CURRICULUM DOCUMENT' 2019

Programme Structures & Syllabi: PhD Course Work

DEPARTMENT OF COMPUTER SCIENCE

FACULTY OF NATURAL SCIENCES

Jamia Millia Islamia: New Delhi, India

DEPARTMENT OF COMPUTER SCIENCE

Faculty of Natural Sciences, Jamia Millia Islamia

HIGHLIGHTS

(Revision'2019)

<PhD Course Work>

A.	**Motivation**	1. Improvements warranted by rapidly changing academic, social and technological scenario around the world. 2. Conformance to different prescriptions from the statuary, regulatory bodies (JRF-NET), and JMI ordinance provisions.
B.	**Abbreviations**	Computer Science: **CS**, Core: C, Elective: E
C.	**Course Codes**	Unique code to be assigned to each course offered by the Department for Ph.D. course work using the following coding scheme: • Computer Science Core: CSC + Semester Number (1) + Level (7) + Course Number(1-2) • Computer Science Elective: CSCE + Semester Number (1) + Level (7-8) + Course Number(1-9)
D.	**Course L-T-P**	1. Theory Courses: 4-0-0 2. Literature Review: 0-1-6
E.	**Credits and Marks**	1. Each course has 4 credits. 2. Each course has 100 marks (25 Internal Assessments and 75 University Examination)

PhD Course-Work Structure: 2019

Course Code	Course Title	L-T-P	Credits
CSC171	Research Methods in Computer Science	4-0-0	04
CSC172	Literature Review and Term Paper	0-1-6	04
CSCE181	Elective-I: Frontiers in Computer Science	4-0-0	04
CSCE182	Elective-II: Special Topics in Computer Informatics	4-0-0	04
		Total	**16**

NOTES
- CSC172 shall be pursued under the guidance of respective supervisor(s) by reviewing a set of at least 20 research papers.
- CSC172 students shall produce a well-structured 'Review Report' and a 'Term-Paper', as per the guidelines of the Department.

SYLLABI

CSC171: Research Methods in Computer Science (4-0-0)

1. **Research Foundations:** Research Primitives - Overview, Terminology, Prominent Definitions, Characteristics, Purpose, Goals and Objectives, Beneficiaries and Values, Methodology, Method and Skills; Scientific Research- Overview, Scientific Knowledge, Knowledge Acquisition, Science, Pseudoscience, Characteristics and Values, Generic Process; and Scientific Methods - Overview, Principles of Scientific Method, Scientific Attitude and Temper, Elements of Scientific Methods, Scientific Process, Scientific Objectivity, Scientific Misconceptions.

2. **Research Paradigms, Models and Types:** Research Paradigms- Overview, Generic Elements, Positivist, Post-Positivist, Interpretivist, Critical, Pragmatic; Research Models: Overview, Generic Research Process, Sequential, Generalized, Circulatory, Evolutionary, Mixed-Methods; Research Types- Overview, Nature Based Classification, Application Based Classification, Mode Based Classification, Objective Based Classification, Experiment Based Classification, Other Researches.

3. **Reasoning, Argument and Proofs**: Reasoning and Arguments – Overview, Terminology, Logic, Reasoning, Arguments, Common Fallacies; Methods of Proof – Overview, Mathematical Proof, Good Proof, Informal Proof, Formal Proof, Supplementary Proof, Classical Proof Fallacies.

4. **Research in Computer Science:** Computer Science, Focal Areas, Dialectic of research, Models of Argument, Types of Research in CS, Research Methods in Computer Science, Research Paradigms in CS, Grand Challenges for CS Research, Scientific Methods in Computer Science -Modelling, simulation, CBR & eScience.

5. *Research Skills:* Introduction to Literature Review, Research Design, Inferential Statistics, Synopsis Writing, Citation Formats and Style, General Conventions, Issues, Research Ethics, Plagiarism, Copyrights, and Research Tools.

REFERENCES

1. Dawson: Projects in Computing and Information Systems. AWL
2. Walliman: Your Research Project, Vistar publications
3. Relevant Research Papers

CSC172: Literature Review and Term Paper (0-1-6)

1. It is to be pursued under the strict guidance and monitoring of the designated supervisors.
2. The scope of the review shall be considerable critical review of the typical resources of at least 20 research papers.
3. A Student must submit a well-formatted report including the Heads: Background, Pertinent Typical Resources, Selected Research Papers, Summarization of Papers, Trend Report and Findings.
4. The evaluation of 'report and term paper' shall be conducted by a panel of at least two examiners, comprising an external by viva-voce examination.

