SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF COMPUTER ENGINEERING
M. Tech. Computer Engineering

Program Curriculum Structure and Syllabus (2020 Pattern)

(M. Tech. First year w. e. f. academic year 2020-2021)

SANJIVANI RURAL EDUCATION SOCIETY"S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON423603

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF COMPUTER ENGINEERING

Profile: For any revolution to make an impact, Computer Engineering holds the key. The Department of Computer Engineering was established in the year 1989-90 and has qualified and experienced staff. The PG Programme in ME [Computer Engineering] is started from academic year 2011-2012. Department is accredited by NBA in Year 2003, 2008, 2015 and 2020 as well Accredited by Institute of Engineers, India in Year 2015. Department is having all the leading edge software's and hardware's in its state-of-the- art laboratories, because we believe that it will be here from where global professionals will be created!!

Total 300 Computers along with a well-equipped project lab have been set up exclusively for final year students for their project work. Department is providing SAP global certification having separate SAP Training lab with necessary software. System Department is looking after the centralized computing facilities having Computer Centre consisting of 120 nodes with dedicated 100 mbps leased line connectivity and separate 25 mbps leased line connectivity exclusively for Wi-Fi campus. Under Train n Hire programme, Department Faculty is providing training on Web Technology and PHP to shortlisted students by Xento Systems, Pune every year. To complement and make the curriculum more interesting, competitive and practical, lot of co-curricular activities are organized and conducted. The Department has formed an Association of Computer Engineering Students (ACES) and established the student chapters of professional bodies like IEEE and CSI. From time to time, these professional bodies, organize various events such as State Level Software Contest, State and National level paper presentation contest, Project Competitions & Workshops on Embedded Systems, leading technologies like AI and Machine Learning, Data Mining and Cloud Technology, Software Testing, Cyber Security, Java Technology, IOT and Data Analytics etc. We are conducting short term courses and seminars on Advanced C, C++, VB and Oracle, VC++, JAVA Technology, Python, PC Troubleshooting and maintenance, design patterns and extreme programming. The department has its own library consisting of around 527 books and manuals based on latest technology.

Institute Vision

- To Develop World Class Professionals through Quality Education.

Institute Mission

- To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Department Vision

- To develop world class engineering professionals with good moral characters and make them capable to exhibit leadership through their engineering ability, creative potential and effective soft skills which will improve the quality of life in society.

Department Mission

- To impart quality technical education to the students through innovative and interactive teaching learning process to acquire sound technical knowledge, professional competence and to have aptitude for research and development.
- Develop students as excellent communicators and highly effective team members and leaders with full appreciation of the importance of professional, ethical and social responsibilities.

Program Educational Objectives (PEOs)

PEO1: To prepare the committed and motivated graduates by developing technical competency and research attitude with support of strong academic environment.

PEO2: To train graduates with strong fundamentals, domain knowledge and update with modern technology to design and develop novel products and provide effective solutions for social benefits.

PEO3: To exhibit employability skills, leadership and right attitude to succeed in their professional career.

Sanjivani College of Engineering, Kopargaon
(An Autonomous Institute)
Department of Computer Engineering
M.Tech. (Computer Engineering) - Course Structure
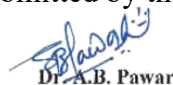### w.e.f. 2020-21

List of Abbreviations			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
PC	Program Core	ESE	End-Semester Evaluation
PE	Program Elective	OR	Oral Examination
OE	Open Elective	PR	Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
CA	Continuous Assessment	AC	Audit Course
MLC	Mandatory Learning Course	PRJ	Project/Seminar

First Year (Semester I)

Cat	Course Code	Course Title	Teaching Scheme (Hrs. /Week)		Credits	Evaluation Scheme (Marks)						
						Theory			OR	PR	TW	Total
			L	P		ISE	ESE	CA				
PC	CO601	Mathematical Foundations of Computer Science	3	-	3	30	50	20	-	-	-	100
PC	CO602	Advanced Data Structures	3	-	3	30	50	20	-	-	-	100
PE	CO603	**Elective – I** **A**-Machine Intelligence **B**-Wireless Networks and IOT **C**-Geographic Information Systems	3	-	3	30	50	20	-	-	-	100
PE	CO604	**Elective – II** **A**-Data Analytics and Business Intelligence **B**-Cloud Technology **C**- Pattern Recognition	3	-	3	30	50	20	-	-	-	100
PC	CO605	Lab Practice-I (Advanced Data Structures)	-	4	2	-	-	-	50*	-	-	50
PE	CO606	Lab Practice-II (Based on Electives)	-	4	2	-	-	-	50*	-	-	50
MLC	CO607	Research Methodology and IPR	2	-	2	-	50	-	-	-	-	50
AC	AC101	Audit Course-1	2	-	-	-	-	-	-	-	-	-
		Total	16	8	18	120	250	80	100	-	-	550

*Oral will be based on the term work submitted by the student.

First Year (Semester II)

Cat	Course Code	Course Title	Teaching Scheme (Hrs. /Week)		Credits	Evaluation Scheme (Marks)						
						Theory			OR	PR	TW	Total
			L	P		ISE	ESE	CA				
PC	CO608	Advance Algorithms	3	-	3	30	50	20	-	-	-	100
PC	CO609	Advance Network and Analysis	3	-	3	30	50	20	-	-	-	100
PE	CO610	**Elective – III** **A**- Parallel Computing **B**- Soft Computing **C**- Digital Forensics	3	-	3	30	50	20	-	-	-	100
PE	CO611	**Elective – IV** **A**- Applied Cloud Technology **B**- Blockchain Technology **C**- Image & Video Processing	3	-	3	30	50	20	-	-	-	100
PC	CO612	Lab Practice-III(Advance Algorithms)	-	4	2	-	-	-	50*	-	-	50
PE	CO613	Lab Practice-IV(Based on Electives)	-	4	2	-	-	-	50*	-	-	50
PRJ	CO614	Mini Project with Seminar	-	4	2	-	-	-	50*	-	-	50
AC	AC201	Audit Course-2	2	-								
		Total	14	12	18	120	200	80	150	-	-	550

*Oral will be based on the term work submitted by the student.

Audit Course 1

AC101A English for Research Paper Writing

AC101B Disaster Management

AC101C Sanskrit for Technical Knowledge

AC101D Value Addition

Audit Course 2

AC201A Constitution of India

AC201B Pedagogy Studies

AC201C Stress Management by Yoga

AC201D Personality Development through Life Enlightenment Skills.

Dr. A.B. Pawar

Second Year (Semester III)

Cat	Course Code	Course Title	Teaching Scheme Hrs./Week			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CA				
PE	CO701	**Elective – V** **A**- User Experience & Usability Engineering **B**- Software Design & Architecture **C**- Optimization Techniques	3	-	-	3	30	50	20	-	-	-	100
OE	CE702 ET702 MB702 ME702 ST702 CO702	**Open Elective** Industrial Safety and Management Machine Learning Startup and Venture Management Project Planning and Operation Research Composite Materials Recent Trends in Computer Technology	3	-	-	3	30	50	20	-	-	-	100
PRJ	CO703	Dissertation Phase – I	-	-	20	10	--	--	--	50	-	-	50
		Total	6	-	20	16	60	100	40	50	-	-	**250**

Second Year (Semester IV)

Cat	Course Code	Course Title	Teaching Scheme Hrs./Week			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CA				
PRJ	CO704	Dissertation Phase-II	-	-	32	16	--	--	--	100	-	50	150
		Total	-	-	32	16	--	--	--	100	-	50	150

Total Credits for the programme = 18 + 18 +16 +16 = 68

SEMESTER I

CO601: Mathematical Foundation of Computer Science

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30Marks
End Sem Exam: 50 Marks
CA :   20 Marks
Total: 100Marks

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Prerequisite Course: Discrete Mathematics
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Course Objectives:

1. To learn and understand the probability mass and density function.

2. To learn and understand the sampling distributions of estimators and methods of moments.

3. To study statistical inference and classification problems.

4. To learn and understand the graph theory, Permutations and Combinations.

5. To learn and understand mathematical and statistical techniques to emerging areas of Information Technology.

6. To learn and understand recent trends of various distribution functions in mathematical field of computer science.

Course Outcomes

After completion of course, students would be able to:

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. **Solve** the problem using probability mass and density function	3	Apply
2. **Demonstrate** sampling distributions of estimators and methods of moments.	2	Understand
3. **Understand** the methods of statistical inference, and the role that sampling distributions play in those methods.	2	Understand
4. **Demonstrate** applications of graph theory and combinatorial problem.	2	Understand
5. **Analyze** the applications of mathematical and statistical techniques to emerging areas of Information Technology	4	Analyze
6. **Demonstrate** recent trends of various distribution functions in mathematical field of computer science.	2	Understand

COURSE CONTENTS

Unit-I	Probability mass, density	No .of Hours
	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	07

Unit-II	Random samples	No. of Hours
	Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood,	07

Unit-III	Statistical inference	No. of Hours
	Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.	08

Unit-IV	Graph Theory	No .of Hours
	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	11

Unit-V	Computer science and engineering applications	No. of Hours
	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.	10

Unit-VI	Recent Trands in various distribution functions	No.of Hours
	Recent Trands in various distribution functions in mathmatical field of computer science for varying fields like bioinformatic, soft computing, and computer vision.	05

Books:

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

CO602: Advanced Data Structures

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30Marks
End Sem Exam: 50 Marks
CA :   20 Marks
Total: 100Marks

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Prerequisite Course: UG level course in Data Structures
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Course Objectives:

1. To know the concept of hash table and various collision resolution techniques in hashing.

2. To operate on skip lists for performing insertion, searching and updations.

3.   To be acquainted with various types of trees like AVL, RBT, B-Tree, Splay Tree.

4. To know and operate on various text processing algorithms.

5. To identify and understand computational geometry problems.

6. To know the recent trends and applications in hashing.

Course Outcomes

After completion of course, students would be able to:

Course Outcomes	Blooms Taxonomy	
	Level	**Descriptor**
1. Understand the concept of hash table and various collision resolution techniques in hashing.	2	Understand
2. Implement various operations on skip list.	3	Apply
3. Design and analyze an algorithm for various types of trees like AVL, RBT, B-Tree, Splay Tree.	4	Analyze
4. Select and use an appropriate text processing algorithm.	3	Apply
5. Identify suitable data structure and design algorithm for computational geometry problems.	3	Apply
6. Demonstrate the recent trends and applications in hashing.	3	Apply

COURSE CONTENTS

Unit-I	Dictionaries and Hashing	No .of Hours
	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, QuadraticProbing, Double Hashing, Rehashing, Extendible Hashing.	07

Unit-II	Skip Lists	No. of Hours
	Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists	05

Unit-III	Trees	No. of Hours
	Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees	09

Unit-IV	Text Processing	No .of Hours
	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.	12

Unit-V	Computational Geometry	No. of Hours
	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.	10

Unit-VI	Recent Trands in Hashing	No.of Hours
	Recent Trands in Hashing, Trees, and various computational geometry methods for effeciently solving the new evolving problem	05

Books:

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.

CO603A: Machine Intelligence

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30Marks
End Sem Exam: 50 Marks
CA :   20 Marks
Total: 100Marks

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Prerequisite Course: discrete structures, probability, statistics and algorithmic analysis
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Course Objectives:

1. To introduce the concepts of   Artificial Intelligence (AI) with emphasis on its use to solve real world problems.

2. To understand searching strategies to build Intelligent Systems (IS).

3. To study knowledge representation for IS.

4. To understand decision making in uncertainty.

5. To learn learning techniques and its applications

6. To study the challenges inherent in building "intelligent systems

Course Outcomes (COs): After successful completion of the course, the student should be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Interpret concepts of Artificial Intelligence.	2	Understand
2. Apply basic knowledge representation, problem solving	3	Apply
3. Analyze the applicability of algorithms in solving particular engineering problems and building intelligent systems	4	Analyze
4. Develop decision-making processes in uncertainty for IS.	6	Create
5. Apply learning techniques in designing IS applications	6	Create
6. Design and Develop IS for real-world problem solving	5	Evaluate

COURSE CONTENTS

Unit-I	Introduction to Intelligent Systems	No. of Hours	COs
	Introduction, History, Foundations and Mathematical treatments, Problem solving with AI, AI models, Learning aspects in AI, What is an intelligent Agents, Rational agent, Environments types, types of Agents, Types of Intelligent Systems,	08	CO1

Unit-II	Search Strategies	No. of Hours	COs
	Problem solving by searching, Uninformed and informed search, Heuristic Functions	08	CO2, CO3

Unit-III	Knowledge Representation and Logic	No. of Hours	COs
	Propositional Logic, Inference rules, First Order Logic, Rule based systems, Deductive Retrieval, Backward Chaining, Second order Logic. Semantic nets, Frames,	08	CO2, CO3

Unit-IV	Uncertain Knowledge and Decision Theory	No. of Hours	COs
	Uncertainty and methods, Inference Using Full Joint Distributions, Bayesian probability and belief networks, Relational and First- Order Probability Models, Other techniques in uncertainty and reasoning, Inference in Temporal Models, Hidden Markov Models, Kalman Filters, Dynamic Bayesian Networks, Decision network, Semi-constraint influence diagram, Decision making and imperfect information, Combining Beliefs and Desires under Uncertainty, The Basis of Utility Theory, Utility Functions, Multi-attribute Utility Functions, Decision Networks, Decision-Theoretic Expert Systems	08	CO4

Unit-V	Learning Techniques and Applications	No. of Hours	COs
	Machine Learning Concepts, methods and models, Supervised Learning, unsupervised and semi-supervised, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, Artificial Neural Networks, Non-parametric Models, Support Vector Machines, Ensemble Learning, empirical learning tasks, Explanation-Based Learning, Inductive Logic Programming, Reinforcement Learning, Active Learning, Learning based on limited information	08	CO5

Unit-VI	Intelligent System Applications	No. of Hours	COs
	Language Models, Text Classification, Information Retrieval, Information Extraction, Phrase Structure Grammars, Syntactic Analysis (Parsing), Augmented Grammars and Semantic Interpretation, Machine Translation, Speech Recognition, Image Formation and object recognition, Early Image-Processing Operations, Object Recognition by Appearance, Reconstructing the 3D World, Object Recognition from Structural Information, Robots	08	CO6

Books:

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Prentice-Hall, 2010, 3rd edition
2. Elaine Rich and Kelvin Knight, Nair, "Artificial Intelligence," McGraw Hill Publication, 3rd edition.

Reference Books:

1. Janakiraman et al., "Foundations of Artificial Intelligence and Expert Systems", Macmilan India Ltd.
2. Laxmidhar Behera, Indrani , "Intelligent Systems & Control Principles & Applications", Kar Oxford UNI, 2009

CO603B: Wireless Network and IOT

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30Marks
End Sem Exam: 50 Marks
CA :   20 Marks
Total: 100Mark

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Prerequisite Course: Data Communication, Computer Network.

