UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)
(Uttarakhand Act No. 11 of 2013)
Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advancements In Computer Science		

Course Objective:

To introduce the advance concepts and techniques of Machine Learning, Data Analytics, Big Data & develop skills of using recent machine learning software for solving practical problems as well as to gain experience of doing independent study and research.

UNIT I DATA ANALYTICS(Total Topics-8 and Hrs-10)

Data science process, Types of data, Sources of data, Data collection, Data Preprocessing – Data Cleaning – Integration – Transformation – Reduction –Discretization Concept Hierarchies – Concept Description Data Generalization and Summarization Based Characterization – Mining Association Rules in Large Databases,Practical application using any programming language

UNIT IIPREDICTIVE MODELING(Total Topics-10 andHrs-10)

Classification and Prediction Issues Regarding Classification and Prediction –Classification by Decision Tree Induction – Bayesian Classification – Other Classification Methods– Prediction –Clusters Analysis – Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.Data visualization: Introduction, Types of data visualization, data visualization. Practical application using any programming language

UNIT- III BIG DATA ANALYTICS (Total Topics- 13 andHrs-10)

Fundamentals of Big Data Types, Big data Technology Components, Big Data Architecture, Big Data Analytics, Framework for Big Data Analysis, Approaches for Analysis of Big Data, ETL in Big Data, Introduction to Hadoop Ecosystem, HDFS, Map-Reduce Programming, Understanding Text Analytics and Big Data, Predictive analysis on Big Data, Role of Data analyst. Practical Application using HADOOP

UNIT-IV MACHINE LEARNING (Total Topics-10 andHrs-10)

Overview of Machine Learning, Types of Machine Learning, Supervised Learning: (Regression/Classification), Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees,

Naïve Bayes, Linear models: Linear Regression, Logistic Regression,

Support Vector Machines, Unsupervised Learning: Clustering: K-means, Dimensionality Reduction: PCA), Ensemble Methods (Boosting, Bagging, Random Forests).

UNIT-V ADVANCEMENT IN MACHINE LEARNING (Total Topics-10 andHrs-10)

Semi-supervised Learning, Active Learning, Reinforcement Learning, Recommender systems, Natural language Processing, Genetic Algorithm, Basics of Neural Network, TensorFlow Basics, TensorFlow Estimators, Practical Application of TensorFlow using Python.

COURSE OUTCOMES

CO1 Understand and apply the data analytics techniques.

CO2 Analyze the problem and perform predictive model using classification, clustering techniques.

CO3 Understand the fundamentals of Big Data, HDFS and Hadoop.

CO4 Apply various machine learning model to solve real world problems.

CO5 Understand advance concepts of Machine Learning.

Reference Books

1. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2002.
2. Alex Berson, Stephen J Smith, “Data Warehousing, Data Mining &OLAP”,TataMcgraw Hill, 2004.
3. John Walker, Saint. "Big data: A revolution that will transform how we live, work, and think.", Mariner Books; Reprint edition (4 March 2014)
4. Turkington, Garry. “Hadoop Beginner's Guide”. Packt Publishing Ltd, 2013

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Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704 (i)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Recent Trends in Cloud Computing and Applications		

Course Objective:

To understand the fundamental and advance concepts of Cloud Computing with the evolution of its paradigm, applicability, benefits and future challenges.

UNIT I THE VISION OF CLOUD COMPUTING(Total Topics-6 andHrs-10)

Cloud: What and Why, Characteristics and benefits, Challenges ahead, Historical Development**,** Pros and Cons of Cloud, Cloud Applications in real life scenario.

UNIT IICLOUD OPERATIONS (Total Topics-7 andHrs-10)

Cloud Operations and Cloud Operating Models**,** Service Management, Administration, Monitoring, Support and Control, Ec2, Amazon Simple Storage Service (S3).

UNIT- III CLOUD COMPUTING ARCHITECTURE (Total Topics-6 andHrs-10)

Cloud Reference Model**,** Types of Clouds, Cloud challenges: Cloud Interoperability and Standards**,** Scalability and Fault Tolerance, Security, Trust and Privacy.

UNIT-IV VIRTUALIZATION (Total Topics-7 andHrs-10)

Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualizationand Cloud Computing, Pros and Cons of Virtualization, Hardware- Assisted Virtualization, Full Virtualization and Para Virtualization.

UNIT-V ADVANCEMENT IN CLOUD COMPUTING & APPLICATIONS (Total Topics- 7 andHrs-10)

Edge and Fog: Introduction, Principles and Paradigm. Green Cloud Computing Architecture: Green Computing, Need of Green Computing in Clouds, Energy savings in the Cloud, VM Migration. Business and Consumer Applications of Clouds; CRM and ERP, Social Networking and Media Applications, Energy-Efficient.

COURSE OUTCOMES

CO 1 Understand fundamentals of Cloud Computing

CO 2 Demonstrate ability to access various common cloud services.

CO 3 Describe the cloud computing architecture.

CO 4 Understand various applications of Clouds Computing.

CO 5 Analyse the significance of virtualization in Cloud Computing.

Reference Books

1. Cloud Computing: Web- Based Applications That Change the way you Work and Collaborate Online, Michael Miller, Que Publishing, August 2008.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Edition.
3. Cloud Computing Principles and Paradigms, RajkumarBuyya, James Broberg and AndrzejGoscinski, Wiley India Edition.
4. Mastering Cloud Computing, RajkumarBuyya, Christian Vecchiola and S. ThamaraiSelvi, McGraw Hill Education (India) private Limited.

