual Interpretation: Characteristics of Photographic Images, Feature Identification, Criteria for Visual Interpretation, Elements of Visual Analysis. Processing: Structure of Digital Image, Media and Data Organization, Visual Enhancements, Image Corrections.

Unit 5: Classification and Accuracy Assessment

Classification: The classification process, Feature Extraction, Training the Classifier, Supervised Classification, Unsupervised classification. Accuracy Assessment: Relevance of Validating Results, Methods to Estimate Accuracy, Sources of Error, Sampling Design, Gathering Information, Measuring errors in classified images, verification of multi-temporal analysis.

Text Books

1. Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, Alfredo Huete (2010), CRC Press, Taylor & Francis Group.
2. Remote Sensing and Image Interpretation. 6th ed. Lillesand, T.M., Kiefer, R.W. and Chipman.J.W. 2008. New York: John Wiley & Sons.
3. Fundamentals of Remote Sensing, George Joseph (2004), Universities Press (India) Private Limited.
4. Remote Sensing Models and Methods for Image Processing, 3rded, Robert A. Schowengerdt,Academic Press is an imprint of Elsevier, 2007.

Reference Books

1. Remote Sensing of the Environment - an Earth Resource Perspective 2nd ed. Jensen, J.R. 2007. Upper Saddle River, NJ, Prentice Hall.
2. Remote Sensing Principles and Interpretation, Floyd, F. Sabins, Jr: Freeman and Co., San Franscisco, 1978.
3. Manual of Remote Sensing Vol. I&II, 2nd Edition, American Society of Photogrammetry.
4. Remote Sensing: The quantitative approach, P.H. Swain and S.M. Davis, McGraw Hill.
5. Introductory Digital Image Processing: A remote sensing perspective, John R. Jensen, P. Hall.
6. Imaging Radar for Resource Survey: Remote Sensing Applications, 3, W Travelt, Chapman & Hall.
7. Remote sensing Notes –Edited by Japan Associates of Remote sensing- JARS 1999
8. Introduction to Remote Sensing, Campbell James, Taylor & Francis London.
9. Photogrammetry and Remote Sensing (2000), Lecture notes, Module I, IIRS
10. Remote Sensing,Agarwal C.S. and Garg, P. K. (2000): A. H. Wheeler and Co. Ltd., New Delhi.

Course Outcomes:

After completion of course, students would be able to:

- Students will be able to articulate the basics of how electromagnetic energy enables remote sensing and be able to describe why different wavelength regions of the electromagnetic spectrum are useful for different types of remote sensing as well as why various portions of the electromagnetic spectrum cannot be used for remote sensing.
- Students will be able to explain the concepts of spatial, spectral, radiometric and temporal resolution and how they impact the selection of the most appropriate data source(s) for a particular analytical task. Students will also be able to compare and contrast current common sensors on the basis of these properties and explain if a sensor is useful for particular tasks.

- Students will be able to describe spectral signatures and use this knowledge to explain how different wavelengths can successfully be used to differentiate between different land surface types.
- Students will be able to explain and perform fundamental digital image processing tasks including radiometric preprocessing, spatial-spectral transform, supervised and unsupervised classification and accuracy assessment using models and methods for remotely sensed images.
- Students will be able to integrate remote sensing results with other geographic variables to obtain a more comprehensive view of particular area of interest.
- Students will be able to perform Remote Sensed Image analysis and classification using Python/ENVI on different data sets.

3. Research Methodology and IPR

Course Code	MTTR286	Course Title	Research Methodology and IPR
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Knowledge of Patents, Copy Rights, Trademarks.

Course Objectives

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

Course Outline:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal,

Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies,
IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outcomes:

At the end of the course, students will demonstrate their ability to: Understanding and formulation of research problem.

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

M. Tech Sem - II

1. Advance Algorithm

Course Code	MTTR403	Course Title	Program Core III - Advance Algorithms
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: UG level course in Algorithm Design and Analysis

Course Objectives

1. Introduce students to the advanced methods of designing and analyzing algorithms.
2. The student should be able to choose appropriate algorithms and use it for a specific problem.
3. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Students should be able to understand different classes of problems concerning their computation difficulties.
5. To introduce the students to recent developments in the area of algorithmic design.

Course Outline:

Unit1

Sorting: Review of various sorting algorithms, topological sorting

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Unit 2

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

Unit 3

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

Unit 4

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

Unit 5

Linear Programming: Geometry of the feasibility region and Simplex algorithm

NP-completeness: Examples, proof of NP-hardness and NP-completeness.