Course Objectives:

1. To understand the fundamental concepts of wireless sensor network
2. To grasp the functionalities of specialized Medium Access protocols and routing protocols used in WSN
3. To learn and understand different concept of Localization and Positioning for WSN
4. To develop comprehensive approach towards building embedded IoT system
5. To learn real world application scenarios of IoT along with its societal and economic impact using case studies
6. To learn to implement infrastructure for IoT applications

Course Outcomes (COs): After completion of the course, students are able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Use appropriate model of WSN.	3	Apply
2. Select appropriate Medium Access protocols and routing protocol for WSN	4	Analyse
3. Select location and position for wireless sensor node and deploy it.	6	Create
4. Design an architecture for IoT for specified requirement	5	Design
5. Solve the given societal challenge using IoT	3	apply
6. Select between available technologies and devices for developing IoT application	6	Create

COURSE CONTENTS

Unit-I	Fundamentals of WSN	No. of Hours	COs
	Introduction: Sensor Network, Background of Sensor Network Technology, Applications of Sensor Networks, Basic Sensor Network Architectural Elements, Typical sensing node, Brief Historical Survey of Sensor Networks **Single-node architecture:** Hardware components, Energy consumption of sensor nodes, Some examples of sensor nodes, **Network architecture:** Sensor network scenarios, Design principles for WSNs, Gateway concepts	7 Hrs.	CO1

Unit-II	MAC and Routing Protocols	No. of Hours	COs
	MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts-STEM, S-MAC, Contention-based protocols- CSMA, PAMAS, Schedule-based protocols- LEACH, SMACS, TRAMA, The IEEE 802.15.4 MAC protocol **Routing Protocols for Wireless Sensor Network:** Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks	7 Hrs.	CO2

Unit-III	Localization and positioning, Applications of WSN	No. of Hours	COs
	Localization and positioning: Properties of localization and positioning procedures , Possible approaches - Proximity, Trilateration and triangulation and Scene analysis Wireless Application Protocol (WAP), WML **Case Study**: MANET, Cellular Network, Wireless Sensor Network, Military and Surveillance Applications.	7 Hrs.	CO3

Unit-IV	Introduction to IOT	No. of Hours	COs
	Definition and characteristics of IOT, Physical design of IOT, Logical design of IOT, IOT Enabling technologies, IOT Levels and Development templates	6 Hrs.	CO4

Unit-V	Domain Specific IoTs	No. of Hours	COs
	Case studies: - Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle M2M and IoT, IoT System Management with NETCONF-YANG	7 Hrs.	CO5

Unit-VI	Developing Internet of Things	No. of Hours	COs
	IoT Platforms Design Methodology, IoT Physical Devices & Endpoints- Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi interfaces, Python Web Application Framework-Django, Development with Django	7 Hrs.	CO6

Books:

Text Books:

1. Holger Karl and Andreas Willig "*Protocols and Architectures for Wireless Sensor Networks"*, John Wiley & Sons, Ltd. ISBN: 0-470-09510-5
2. Kazim Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols and Applications", Wiley ISBN: 978-81-265-2730-4 (Students Edition).
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515

Reference Books:

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks", ISBN 978-0-470-99765-9.
2. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Networks: An information Processing Approach", Elsevier ISBN: 978-81-8147-642-5
3. Edgar H. Callaway, Jr. and Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols", CRC Press, ISBN 9780849318238
4. Anna Hac, "Wireless Sensor Network Designs," John Wiley & Sons, ISBN 0-470-86736-1
5. Robert Faludi, "Building Wireless Sensor Networks:A Practical Guide to the ZigBee Mesh Networking Protocol" , Shroff Publishers, ISBN: 9789350232897
6. Waltenegus Dargie,Christian Poellabauer, " Fundamentals of wireless sensor networks theory and practice",John Wiley and Sons, Ltd., Publication,ISBN 978-0-470-99765-9
7. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345
8. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0

CO603C: Geographic Information System

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100Marks

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Prerequisite Course: Database Management System, Image Processing, Computer Graphics

Course Objectives:

1. To understand the basics components of Geographic Information System.

2. To study the maps, coordinate system and projection of GIS.

3. To learn and understand the data models to represent GIS.

4. To understand and analyse geospatial data.

5. To learn and understand GIS image interpretation, processing and classification.

6. To explore geographical Information system applications and its future

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Aware with the basic components of GIS	2	Understand
2. Understand the maps, coordinate systems and projections	2	Understand
3. Represent GIS data in data models	3	Apply
4. Understand and analyze GIS geospatial data	2,4	Understand, Analyze
5. Process and classify the GIS images	3	Apply
6. Aware with application and future of GIS	2	Understand

COURSE CONTENTS

UNIT I	Geographic Information Systems	No. of Hours	COs

	Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input-Attribute data Management –Data display- Data Exploration- Data Analysis. Coordinate Systems: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections-Map projection parameters Commonly used Map Projections - Projected coordinate Systems	08	CO1, CO2
UNIT II	**Vector Data Model**	**No. of Hours**	**COs**
	Representation of simple features- Topology and its importance; data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules	08	CO3
UNIT III	**Raster Data Model**	**No.of Hours**	**COs**
	Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data. Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing	08	CO3
UNIT IV	**GIS Data Management and Analysis**	**No.of Hours**	**COs**
	Organizational stratergy of DBMS in GIS, Data input and Editing: data stream, data input model and data input method, data editing. Data Quality issue: Components of data quality, accuracy, precision and resolution, consistency completeness, source of error in GIS, Modeling Errors and error evaluation. Spatial Analysis: Raster Data Analysis– Local, neighborhood, Zonal and Global, Vector Data Analysis – Buffering, Overlays, Distance Measurements, Analyzing Geographic Relationship, pattern analysis, Network Analysis, Basics of Geodatabase Model, Difference between 2D,2.5D, 3D and 4D GIS and conversion	08	CO4
UNIT-V	**Visual Image Interpretation**	**No. of Hours**	**COs**

		No. of Hours	COs
	Types of Pictorial data products, image interpretation strategy, image interpretation process, overview of image interpretation equipment. Digital image processing: Basic chapter of digital images, processing, registration, enhancement, spatial filtering, transformation, classification, image classification, image classification and GIS	08	CO5

UNIT-VI	Applications	No. of Hours	COs
	GIS application areas and user segments, creating custom GIS software applications, user interfaces, case studies. Future data, future hardware, future software, future issue: data ownership, privacy, education. GIS career options and how to pursue them.	08	CO6

Books:

Text Books:

1. Kang-tsung Chang, "Introduction to Geographical Information Systems", Tata McGraw Hill, Fourth Edition, 2008
2. Peter A. Burrough, Rachael A. McDonnell, " Principles of Geographical Information Systems", Oxford University Press

Reference Books:

1. B. Bhatta , "Remote Sensing and GIS," Oxford Publishers, 2015.
2. M Anji Reddi," Remote sensing & Geographical Information Systems" , BS Publication, Second Edition.
3. Terry-Karen Steede, "Integrating GIS and the Global Positioning System," ESRI Press, 2002.
4. Hofmann W.B & Lichtenegger, H. Collins, "Global Positioning System –Theory and Practice," Springer-Verlag Wein, New York, 2001
5. Gunter Seeber, "Satellite Geodesy Foundations-Methods and Applications,Gruyter," Walter de GmbH, 2003

CO604A: Data Analytics and Business Intelligence

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Data Mining

Course Objectives:

1. To learn & develop problem solving abilities using Mathematics.
2. To understand principles and methods of data analytics.
3. To learn & explore decision support systems.
4. To explore data Analytics life cycle.
5. To learn & manage BI Systems.
6. To learn advanced BI Tools.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand fundamental concepts in Data Analytics & Business Intelligence.	2	Understand
2. Apply Business Intelligence to Make Business Decisions.	3	Apply
3. To demonstrate a survey on applications for Business Analytic and Intelligence.	2	Understand
4. Ability to visualize the data.	5	Evaluate
5. Apply recent BI Tools for various Applications.	3	Apply
6. To write case studies in Data Analytics & Business Intelligence using mathematical models.	6	Create

COURSE CONTENTS

Unit-I	Data Analytics	No. of Hours	COs

	Introduction: Data Analytics, Data Analytics life cycle, Discovery, Data preparation, Preprocessing requirements, Results & Findings, Operationalizing, Introduction to OLAP. Real-world Applications, types of outliers, outlier challenges, Outlier detection Methods, Proximity-Based Outlier analysis, Clustering Based Outlier	06	CO1

Unit-II	**Decision Making Concepts**	No. of Hours	COs
	Concepts of Decision Making, Techniques of Decision Support System (DSS), Development of Decision Support System (DSS), The DSS Development Methodology, Change Management, DSS Technology Levels and Tools; DSS Development Platforms; Applications of DSS, Role of Business Intelligence in DSS.	06	CO2

Unit-III	**Introduction to Business Intelligence**	No. of Hours	COs
	Introduction to Business Intelligence, Defining BI Cycle, BI Environment and Architecture, Identify BI opportunities, Benefits of BI. Role of Mathematical model in BI, Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization.	08	CO1

Unit-IV	**Advanced Business Intelligence Tools**	No. of Hours	COs
	SAP Business Intelligence Tool, Yellowfin BI Tool, Microstrategy BI Tool for powerfull dashboarding & data analytics, Sisense BI Tool, SAS BI Tool, Microsoft Power BI a web-based business analytics tool, Data analytics, business analytics, ERP and Business Intelligence, Looker BI Tool, Tableau Business Intelligence tool for data discovery and data visualisation	06	CO4, CO5

Unit-V	**Designing and managing BI systems**	No. of Hours	COs
	Introduction, Business Intelligence Lifecycle, Enterprise Performance Life Cycle (EPLC)Framework Elements, Life Cycle Phases, Human Factors in BI Implementation, BI Strategy, Objectives and Deliverables, Transformation Roadmap, Building a transformation roadmap, BI Development Stages and Steps, Parallel Development Tracks, BI Framework Determining infrastructure requirements, planning for scalability and availability, managing and maintenance of BI systems, managing BI operations for business continuity	06	CO1, CO5, CO6

Unit-VI	Business Intelligence Implementation & Applications	No. of Hours	COs
	Implementing Business Intelligence: Introduction, Business Intelligence Platform, Business Intelligence Platform Capability Matrix, BI Target Databases, Data Mart, BI Products and Vendor, The Big Four Business Intelligence vendors. **BI Applications in** CRM, Marketing, Logistics and Production, Finance, Banking, Telecommunications, Fraud Detection, Retail Industry.	06	CO4, CO5, CO6

Books:

Text Books:

1. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support, 10th Edition. Pearson/Prentice Hall, 2015. ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4;
2. Anil Maheshwari, "Data Analytics" McGraw Hill Publication, ISBN: 9789352604180
3. Business Process Automation, Sanjay Mohapatra, PHI

Reference Books:

1. U. Dinesh Kumar, "Business Analytics", Willey, ISBN: 9788126568772, 8126568771
2. Introduction to business Intelligence and data warehousing, IBM, PHI.
3. Data mining concepts and techniques, Jawai Han, Michelline Kamber, Jiran Pie, Morgan Kaufmann Publishers 3rd edition
4. Data Mining for Business Intelligence, WILEY
5. Ken W. Collier,Agile Analytics: Avalue driven Approach to Business Intelligence and Data
Warehousing, Pearson Education,2012, ISBN-13 978 8131786826

CO604B: Cloud Technology

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Computer Network

Course Objectives:

1. To study cloud computing fundamentals.

2. To understand virtualization environment in cloud computing.

3. To study various cloud computing platforms.

4. To study the applications that uses cloud computing.

5. To study cloud monitoring and security aspects.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand the fundamentals and roots of cloud computing	2	Understand
2. Install and create virtualization environments that forms the basics for cloud	6	Create
3. Study and Analyse different cloud file systems. Compare available cloud file systems.	4	Analyse
4. Develop Open source type of cloud	6	Create
5. Understand Service Level Agreements in cloud services offered by cloud service provider to cloud service consumer.	2	Understand
6. Design and Analyse the IoT sensor data by sending data on cloud.	4	Analyse

COURSE CONTENTS

Unit-I	Introduction cloud computing	No. of Hours	COs
	Roots of Cloud Computing: Distributed computing (Cluster and Grid), Virtualization, Internet Techniques(Web services and SOA) & Autonomic computing. Cloud Fundamentals: cloud definition, hardware and software resources, benefits of cloud computing, limitations of cloud computing.	05	CO1

Unit-II	Cloud architecture	No. of Hours	
	Cloud computing reference model, Cloud computing service models and deployment models. Web Services, Service Oriented Architecture(SOA), Web service model, Web service components, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and XAMP)	06	CO2

Unit-III	Virtualization	No. of Hours	
	Virtualization: Definition, types of virtualization, types of hypervisors, virtualization tools and mechanisms- Xen, VMware. Issues with virtualization, advantages of virtualization. Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management. Virtualization for Data-Center Automation.	06	CO3

Unit-IV	Data Storage in cloud	No. of Hours	
	Storage system architecture, Big data, Block and level storage virtualization, Virtual Provisioning, and automated storage tiering, VLAN, VSAN and benefits, Cloud file systems: GFS and HDFS, BigTable, Hbase and Dynamo. Features and comparisons among GFS, HDFS. Cloud Storage Providers.	07	CO4

Unit-V	Cloud monitoring and Management	No. of Hours	
	Interoperability and Service Monitoring: Issues with interoperability, Vendor lock-in, Interoperability approaches. SLA Management, Metering Issues, and Report generation. Resource Management and Load Balancing: Virtual machine migration, Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management.	06	CO5

Unit-VI	Cloud and the Internet of Things	No. of Hours	
	Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Cyber-Physical System), Online Social and Professional Networking.	06	CO6

Books:

Text Books:

1. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.
2. Dr. Kris Jamsa, " Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more" , Wiley Publications, ISBN: 978-0-470-97389-9.
3. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476.

Reference Books:

1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039.
2. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0.
3. Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8.
4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.

CO604C: Pattern Recognition

Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	In-Sem Exam:	30 Marks
Credits: 3	End Sem Exam:	50 Marks
	CA:	20 Marks
	Total:	100 Marks

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Prerequisite Course: Image Processing, Machine Learning

Course Objectives:

1. To study the fundamentals of pattern recognition and its relevance to classical and modern problems.

2. To familiar with general approaches such as Bayes Classification, Nearest Neighbor Rule.

3. To study of Maximum-likelihood parameter estimation in relatively complex probabilistic models.

4. To study various Nonparametric Techniques like Fuzzy Classification- Reduced Coulomb Energy Networks.

5. To study of Linear Discriminants functions and Decision Surfaces

6. To study of Stochastic Search-Boltzmann Learning-Boltzmann Network and Graphical Models.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcomes	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. Design systems and algorithms for pattern recognition (signal classification), with focus on sequences of patterns that are analyzed using, hidden Markov models (HMM),	3	Apply
2. Understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models	3	Apply
3. Apply Maximum-likelihood parameter estimation in relatively complex probabilistic models, such as mixture density models and hidden Markov models,	5	Evaluate
4. Apply pattern recognition techniques to real-world problems such as document analysis and recognition using Nonparametric Techniques	4	Analyze
5. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.	2	Understand
6. Understand the principles of Stochastic Methods estimation a relatively simple probabilistic models.	5	Evaluate

COURSE CONTENTS

Unit-I	Introduction to Pattern Recognitions	No. of Hours	COs
	Pattern recognition System-Design Cycles- Sensing-Segmentation-feature extraction- classification-post processing-Design Cycle-Learning and Adaption-Supervised Learning, Unsupervised Learning, Reinforcement Learning.	09	CO1

Unit-II	Bayesian Decision Theory	No. of Hours	COs
	Introduction- Bayesian Decision Theory- Minimum Error Rate Classification-Classifiers-Discriminant Functions and Decision Surfaces-The normal Density, Error Bounds for Normal Densities-Missing and Noisy Features –Bayesian Belief Networks.	08	CO1, CO3

Unit-III	Maximum Likelihood and Bayesian Parameters Estimations	No. of Hours	COs
	Introduction-maximum likelihood Estimation-Bayesian Estimation- Bayesian parameter Estimation-Sufficient Statistics-Component Analysis and Discriminants-Hidden Markov Models- Hidden Markov Models.	09	CO2

Unit-IV	Nonparametric Techniques	No.of Hours	COs
	Introduction- Density Estimation-Parzen windows-K Nearest Neighbor Estimation- The Nearest neighbour Rules-Metrics and Nearest Neighbor Classification-Fuzzy Classification- Reduced Coulomb Energy Networks.	08 .	CO1, 4

Unit-V	Liner Discriminate Functions	No. of Hours	COs
	Introduction-Linear Discriminant functions and Decision Surfaces- Generalized Linear Discriminant Functions-The Two Category Linearly Separable Case-Minimizing the perception Criterion function- Relaxation Procedures- Nonseparable Behavior-Minimum Squared Error Procedures- Linear Programming Algorithms-Support Vector Machines	09	CO6

Unit-VI	Stochastic Methods	No. of Hours	COs
	Introduction- Stochastic Search-Boltzmann Learning-Boltzmann Network and Graphical Models-Evolutionary Methods- Genetic Programming-NonMetric Methods- Decision Tree-CART.	09	CO5

Books:
Text Books:
1. R.O.Duda, P.E.Hart and D.G.Stork, " Pattern Classification," John Wiley, 2001 2. S.Theodoridis and K.Koutroumbas, " Pattern Recognition", 4th Ed., Academic Press,2009 3. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
Reference Books:
1. Richard. E.G., Johnsonbaugh and Jost.S. "Pattern Recognition and Image Analysis", Prentice Hall of India Pvt. Ltd., New Delhi, 1999. 2. Duda R.O. and Hart P.E., "Pattern Classification and Scene Analysis", Wiley, New York, 1973. 3. Morton Nadler and Eric Smith P.,"Pattern Recognition Engineering", John Willey and Sons, New York, 1993. 4. Tou and Gonzalez R.," Pattern Recognition Principles", Addision Wesley, 1974. 4. Rober J. Schalkoff, "Pattern Recognition – Statistical, Structural and Neural Approaches", John Wiley & Sons Inc, New York, 1992.

