Evaluation for M.Tech (CSE Part time)

SEMESTER-III													
Sl. No.	**Subject Codes**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	WCS-300	Advance Algorithms	3	0	0	20	10	30		70		100	3
2	WCS-031	Data Preparation and Analysis	3	0	0	20	10	30		70		100	3
3	WCS-310	Advance Algorithms Lab	0	0	4				25		25	50	2
4	MLC-301	Research Methodology and IPR	2	0	0	20	10	30		70		100	2
		Total										350	10

Course Code	WCS-300
Course Name	Advanced Algorithms
Credits	3
Pre-Requisites	UG level course in Algorithm Design and Analysis

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

LECTURE WITH BREAKUP	NO. OF LECTURES
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.	6
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.	8
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 andconquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	9
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	10
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	10
Unit 6 Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5

COURSE OUTCOMES
After completion of course, students would be able to:
• Analyze the complexity/performance of different algorithms.
• Determine the appropriate data structure for solving a particular set of problems.
• Categorize the different problems in various classes according to their complexity.
• Students should have an insight of recent activities in the field of the advanced data structure.

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 Code	WCS-031	
Course Name	Data Preparation and Analysis	
Credits	3	
Pre-Requisites		
COURSE OBJECTIVE		
• To prepare the data for analysis and develop meaningful Data Visualizations		
LECTURE WITH BREAKUP		**NO. OF LECTURES**
Unit1: **Data Gathering and Preparation:** Data formats, parsing and transformation, Scalability and real-time issues		9
Unit2: **Data Cleaning:** **Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation**		11
Unit3: **Exploratory Analysis:** **Descriptive and comparative statistics, Clustering and association, Hypothesis generation**		13
Unit4: **Visualization:** **Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity**		15
COURSE OUTCOMES		
After completion of course, students would be:		
• Able to extract the data for performing the Analysis.		

References:

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

Research Methodology and IPR	SUBJ. CODE - MLC-101
Teaching Scheme	Lectures: 1hrs/week

Course Outcomes:

At the end of this course, students will be able to

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

LECTURE WITH BREAKUP

Unit 1: INTRODUCTION

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, and 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:

i. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

ii. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

iii. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

iv. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.

v. Mayall, "Industrial Design", McGraw Hill, 1992.

vi. Niebel, "Product Design", McGraw Hill, 1974.

vii. Asimov, "Introduction to Design", Prentice Hall, 1962.

viii. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

ix. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008