CSCE181: Elective-I: Frontiers in Computer Science (4-0-0)

1. **Cloud Computing:** Cloud Computing, Characteristics of Cloud Computing, Components, Cloud Provider, Organizational Scenarios of Clouds administering and Monitoring Services, Benefits and Limitations. Cloud Computing Architecture: Cloud Delivery Models- SaaS, PaaS, LaaS. Cloud Deployment Models- Public Cloud, Private Cloud, External Cloud, and Hybrid Cloud. Service Oriented Architecture and Cloud.

2. **Machine Learning and Soft Computing:** AI and Machine Learning, Soft Computing, ANN: Feed-forward, Feedback, Recurrent Networks, Different Models: McCulloch and Pitts Model, Hopfield Model and Memories, Boltzmann Machines and Energy Computations, Delta rule and Backpropagation Learning, Unsupervised Learning, Competitive Learning, Hebbian Coincidence Learning, SOM, Ensemble methods, Hybrid Machine Learning, Scalable Machine Learning, Deep learning, Convolutional Neural Network, Transfer Learning, Genetic Algorithm (GA), Encoding, Fitness Functions, Genetic Operators, Reproduction, Evolutionary Strategies, Multi-Objective GA, Neuro-Genetic Hybrid Algorithm, Fuzzy Systems, Fuzzy Sets; Fuzzy Logic and Fuzzy Rules, Mamdani Fuzzy Rule Inferencing Mechanism, Fuzzy Logic based Systems, Neuro Fuzzy Systems, Fuzzy Neural Network.

3. **Data Mining Concepts and Applications**: Data Mining, Data Warehouses, Data Mining Functionalities, Classification of Data Mining Systems, Integration of Data Mining Systems with Data Warehouse Systems, Data Preprocessing, Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation; Frequent Patterns, Associations and Classification, Association Rules, Frequent Itemsets, Closed Itemsets, Apriori Algorithm, Generating Association Rules from Frequent Itemsets, Mining Closed Frequent Itemsets, Correlation Analysis, Classification v/s Prediction Methods, Rule-based Classification, Support Vector Machines based Classification, Classification by Association Rule Analysis, k- Nearest-Neighbor Classifier.

4. **Central Tendency and Probability Distributions:** Population, Sample, Measure of Central Tendency and Dispersion, Space, Events, Equally Likely Events, Probability, Independent Events, Addition and Multiplication Rules, Conditional Probability, Probability Distributions – Normal, Binomial, and Poison Distributions.

5. **Correlation, Regression and ANOVA:** Correlation using Karl Pearson and Spearman Method, Regression Analysis, Auto Regression, Ridge Regression; Hypothesis: Hypotheses, Hypothesis Testing, t-Test, Chi-Square Test, Analysis of Variance (ANOVA), One and Two-way ANOVA, F-Test.

REFERENCES

1. Rajkumar Buyya et. al. , Mastering Cloud Computing, Morgan Kaufmann, 2013.

2. Michael Negnevitsky, Ärtificial Intelligence-A guide to intelligent systems", 2nd edition, Pearson Education.

3. A.P. Engelbrecht, Computational Intelligence: An Introduction, Wiley.

4. Jyh-Shing Roger Jang, Cuen Tsai Sun, EijiMizurani, Neuro Fuzzy and Soft Computing, A Computational Approach to Learning and Machine, PEA.

5. S. Rakasekharan, GA Vijayalakshmi, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI. Padhy, N. P. (2005). Artificial intelligence and intelligent systems. Oxford University Press.

6. S.N. Sivanandam& S.N. Deepa, Principles of Soft Computing, Wiley Publications.

7. Stuart Russel and Peter Norvig: Artificial Intelligence–A Modern Approach, 3rd Ed., 2012, Pearson Education, ISBN: 0-13-790395-2 (2nd edition downloadable).

8. Deb, Kalyanmoy (1999). Multi-objective genetic algorithms: Problem difficulties and construction of test problems. Evolutionary computation, 7(3), 205-230.