Lab Practice-1
CO605: Advanced Data structures Lab

Teaching Scheme
Practical: 4 Hrs./Week
Credits: 2

Examination Scheme
Oral Exam: 50 Marks
Total: 50 Marks

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Prerequisite Course: Design and Analysis of Algorithms, Data Structures

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Course Objectives:

1. To be familiar with advanced data structure like hashing, skip list etc.

2. To use various types of search trees like AVL tree, Red-Black tree, B-tree.

3. To learn different algorithms for pattern matching or string matching.

4. To examine text processing with different algorithm like Huffman coding and dynamic programming algorithm.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. To design and implement advanced data structure like hashing , skip list	6	Create
2. To design and implement various types of search trees like optimal binay search tree, AVL tree, Red-Black tree, B-tree.	6	Create
3. To examine trie tree and brute-force algorithm and dynamic programming for pattern matching or string matching.	4	Analyze
4. To implement Huffman coding algorithm for text processing.	6	Create

List of Assignmnets
1. Write a menu driven program to implement all the functions of a phone book (ADT) using hashing.   Data: Set of (key, value) pairs, Keys are mapped to values in the hash table and apply the following collision resolution techniques- (i) Linear Probing (ii) Quadratic Probing (iii) Chaining
2. Write a program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques. a. Quadratic probing   c. Double hashing/rehashing   d. linear probing with Chaining

3. For given set of elements create skip list. Find the element in the set that is closest to some given value.

4. A binary search tree containing n keys with order as k1<k2…<kn. Every key has search probability. Construct a binary search tree with least search cost for accessing each key in tree.

5. Construct AVL Tree with following operations: (consider nodes with integer type of data)
    a. Insertion: Test program for all cases (LL, RR, RL, LR rotation)
    b. Deletion: Test Program for all cases
    c. Display
  d. Find how many maximum comparisons may require for finding any keyword and the complexity for finding a keyword.

6. Construct a B-tree with order m=3, 5(m= non-leaf nodes have at most m children) . Perform operations as insertion, deletion and display operation on the given tree.

7. Write a program to implement Red-Black trees with insertion and deletion operation for the given input data as Strings.

8. Create a *Contacts* application using trie tree. The application must perform two types of operations:

    1. Add name, where **name** is a string denoting a contact name. This must store name as a new contact in the application.
    2. Find partial, where partial is a string denoting a partial name to search the application for. It must count the number of contacts starting with partial and print the count on a new line.

9. Construct a suffixed tree with brute force approach. Find out time complexity of brute force approach.

10. Write a program to print all the possible LCS presents in given two strings. Use dynamic programming approach to solve the problem.

11. A file contains the following characters with the frequencies as shown. If Huffman Coding is used for data compression, determine-

    1. Huffman Code for each character
    2. Average code length
    3. Length of Huffman encoded message (in bits)

Characters	Frequencies

A	10
E	15
I	12
O	3
U	4
S	13
T	1

12. Write a program to construct priority search tree.

Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition, Pearson, 2004.

2. Michael T Goodrich, Roberto Tamassia, Algorithm Design and Applications, John Wiley,2002.

3. Michael T Goodrich, Roberto Tamassia, Algorithm Design,Data Structures and Algorithms in C++,Second Edition John Wiley & Sons, Inc., 2011.

4. Ellis Horowitz ,Dinesh Mehta ,Sartaj Sahni ,Fundamentals of Data Structures in C++, University Press

Lab Practice-2
CO606: Data Analytics and Business Intelligence Lab

Teaching Scheme   **Examination Scheme**
Practical: 4 Hrs./Week   **Oral Exam: 50 Marks**
Credits: 2   **Total: 50 Marks**

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Prerequisite Course: Data Mining, Discrete Mathematics, Database
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Course Objectives:

1. To understand the need for machine learning for various problem solving

2. To study of neural Networks and Genetic Algorithms relate it with machine learning concepts.

3. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning

4. To understand the latest trends in machine learning

5. To design appropriate machine learning algorithms for problem solving

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Students able to differentiate between supervised, unsupervised, semi-supervised Machine learning approaches	3	Apply
2. Discuss and apply the back propagation algorithm and genetic algorithms to various problems	2	Understand
3. Discuss and apply the back propagation algorithm and genetic algorithms to various problems	3	Apply
4. Apply different preprocessing methods to prepare training data set for machine learning.	4	Analyze
5. Implement different learning models Learn Meta classifiers and deep learning concepts.	6	Create
6. Apply Advanced machine Learning for various types of problems	3	Apply

List of Assignments
1. Assignment on Linear Regression:

Create linear regression model where height is input or predictor variable and weight is output or response variable. After LR model is created, print the accuracy of this model and predict the weight of the person whose height is 180 cms.

These are values of height and their respective weights as mentioned below:

Values of height (in cms.)

151, 174, 138, 186, 128, 136, 179, 163, 152, 131

Values of weight (in kgs)

63, 81, 56, 91, 47, 57, 76, 72, 62, 48

2. Assignment on Decision Tree Classifier:

A dataset collected in a Cloth shop showing details of customers and whether or not they responded to a special offer to buy a new product is shown in table below. Use this dataset to build a decision tree, with Buys as the target variable, to help in buying lip-sticks in the future. Find the root node of decision tree. According to the decision tree you have made from previous training data set, what is the decision for the test data: [Age < 21, Income = Low, Gender = Female, Marital Status = Married]?

ID	Age	Income	Gender	Marital Status	Buys
1	< 21	High	Male	Single	No
2	< 21	High	Male	Married	No
3	21-35	High	Male	Single	Yes
4	>35	Medium	Male	Single	Yes
5	>35	Low	Female	Single	Yes
6	>35	Low	Female	Married	No
7	21-35	Low	Female	Married	Yes
8	< 21	Medium	Male	Single	No
9	<21	Low	Female	Married	Yes
10	> 35	Medium	Female	Single	Yes
11	< 21	Medium	Female	Married	Yes
12	21-35	Medium	Male	Married	Yes
13	21-35	High	Female	Single	Yes
14	> 35	Medium	Male	Married	No

3. Apply the Principal Component Analysis for feature reduction on IRIS Dataset.

4. Assignment on k-NN Classification:

In the following diagram let blue circles indicate positive examples and orange squares indicate Negative examples. We want to use k-NN algorithm for classifying the points. If k=3, find the Class of the point (6,6). Extend the same example for Distance-Weighted k-NN.
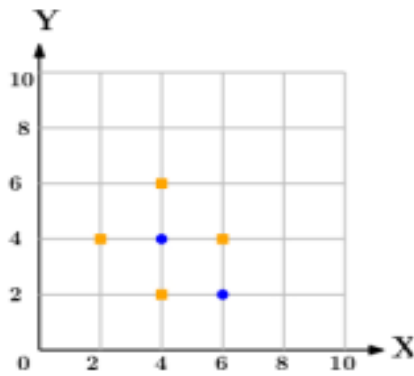
5. Assignment on k-Means: Apply the k-Means on any Dataset.

Books:

Text Books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

2. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622

3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O"REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

Reference Books:

1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

3. Ethem Alpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0262-01243-0

Lab Practice-2
CO606: Cloud Technology Lab

Teaching Scheme   **Examination Scheme**
Practical: 4 Hrs./Week   **Oral Exam: 50 Marks**
Credits: 2   **Total: 50 Marks**

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Prerequisite Course:
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Course Objectives:

1. To study cloud computing fundamentals.

2. To understand virtualization environment in cloud computing.

3. To study various cloud computing platforms.

4. To study the applications that uses cloud computing.

5. To study cloud monitoring and security aspects.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand the fundamentals and roots of cloud computing	2	Understand
2. Install and create virtualization environments that forms the basics for cloud	6	Create
3. Study and Analyse different cloud file systems. Compare available cloud file systems.	4	Analyse
4. Develop Open source type of cloud	6	Create
5. Understand Service Level Agreements in cloud services offered by cloud service provider to cloud service consumer.	2	Understand
6. Design and Analyse the IoT sensor data by sending data on cloud	4	Analyse

List of Assignments
1. Installation and configuration of own Cloud
2. Implementation of Virtualization in Cloud Computing to Learn Virtualization Basics, Benefits of Virtualization in Cloud using Open Source Operating System

3.	Study and implementation of infrastructure as Service using Open Stack.
4.	Write a program for Web feed using PHP and HTML
5.	Assignment to install and configure Google App Engine.
6.	Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.

Books:

Text Books:

1. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.

2. Dr. Kris Jamsa, " Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more" , Wiley Publications, ISBN: 978-0-470-97389-9.

3. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476.

Reference Books:

1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039.

2. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0.

3. Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8.

4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.0262-01243-0

Lab Practice-2
CO606: Pattern Recognition Lab

Teaching Scheme   **Examination Scheme**
Practical: 4 Hrs./Week   **Oral Exam: 50 Marks**
Credits: 2   **Total: 50 Marks**

==
Prerequisite Course: Image Processing, Machine Learning, Soft computing
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Course Objectives:

1. Study the image fundamentals, mathematical transforms necessary for image processing.
2. Study about the various techniques of image enhancement, reconstruction, compression and segmentation
3. To Know sampling and reconstruction procedure
4. To learn fundamentals of Image and Speech Processing.
5. To learn image enhancement and restoration techniques.
6. To learn image compression & segmentation techniques.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Apply image processing algorithms for practical object recognition applications.	**3**	**Apply**
2. Identify areas of knowledge which are required, select an appropriate approach to a given image processing task, and critically evaluate and benchmark the performance of alternative techniques for a given problem by simulation.	**3**	**Apply**
3. Implement image processing tasks with a high level of proficiency via software and hardware systems	**5**	**Evaluate**
4. Demonstrate a high level of self-directed learning ability and good oral and written communication skills on technical topics of image processing and systems engineering.	**2**	**Understand**
5. Understand image enhancement and restoration techniques.	**2**	**Understand**
6. Describe and use image compression & segmentation techniques.	**3**	**Apply**

List of Assignments
1. To perform conversion between color spaces
2. Display of Gray scale Images.
3. To perform image compression using DCT / Wavelet transform
4. Design of Non-linear Filtering
5. Determination of Edge detection using Operators
6. 2-D DFT and DCT.
7. Filtering in frequency domain.
8. Segmentation using watershed transform.
9. To apply morphological operators on an image
10. To perform image classification / recognition
11. Case Studies on Intellectual Property (IP Advantage)
12. Case Studies on Creating an IP Solution for Company and Client

Books:

Text Books:

1. Rafael.C,Gonzalez, Richard E Woods, "Digital Image Processing",3rdEdition, Pearson India, 2013.
2. Jain A.K, "Fundamentals of Digital Image Processing", 4th Edition, Prentice hall of India, 2004.
3. S Sridhar, "Digital Image Processing", Oxford University Press

Reference Books:

1. .B.Chanda, D. DuttaMajumder, "Digital Image Processing and Analysis", 2ndEdition, Phi learning, 2011.
2. William K Pratt, "Digital Image Processing", 4th Edition, Wiley, 2012.
3. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication

CO607: Research Methodology and IPR

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits: 2

Examination Scheme
In-Sem Exam:
End Sem Exam: 50 Marks
Total: 50 Marks

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Prerequisite Course: Nil
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Course Outcomes:

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

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 CONTENTS

Unit-I	Research problem	No. of Hours
	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	07
Unit-II	**Effective literature studies**	**No. of Hours**
	Effective literature studies approaches, analysis Plagiarism, Research ethics,	08
Unit-III	**Effective Technical Writing**	**No. of Hours**

	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	08

Unit-IV	**Nature of Intellectual Property**	**No. of Hours**
	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.	09

Unit-V	**Patent Rights**	**No. of Hours**
	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	08

Unit-VI	**New Developments in IPR**	**No. of Hours**
	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.	08

Books:

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, 2 nd 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

AC101A: ENGLISH FOR RESEARCH PAPER WRITING

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits:

Examination Scheme
In-Sem Exam:
End Sem Exam:
CA :

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Course Objectives:

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

COURSE CONTENTS

Units	Contents	No. of Hours
Unit-I	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	04
Unit-II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	04
Unit-III	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	04
Unit-IV	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,	04
Unit-V	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	04
Unit-VI	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	04
Books:		

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

AC101B: DISASTER MANAGEMENT

Teaching Scheme   **Examination Scheme**
Lectures: 2 Hrs. / Week   **In-Sem Exam:**
Credits: **End Sem Exam:**
                                        CA :
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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 CONTENTS

Units	Contents	No. of Hours
Unit-I	Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	04
Unit-II	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.	04
Unit-III	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	04
Unit-IV	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.	04

Unit-V	**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.	04
Unit-VI	**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.	04

Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.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

AC101C: SANSKRIT FOR TECHNICAL KNOWLEDGE

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits:

Examination Scheme
In-Sem Exam:
End Sem Exam:
CA :

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Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcome: Students will be able to
1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

COURSE CONTENTS

Units	Contents	No. of Hours
Unit-I	• Alphabets in Sanskrit, • Past/Present/Future Tense, • Simple Sentences	08
Unit-II	• Order • Introduction of roots • Technical information about Sanskrit Literature	08
Unit-III	• Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	08
Books:		
1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi 2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication 3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.		

AC101D: VALUE EDUCATION

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits:

Examination Scheme
In-Sem Exam:
End Sem Exam:
CA :

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Course Objectives:

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 outcomes: Students will be able to

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

COURSE CONTENTS

Units	Contents	No. of Hours
Unit-I	• 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	04
Unit-II	• 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	06
Unit-III	• 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	06

Unit-IV	• 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	06

Books:

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

SEMESTER II

CO608: Advanced Algorithms

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Design and Analysis of Algorithms, Data Structures
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Course Objectives:

1. To teach problem formulation and problem-solving skills.

2. To introduce students to the advanced methods of designing and analyzing algorithms.

3. The student should be able to choose appropriate algorithms and use it for specific problem.

4. To understand different classes of problems concerning their computation difficulties.

5. To learn about problem formulation and problem solving using different algorithmic techniques.

6. To study approximation algorithms and randomized algorithms to address the limitations on the time complexity

Course Outcomes (COs): On completion of the course student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand the basic principles of different paradigms of designing algorithms	2	Understand
2. Apply mathematical principles to solve various problems	3	Apply
3. Analyze the complexities of various algorithms	4	Analyze
4. Evaluate the performance of various algorithms in best case, worst case and average case	5	Evaluate
5. Design efficient algorithms using modern techniques.	6	Create
6. Apply learned algorithm design techniques and data structures to solve various real life problems.	3	Apply

COURSE CONTENTS

Unit-I	Analysis of Algorithms	No. of Hours	COs

		08	CO1, CO3, CO4
	Review of algorithmic strategies, Asymptotic analysis: upper and lower complexity bounds. Identifying differences among best, average and worst Case Behaviors. Big O, little o, omega and theta notations, Standard complexity classes. Empirical measurements of performance. Time and space tradeoffs in algorithms. Analyzing recursive algorithms using recurrence relations.		
Unit-II	**Graph Algorithms**	**No. of Hours**	**COs**
	Strongly connected components, Bellman-Ford, Floyd-Warshall, Flow networks, max-flow min-cut theorem, Ford-Fulkerson method, Edmonds–Karp algorithm, Maximum bipartite matching, Push-relabel algortihms, Relabel-to-front algorithm	08	CO4, CO5
Unit-III	**Linear Programming**	**No. of Hours**	**COs**
	Standard and Slack forms, formulation of problems as linear programs, simplex algorithm, duality, initial basic feasible solution. Problem formulation for – single source shortest path, maximum flow problem, Vertex cover problem, Knapsack problem.	08	CO4, CO5
Unit-IV	**Geometric Algorithms**	**No. of Hours**	**COs**
	Line segment properties, determining whether any pair of segments intersects, Finding the convex hull-problem formulation, solving by Graham scan algorithm, Jarvis march algorithm, Finding the closest pair of points – problem formulation, solving by divide & conquer method.	08	CO4, CO5
Unit-V	**Approximation Algorithms**	**No. of Hours**	**COs**
	Vertex-cover problem, Travelling-salesman problem, set-covering problem, Randomization and linear programming, Subset-sum problem	08	CO4, CO5
Unit-VI	**Advanced Algorithmic Analysis**	**No. of Hours**	**COs**
	Amortized analysis, randomized algorithms. Dynamic programming: matrix chain multiplication and longest common subsequence, Greedy algorithms: activity-selection problem and Huffman codes, Combinatorial optimization	08	CO2, CO6

