PhD Course Work: Structure/Syllabus as per UGC regulations
(Tentative subject to the approval of the School Board)

As per Clause 7 of UGC 2016 regulations:

7.1 The credit assigned to the M.Phil. or Ph.D. course work shall be a minimum of 08 credits and a maximum of 16 credits.

7.2 The course work shall be treated as prerequisite for M.Phil./Ph.D. preparation. A minimum of four credits shall be assigned to one or morecourses on Research Methodology which could cover areas such asquantitative methods, computer applications, research ethics and review ofpublished research in the relevant field, training, field work, etc. Other courses shall be advanced level courses preparing the students for M.Phil./Ph.D.degree.

Proposal for Course Structure is placed below

PhD Course Work (2 Semesters)			
S. No.	**Course Title**	**Credits**	**Type**
SEMESTER – I			
1	Algorithms	4	HC
2	Data Structures and Programming Lab	2	P
SEMESTER – I or SEMESTER – II			
3	Research Methods in Computer Science†	4	AECC
4	Elective†	3/4	DSE

† These courses can be taken in either semester subject to their availability.

Note: Minimum number of credits required to pass the PhD course work is 13

Course Type Codes	
HC	Hard Core
SC	Soft Core
DSE	Discipline Specific Elective
GE	Generic Elective (Non-discipline)
AECC	Ability Enhancing Compulsory Course
P	Practicals
SE	Skill Enhancement Course
PD	Project/Dissertation
(*)	Offered to other Schools/Depts

Syllabus for the PhD Course Work

Syllabus for Algorithms

The syllabus for algorithms will be identical to that of M. Tech course by the same name but can require extra work in case the university decides that all PhD courses MUST be different from M. Tech courses.
An alternative is to label the course "Current Trends in Algorithms" and have the same syllabus as M. Tech course but have an extra component that talks of recent advances in algorithms or go beyond what is covered in M. Tech course.

Syllabus for DSP Lab

1. Linked List problems (**suggested assignments:** circular queue, priority queue and ordered doubly linked list)
2. Tree problems (**suggested assignments:** Binary search tree, Heap, Binary trie)
3. Graph problems (**suggested assignments:** Spanning tree, DFS, BFS, Connected components)
4. Matrix and Sparse matrix problems
5. Sorting and Searching: (**suggested assignments:** hash tables with open addressing, quick sort, merge sort)
6. Optional Module: Advanced Data Structures like Skiplist if there is time.
7. An optional mini-project may be done for the final examination and counts for 40% of the grade.

Syllabus for Elective

Elective is any one of the electives offered to M. Tech students in the ongoing semester. The elective shall be based on the candidate's choice in consultation with the supervisor. Change in Simulation and Modelling elective subject to be noted:

Unit 1: Introduction to real world, Physical Systems, Physical models, Mathematical Models, Principles of Modeling, introduction to Random Experiments, Probability, Random Variable, Distributions, estimation, testing, Markov Chains, few motivating case studies …….
Unit 2: Randomness and Random number generation:
Unit 3: Monte Carlo Integration:
Unit 4: Deterministic Systems (includes simple OR models)
Unit 5: Stochastic Systems (Simulation of Markov Chains, Markov Process, queues, inventory system, Regression models, time series, PERT, …)

[Expected to work in Matlab environment]

Books:

1. Geoffry Gordon (2005) "System Simulation" Prentice-Hall of India Private Limited New Delhi Chapters 1 to 3

2. NarsinghDeo (1996) “System Simulation with Digital computer” Prentice-Hall of India Private Limited New Delhi Chapters 2 to 5

3. Jerry Banks, John S Carson II, Barry L. Nelson and David M. Nicol (2013) “Discrete-Event System Simulation” 4/e Pearson. Chapters 7-10
4. Morgon, J.T (1984) “Elements of Simulation” Chapman & Hall. Chapters 7-8
5. Additional Book:
    a. Donald E. Knuth. (1997) “ The art of Computer Programming” Vol 2 Seminumerical Algorithms, Third Edition Addison-Wesley
    b. REUVEN Y. RUBINSTEIN(1981)”Simulation and the Monte Carlo Method” John Wiley & Sons

Syllabus for Research Methodology in Computer Science

Module-A: What is research? what is not research? why? Types of research? Stages of research, Approaches, Qualities desirable, Design thinking, Research Mind, Research Attitude, openness for discussion and criticism. Creations of Mind and Intellectual Property. Creativity, Innovation and problem solving. Good habits and Best practices for a good research output.

Module-B: Planning the research, Study of existing literature, survey of top journals, top conferences, top experts, top websites, top tools and techniques, top problems, top applications and top x. Problem statement and scope of work.
Carrying out research, experimental plans, test data, parameters, measurements to be done, programs to be written, literature to be seen - focused, literature analysis and critiques.

Data Processing: Facility with UNIX commands, awk, sed, Shell Scripting, GNUPLOT, MATLAB/ SCILAB / R.

Module-C: Research Ideas and implementation methodology, experimental setup, standard and non standard data sets, performance metrics, comparison of performance, evaluation of results.
Benchmark Data sets, Performance Metrics: Precision, Recall, F-measure, AUROC, AUPR etc.

Statistical Analysis:Testing for statistical significance using P-value. Statistical hypothesis tests like T-test, Friedman Test, Posthoc Test, Wilcoxon Test etc. *Statistical software* such as R/Scilab/Scala and languages with powerful data handling capabilities such as Python/Java.

Module-D: To publish or not publish. Types of Publications - conference paper and presentations, Journal Paper, High impact and reputed journals, and Patents. Publishing your work, how to read a paper, how to write a paper. Research without any reference.where to publish your work, whether to patent or to publish, criteria for patent filing. Impact of Research, contributions, prototypes, tools, plug ins, and Writing a thesis. *Research Ethics:* Plagiarism issues, Social implications

LINUX software for Document Preparation and presentation: Drawing packages, LATEX and BEAMER.

References:

1. Kothari C R, “Research Methodology - Methods and Techniques,” Willey Eastern Ltd., New Delhi 1992.
2. Donald H. McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore, 2002.
3. Alan M Johnson, Charting a course for a successful research career, Elsevier 2011
4. Lowry, Richard. Concepts & Applications of Inferential Statistics. March 2015.
5. Statistics: An Introduction using R, Michael J. Crawley, Wiley 2011.
6. Statistical Design for Research, Leslie Kisch, Journal of Educational Statistics, 1990
7. LaTex and Beamer tutorials : Tex Users Group : https://www.tug.org/

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