9. B. Yegna Narayana: Artificial Neural Network, EEE, PHI, 2001, ISBN 81-203-1253-8.

10. Han & Kamber: Data Mining - Concepts and Techniques.

11. Elsevier Witten, Frank & Hall: Data Mining: Practical Machine Learning Tools and Techniques, Elsevier.

12. Mohammed Zaki, Wagner Meira: Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge Press.

13. Sastry, Introductory Methods of Numerical Analysis, PHI.

14. Gupta and Kapoor, Fundamentals of Mathematical Statistics a Modern Approach, S. Chand.

15. Seymour Lipschutz, John Schiller: Introduction to Probability and Statistics, TMH.

CSCE182: Elective-II: Special Topics in Computer Informatics (4-0-0)

1. **Big Data Analytics and IoT:** Big data Analytics, Tools and techniques for Big data Analytics, sources of Big data. Difference between tradition data analytics and Big data Analytics. Type of Big data analytics. Data analytics using Panada, Spark scala for big data analytics. IoT, various applications of IoT. Programming with IoT using various sensors.

2. **Digital Image Processing:** Components of a DIP System, Image Sensing, Acquisition, Sampling and Quantization, Spatial and Intensity resolution, Histogram Processing, Spatial and Frequency Domain Filtering, 1-D and 2-D Discrete Fourier Transform (DFT) and IDFT, Lowpass, Highpass, Selective Frequency Domain Filters, Fast Fourier Transform (FFT), Model of Image Restoration and Reconstruction, Noise Models, Color Models: RGB, HSI, CMYK, YCbCr; Color Image Processing, Image Compression, Relative Data Redundancy, Compression Ratio, Coding Redundancy, Fidelity Criteria, Lossless v/s Lossy Image Compression, Image compression Model, Huffman Coding, Run-length Coding, Bit Plane Coding, Image Formats, KLT, JPEG, Image Segmentation and Classification.

3. **Text Mining and Social Network Analysis**: Text Mining and Graph Mining, Social Network Analysis, Web/ Link Mining, Social Network Data, Representation of Social Relations using Graphs and Matrices, Properties of Networks and Actors, Centrality and Power, Community Detection, Recommender Systems, Emotion Mining, Spam Detection, Information Diffusion in Online Social Networks, Python Modules for Text Mining and Social Network Analysis.

4. **Statistical Data Analysis and Visualization in R:** Matrix Construction; List: Named List Members, Data Frame, Data Frame Column Vector, Data Frame Column Slice, Data Frame Row Slice and Data Import, Probability Distributions: Binomial Distribution, Poisson distribution, Chi-squared Distribution, Student t Distribution. Qualitative Data: Frequency Distribution of Qualitative Data, Relative Frequency, Distribution of Qualitative Data. Mean, Median, Quartile, Percentile, Range, Interquartile Range, Variance, Standard Deviation, Covariance, Correlation Coefficient. Visualization: Bar Graph, Histogram, Pie Chart, Category Statistics, Stem-and-Leaf Plot and Scatter Plot, Box Plot, Word Cloud.

5. **Intelligent Tutorial Systems:** Context Encapsulation, Technology Evolution, Learning and Tutoring; Central Frame and Organization; ITS vs Expert Systems; ITS vs Adaptive Hypermedia; Domains – Knowledge, Student and Design Models; Pertinent Knowledge Representation Techniques; Adaptation and Micro-adaptation; ITS developments, Scenarios, Challenges and Current Issues.

REFERENCES

1. Kai Hwang and Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, wiley.

2. Gonzalez and Woods, Digital Image Processing, 4th Edition, 2018, Pearson Education.

3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins: Digital Image Processing using MATLAB, PE.

4. Milan Sonka et al: IMAGE PROCESSING, ANALYSIS AND MACHINE VISION, Brookes/Cole, VPH.

5. Robert A. Hanneman and Mark Riddle,Introduction to Social Network Methods.

6. Sandip Rakshit: R Programming for Beginners. McGraw Hill Education.

7. Lander: R for Everyone: Advanced Analytics and Graphics. Pearson Education India.

PhD Course-Work: 2019

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REGISTRATION

I, as a student of Ph.D. hereby register to pursue the pre-Ph.D. courses, as per the university prescriptions and as per following details.

Name : …………………………………………..

Enrollment No : …………………………………………..

Semester and Session : …………………………………………

Course Code	Course Title	L-T-P	Credits
CSC171	Research Methods in Computer Science	4-0-0	04
CSC172	Literature Review and Term Paper	0-1-6	04
…	Elective-I: ………………………………… … ..	-	-
…	Elective-II: ………………………………… … ..	-	-
		Total	**…**
	NOTES		
1.	Literature Review and Term Paper is to be pursued under the guidance of respective supervisor(s).		

Date: …………………….. (Signature of the Student)

(Supervisor) (Coordinator)

(Head)