One or more of the following topics based on time and interest

Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

Unit 6

Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

References:

1. "Introduction to Algorithms" byCormen, Leiserson, Rivest, Stein.

2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.

3. "Algorithm Design" by Kleinberg and Tardos.

Course Outcomes:

- Describe analysis techniques for algorithms.
- Identify appropriate data structure and design techniques for different problems
- Identify appropriate algorithm to be applied for the various application like geometric modeling, robotics, networking, etc.
- Appreciate the role of probability and randomization in the analysis of algorithm
- Analyze various algorithms. 6. Differentiate polynomial and non-deterministic polynomial algorithms.

2. Soft Computing

Course Code	MTTR404	Course Title	Program Core IV - Soft Computing
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Basic knowledge of mathematics

Course Objectives

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial
4. Neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
5. To provide studentan hand-on experience on MATLAB to implement various strategies.

Course Outline:

Unit 1

INTRODUCTION TO SOFT COMPUTING AND NEURAL

NETWORKS: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

Unit 2

FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Unit 3

NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks,

Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

Unit 4

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in **Machine Learning:** Machine Learning Approach to Knowledge Acquisition.

Unit 5

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Unit 6

Recent Trands in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

References:

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing□, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications□, Prentice Hall, 1995.
3. MATLAB Toolkit Manual

Course Outcomes:

After completion of course, students would be able to:

- Identify and describe soft computing techniques and their roles in building intelligent machines
- Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

Elective III

1. Data Preparation and Analysis

Course Code	MTTR441	Course Title	Data Preparation and Analysis
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites:

- **Familiarity with maths and statistics** - He should be good at statistics and possess an analytical aptitude
- **Programming** - It's vital to know the basic concepts of object oriented programming like C, C++ or Java
- **Basics of SQL** - It's important to know how to write a basic SQL query
- **Have passion to develop business acumen & curious about playing with data**

Data Analysts need to have a baseline understanding of five core competencies, namely, statistics, programming, data visualization, machine learning, and data mining. It is important for a data analyst to have the knowledge of data mining/data warehouse, data modeling, R or SAS, SPSS, and SQL.

Course Objectives

To prepare the data for analysis and develop meaningful Data Visualizations

Course Outline:

Unit1:

Data Gathering and Preparation:

Data formats, parsing and transformation, Scalability and real-time issues

Unit2:

Data Cleaning:

Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation

Unit3:

Exploratory Analysis:

Descriptive and comparative statistics, Clustering and association, Hypothesis Generation.

Unit4:

Visualization:

Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity

References:

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Course Outcomes:

After completion of course, students would be able to:

- Able to extract the data for performing the Analysis.

2. Computer Vision

Course Code	MTTR442	Course Title	Computer Vision
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Linear algebra, vector calculus, Data structures and Programming

Course Objectives

1. Be familiar with both the theoretical and practical aspects of computing with images.
2. Have described the foundation of image formation, measurement, and analysis.
3. Understand the geometric relationships between 2D images and the 3D world.
4. Grasp the principles of state-of-the-art deep neural networks.

Course Outline:

Unit 1:

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

Unit 2:

Edge detection, Edge detection performance, Hough transform, corner detection

Unit 3:

Segmentation, Morphological filtering, Fourier transform

Unit 4:

Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing

Unit 5:

Pattern Analysis:

Clustering: K-Means, K-Medoids, Mixture of Gaussians

Classification: Discriminant Function, Supervised, Un-supervised, Semisupervised

Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA,

ICA, and Non-parametric methods.

Unit 6:

Recent trends inActivity Recognition, computational photography, Biometrics

References:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Goodfellow, Bengio, and Courville.
3. Dictionary of Computer Vision and Image Processing, by Fisher et al.

Course Outcomes:

After completion of course, students would be able to:

- Developed the practical skills necessary to build computer vision applications.
- To have gained exposure to object and scene recognition and categorization from images.