Books:
Text Books:
- Cormen, Leiserson, Rivest, "Introduction To Algorithms", PHI   - Brassard, Bratley "Fundamentals of Algorithmics", PHI
Reference Books:
- Horowitz, Sahni, "Fundamentals of Computer Algorithm", Galgotia   S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition. Addison Wesley,2000   - Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley   - C Papadimitriou and K Steiglitz, "Combinatorial Optimization", PHI

CO609: Advance Network and Analysis

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
TOTAL: 100 Marks

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Prerequisite Course: Computer Network

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Course Objectives:

1. To develop a comprehensive understanding of computer Networks

2. To learn delay models in data networks

3. To study design issues in networks.

4. To understand various issues hindering the performance of the network.

5. To learn estimation of network requirements.

6. To learn and understand advances in computer networks

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Get aware with general principles, issues and tools of network design	2	Understand
2. Use delay models to evaluate the performance of networks	5	Evaluate
3. Apply the knowledge to design computer networks	6	Create
4. Analyze the performance of networks based on chosen metrics	4	Analyze
5. Choose appropriate and advanced techniques to build the computer network	5	Evaluate
6. Use network simulation tool like NS2/NS3 and network testing tool like Wireshark	3	Apply

COURSE CONTENTS

Unit-I	Introduction	No. of Hours	COs

	Types of Networks. Network design issues. Network design tools, advanced network architectures. Reliable data delivery, Routing and forwarding, resource allocation, Mobility, Networked applications, Data in support of network design, General Principles of Network Design, network characteristics.	08	CO1

Unit-II	**Delay Models in Data Networks**	No. of Hours	COs
	Modeling and Performance evaluation. Multiplexing of Traffic on a Communication Link, Queuing Models- Little's Theorem, Probabilistic Form of Little's Theorem, Application of Little's Theorem, Queuing Systems: M/M/1, M/M/2, M/M/m, M/M/∞, M/M/m/m, M/M/m/q, M/M/1/N, D/D/1, M/G/1 System, M/G/1 Queues with Vacations, Reservations and Polling, Priority Queuing	08	CO2

Unit-III	**Network Design**	No. of Hours	COs
	Modeling Networks as Graphs, Problems & algorithms, Multipoint line topology- CMST, Esau-William's Algorithm, Sharma's Algorithm, Bin Packing algorithms. Terminal Assignment- Greedy algorithm and exchange algorithms, Concentrator location- COM, Add, Drop, Relaxation algorithm. Network of queues, Open, closed and semi-open queues, Network node, Kleinrock's Independent approximation.	08	CO3

Unit-IV	**Network Analysis**	No. of Hours	COs
	Queuing Networks, Closed Queuing Network Example, Nodes in a Packet Switched Network (PSN), Queuing Network Model of Nodes in a PSN, Queuing Network Analysis of a PSN, performance analysis of Data Link Layer, Network layer, QoS,	08	CO4

Unit-V	**Network Administration**	No. of Hours	COs
	Functions and responsibilities, Network planning and implementation, Sub-netting, Bandwidth management, security issues, Tools for BW and security management, modifying network implementation	08	CO5

Unit-VI	**Advances in Computer Networks**	No. of Hours	COs

	Wireless and sensor networks, multimedia networking, content distribution networks, Domain-specific networks, Next generation networks, cyber physical systems, computer network simulation NS2/NS3, network testing, testing tool – wireshark	08	CO6

Books:

Text Books:

1. Kershenbaum A., "Telecommunication Network Design Algorithms", Tata McGraw Hill
2. Bertsekas D. and Gallager R., "Data Networks," 2nd Ed., Prentice-Hall, Englewood Cliffs, N.J., 1992.

Reference Books:

1. Keshav S., "An Engineering Approach to Computer Networking," Addison-Wesley,1997.
2. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill
3. Stallings W., "High Speed Networks and Internet : Performance and Quality of Service", Prentice-Hall
4. Zacker, "Networking – The Complete Reference", Tata McGraw Hill
5. Simulation Modeling and analysis, Averill M. Law, W. D. Kelton
6. Computer Networks, Priciples, Technologies and Protocols for network design Natalia Olifer, Victor Olifer, Wiley India

CO610A: Parallel Computing

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course:

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Course Objectives:

1. To learn and understand the parallel processing and advances in Grid Computing.

2. To learn and understand the advances in cluster computing.

3. To learn and understand the advance parallel algorithms.

4. To learn and understand the advancement in pervasive & quantum computing.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand how large scale parallel systems are architectured and how massive parallelism are implemented in accelerator architectures	2	Understand
2. Understand and apply the methodologies for cluster setup and administration	6	Create
3. Understand and explore the distributed share memory and resource management	2	Understand
4. Write parallel programs for large scale parallel systems, load sharing and load balancing approach	4	Analyze
5. Design efficient parallel algorithms and applications	6	Create
6. Explore and analyses the ubiquitous computing and quantum computing	2	Understand

COURSE CONTENTS

Unit-I	Introduction Parallel Computing	No. of Hours	COs

	Introduction: Computational demand in various application areas, advent of parallel processing, terminology pipelining, Data parallelism and control parallelism-Amdahl's law. Basic parallel random access Machine Algorithms-definitions of P, NP and NP-Hard, NP Complete classes of sequential algorithms-NC – class for parallel algorithms. Grid Computing: Data & Computational Grids, Grid Architectures and its relations to various Distributed Technologies. Autonomic Computing, Examples of the Grid Computing Efforts (IBM)	09	CO1

Unit-II	**Cluster Computing 1**	**No. of Hours**	**COs**
	Cluster setup & its Administration, Performance Models & Simulations; Networking, Protocols & I/O, Lightweight Messaging systems, Active Messages	08	CO2

Unit-III	**Cluster Computing 2**	**No. of Hours**	**COs**
	Distributed shared memory, parallel I/O Clusters, Jib and Resource management system, scheduling parallel jobs on clusters	09	CO3

Unit-IV	**Cluster Computing 3**	**No. of Hours**	**COs**
	Load sharing and Fault tolerance manager, parallel programming scheduling techniques, Dynamic load balancing, Example Cluster System – Beowlf, COMPaS and NanOS	09	CO4

Unit-V	**Parallel Algorithms**	**No. of Hours**	**COs**
	Parallel algorithms for Graph searching— All Pairs shortest paths and minimum cost spanning tree. Parallelization aspects of combinatorial search algorithms with Focus on Branch and Bound Methods and, Alpha-beta Search methods.	08	CO5

Unit-VI	**Pervasive Computing & Quantum Computing**	**No. of Hours**	**COs**
	Pervasive Computing: Pervasive Computing concepts & Scenarios, Hardware & Software, Human - machine interface Device connectivity, Java for Pervasive devices, Application examples, Quantum Computing : Introduction to Quantum Computing, QUbits, Quantum Mechanics, Quantum gates, Applications of quantum computing.	08	CO6

Books:

Text Books:
1. Raj Kumar Buyya, "High performance cluster computing," PEA 2. J. Joseph & C. Fellenstein, "Grid Computing," PEA. 3. J.Burkhardt et .al, " Pervasive computing," PEA. 4. Vishal Sahni, "Quantum computing," Tata McGraw Hill.
Reference Books:
1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984 2. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann,1999, ISBN 978-1-55860-343-1 3. Rod Stephens, " Essential Algorithms", Wiley, ISBN: *ISBN*: 978-1-118-61210-1 4. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2

CO610B: Soft Computing

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course: ----
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Course Objectives:
1. To know the Nero-Fuzzy and Soft computing
2. To acquire the knowledge of Fuzzy Logic
3. To understand and explore the regression and optimization.
4. To acquire the knowledge of Neural networks
5. To learn and understand the Advanced Neuro -Fuzzy Modeling

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand and explore the Neuro- Fuzzy and soft computing methodologies	2	Understand
2. Understand and apply ANNs methodologies	3	Apply
3. Design and development of certain scientific and commercial application using Fuzzy logic	6	Create
4. Understand and explore the soft computing methodologies such as Genetic algorithms	2	Understand
5. Analyze different hybrid soft computing frameworks	4	Analyze
6. Understand and Develop soft computing applications	6	Create

COURSE CONTENTS

Unit-I	Introduction to Nero-Fuzzy and Soft Computing	No .of Hours	COs

	Introduction, Soft computing Constituents and Conventional Artificial Intelligence, Neural Networks, Application Scope of Neural Network, Fuzzy Logic, Genetic Algorithm, Hybrid Systems.	09	CO1

Unit-II	**Artificial Neural Network**	**No. of Hours**	**COs**
	Neural Network Architecture, Characteristics of Neural Network, Learning Methods, Taxonomy of Neural Network Architecture, History of Neural Network Research, Early Neural Network Architecture, Some application domains, Back-Propagation Networks, Associative Memory, Adaptive Resonance Theory.	08	CO2

Unit-III	**Fuzzy Logic**	**No. of Hours**	**COs**
	Fuzzy Sets, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Defuzzification, Fuzzy Arithmetic and Fuzzy Measures , Fuzzy Decision Making, Fuzzy Logic Control Systems	09	CO3

Unit-IV	**Genetic Algorithm**	**No. of Hours**	**COs**
	Introduction, Genetic Algorithm and Search Space, Operators in Genetic algorithm- Encoding, Selection, Crossover, Mutation, Classification of Genetic Algorithm, Genetic Programming.	09	CO4

Unit-V	**Hybrid Soft Computing**	**No. of Hours**	**COs**
	Neuro- Fuzzy Hybrid System, Genetic Neuro – Hybrid Systems, Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Syste Laxmidhar Behera, Indrani ms , Simplified Fuzzy ARTMAP, Problem Using MATLAB.	08	CO5

Unit-VI	**Application of Soft Computing**	**No.of Hours**	**COs**
	Introduction, A Fusion Approach of Multi spectral Images with SAR (Synthetic Aperture Radar), Optimization of Traveling Salesman Problem using Genetic Algorithm Approach, Genetic Algorithm-Based Internet Search Technique Soft Computing Based Hybrid Fuzzy Controllers, Soft Computing Based Rocket Engine Control. MATLAB Environment for Soft Computing Technique	08	CO6

Books:

Text Books:

1. S.N. Sivanandam, "Principles of Soft Computing", Wiley India- ISBN- 9788126527410
2. S. Rajsekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic
3. J S R Jang, CT Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing" , PHI PVT LTD, ISBN 0-13-261066-*3*.

Reference Books:

1. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", 2nd Edition-Wiley India- ISBN: 978-0-470-51250-0
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press, ISBN 10: 0195671546
3. Siman Haykin, "Neural Networks", Prentice Hall of India, ISBN: 0-7923-9475-5
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" , Wiley India, ISBN: 978-0-470-74376-8
5. Eiben and Smith, "Introduction to Evolutionary Computation", Springer, ISBN-10: 3642072852

CO610C: Digital Forensics

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Operating system, Computer organization, Cyber security
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Course Objectives:

1. To emphasize the fundamentals and importance of digital forensics.

2. To learn different techniques and procedures that enables them to perform a digital investigation

3. To conduct a digital investigation in an organized and systematic way

4. To learn open-source forensics tools to perform digital investigation and understand the underlying theory behind these tools.

5. To emphasize theoretical and practical knowledge, as well as current research on Digital Forensics

6. To learn programming for Computer Forensics.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Students will explain and properly document the process of digital forensics analysis	2	Understand
2. Students will be able to describe the representation and organization of data and metadata within modern computer systems.	2	Understand
3. Students will gain an understanding of the trade-offs and differences between various forensic tools.	2	Understand
4. Students will be able to investigate Networks	6	Create
5. Students will be able to investigate Mobile Networks	6	Create
6. Students will be able to demonstrate forensics of hand held devices.	3	Apply

COURSE CONTENTS

Unit-I	Introduction to digital Forensics	No. of Hours	Cos
	Digital crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata.	08	CO1

Unit-II	Data recovery and Digital evidence controls	No. of Hours	Cos
	Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary &cache files.	08	CO2

Unit-III	Computer Forensics analysis and validation	No. of Hours	Cos
	Computer Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project. Computer Forensic tools: Encase, Helix, FTK, Autopsy, Sleuth kit Forensic Browser, FIRE, Found stone Forensic ToolKit, WinHex, Linux dd and other open source tools.	08	CO3

Unit-IV	Network Forensic	No. of Hours	Cos
	Network Forensic: Collecting and analyzing network-based evidence, reconstructing web browsing, e-mail activity, and windows registry changes, intrusion detection, tracking offenders, etc. Mobile Network Forensic: Introduction, Mobile Network Technology, Investigations, Collecting Evidence, Where to seek Digital Data for further Investigations, Interpretation of Digital Evidence on Mobile Network.	08	CO4

Unit-V	Software Reverse Engineering	No. of Hours	Cos
	Software Reverse Engineering: defend against software targets for viruses, worms and other malware, improving third-party software library, identifying hostile codes-buffer overflow, provision of unexpected inputs, etc.	08	CO5

Unit-VI	Computer crime and Legal issues	No. of Hours	Cos
	Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.	08	CO6

Text Books:
1. Cory Altheide and Harlan Carvey, " Digital Forensics with Open Source Tools", ISBN: 978-1-59749-586-8, Elsevier publication, April 2011.
2. B. Nelson, A. Phillips, F. Enfinger, C. Steuart , "Guide to Computer Forensics and Investigations", 4th edition), ISBN 0-619-21706-5, Thomson, 2009.
3. Marjie T. Britz, "Computer Forensics and Cyber Crime: An Introduction",3rd Edition, 2013.

Reference Books:
1. Sherri Davidoff, Jonathan Ham , "Network Forensics: Tracking Hackers Through Cyberspace", Prentice Hall, 2012
2. EC Council , "Computer Forensics: Hard Disk and Operating Systems", September 17, 2009
3. Computer Forensics Investigation Procedures and response, EC-Council Press, 2010
4. EnCase Computer Forensics., 2014
5. Brian Carrier, " File System Forensic Analysis",. Addison-Wesley Professional, March 27, 2005.
6. NIST Computer Forensic Tool Testing Program (www.cftt.nist.gov/)
7. Computer Forensics: Investigating Data and Image Files (Ec-Council Press Series: Computer Forensics), EC-Council (Paperback - Sep 16, 2009)
8. Eoghan Casey, " Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet" Third Edition , 2011
9. Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters, " The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory", ISBN: 978-1-118-82509-9, July 2014

CO611A: Applied Cloud Technology

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End Sem Exam:**	**50 Marks**
	CA:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: Cloud Technology, Network Security

Course Objectives:

1. To study virtualization and cloud computing fundamentals.

2. To study cloud security aspects in cloud.

3. To study cloud services offered by cloud service providers.

4. Define trust boundaries between Cloud providers and consumers to ensure that the responsibility for providing security is clear.