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Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704 (ii)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	E-Learning		

Course Objective:

Enhance the quality of learning and teaching. Meet the learning style or needs of students. Improve the efficiency and effectiveness. Improve user-accessibility and time flexibility to engage learners in the learning process.

UNIT I FUNDAMENTALS (Total Topics-7 andHrs-10)

E-learning-it's definition, Scope and various approaches of E-learning service. Advantages of E-learning, CBL(computer based learning) Methodology, Learning Management System, Advantages of LMS, Adaptive and Cognitive learning Technological issues

UNIT IIE-LEARNING FRAME WORK (Total Topics-6 andHrs-10)

E-Learning Frame Work, History of E-learning, Pedagogical and Technological dimensions of e-learning, Online Learning, Matrixes of e-learning, Evaluation Resource Support

UNIT- III MASSIVE OPEN ONLINE COURSES (Total Topics-6 andHrs-12)

History of MOOC, Importance of MOOC, Architecture, Framework of MOOC, Study of various courses available by different university as MOOC courses and its applicability, Major initiatives and platforms for MOOC.

UNIT-IV OER AND IT'S ETHICS (Total Topics-6 andHrs-10)

What is OER, Ethic of using OER, Fair use policy, Do's and Dont's of E-learning, Ethical and legal aspects of OER, Copyright, Licensing.

UNIT-V CASE STUDY (Total Topics-4 andHrs-8)

Case study of NPTEL, SWAYAM, COURSE ERA, UDEMY.

COURSE OUTCOMES

CO 1 Understand fundamentals of E-Learning
CO 2 Understand fundamentals of E-Learning Framework
CO 3 Understand fundamentals of MOOC
CO 4 Understand and practice the fundamentals of OER and apply learnt ethics

CO 5 Analyse and evaluate the courses offered through different online platforms

Reference Books

1. eLearning and the Science of Instruction.- Clark, R. C. and Mayer, R. E. - 3rd edition - (2011).
2. Grainne Conole, “Contemporary perspectives in E-learning research”
3. Bryn Holmes, John,”E-learnig Concepts and Practice”, Gardner,2006

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Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704 (iii)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advanced Research &Instrumentation Techniques		

Objectives of the Course:

1. To learn & apply concept of Thermogravimetric techniques in research.
2. To provide knowledge about spectroscopic techniques for research.

UNIT I (Total Topics-12 and Hrs-12)

UV-Visible spectroscopy

Basic principle, Various electronic transitions Beer-Lambert law, effect of solvent on electronic transitions, molar extinction coefficient, concept of chromospheres and auxochromes, bathochromic, hypsochromic, hyperchromic and hypochromic, UV spectra of conjugated enes and enones, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Woodward-Fiesher rules for conjugate dienes and carbonyl compounds.

Infrared spectroscopy

Infra-red spectroscopy: Basic principle, Instrumentation Selection rules, fundamental modes of vibration, overtones, combination bands, Fermi resonance, Factors affecting IR spectra. Effect of hydrogen bonding, solvent effect on IR of gaseous, solids and polymeric Interactions with molecules: absorption and scattering. Means of excitation (light sources), detection of the signal (heat differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR).Interpretation of IR spectra of aliphatic, aromatic hydrocarbons, amines, amides, carbonyl compounds etc

UNIT- II(Total Topics- 12 and Hrs-12)

NMR spectroscopy

Principle, Instrumentation, Factors affecting chemical shift, Uses of TMS equivalent and non-equivalent protons, chemical shifts, factors affecting chemical shifts, shielding of magnetic nuclei, deshielding, anisotropic effects in alkene, alkyne, aldehydes and aromatics, spin-spin coupling, coupling constant, chemical exchange,Simple applications, Interpretation of NMR spectra of aliphatic, aromatic hydrocarbons, carbonyl compounds etc.

Thermal methods of analysis:

Thermal methods: Principle & application of Thermogravimatric analysis; TGA, DTA & DSG , DSC : Principle instrumentation and applications.

UNIT-III (Total Topics- 12 and Hrs- 12)

Microscopic Techniques: Preparation of Thin-films, Physical vapor deposition, Evaporation Techniques-Sputtering (RF & DC), Spin Coating, Pulsed Laser deposition, Working Principle of X-ray Diffractometer, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning tunneling microscopy (STM), Introduction & application of Bio analytical techniques

UNIT-IV (Total Topics- 12 and Hrs-12)

Physical instrumentation techniques: Physical Properties: Introduction, & applications of different physical Characteristics: Viscosity, optical activity & conductivity, Instrumentation: Viscometer, pH meter, Refractometer, Polarimeter.

CO-1: Inculcate knowledge about advanced techniques for physical parameters of materials.
CO-2: Apprcise UV visible&Spectroscopic techniques.
CO-3: Learn interpretation of data used in spectroscopy analysis.
CO-4: Learn principle and method of microscopic & thermogravimatric techniques for characterisation of material for research.

Reference Books:

1. Spectroscopy of Organic Compounds, New Age International Publishers; PS Kalsi
2. Spectrometric Identification of Organic Compounds, John Wiley; Silverstein, Robert M.; Webster, Francis X.; Kiemle
3. Practical NMR Spectroscopy, ML Martin, JJ Delpeach and GJ Martin, Heyden.
4. Fundamentals of Molecular Spectroscopy Colin N. Banwell and Elaine M. Mc Cash Tata McGraw Hill.
5. Introduction to NMR Spectroscopy: RJ Abraham, J Fischer and P Loftus, Wiley.
6. Spectroscopic Method in Organic Chemistry: DH Williams, I Fleming, Tata MacGraw Hill.
7. Instrumental Method of Analysis: Seventh Edition, Willard Merritt, Dean, Settle. CBS