3. Knowledge Discovery

Course Code	MTTR442	Course Title	Knowledge Discovery
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Data structures, Basic Statistics

Course Objectives

1. Conduct case studies on real data mining examples

Course Outline:

Unit 1:

Introduction KDD and Data Mining - Data Mining and Machine Learning, Machine Learning and Statistics, Generalization as Search,Data Mining and Ethics

Unit 2:

Knowledge Representation - Decision Tables, Decision Trees, Classification Rules, Association Rules, Rules involving Relations, Trees for Numeric Predictions, Neural Networks, Clusters

Unit 3:

Decision Trees - Divide and Conquer, Calculating Information, Entropy, Pruning, Estimating Error Rates, the C4.5 Algorithm

Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation

Unit 4:

Classification Rules - Inferring Rudimentary Rules, Covering Algorithms for Rule

Construction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency.

Unit 5:

Numeric Predictions - Linear Models for Classification and Numeric Predictions, Numeric Predictions with Regression Trees, Evaluating Numeric Predictions

Unit 6:

Artificial Neural Networks – Perceptrons, Multilayer Networks, the Backpropagation Algorithm

Clustering - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm

References:

1. Data mining and knowledge discovery handbook by Maimon, oded(et al.)
2. Data Cleansing : A Prelude to knowledge Discovery

Course Outcomes:

After completion of course, students would be able to:

Able to have knowledge of various knowledge representation methods

Elective IV:

1. Human and Computer Interaction

Course Code	MTTR451	Course Title	Human and Computer Interaction
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites:

The course catalog lists "knowledge of C programming language/UNIX." In reality, the prerequisite is programming skill in some practical programming language such as Java, C#, HTML, or Processing. The course focuses on human-computer interaction and interface design and assumes that students will have the skills required to program prototypes of computer interfaces. Students without programming experience who wish to take this course should speak with the instructor before the second class.

Course Objectives

1. Learn the foundations of Human Computer Interaction.
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Be aware of mobile Human Computer interaction
4. Learn the guidelines for user interface.

Course Outline:

Unit 1:

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

Unit 2:

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping

in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Unit 3:

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

Unit 4:

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Unit 5:

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Unit 6:

Recent Trends: Speech Recognition and Translation, Multimodal System

References:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O□Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O□Reilly, 2009.(UNIT- V)

Course Outcomes:

After completion of course, students would be able to:

- Understand the structure of models and theries of human computer interaction and vision.
- Design an interactive web interface on the basis of models studied.

2. Geographic Information System

Course Code	MTTR452	Course Title	Geographic Information System (GIS)
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: The students are required to know the theoretical and practical knowledge of Remote Sensing, Digital Image Processing, Digital Signal Processing and Pattern Recognition.

Course Objectives

- Introducing to Geographic Information System & its various Concepts, components to improve the skills for handling, processing & analysis of geospatial data related to various applications through GIS.

Course Outline:

Unit 1: Introduction to GIS

Introduction, Components of Geo-spatial Technology, Global positioning system, Coordinate system, Projection, Geo-relational vector Data model, Object based vector Data model, Raster Data model.

Unit 2: Data Models

Spatial Data Models, Database concepts, Spatial Data Models Data formats and structures

Unit 3: Data input, transformation, editing & Cartography:

Data input, Geometric transformation, Spatial Data Editing Attribute Data input & Management, surveying & mapping, Data display & Cartography.

Unit 4: Data Exploration & Analysis:

Data Exploration, Vector Data Analysis, Raster Data Analysis, Terrain Mapping &analysis, DEM,TIN.

Unit 5: Spatial interpolation, Geocoding & Modeling:

View sheds & Watersheds, spatial interpolation, Geocoding & Dynamic segmentation, Path analysis & Network Application, GIS model & modeling, Advanced Trends in Geospatial Technology.

References:

Text Books

1. Remote sensing models & methods for image processing, third edition, Robert's A.Schowengerdt
2. Geographic Information System, Kang-tsung Chang, fourth edition Tata McGraw-Hill.
3. An Introduction to Geographic Information Technology, Sujit Choudhary, Deepankar Chakrabarty, Suchandra Choudhary ,IK international.

Reference Books

1. Digital Analysis of Remotely sensed Imagery, Jay Gao, McGraw Hill
2. Remote sensing Digital image Analysis An Introduction, John A. Richards, XiupingJia
3. Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, and Alfredo Huete
4. An introduction to geographical information systems, Ian Heywood, Sarah Cornelius, Steve Carver

Web Resources

1. http://www.gis.com/whatisgis/index.html
2. http://www.gis.nic.in
3. http://www.esriindia.com
4. http://www.qgis.org
5. http://www.exelisvis.com/ProductsServices/ENVI.aspx

6. http://rst.gsfc.nasa.gov/start.html
7. http://www.isro.org

Course Outcomes:

After completion of course, students would be able to:

- Critically evaluate and analyze data quality for their GIS projects.
- Design a geo-database and defend the data type selection.
- Interpretation of the various GIS algorithms and data models.
- Interpret the significance of various GIS techniques and its applications.