5. Learn the legal and compliance issues related to using cloud services.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand the the cloud computing reference model and its fundamentals	2	Understand
2. Explain major security and privacy problems in the cloud and address them by applying the various security mechanisms.	3	Apply
3. Understand the cloud security architecture and related security aspects that are to be monitored.	2	Understand
4. Design the cloud applications as per the business needs using Google and amazon cloud services.	6	Design
5. Understand and apply privacy tools and best practices of cloud security to real time cloud projects	3	Apply
6. Describe the legal issues and compliance for the cloud services provided across different countries having different security laws	2	Understand

COURSE CONTENTS

Unit-I	Fundamentals of Cloud Computing	No. of Hours	COs
	Cloud Fundamentals: cloud definition, hardware and software resources, the role of networks in cloud computing, cloud computing reference model, benefits of cloud computing, limitations of cloud computing, essential characteristics of cloud computing, cloud computing service models and deployment models, Multitenancy, Cloud economics and benefits. Virtualization: Definition, virtualization architecture, types of virtualization, types of hypervisors, virtualization tools and mechanisms- Xen, KVM. Issues with virtualization, advantages of virtualization. Virtualization of CPU, Memory, and I/O Devices. Server virtualization, Storage virtualization, Network virtualization, Service virtualization.	08	CO1

Unit-II	Cloud Security Concepts	No. of Hours	
	Cloud Information Security Objectives, Confidentiality, Integrity, and Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation and Decomposition, Secure Cloud Software Testing, Testing for Security Quality Assurance, Cloud Penetration Testing, Regression Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.	07	CO2

Unit-III	Cloud Computing Security Architecture	No. of Hours	
	Architectural Considerations, General Issues, Trusted Cloud Computing, Secure Execution Environments and Communications, Identity Management and Access Control, Autonomic Security	05	CO3

Unit-IV	Cloud Applications	No. of Hours	

	Cloud Computing Open Source Technologies: Open Stack, Eucalyptus. **Amazon Web Services:** Services offered by Amazon- EC2(Creating a instance, installing web server and configuring a server), AWS Storage and Content Delivery, Identify key AWS storage options, EBS (Describe Amazon EBS, Creating an Elastic Block Store Volume, Adding an EBS Volume to an Instance, Snap shot- ing an EBS Volume. S3 (Create an Amazon S3 bucket and manage associated objects). AWS Load Balancing Service- Introduction Elastic Load Balancer, Creating and Verifying Elastic Load Balancer. **Google:** Services offered by Google- Google compute engine(Creating a instance, installing web server and configuring a server), Google Storage-S3 (Create an Google bucket and manage associated objects).	07	CO4
Unit-V	**Docker, Privacy Tools and Best Practices in cloud**	**No. of Hours**	
	Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.	06	CO5
	Privacy Tools and Best Practices, 2-factor authentication, secure email for cloud storage, Deletion of private data, security as service, distributed cloud storage, what are best practices, cloud data security and check list, Future of cloud data security.		
Unit-VI	**Legal and Compliance Issues**	**No. of Hours**	
	Who wants your data? Legal issues, criminals and authorization. Government and friends, legal responsibility, US Federal Law and regulations affecting cloud storage. Cloud storage provider and compliance. Laws and regulations of other countries. Responsibility, ownership of data, right to penetration test, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization.	06	CO6
Books:			
Text Books:			

1. Tim Mather, SubraKumaraswamy, ShahedLatif, "Cloud Security and Privacy:An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1st edition [ISBN: 0596802765], 2009 .
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security" [ISBN: 0470589876],2010.
3. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476.
4. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.

Reference Books:

1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039.
2. John Rittinghouse, James Ransome, "Cloud Computing" CRC Press; 1st edition [ISBN: 1439806802], 2009.
3. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0.
4. J.R. ("Vic") Winkler, "Securing the Cloud" Syngress [ISBN: 1597495921]2011..
5. Cloud Security Alliance, "Security Guidance for Critical Areas of Focus in Cloud Computing" 2009.

CO611B: Blockchain Technology

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End Sem Exam:**	**50 Marks**
	CA:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: Digital forensics, Cyber security, Cryptography and Information security

Course Objectives:
1. To understand how Blockchain systems (mainly Bitcoin and Ethereum) work.
2. To provide Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
3. To design, build, and deploy smart contracts and distributed applications.
4. To provide a critical evaluation of existing "smart contract" capabilities and platforms, and examines their future directions, opportunities, risks and challenges.
5. To understand the concept of crypto currency and its applications.
6. To apply Blockchain technology for different real time applications.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand how Blockchain systems (mainly Bitcoin and Ethereum) work	2	Understand
2. Understand the Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved	2	Understand
3. Design, build, and deploy smart contracts and distributed applications.	2	Create
4. Evaluation of existing "smart contract" capabilities and platforms, and examines their future directions, opportunities, risks and challenges.	6	analyze
5. Apply Blockchain technology for different real time applications.	3	Apply
6. Understand the concept of crypto currency and its applications.	4	Understand

COURSE CONTENTS

Unit-I	Introduction to Blockchain	No. of Hours	Cos
	Introduction to Blockchain, the technology of Blockchain, network and mechanism, history of blockchain, the benefits of Blockchain, blocks and transactions, Peer to Peer systems, the block structure in blockchain, what is Dynamic shared ledger, digital signatures, how to build a blockchain solution, hashes as addresses, using a key as identity, ways of storing Bitcoin Keys, Trade and transact with Bitcoins, Global Blockchain Ecosystem Core, Layers Of A Blockchain, Data Layer, Network Layer, Consensus Layer.	08	CO1

Unit-II	Blockchain and Bitcoin	No. of Hours	Cos
	Identify Bitcoin and its Era Understand Where & How to Get Bitcoins Identify Bitcoin Wallets Identify Jaxx Wallet Define Selling Bitcoins Compare Bitcoin Blockchain, Transaction & Transaction Script Describe Various Transaction Forms in Bitcoin, Define Scripts in Bitcoin, List Nodes in Bitcoin Network.	08	CO2

Unit-III	Bitcoin Mining	No. of Hours	Cos
	Understand Economics of Bitcoin Define Bitcoin Mining Describe Fabrication of a Block Header Define Mining Identify Successful Mining List Difficulties in Solo Mining Understand Mining: By pool of Miners, Mining and consensus, autonomous verification of mining, independent verification of mining, checklist for verification of mining, combining transactions into blocks, creation of block header, main chain, orphan block, creation of new block, independent validation of new block.	08	CO3

Unit-IV	Ethereum and working with Smart Contracts	No.of Hours	Cos
	Understand Ethereum, Define Smart Contracts, Identify Cryptocurrency used in Ethereum, Describe Transactions in Ethereum, Define Consensus Mechanism in Ethereum, List Development Technologies, Identify Ethereum Clients, Define Platform Functions, Understand Solidity, Describe Solidity Operators and Functions, setting up Metamask, how to interface with ethereum network, first smart contract, Ethereum accounts and how to receive ether, structuring a contract, declaring a function, deploying and redeploying of a contract, comparing Wei & Ether, what is a gas transaction, Remix testing.	08	CO4

Unit-V	Hyperledger and Hyperledger Composer	No. of Hours	Cos
	Introduction to Hyperledger, What is Hyperledger?, Distributed Ledger Technology & its Challenges, Setting up the Hyperledger Fabric Developer Environment Tools, Linux/Ubuntu & AWS: Setup of Fabric Development on Local & Cloud VM. Hyperledger Composer: What is hyperledger composer, benefits of hyperledger composer, conceptual components and structure, example business network car auction market, conceptual components and structures, the model, ACL, script file, metadata, the archive, open development toolset, modeling business networks, testing business networks, hyperledger composer playground, developing application using Hyperledger composer.	08	CO5

Unit-VI	Blockchain Use Cases	No. of Hours	Cos
	Selected potential Use Cases in Blockchain, Proof of existence, Record keeping, Identity management, UPROOV – Mobile Trust Machine, Log operational maintenance data, Car leasing and Sales – DocuSign, Forecasting – Augur, Online music problem solution, Cloud storage, STORJ – Decentralized cloud storage, Retail – OpenBazaar, Ascribe – Secure your work, Ride sharing, supply chain management, Blockchain and IoT,	08	CO6

Text Books:

1. Mastering Blockchain - Second Edition, by Imran Bashir,Publisher: Packt Publishing,Release Date: March 2018, ISBN: 9781788839044.
2. Blockchain : Blueprint for a New Economy Melanie Swan O'Reilly.

Reference Books:

1. Decentralized computing using blockchain technologies and smart contracts by a Adarsh Sasharaf ; ed. ; vol. ; : igs, 2017
2. Mastering bitcoin programming the open blockchain by Andreas M. Antonopoulos ;1st ed. ; vol. ; : o reilly, 2017.
3. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos.
4. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric.
5. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html.
6. Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer Paperback – June 21, 2018 by Nitin Gaur, Luc Desrosiers, Petr Novotny, Venkatraman Ramakrishna, Anthony O'Dowd, Salman A. Baset.

CO611C: Image and Video Processing

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End Sem Exam:**	**50 Marks**
	CA:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: Digital signal processing, Engineering Mathematics, Computer Graphics
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Course Objectives:

1. To learn fundamentals of Image and Speech Processing.

2. To learn image enhancement and restoration techniques.

3. To learn image compression & segmentation techniques.

4. To explore basics of video representation, motion estimation.

5. To learn video coding and video compression standards.

6. To study motion segmentation

Course Outcomes (COs): After the successful completion of the course, the student should be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand basics of Image Processing.	2	Understand
2. Understand image enhancement and restoration techniques.	2	Understand
3. Describe and use image compression & segmentation techniques.	3	Apply
4. Understand the methods of video representation, motion estimation and manipulation to design and develop algorithms for solving video processing problems related to various applications fields involving video data.	2	Understand
5. Develop mathematical skills to solve video processing problems and apply them to model real life problems in video processing	3	Apply
6. Design Video processing application like video surveillance using Video processing algorithms.	6	Create

COURSE CONTENTS

Unit-I	Introduction to Image Processing	No. of Hours	COs
	What is Digital Image processing, Fundamental steps in Digital Image processing, Components of an Image Processing System, Image sampling and Quantization: Basic concept in Sampling and Quantization, Representing Digital Images, Spatial and Gray Level resolution. Basic relationships between pixels.	08	CO1
Unit-II	Image Enhancement and Restoration	No. of Hours	COs
	Image Enhancement: Introduction, Intensity transformation and spatial filtering, Smoothing And Image Sharpening in frequency domain **Restoration:** Introduction, Minimum mean square error restoration, Least square error restoration, Restoration by: Singular value decomposition, Maximum a Posterior estimation, Homomorphic Filtering. Blind deconvolution, Super resolution imaging	08	CO2
Unit-III	Image Compression and Segmentation	No. of Hours	COs
	Compression: Introduction, Error criterion, Lossy Compression methods, Lossless compression methods. **Segmentation:** Introduction, Region extraction, Pixel based approach, Multi level thresholding, Local thresholding, Region based approach, GrowCut region growing, Colour image segmentation.	08	CO3
Unit-IV	Representation of video and motion estimation	No. of Hours	COs
	Representation of digital video: Introduction and fundamentals, Time-varying image formation models: Motion models, Geometric image formation. Photometric image formation, Sampling of video signals. Video Motion estimation: Two dimensional - Optical flow methods, Block based methods, Three dimension – Methods using point correspondences, Optical flow and direct method	09	CO4
Unit-V	Video Coding and Video Compression	No. of Hours	COs

		No. of Hours	COs
	Video Coding: Basics of video coding, Content dependent video coding, Two dimensional shape coding, Texture coding for arbitrarily shaped region, Joint shape and texture coding, Region based video coding, Object based video coding, Knowledge based video coding, Semantic Video coding, Layered coding system, Scalable video coding, Basics modes of scalability, Object based scalability, Wavelet transform based coding, Application of motion estimatior in video coding **Video Compression Standards:** MPEG-4 Visual and H.264/AVC, Standard for modern digital video: H.265/HEVC, HEVC coding tools and extensions.	09	CO5, CO6

Unit-VI	**Motion Segmentation**	**No. of Hours**	**COs**
	Stereo and multi view sequence processing: Depth perception Stereo imaging principle Disparity estimation Intermediate view synthesis Stereo sequence coding. Video Segmentation: Motion Segmentation; Tracking; Motion Tracking in Video: 2D and 3D Motion Tracking in Digital Video, Methods using Point Correspondences, Optical Flow and Direct Methods, Applications	09	CO5, CO6

Books:

Text Books:

1. Rafel Gonzallez and R. Woods, "Digital Image Processing", Second edition.
2. Bhabatosh Chanda and Dwijesh Dutta Majumder, "Digital Image Processing And Analysis"
3. A. Murat Tekalp, "Digital Video Processing", Prentice Hall, 2nd Edition, 2015

Reference Books:

1. Gonzalez R C, Woods R E, and Eddins S L, Digital Image Processing using MATLAB, Pearson Education, 2004.
2. Milan Sonka Vaclav Hlavac Roger Boyle, "Image Processing, Analysis, and Machine Vision", Second Edition, Thomson Publication
3. Alan C. Bovik, "The Essential Guide to Video Processing", Elsevier Science, 2nd Edition, 2009.
4. Yao Wang, Jorn Ostermann, Ya-Qin Zhang,"Video Processing and Communications", Prentice Hall, 2002.
5. Iain E. Richardson, "H.264 and MPEG-4 Video Compression: Video Coding for Next-generation Multimedia", John Wiley & Sons, 2nd Edition, 2003. 5
6. J.W. Woods, "Multidimensional Signal, Image and Video Processing and Coding," Academic Press, 2nd edition, 2012.

Lab Practice-III
CO612: Advanced Algorithms Lab

Teaching Scheme	Examination Scheme
Practical: 4 Hrs./Week	**Oral Exam: 50 Marks**
Credits: 2	**Total: 50 Marks**

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Prerequisite Course: Design and Analysis of Algorithms, Data Structures
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Course Objectives:

1. To teach problem formulation and problem solving skills.

2. To understand different classes of problems concerning their computation difficulties.

3. To be capable of understanding basic ability to analyze algorithms

4. To learn about problem formulation and problem solving using different algorithmic techniques.

5. To understand basic features of different algorithm design paradigms like divide and conquer, greedy, dynamic programming etc.

6. To learn algorithm design techniques and data structures to solve various real life problems.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand the basic principles of different paradigms of designing algorithms	2	Understand
2. Apply mathematical principles to solve various problems	3	Apply
3. Analyze the complexities of various algorithms	4	Analyze
4. Evaluate the performance of various algorithms in best case, worst case and average case	5	Evaluate
5. Determine algorithm correctness and time efficiency class.	2	Understand
6. Apply and implement learned algorithm design techniques and data structures to solve various real life problems.	3	Apply

List of Assignments
In this laboratory Students should run all the programs using C/C++/Java programming language on LINUX platform and then estimate the running time of their programs in best, worst and average case situations for large dataset.
1. Divide and Conquer: Find Maximum and Minimum element from an array of integer using Divide and Conquer approach
2. Divide and Conquer: Implement Quick Sort using Divide and Conquer approach. Check the running time for different positions of pivot elements. Implement the randomized version of quick sort
3. Dynamic Programming: Find the minimum number of scalar multiplication needed for chain of Matrices
4. Implement Single Source shortest Path for a graph (Dijkstra and Bellman Ford Algorithm)
5. Dynamic Programming: Implement all pair Shortest path for a graph (Floyd- Warshall Algorithm)
6. Greedy method: implement fractional Knapsack Problem, MST by Prim's algorithm
7. Greedy method: Implement MST by Kruskal's algorithm by using Union operation on Disjoint data Structures.
8. Graph Traversal Algorithm: Implement Depth First Search (DFS), application of DFS (do topological sorting, identify strongly connected components)
9. Implement KMP algorithm for string matching
10. Implement Ford-Fulkerson algorithm to get maximum flow of a given flow network.

Books:

Text Books:

1. Cormen, Leiserson, Rivest, "Introduction To Algorithms", PHI
2. Brassard, Bratley "Fundamentals of Algorithmics", PHI

Reference Books:

1. Horowitz, Sahni, "Fundamentals of Computer Algorithm", Galgotia
2. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley
3. S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition. Addison Wesley,2000

Lab Practice-IV
CO613: Applied Cloud Technology Lab

Teaching Scheme   **Examination Scheme**
Practical: 4 Hrs./Week   **Oral Exam: 50 Marks**
Credits: 2   **Total: 50 Marks**
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Prerequisite Course: Cloud Technology, Operating System

Course Objectives:

1. To study virtualization and cloud computing fundamentals.

2. To study cloud secuirty aspects in cloud.

3. To study cloud services offered by existing cloud service provider.

4. To study the privacy tools of cloud security.

5. To study cloud security architecture in cloud computing.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand the the cloud computing reference model and its fundamentals	2	Understand
2. Design cloud services using google and amazon cloud services.	6	Design
3. Study about AWS Identity Management and Security in the Cloud.	2	Understand
4. Understand the cloud security architecture and related security aspects that are to be monitored.	2	Understand
5. Design and implement Authentication mechanism in Cloud Environments.	2	Understand
6. Select the appropriate privacy tools of cloud security to real time cloud projects	5	Select

List of the Assignment
1. Install and configure VirtualBox or VMWare to create virtual machines in order to understand basic concepts of virtualization.
2. Demonstrate an application using Google App Engine as a Platform-as-a-Service.
3. Study and demonstrate AWS Identity and Access Management (IAM) in the Cloud.
4. Demonstrate the use of Amazon web services to create a cloud service.
5. Install and configure Cloudsim Toolkit and demonstrate cloudlet example.
6. Design and implement Authentication mechanism in Cloud Environments.
7. Study and demonstrate any one of Cloud security tool.

Books:

Text Books:

1. Tim Mather, Subra Kumaraswamy, ShahedLatif, "Cloud Security and Privacy:An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1st edition [ISBN: 0596802765], 2009 .
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security" [ISBN: 0470589876],2010.
3. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476.

Reference Books:

1. John Rittinghouse, James Ransome, "Cloud Computing" CRC Press; 1st edition [ISBN: 1439806802], 2009.
2. J.R. ("Vic") Winkler, "Securing the Cloud" Syngress [ISBN: 1597495921]2011..
3. Cloud Security Alliance, "Security Guidance for Critical Areas of Focus in Cloud Computing" 2009.

Lab Practice-IV
CO613: Blockchain Technology Lab

Teaching Scheme	**Examination Scheme**
Practical: 4 Hrs./Week	**Oral Exam: 50 Marks**
Credits: 2	**Total: 50 Marks**

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Prerequisite Course: Digital forensics, Cyber security, Cryptography and Information security

Course Objectives:
1. To provide conceptual understanding of the function of Blockchains.
2. To provide Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
3. To understand the technological underpinnings of blockchain operations as distributed data structures and decision making systems, their functionality and different architecture types.
4. To provide a critical evaluation of existing "smart contract" capabilities and platforms, and examines their future directions, opportunities, risks and challenges.
5. To understand the concept of crypto currency and its applications.
6. To apply blockchain technology for different real time applications.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcome	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. Understand the function of Blockchains	2	Understand
2. Understand the Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved	2	Understand
3. understand the technological underpinnings of blockchain operations as distributed data structures and decision making systems	2	Understand
4. evaluation of existing "smart contract" capabilities and platforms, and examines their future directions, opportunities, risks and challenges.	6	Analyse
5. apply blockchain technology for different real time applications.	3	Apply
6. understand the concept of crypto currency and its applications.	4	Understand

List of Block chain mini projects (Complete Any One)

Project 1: Setting up the Hyperledger Composer

Industry: General

Problem Statement : How to setup the Hyperledger Composer

Topics : In this project you will understand how to setup the Hyperledger Composer. This includes learning what is a business network, defining your assets, who are the participants, what are the transactions that will go through the Hyperledger, testing the network by creating the participants and the assets, submitting the transactions to change the ownership of the asset.

Highlights

1. Hyperledger Composer execution runtime
2. Command line interface
3. Playground web user interface

Project 2 : Creating a 'to-do' list with blockchain

Industry : General

Problem Statement : How to successfully manage a project with blockchain based assigning of tasks to various team members

Topics : In this blockchain project you will work on creating a 'to-do' list. You will define the structure of each list, create the mapping of the notes, create function to add new to-do to the sender, add a function to mark a task as completed all using blockchain technology. Each note will have a date of creation and owner information stamped on it.

Highlights :

1. Deploying Ethereum smart contract
2. Implementing Solidity code
3. Creating a web3.js app to interact with contract.

Project 3 : Creating an online auction system with DApp

Industry – Internet related

Problem Statement – How to build a model auction website with the least human intervention using DApp.

Topics : In this project you will build an auction contract with a simple interface that allows users to place bids and, after the auction is complete, they should be able to withdraw their funds. The owner of the auction needs to be able to cancel the auction in any exceptional cases and the winner must be allowed to withdraw the winning bid as well as this is for demo purpose.

Highlights :
1. Build an algorithm to meet various conditions
2. Designing the smart contract using Solidity
3. Deploying a blockchain-based DAPP

Project 4 : Supply Chain Management with Hyperledger Composer

Industry : Logistics

Problem Statement : How to build an SCM application to keep track of the product flow
Topics: Build a Supply Chain Management application using the Hyperledger Composer Online, the type of application that you will develop should be coded, deployed and tested on your Online Hyperledger Composer Playground and then should be deployed locally in your computer and build an Angular front-end platform to interact with it.

Highlights:
1. Deploy a Business Network
2. Hyperledger Composer Playground
3. Build an angular front-end platform

Project 5 : Sample car auction with Hyperledger Composer

Industry : Internet related

Problem Statement : How to deploy a Business Network using the Online Hyperledger Composer Playground

Topics : The car auction Business Network has a set of known participants (buyers and sellers), assets (cars and car listings) and transactions (placing bids and closing auctions). We will model these using Hyperledger Composer and test the business logic that makes the online auction work.

Highlights :
1. Hyperledger Composer Playground
2. Developing the Business Network
3. Modelling assets, participants & transactions

Project 6 : Voting with Ethereum blockchain

Industry : Government

Problem Statement : To ensure there is no vote rigging in a democratic election and there is complete transparency.

Topics : This project includes deploying the Ethereum blockchain for building a secure voting system to elect a democratic government. You will learn how the Ethereum blockchain ensures confidentiality. Some of the aspects of this project include learning how to secure and validate the voting process, understanding how blockchain overcomes vote rigging, guarantees immutability and more.

Highlights :
1. Building a decentralized blockchain network
2. Issuing digital tokens to all eligible voters
3. Recording the votes with Ethereum blockchain
4. Announcing the winner in a swift manner

Lab Practice-IV
CO613: Image and Video Processing Lab

Teaching Scheme   **Examination Scheme**
Practical: 4 Hrs./Week   **Oral Exam: 50 Marks**
Credits: 2   **Total: 50 Marks**
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Prerequisite Course: Digital signal processing, Engineering Mathematics, Computer Graphics

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Course Objectives:
1. To learn fundamentals of Image and video Processing.
2. To learn image enhancement techniques.
3. To learn image compression & segmentation techniques.
4. To explore basics of video representation.
5. To study motion estimation.

Course Outcomes (COs): After successful completion of this course student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand basics of image and video processing.	2	Understand
2. Develop image enhancement module in various image processing applications.	6	Create
3. Design image processing application involving image segmentation.	6	Create
4. Use image compression algorithms.	3	Apply
5. Demonstrate the methods of video representation, motion estimation and manipulation to design and develop algorithms for solving video processing problems related to various applications fields involving video data	3	Apply
6. Design Video processing application like video surveillance using Video processing algorithms.	6	Create

Guideline for Laboratory Conduction
• Students should perform at least 6 assignments- Any 4 assignments from group A and any 2 assignments from group B.

List of the Assignment
Group A (Use C, C++, JAVA or any suitable programming language)
1. Develop a program to compute the histogram of given gray scale image. Implement the algorithm for Histogram Equalization and Comment on the results.

2. For a gray scale image apply following Image Enhancement Techniques :
      i. Contrast Stretching
      ii. Digital Negative
      iii. Bit level slicing

3. Implement following Image Filtering operations w.r.t. a given gray scale image: LPF, HPF and Sobel / Prewitt Masks. Comment on the result of filtering operations performed on the image.
4. Perform Image Smoothing with following special filters: Median, Weiner and Homomorphic filters. Comment and compare results
5. Perform Image segmentation using watershed /fuzzy/clustering segmentation technique.

6. Perform image sharpening on gray scale image using following frequency domain filters
      a. Ideal High pass filtering
      b. Butterworth High Pass Filtering
      c. Gaussian High Pass Filter

7. To perform DCT based image compression and recover the original image file. Compare the original image file with compressed image file.
Group B (Use MATLAB or any suitable programming language)

1. Implement following basic Operation on gray scale/colour video
      a) Extracting frames from video
      b) Playing video in reverse
      c) Applying background subtraction

2. Perform following Digital Video Manipulation In MATLAB   a) Gather video file information using the aviinfo function.   b) Read video data into a variable using the aviread function.   c) Explore the montage function for viewing multiple frames simultaneously.   d) Play a video using the movie function and the implay movie player.   e) Convert from frame to image and vice versa using the frame2im and im2frame functions.   f) Explore techniques for assembling images into video, including the immovie function.   g) Write video data to a file using the movie2avi function.   h) Read and play video files in different formats using the mmreader function
3. Write a MATLAB script to

a) Read an RGB color image and convert it to YcrCb. b) Subsample this image into the 4:2:0 format. c) Up sample the Cr and Cb components to full size (4:4:4 format) and convert the result back to RGB. Compute the difference between the original and processed RGB images.

4. Implement motion estimation algorithms in MATLAB.
    a. Explore EBMA using both integer-pixel and half-pixel accuracy.
    b. Explore HBMA using both integer-pixel and half-pixel accuracy.
    c. Explore the phase correlation method.

Books:

Text Books:

1. Rafael.C,Gonzalez, Richard E Woods, "Digital Image Processing",3rdEdition, Pearson India, 2013.
2. Jain A.K, "Fundamentals of Digital Image Processing", 4th Edition, Prentice hall of India, 2004.
3. S Sridhar, "Digital Image Processing", Oxford University Press

Reference Books:

1. B.Chanda, D. DuttaMajumder, "Digital Image Processing and Analysis", 2ndEdition, Phi learning, 2011.
2. William K Pratt, "Digital Image Processing", 4th Edition, Wiley, 2012.
3. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication

CO614: Mini Project with Seminar

Teaching Scheme   **Examination Scheme**
Practical: 04 Hrs. / Week   **Oral/Presentation: 50 Marks**
Credits: 02   **Total: 50 Marks**

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Term work of the seminar should consist of spiral bound report printed on both the sides of pages on any technical topic of interest. The topic should be related to specialization and it should be on latest technology. Report should be submitted in a standard format having the following contents.

1. Introduction
2. Literature Survey
3. Theoretical contents
4. Relevance to the present national and global scenario of industry
5. Field Applications / case studies / Experimental work etc
6. Conclusions
7. References

Marks will be based on proper submission of report and examination in the form of presentation.

AC201A: CONSTITUTION OF INDIA

Teaching Scheme   **Examination Scheme**
Lectures: 2 Hrs. / Week   **In-Sem Exam:**
Credits: **End Sem Exam:**
                                                 CA :
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Course Objectives:

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' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

3. 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 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.

COURSE CONTENTS

Units	Contents	No. of Hours
Unit-I	• History of Making of the Indian Constitution: • History • Drafting Committee, (Composition & Working)	04
Unit-II	• Philosophy of the Indian Constitution: • Preamble • Salient Features	04

Unit-III	• 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.	04
Unit-IV	• 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	04
Unit-V	• 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: Zila Pachayat. • Elected officials and their roles, CEO Zila Pachayat: Position and role. • Block level: Organizational Hierarchy (Different departments), • Village level: Role of Elected and Appointed officials, Importance of grass root democracy	04
Unit-VI	• Election Commission: • Election Commission: Role and Functioning.	04

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

Books:
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.

AC201B: PEDAGOGY STUDIES

Teaching Scheme   **Examination Scheme**
Lectures: 2 Hrs. / Week   **In-Sem Exam:**
Credits: **End Sem Exam:**
                                        CA :
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Course Objectives:

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 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?

COURSE CONTENTS

Units	Contents	No. of Hours
Unit-I	- Introduction and Methodology: - Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education. - Conceptual framework, Research questions. - Overview of methodology and Searching.	04
Unit-II	- Thematic overview: Pedagogical practices are being used by teachers in - formal and informal classrooms in developing countries. - Curriculum, Teacher education.	02
	Evidence on the effectiveness of pedagogical practices	04

Unit-III	• Methodology for the in depth stage: quality assessment of included studies. • How can teacher education 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-IV	• 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	04
Unit-V	• Research gaps and future directions • Research design • Contexts • Pedagogy • Teacher education • Curriculum and assessment • Dissemination and research impact.	02

Books:

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.

AC201C: STRESS MANAGEMENT BY YOGA

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits:

Examination Scheme
In-Sem Exam:
End Sem Exam:
CA :

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Course Objectives:

1. To achieve overall health of body and mind

2. To overcome stress

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also

2. Improve efficiency

COURSE CONTENTS

Units	Contents	No. of Hours
Unit-I	Definitions of Eight parts of yog. (Ashtanga)	08
Unit-II	• Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	08
Unit-III	• Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	08
Books:		
1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur 2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata		

AC201D: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits:

Examination Scheme
In-Sem Exam:
End Sem Exam:
CA :

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Course Objectives:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Course Outcomes:

Students will be able to:

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

COURSE CONTENTS

Units	Contents	No. of Hours
Unit-I	Neetisatakam-Holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) - Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)	08
Unit-II	Approach to day to day work and duties. - Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, - Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, - Chapter 18-Verses 45, 46, 48.	08

Unit-III	Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad Bhagwad Geeta: • Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37,38,63	08

Books:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

SEMESTER III

CO701A: User Experience and Usability Engineering

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End Sem Exam:**	**50 Marks**
	CA:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: --

Course Objectives:

1. To learn and understand basics of user experience and its importance

2. To learn and understand design process and examples of real world design

3. To understand available methods for measuring the user experience

4. To know the methods and processes used by user experience in industry

5. To understand the s pros and cons of various Ux design tools.

6. To know career path and identifying research opportunities in Ux.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Define user experience and its importance, and compare its alternative definitions.	2	Understand
2. Describe the prevailing theories of high-level perception, attention, engagement, emotion, communication, learning, persuasion and behavior	2	Understand
3. List the generative and evaluative techniques used in design for creating products and systems.	4	Analyse
4. Enumerate existing tools and methods for measuring the effects on users of products, devices and systems.	5	Evaluate
5. Apply foundational theories, design techniques to build and evaluate a device or system.	5	Evaluate
6. Identify the career path and outstanding problems in user experience practice, and corresponding research opportunities.	2	Understand

COURSE CONTENTS

UNIT 1	UX Fundamentals	No. of Hours	COs
	Introduction and history. What is "User eXperience"? ,What Makes a Great User eXperience? , Why is the User eXperience Important? The growth of user experience as a field. Defining user experience. Definitions of user experience, including both early and current theoretical definitions as well as the concrete definitions of what practitioners actually do.	08	CO1
UNIT 2	Designing Alternatives		
	Recreating an Existing Interface, Conceptualization of Design Principles, User Experience Design, Design Workflow, Mobile App Design for iPhone and Android,Approaches to products and systems with great user experience. Design thinking, design process, and examples of real world design processes. Gathering information, brainstorming, prototyping and evaluation as part of the generative process.	08	CO2,3
UNIT 3	Methods and tools of measurement.		
	The wide range of available methods for measuring the user experience, and their relationships. Qualitative methods including interviews, focus groups, field studies, diaries and experience sampling. Quantitative methods such as online unique visits and click through, surveys, ratings, standard scales, speed and accuracy. Formative vs. summative assessments. Biometric methods like galvanic skin response, heart rate, eye tracking and fMRI.	08	CO4
UNIT 4	Real world application & Research frontiers		

	Comparing and contrasting the methods and processes used by user experience teams in industry, at companies such as IBM and All scripts.Research frontiers: New measurement methods made possible by the widespread adoption of mobile devices and the continuing improvement of the web platform, including real time location and social network analyses, Amazon's mechanical Turk and Survey Monkey. Emerging sensing technologies, such as lightweight eye trackers and alternatives to fMRI. New measurement techniques, from implicit association to subjective duration assessment. Emerging research sub fields like visual experience and behavioral economics.		CO4,5,6
UNIT 5	**UX design tools**		
	Below is a list of some of the most popular UX design tools. A UX design course should discuss these tools in detail and provide pros and cons so that you can understand which one might be the best for you:\ InVision - Great for creating interactive prototypes that can be shared with others. Sketch App - Industry standard interface design tool. Adobe Experience Design - A tool by Adobe that's specifically for UX designers. It's still in beta, but this one will likely grow very popular once it's officially released. Omnigraffle - Industry standard tool for creating detailed flow charts and wireframes. UserTesting - This site allows you to test your prototypes on real live users. UXPin - A well-rounded UX design platform complete with wireframing and prototyping tools as well as built in collaboration. Optimizely - Easily conduct A/B tests on web based apps and landing pages. Balsamiq - Industry standard tool for creating quick, interactive wireframes	08	CO5
UNIT 6	**UX Specialization**		

	Present Your Work: Present your design process and solution to stakeholders in a clear, engaging and convincing manner, substantiating the decisions you've made every step of the way. Choose a Specialization: UI for UX Designers, Voice User Interface Design, Front end Development for Designers A Career In UX Design: Draft a personal design profile to map out a path for continuing design education and decide whether you would like to pursue a creative, rewarding career in UX.	08	CO6

References:

1. Robier, J. (2016). UX Redefined: Winning and Keeping Customers with Enhanced Usability and User Experience, Springer.

2. Turner, P. (2017). A psychology of user experience involvement, affect and aesthetics, Springer.

3. Tullis, T., & Albert, W. (2013). Measuring the user experience: collecting, analyzing, and presenting usability metrics, 2nd ed. Morgan Kaufmann.