3. Secure Software Design & Enterprise Computing

Course Code	MTTR453	Course Title	Secure Software Design & Enterprise Computing
Number of Credits	4 Credits (TH)	Internal	Tests: I- 10%, II – 10% Assignments/Homework: 20%
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	Final Examination: 60%
		(Semester/Term Exam)	

Prerequisites: Computer Programming, Software Engineering

Course Objectives

1. To fix software flaws and bugs in various software.
2. To make students aware of various issues like weak random number generation
3. Techniques for successfully implementing and supporting network services on an
4. Methodologies and tools to design and develop secure software containing minimum

Course Outline:

Unit 1:

Secure Software Design

Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

Unit 2:

Enterprise Application Development

Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a Multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Unit 3:

Enterprise Systems Administration

Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

Unit 4:

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

Unit 5:

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Unit 6:

Case study of DNS server, DHCP configuration and SQL injection attack.

References:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Outcomes:

After completion of course, students would be able to:

- Differentiate between various software vulnerabilities.
- Software process vulnerabilities for an organization.
- Monitor resources consumption in a software.
- Interrelate security and software development process.

Audit Course:

1. English For Research Paper Writing:

Course Code	MTTR291	Course Title	English For Research Paper Writing
Number of Credits	2 Credits (TH)	Internal	
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	
		(Semester/Term Exam)	

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Ensure the good quality of paper at very first-time submission.

Course Outline:

Unit 1:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Unit 2:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

Unit 5:

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions

Unit 6:

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Model Curriculum of Engineering & Technology PG Courses [Volume-I]
3. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
4. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
5. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht
6. Heidelberg London, 2011

2. Disaster Management

Course Code	MTTR292	Course Title	Disaster Management
Number of Credits	2 Credits (TH)	Internal	
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	
		(Semester/Term Exam)	

Course Objectives: -Students will be able to:

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

Course Outline:

Unit 1:

Introduction

Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit 2:

Repercussions Of Disasters And Hazards:

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster:

Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3:

Disaster Prone Areas in India

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Unit 4:

Disaster Preparedness and Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 5:

Risk Assessment

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit 6:

Disaster Mitigation

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

References:

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

3. Value Education

Course Code	MTTR293	Course Title	Disaster Management
Number of Credits	2 Credits (TH)	Internal	
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	
		(Semester/Term Exam)	

Course Objectives

Students will be able to

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

Course Outline:

Unit 1:

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements

Unit 2:

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism.Love for nature,Discipline

Unit 3:

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.

- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

Unit 4:

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

References:

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

Course Outcomes:

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

4. Constitution Of India:

Course Code	MTTR294	Course Title	Disaster Management
Number of Credits	2 Credits (TH)	Internal	
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	
		(Semester/Term Exam)	

Course Objectives:

Students will be able to:

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

Course Outline:

Unit 1:

History of Making of the Indian Constitution:

- History
- Drafting Committee, (Composition & Working)

Unit 2:

Philosophy of the Indian Constitution:

- Preamble
- Salient Features

Unit 3:

Contours of Constitutional Rights & Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom

- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit 4:

Organs of Governance:

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit 5:

Local Administration:

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: ZilaPachayat.
- Elected officials and their roles, CEO ZilaPachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit 6:

Election Commission:

- Election Commission: Role and Functioning.

- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.

2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the Conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

5. Pedagogy Studies:

Course Code	MTTR295	Course Title	Disaster Management
Number of Credits	2 Credits (TH)	Internal	
Total Contact Hours	4 Hrs. (TH/Week) 2 Hrs. (TH/Week)	External	
		(Semester/Term Exam)	

Course Objectives:

Students will be able to:

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

Course Outline:

Unit 1:

Introduction and Methodology: History

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions.
- Overview of methodology and Searching.

Unit 2:

- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

Unit 3:

- Evidence on the effectiveness of pedagogical practices
- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.

- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4:

- Professional development: alignment with classroom practices and follow-up support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

Unit 5:

Research gaps and future directions

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact

References:

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

Course Outcomes:

Students will be able to:

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

IQAC Cell

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