4. Kuniavsky, M. (2012). Observing the user experience: a practitioner's guide to user research, 2nd ed. Morgan Kaufmann

5. Sauro, J., & Lewis, J. R. (2016). Quantifying the user experience: Practical statistics for user research. Morgan Kaufmann.

6. Emrah Yayici. UX Design and Usability Mentor Book : With Best Practice Business Analysis and User Interface Design Tips and Techniques

7. Beasley, M. (2013). Practical Web Analytics for User Experience: How Analytics Can Help You Understand Your Users. (Focused very specifically on web analytics for user experience)

CO701B: Software Design & Architecture

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Software Modeling & Design, Software Engineering

Course Objectives:

1. To understand the concept software architecture.

2. To learn design issues in software system.

3. To learn different software architectures views and styles.

4. To study different approaches of software design.

5. To learn different analysis & design languages.

6. To know how to analyse and review software architecture.

Course Outcomes (COs): After completion of the course, students should be able to

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Describe the essential elements of software architecture.	2	Understand
2. Discuss the issues related to designing a large-scale software system.	2	Understand
3. Describe and understand different software architectures views and styles.	4	Analyse
4. Describe, understand, and be able to use the Siemens four-view approach for developing and documenting software architectures.	2	Understand
5. Describe, understand, and be able to use the AADL (Architecture Analysis & Design Language).	6	Create
6. Work as part of a team, develop, analyze and review architecture of a software system.	5	Evaluate

COURSE CONTENTS

Unit-I	Software Design Process	No. of Hours	COs
	Role of Software Design: Software design process, nature of design process, software design process, design qualities; Transferring Design Knowledge: describe design solution, design notations, design strategies, design patterns-design by template and design reuse.	09	CO1, CO2

Unit-II	Introduction to Software Architecture	No. of Hours	COs
	Software Architecture, Relationships to Other Disciplines, Multi-Disciplinary Overview, Foundations of Software Architecture, Software architecture in the context of the overall Software life cycle, Architectural Styles, CASE study of Architectures.	09	CO2

Unit-III	Design Patterns	No. of Hours	COs
	Design Patterns-Introduction, creational, Structural and behavioralpatterns,singleton,proxy,adapter,factory, iterator,observer pattern with application.	08	CO2

Unit-IV	Software Architecture Design	No. of Hours	COs
	Conceptual Architecture View, Module Architecture View, Styles of the Module Viewtype, Execution Architecture View, Code Architecture View. Component-and-Connector Viewtype, Styles of Component-and-Connector Viewtype, Allocation Viewtype and Styles.	09	CO3, CO4

Unit-V	Software Architecture Documentation	No. of Hours	COs
	Advanced Concepts, Documenting Software Interfaces, Documenting Behavior, Choosing the Views, Building the Documentation Package.	08	CO3, CO4, CO5

Unit-VI	Archetype Patterns	No. of Hours	COs

	Archetypes and Archetype Patterns, Model Driven Architecture with Archetype Patterns. Literate Modeling, Archetype Pattern. , Customer Relationship Management (CRM) Archetype Pattern, Product Archetype Pattern, Quantity Archetype Pattern, Rule Archetype pattern.	09	CO5, CO6

Books:

Text Books:

1. David Budgen, "Software Design", 2nd edition, Pearson Education (LPE)
2. Christine Hofmeister, Robert Nord, Deli Soni"Applied Software Architecture",Addison-Wesley Professional; first edition (November 4, 1999), ISBN-13: 978-0201325713.

Reference Books:

1. Ian Gorton, "Essential Software Architecture", Springer, first edition (2006) ISBN-10:3540287132 ISBN-13: 978-3540287131
2. Jan Bosch, "Design and Use of Software Architectures", Addison-WesleyProfessional; first edition (May 19, 2000) ISBN-10: 0201674947 ISBN-13: 978-0201674941
3. Paul Clements,Felix Bachmann,Len Bass,"Documenting Software Architectures: Views and Beyond", Stafford Publisher:Addison-Wesley Professional 2003 ISBN-10: 0201703726 ISBN-13:9780201703726
4. Jim Arlow, Ila Neustadt, "Enterprise Patterns and MDA: Building Better Software with Archetype Patternsand UML", Addison-Wesley Professional, 2004, ISBN-10:032111230X ISBN-13: 9780321112309.

CO701C: Optimization Techniques

Teaching Scheme	Examination Scheme

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Linear Algebra and Numerical Methods

Course Objectives:

1. The objective of this course is to provide insight to the mathematical formulation of real world problems.

2. To optimize these mathematical problems using nature based algorithms. And the solution is useful specially for NP-Hard problems

Course Outcomes (COs): After completion of the course, students should be able to
1. Formulate optimization problems.
2. Understand and apply the concept of optimality criteria for various types of optimization problems.
3. Solve various constrained and unconstrained problems in Single variable as well as multivariable.
4. Apply the methods of optimization in real life situation.

COURSE CONTENTS

Unit-I		No. of Hours
	Engineering application of Optimization, Formulation of design problems as mathematical programming problems.	07

Unit-II		No. of Hours
	General Structure of Optimization Algorithms, Constraints, The Feasible Region.	07

Unit-III		No. of Hours
	Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.	11

Unit-IV		No. of Hours
	Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.	12
Unit-V		No. of Hours
	Real life Problems and their mathematical formulation as standard programming problems.	06
Unit-VI		No. of Hours
	Recent trends: Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications.	05
Books:		

1. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
2. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
3. An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.
4. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas.ISBN 978-0-9759146-2-5.
5. John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN 978-0-8493-1914-3.
6. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-7. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser;
7. William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer. ISBN 978-3- 540-68274-5.
8. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

CE702: Industry Safety Management

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

Unit-I	Safety and Health Management	No. of Hours
	Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. Musculoskeletal Disorders and Cumulative Trauma Disorders. Importance of Industrial safety, role of safety department, Safety committee and Function. INTRODUCTION TO SAFETY STANDARDS Safety – Safety and Productivity – Role of Government – National Safety Council – Standards – ILO Model code of safety regulation / legislation – Factory Act – Boiler Act – Electricity Act – Workman's compensation act, Safety policies – Elements of safety policy – Implementation	07

Unit-II	Occupational Health and Ergonomics	No. of Hours
	Ergonomics – Human-body – Health – Posture – Workplace or office ergonomics – Ergonomics for women at work – physical work and environment – Anthropometry – Work related stress –Causes of stress – Signs of stress – Measurement of stress – Stress management systems – Prevention – Stress health and productivity – Occupational safety and health Act – Health program – First Aid	07

Unit-III	Accident and Incident Investigation	No. of Hours
	Reporting and Analysis – Accident and Incident Investigation – Identifying the key factors and the immediate and basic causes. Corrective Action – Agencies investigating accident. Accident reporting: Report forms, writing reports, essential elements. Accident and Incident Analysis Standard classification of factors associated with accident – Record keeping. **Personal Protective Equipment** Need for personal protection equipment – selection, applicable standards, supply, use, care & maintenance respiratory and non-respiratory personal protective equipment. – Classification and selection.	07

Unit-IV	Radiation and Industrial Hazards	No. of Hours
	Types and effects of radiation on human body, Measurement and detection of radiation intensity. Effects of radiation on human body, Measurement – disposal of radioactive waste, Control of radiation Industrial noise -Sources, and its control, Effects of noise on the auditory system and health, Measurement of noise , Different air pollutants in industries, Effect of different gases and particulate matter ,acid fumes ,smoke, fog on human health, Vibration - effects, measurement and control measures Industrial Hygiene	07

Unit-V	Electrical Hazards	No. of Hours
	Safe limits of amperages, voltages, distance from lines, etc., Joints and connections, Overload and Short circuit protection, Earthing standards and earth fault protection , Protection against voltage fluctuations, Effects of shock on human body Hazards from Borrowed nutrals, Electrical equipment in hazardous atmosphere, Criteria in their selection, installation, maintenance and use, Control of hazards due to static electricity.	07

Unit-VI	Fire and other Hazards	No. of Hours
	General causes and classification of fire, Detection of fire, extinguishing methods, firefighting installations with and without water. Machine guards and its types, automation. High pressure hazards, safety, emptying, inspecting, repairing, hydraulic and nondestructive testing, hazards and control in mines. Safety Precautions for transporting hazardous, toxic, flammable, explosive, radioactive substances by all modes.	07

Reference Books:

1. Anupama Prashar & Bansal, "Industrial Safety and Environment", S.K. Kataria & sons, New Delhi, 2005.
2. Agrawal S. K. "Industrial Environment Assessment and Strategy", APH Publishing Corporation, New Delhi, 1996.
3. Safety- Health and working conditions: Training Manual, National Safety Council, Mumbai, 2000.
4. Suresh K. Dhameja, "Environmental Engineering and Management", S. K. Kataria & Sons, New Delhi. 2004.
5. R.K. Jain and Sunil S. Rao , Industrial Safety , Health and Environment Management Systems, Khanna publishers , New Delhi (2006)
6. Slote. L, Handbook of Occupational Safety and Health, John Willey and Sons, NewYork .

ET702: Machine Learning

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Course Objective:
1. Explore spectrum of machine learning and its applications
2. elaborate fundamentals of python programming language
3. understand different feature extraction techniques
4. understand different classification and clustering techniques
5. case study of machine learning applications

Course outcomes:
1. Understand taxonomy of machine learning
2. Write a simple python codes
3. Design machine learning models
4. Chose between different feature extraction techniques and classifiers
5. Implement machine learning based solutions to real life problems

COURSE CONTENTS

Unit-I	Introduction to Machine Learning	No. of Hours
		07
	What is Machine Learning?, Challenges in Machines Learning, Perception, Pattern Recognition Tasks, Pattern Recognition Systems and Design cycle, Machine learning taxonomy: Classifier, Confusion Matrix, Accuracy (error rate), Precision and Recall or Sensitivity, Specificity, Support, F1 Score, Area Under ROC curve, Logarithmic Loss, Mean Absolute Error (MAE), Mean Square Error (MSE), R Squared (R^2) error, Confusion Matrix . Learning Model- Training versus Testing, Learning Types- Supervised versus Unsupervised, Prediction versus Classification, Reinforced Learning, Semi-supervised Learning, Examples of Machine Learning Problems.	
Unit-II	An Introduction to Python and dataset preprocessing	No. of Hours

	Basics of Python: Advantages and futures of python, installing python, installation of python libraries: numpy, scikit, pandas, Installation of Jupyter notebook, Processing Data with Python: Representation and Visualization of Data: Loading Data, Visualizing data: Histograms, Density Plots, Box and Whisker Plots, Correlation Matrix Plot, Scatter plot, Splitting of dataset in training and Test Data, Generate Datasets in Python, Statistical Summary of Data, Reviewing Correlation between Attributes. Preprocessing of data: normalization, binarization, Standardization, Implementation in Python	07
Unit-III	**Feature extraction**	**No. of Hours**
	Importance of Data Feature Selection, Feature Selection Techniques, Univariate Selection, Recursive Feature Elimination, Principal Component Analysis (PCA), Local and global features, application specific feature extraction techniques, Implementation in Python	07
Unit-IV	**Introduction to Classification**	**No .of Hours**
	Introduction, Regression: Linear Regression- Least Squares and Maximum Likelihood Methods. Classification: Linear Discriminant Analysis (LDA), Logistic Regression- Naïve Bayes Classifier, K-Nearest Neighbor (KNN) classifier. Tree based methods for classification and Regression- Bagging and Boosting, Implementation in Python	07
Unit-V	**Introduction to Clustering**	**No. of Hours**
	Introduction, Types of ML Clustering Algorithms: K-means Clustering, Mean-Shift Algorithm, Hierarchical Clustering, KNN Algorithm - Finding Nearest Neighbors, introduction to TensorFlow, Implementation in Python,	07
Unit-VI	**Case studies of machine learning**	**No. of Hours**
	Speech Recognition, Handwriting Recognition, Biometric Identification, Document Classification, Data summarization and compression, Trend detection in dynamic data, Social network analysis.	07

Text Books:
1. Abhishek Vijayvargia, "Machine learning with Python: an approach to applied machine learning", BPB Publications , 1st Edition 2. Ethem Alpaydin, "Introduction to Machine Learning", PHI 2nd Edition-2013. 3. Andreas C Muller and Sarah Guido, "Introduction to Machine learning with Python: Guide for data scientists", O'Reilly publication 1st Edition

Reference Books:
1. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer 1st Edition-2013. 2. Hastie, Tibshirani, Friedman, "Introduction to Machine Learning", Springer, 2nd Edition-12.

MB702: Startup and Venture Management

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End Sem Exam:**	**50 Marks**
	CA:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: ---

Course Objectives

1. To provide the basics conceptual framework on entrepreneurship development and management of business enterprise.

2. To understanding the contribution of Small Scale Industries in the growth and development of individual and the nation.

3. To acquaint students with the emerging challenges and concepts in the field of entrepreneurship

4. To instill a spirit of entrepreneurship among the student participants.

5. To provide an overview of the competences needed to become an entrepreneur.

6. To develop Learners with a Risk taking ability and go getter attitude.

Course Outcomes: At the end of the Course, the Student will be able to:

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Remember the importance and functionalities of enterprise and entrepreneurship and to learn basic entrepreneurial skills and knowledge to run a business efficiently and effectively.	1	Remember
2. Understand different aspects and stages of entrepreneurial process.	2	Understand
3. Apply the knowledge of Entrepreneurship Development in scanning the different environments to initiate a business.	3	Apply
4. Analyze the feasibility of various type of enterprises.	4	Analyze
5. Evaluate the extent of entrepreneurial cultural and industrial growth so as to prepare student to set up and manage own business.	5	Evaluate

6.	Create the pool of students who are willing to take risk in their Career Choices with a view to proceed towards Entrepreneurship.	6	Create

COURSE CONTENTS

Unit I	Introduction	No. of Hours	COs
	Meaning, Definition and its importance, Evolution of the concept: Functions entrepreneur, types of entrepreneur, Concept of Entrepreneurship- evolution of entrepreneurship: Development of Entrepreneurship; the entrepreneurial cultures, Stages of Entrepreneurial process, Entrepreneurship in India and Intrepreneur, Women Entrepreneur and SHG's.	09	CO1, CO2
Unit II	Business Plan, Creativity and innovation	No. of Hours	COs
	Idea generation–sources and methods, Identification and classification of ideas. Environmental Scanning and SWOT analysis, Business Opportunities in various sectors, Preparation of project plan, Components of an ideal business plan – market plan, financial plan, operational plan, and HR plan. Project formulation –project report significance and contents, Project appraisal –Aspects and methods: Economic oriented appraisal, financial appraisal, Market oriented appraisal-Technological feasibility, Managerial competency, Business Set up, concept of Creativity and Innovation.	09	CO3, CO6
Unit III	MSME's	No. of Hours	COs
	Meaning and definition (evolution), Role and importance, Policies governing MSMEs, Organizational structure, Steps in setting up a MSME unit. Small industry financing developing countries, a brief overview of financial institutions in India	09	CO5
Unit IV	Institutions supporting entrepreneurs	No. of Hours	COs

	Financial institutions in India- Central and State level Institutions, SIDBI, NABARD, IDBI, SIDCO, KVIC Indian institute of entrepreneurship, DIC, single window and industrial policy of government of India.	09	CO5,
Unit V	**Venture Capital**	**No. of Hours**	**COs**
	Meaning of Venture capital and informal risk capital market, nature and overview of venture capital, venture capital process, Angel Investors.	06	CO2, CO3
Unit VI	**International Entrepreneurship opportunities**	**No. of Hours**	**COs**
	The nature and importance of international business of the firm, international versus domestic entrepreneurship, entrepreneurship entry levels into international business.	06	CO1, CO6

Text Books:
1. Entrepreneurship Development-Small Business Enterprise-Poornima Charantimath Pearson Education, 2007
2. Entrepreneurship- Robber D Hisrich, Michael P Peters, Dean A Shepherd 6/e, the McGraw-Hill co, 2007
3. Entrepreneurship Development- Khanka, S chand Publication
4. Entrepreneurship Development-B Janakiram
5. Hisrich Peters Shephard, ―Entrepreneurship, Tata McGraw Hill

Reference Books:

1. Dr. Vasant Desai, ―Small scale industries and entrepreneurship, Himalayan Publishing House
2. Dr. Vasant Desai, ―Management of small scale industries , Himalayan Publishing House
3. J.C. Saboo,Megha Biyani, ―Management of small scale industries, Himalayan Publishing House
4. Dr. Vasant Desai, ―Dynamics of entrepreneurial development and Management

ME702: Project Planning and Operation Research

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End Sem Exam:**	**50 Marks**
	CA:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: Mathematics I, II and III

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Course Objectives:

1. To explain and apply the Precedence Diagramming Method formulas (PDM) and Path Method (CPM) analysis to determine the project schedule baseline
2. To familiarize the learners with various tools of project control.
3. To make aware learners the techniques of process time minimization
4. To familiarize the learners transportation and assignment techniques
5. To teach the learner methods of Sensitivity and duality
6. To familiarize the learners with multistage decision-making techniques

Course Outcomes (COs): After learning this subject, the students will be able to,

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Implement the project management techniques	3	Apply
2. Control projects effectively	2	Understand
3. Decide optimal strategies in conflicting situations.	4	Analyze
4. Apply the concept of transportation models to optimize available resources.	3	Apply
5. Find effect of any parameters on overall output of process	5	Evaluate
6. Optimize multi stage decision making problems	5	Evaluate

COURSE CONTENTS

Unit-I	Introduction to Project Management	No. of Hours	Cos
	Project Phases and project life cycle, Project stake holders ,Organizational influences, Project Processes, Project Groups, process interactions, customizing process interactions, Project cost management, Project Procurement management	05	CO1
Unit-II	Project Control Methods.	No. of Hours	Cos
	Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource Constraints: Resource Leveling and Resource Allocation. Time Cost Tradeoff: Crashing Heuristic. Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management; Post Project Analysis.	06	CO2
Unit-III	Theory of Games and Linear Programming	No. of Hours	Cos
	Theory of Games: Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance, Solution by Graphical Method. m x n size Game Problem, Iterative method, Introduction to formulation of games using Linear Programming. Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly.	06	CO3
Unit-IV	Transportation & Assignment Model	No. of Hours	Cos
	Iintroduction, Formulation, Basic Method of Solving Transportation Problem. Optimization Methods like UV and Stepping Stone Method. Assignment Problem- Hungarian Method to solve Assignment Problem..	06	CO4
Unit-V	Duality and sensitivity analysis.	No. of Hours	Cos
	The Essence of Duality Theory, Economic Interpretation of Duality , Primal-Dual Relationships , Adapting to Other Primal Forms ,The Role of Duality Theory in Sensitivity Analysis ,The Essence of Sensitivity Analysis , Applying Sensitivity Analysis	05	CO5

Unit-VI	Integer and Dynamic Programming	No. of Hours	COs
	Integer Programming Introduction to Integer Programming, Cutting plane method and Branch and Bound Method. Dynamic Programming: Introduction, DP Model, Applications of DP Model to shortest route problems. Solution of LPP by Dynamic Programming	05	CO6

Books:

Text Books:

1. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
2. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, PH Inc.
3. S. Choudhury, Project Scheduling and Monitoring in Practice.
4. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research: Principles and Solutions, S. Chand, 1991
5. J. K. Sharma, Operations Research: Theory and Application, Laxmi pub. India.
6. Operations Research, S. D. Sharma, Kedar Nath Ram Nath-Meerut.
7. Manohar Mahajan, Operation Research, Dhanpatrai Publication.

Reference Books:

1. Wysocki, R. K. (2014). Effective project management: Traditional, agile, extreme (7th ed.). Indianapolis, IN: John Wiley & Sons, Inc. ISBN13: 978-1-118-72916-8 softcover
2. Robert K. Wysocki, Robert Back Jr. and David B. Crane, Effective Project Management, John Wiley, 2002
3. Hillier F.S., and Lieberman G.J., Operations Research, Eight Edition, Mc. Tata McGraw Hill, India.
4. Ravindran, ―Engineering optimization Methods and Applications‖, 2nd edition, Wiley, India.
5. Ravindran, Phillips and Solberg, Operations Research Principles and Practice, Second Edition, Mc. WSE Willey,
6. Operations Research - An introduction, Hamdy A Taha, Pearson Education.

ST702: Composite Materials

Teaching Scheme
Lectures: 3 Hrs. / Week
Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CA: 20 Marks
Total: 100 Marks

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Unit-I	INTRODUCTION	No .of Hours
	Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance	07

Unit-II	REINFORCEMENTS	No. of Hours
	Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particlereinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.	07

Unit-III	Manufacturing of Metal Matrix Composites	No. of Hours
	Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.	07

Unit-IV	Manufacturing of Polymer Matrix Composites:	No .of Hours
	Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.	07

Unit-V	Strength:	No. of Hours
	Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.	07

Text Books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. 4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi

CO702: Recent Trends in Computer Technology

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End Sem Exam:**	**50 Marks**
	CA:	**20 Marks**
	Total:	**100 Marks**

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Course Objectives
1. To understand the concept of Artificial Intelligence and Robotics
2. To understand the need for machine learning for various problem solving
3. To study of neural Networks and Genetic Algorithms relate it with machine learning concepts.
4. To know the basics behind the Design and development of intelligent systems in the framework of soft computing
5. To study data analytics basics and its life cycle
6. To explore the applications of AI, Robotics, soft computing and Data Analytics

Course Outcomes
1. Identify and apply suitable Intelligent agents for various AI applications
2. Students able to differentiate between supervised, unsupervised, semi-supervised Machine learning approaches
3. Discuss and apply the back propagation algorithm and genetic algorithms to various problems
4. Understand and explore the soft computing methodologies such as Genetic algorithms
5. Deploy a structured lifecycle approach to data science and big data analytics projects
6. Understand and Develop the applications of AI, Robotics, soft computing and Data Analytics

COURSE CONTENTS

Unit-I	Intelligent Systems and Robotics	No. of Hours
	Introduction, History, Foundations and Mathematical treatments, Problem solving with AI, AI models, Learning aspects in AI, What is an intelligent Agents, Rational agent, Environments types, types of Agents, Types of Intelligent Systems, **Robotics**:Fundamentals, path Planning for Point Robot, Sensing and mapping for Point Robot, Mobile Robot Hardware, Non Visual Sensors like:Contact Sensors, Inertial Sensors, Infrared Sensors, Sonar, Radar, laser Rangefinders, Biological Sensing. Robot System Control: Horizontal and Vertical Decomposition, Hybrid Control Architectures.	07

Unit-II	Machine Learning Concepts	No. of Hours
	Introduction to Machine Learning, Machine Learning applications, Types of learning:Supervised, Unsupervised and semi-supervised, reinforcement learning techniques, Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models, Predictive and descriptive learning, Classification concepts, Binary and multi-class classification.	07

Unit-III	Neural Networks and Genetic Algorithms	No. of Hours
	Artificial Neural Networks(ANNs): Concept, Feed forward and Feedback ANNs, Error Back Propagation, Boltzmann Machine, Neural Network Representation, Problems, Perceptrons, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms , Hypothesis Space Search, Genetic Programming.	07

Unit-IV	Soft Computing Concepts	No. of Hours
	Introduction, soft computing vs. hard computing, various types of soft computing techniques, and applicationsof soft computing. Basic tools of soft computing –Fuzzy logic, neural network, evolutionary computing. Introduction to Hybrid Soft computing Techniques	07

Unit-V	Data Analytics Introduction and Life Cycle	No. of Hours
	Big data overview, BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Overview, phase 1-Discovery, Phase 2-Data preparation, Phase 3-Model Planning, Phase 4-Model Building, Phase 5-Communicate Results, Phase 6-Opearationalize.	07

Unit-VI	Applications of Recent Technologies	No. of Hours

	Intelligent System Applications Language Models, Text Classification, Information Retrieval and Extraction, Speech Recognition, Image Formation and object recognition **Robots in Practice** Delivery Robots, Intelligent Vehicles, Mining Automation, Space Robotics, Autonomous Aircrafts, Agriculture, Forestry, Domestic Robots **Applications of Soft computing** A Fusion Approach of Multi spectral Images with SAR (Synthetic Aperture Radar), Optimization of Traveling Salesman Problem using Genetic Algorithm, Soft Computing Based Hybrid Fuzzy Controllers, Soft Computing Based Rocket Engine Control. **Data Analytics Applications** Application in Industries: Retail, E- commerce, Finance, Sports, Others -healthcare, education, telecom etc. Application in business functions: Marketing Sales, Supply chain management, HR, Others - Finance, IT, Manufacturing and Strategy.	07

Text Books:

1. Elaine Rich, Kevin Knight and Nair, "ArtificialIntelligence", TMH,ISBN-978-0-07-008770-53.
2. Stuart Russell and Peter Norvig, "ArtificialIntelligence: A Modern Approach", Third edition, Pearson, 2003, ISBN :10: 01360425974.
3. Michael Jenkin, Gregory, " Computational Principals of Mobile Robotics", CambridgeUniversity Press, 2010, ISBN : 978-0-52-187157-0
4. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
5. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622
6. S.N. Sivanandam- "Principles of Soft Computing", Wiley India- ISBN- 9788126527410
7. S. Rajsekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" , Prentice Hall of India, ISBN: 0451211243
8. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X

Reference Books:

1. Nilsson Nils J , "Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-42.Patrick Henry Winston, "Artificial Intelligence", Addison-Wesley Publishing Company, ISBN: 0-201-53377-4
2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. Ethem Alpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0262-01243-0
4. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", 2nd Edition-Wiley India- ISBN: 978-0-470-51250-0
5. N.P.Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press, ISBN 10: 0195671546

6. Siman Haykin, "Neural Networks", Prentice Hall of India, ISBN: 0-7923-9475-5
7. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" , Wiley India, ISBN: 978-0-470-74376-8
8. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.

CO703: Dissertation Phase I

Teaching Scheme   **Examination Scheme**
Practical: 20 Hrs. / Week   **Oral/Presentation : 50 Marks**
Credits: 10   **Total: 50 Marks**

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The dissertation phase I work should start in semester III, and should preferably be recent problems/developments in the respective specializations. It should involve scientific research, designs, collection, and analysis of data, determining solutions and must preferably bring out the individuals contribution. Minimum 40% work of dissertation should be completed in the dissertation phase I.

The dissertation Phase I report should be presented in a standard format, in a spiral bound hard copy, preferably printed on both the sides of paper, containing the following contents.

1. Introduction including scope and objectives.
2. Literature Survey, including research gap.
3. Problem statement and methodology of work
4. Theoretical contents associated with topic of research
5. Data collection from field/organizations or details of experimental work/analytical work
6. Development of procedure for Modelling, Design or simulation of research work.

Marks will be base on proper submission of report and examination in the form of presentation

SEMESTER IV

CO704: Dissertation Phase II

Teaching Scheme
Practical: 32 Hrs. / Week
Credits: 16

Examination Scheme
Oral/Presentation: 100 Marks
Term Work: 50 Marks
Total: 150 Marks

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The final dissertation should be submitted in black bound hard copy preferably typed on both the sides of pages as well as a soft copy on CD.
The Term Work of Dissertation phase II of semester IV will be assessed jointly by the pair of internal and external examiners, along with oral examination of the same.

In Dissertation Phase–II, the student shall consolidate and complete the remaining part of the dissertation which will consist of implementations, testing, Results, measuring performance, discussions using data tables, performance parameter considered for the improvement with existing/known algorithms/systems, comparative analysis, validation of results and conclusions. Students should prepare and submit the duly certified final report of Dissertation phase II in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. The students are expected to validate their research/study undertaken by publishing it at standard platforms, such as an international   conference and/or peer reviewed journals. The continuous assessment of the progress of dissertation work needs to be documented unambiguously.

Guidelines for Submission of M. Tech Dissertation

- The M. Tech dissertation work shall be based on the knowledge acquired by the student and preferably it should meet and contribute towards the needs of the Industry and Society. The dissertation aims to provide an opportunity of designing and building complete system or subsystems based on area where the student likes to acquire specialized skills.

- Dissertation work shall be carried out under the supervision of a *qualified teacher* in the Department concerned. In this context *qualified teacher* means the faculty member possessing Ph.D degree or PG degree with a minimum 5 years' of experience in teaching at PG courses. Also he/she should have PG Teacher Approval of the SPPU.

- The Guides are advised to give dissertation and suggest dissertation titles focussing more on the current field of research and ensure the level of innovation. Staff member cannot guide more than five candidates on the academic schedule.

- PG students have to complete their dissertation work within College premises, however, candidate may, in certain cases, be permitted to work on dissertation in an Industrial/Research Organization, on the recommendations of the Head of his/her Department. In such cases, the dissertation work shall be jointly guided by a guide of the department and an expert-as a Co-guide from the Industry/organization (provided co-guide must have M.E./ M. Tech qualification) and the student shall be instructed to meet the guide periodically and to attend the review committee meetings for evaluating the progress.

- Students those who have no backlog are only eligible for submission of dissertation phase II. Also students have to complete the dissertation with 5 years from the date of admission. If it is not completed, they have to apply for extension by paying Rs.5000 as an extension charges.

- Dissertation Phase – I is an integral part of the dissertation work. In this, the student shall complete the partial work of the dissertation which will consist of problem statement, literature review, objectives, scheme of implementation (Mathematical Model/design of experiment/block diagram/ PERT chart, etc.) and Layout & Design of the Set-up. As a part of the progress report of dissertation Phase-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected dissertation topic.

- Minimum 2 reviews should be conducted for dissertation phase I and phase II. If the student fails to attend the review or the guide refuses to endorse the student's work. In such cases a committee consisting of HOD, PG Coordinator, guide and 2 Senior faculty can resolve the issue/matters.

- In dissertation Phase – II, the student shall complete the remaining part of the dissertation which will consist of the implementation of set up required for the dissertation, Software /Hardware and other facilities, work station, conducting experiments and taking results, analysis & validation of results and conclusions.

- The dissertation Phase II work shall be pursued for a minimum of 15 weeks during the final semester.

- The deadline for submission of final dissertation phase II report is 10 calendar days from the last working day of the semester in which dissertation / thesis is done.

- Students can also submit dissertation phase II report after every three months from the last working day of the semester in which dissertation is done. For such late submission students has to pay late fee as prescribed by the Controller of Examination.

- The evaluation of the dissertation phase - I and phase - II will be based on the dissertation report submitted in each of the semesters and a Viva-Voce examination by a team consisting of the Internal Examiner a Guide, and an External Examiner for each specialization/programme.

- If a candidate fails in the viva-voce examinations of Phase–I he/she has to redo the Phase–I in the subsequent semester. If he / she fail in the viva-voce examination of Phase–II of dissertation work of M. Tech., he/she shall resubmit the dissertation report within 60 days from the date of viva-voce. The resubmitted dissertation will be evaluated during the subsequent academic session.

- Every candidate doing M. Tech has to publish a paper in a Scopus/SCI/Web of Science/UGC approved Journals. An acknowledgement from the Guide for having communicated the paper to the journal or conference shall be attached to the report of the dissertation work. Such acknowledgements shall be considered for submission and evaluation marks by the team of examiners without which the dissertation shall not be accepted.

- At the time of submission of dissertation phase I and dissertation phase II report, plagiarism in the report shall not be more than 30%. M. Tech students have to attach the certificate from institute PG-coordinator regarding the percentage plagiarism in the report and then take the signature of the director.

- External Examiner for the dissertation phase I can be appointed in consultation with Head of the department and then name can be send to Controller of Examination for appointment order.

- For dissertation phase II examination, guide has to finalize the three name from Industry/Govt Colleges/ Autonomous College/Govt Organizations and send to Director, director will finalize any one examiner and name will sent to the Controller of Examination for appointment order. The qualification of external examiner appointed should be PhD degree/ME/M. Tech with more the 15 years' experience in Industry.

- Guidelines for preparation of dissertation report (typing, binding etc) will be same as that of SPPU guidelines.

- After the successful completion of viva examinations, a copy of the dissertation report hard and soft shall be submitted in the library of the department.