SCHEME
&
SYLLABUS

Of

First, Second, Third & Fourth Semester
Choice Base Credit System (CBCS)
Of
Master of Technology (M.Tech)

In
Artificial Intelligence and Data Science()
Of
RASHTRASANT TUKDOJI MAHARAJ
NAGPUR UNIVERSITY, NAGPUR

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
Choice Base Credit System(CBCS)

I Semester M. Tech. (AIDS)

Subject Code	Subject	Teaching Scheme			Examination Scheme								
					Theory					Practical			
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGAIDS101T	Data Science Using Python	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS102T	Artificial Intelligence	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS103T	Research Methodology and IPR	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS104T	Elective-1(Discipline Specific)	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS105T	Elective-2 (Open)	4	-	4	3	70	30	100	50				
PGAC106T	Audit Course-1	2	-		2	0	-	0	0	-	-	-	-
PGAIDS107P	Natural Language Processing Lab 1	-	2	1	-	-	-	-	-	50	50	100	50
PGAIDS108P	Artificial Intelligence Lab 2	-	2	1	-	-	-	-	-	50	50	100	50
Total		22	4		-	350	150	500	-	100	100	200	-
Semester Total		26		22	700 Marks								

L: Lecture P: Practical

Elective –1 (Discipline Specific) PGAIDS104/1T- Soft Computing**,** PGAIDS104/2T- Cloud Computing, PGAIDS104/3T- Data Analytics
Elective –2 (Open) PGOPEN105/1T- Business Analytics**,** PGOPEN105/2T- Optimization Techniques, PGOPEN105/3T- Big Data Analytics

Audit Course-1- PGAC105T- Value Education

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II Semester M. Tech. (AIDS)

Subject Code	Subject	Teaching Scheme			Examination Scheme								
					Theory					Practical			
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGAIDS201T	Natural Language Processing	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS202T	Machine Learning	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS203T	Neural Networks	4		4									
PGAIDS204T	Elective-3(Discipline Specific)	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS205T	Elective-4 (Discipline)	4	-	4	3	70	30	100	50	-	-	-	-
PGAC206T	Audit Course -2	2	-	0	3	0	-	0		-	-	-	-
PGAIDS207P	Introduction to Data Science Lab 3	-	2	1	-	-	-	-	-	50	50	100	50
PGAIDS208P	Machine Learning Lab 4	-	2	1	-	-	-	-	-	50	50	100	50
Total		22	4		-	350	150	500	-	100	100	200	-
Semester Total				22	600 Marks								

Elective –3 (Discipline Specific) PGAIDS204/1T- Information Retrieval Systems**,** PGAIDS204/2T- Block Chain Technology **,** PGAIDS204/3T- Computer Vision
Elective –4 (Open) PGAIDS205T/1T- Digital Image Processing and Analysis , PGAIDS205T/2T - Cyber Security,
PGAIDS205T/2T- Internet of Things.
Audit Course-II- PGAC205T- Indian Constitution and Fundamental Rights.

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III Semester M. Tech. (AIDS)

Subject Code	Subject	Teaching Scheme			Examination Scheme								
					Theory					Practical			
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGAIDS301T	Deep Learning	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS302T	Elective–5 (Open)	4	-	4	3	70	30	100	50	-	-	-	-
PGAIDS303T	Audit Course - 3	2											
PGAIDS304P	Dissertation/Phase-1	-	16	8	-	-	-	-	-	-	200	200	100
Total		10	-	-		140	60	200	-	-	200	200	-
Semester Total		26		16	400 Marks								

Elective –5 (Open) PGAIDS302T/1T - Predictive Analytics with R, PGAIDS302T/2T - GPU Computing , PGAIDS302T/3T-

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IV Semester M. Tech. (CSE)

Subject Code	Subject	Teaching Scheme			Examination Scheme								
					Theory					Practical			
		Hours per week		No. of Credits	Duration of Paper (Hrs.)	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks	Max. Marks	Max. Marks	Total Marks	Min. Passing Marks
		L	P			University Assessment	College Assessment			University Assessment	College Assessment		
PGAIDS401P	Dissertation/Phase-2	-	32	16	-	-	-	-	-	400	-	400	200
Total		-	-		-	-	-	-	-	400	-	400	-
Semester Total		32		16	400 Marks								

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Course and Examination Scheme of Master of Technology
Choice Base Credit System (CBCS)

M. Tech. (AIDS) - I Semester

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGAIDS101T	Data Science Using Python	4	-	4

Course Objectives:

1. To provide theoretical concepts of language processing that shows how to explore interesting bodies oftext.
2. To familiarize with fundamental topics in language processing that include tagging, classification, and information extraction using tiny Python programs.
3. To facilitate understanding of formal grammar to describe the structure of an unlimited set ofsentences.
4. To acquaint with methods to parse a sentence, recognize its syntactic structure and construct representations of meaning.
5. To familiarize with design of existing corpora, the typical workflow for creating a corpus and the lifecycle of a corpus

Course Outcomes:

Upon completing this course, students will be able to:

1. Comprehend the concept of natural language processing, its challenges and applications.
2. Demonstrate skills in natural language processing using Natural Language Toolkit (NLTK).
3. Build and evaluate classifiers for textual data.
4. Analyze linguistic structure of text and build feature based grammar.
5. Determine the semantics of sentences using WordNet and Treebank.

UNIT-I

Language Processing: Computing with Language- Texts and Words, A Closer Look at Python-: Texts as Lists of Words, Computing with Language- Simple Statistics, Automatic Natural Language Understanding, **Accessing Text Corpora and Lexical Resources**: Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, WordNet

UNIT-II

Processing Raw Text: Strings- Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings

Categorizing and Tagging Words: Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging

UNIT-III

Learning to Classify Text: Supervised Classification, Evaluation, Modeling Linguistic Patterns

Extracting Information from Text: Information, Chunking, Developing and Evaluating Chunkers Recursion in Linguistic Structure

UNIT-IV

Analyzing Sentence Structure: Context-Free Grammar, Parsing with Context-Free Grammar, Dependencies and Dependency Grammar, Grammar Development.

Building Feature-Based Grammars: Grammatical Features, Processing Feature Structures, Extending a Feature-Based Grammar.

UNIT-V

Analyzing the Meaning of Sentences: Natural Language Understanding, Propositional Logic, First-Order Logic, The Semantics of English Sentences.

Managing Linguistic Data: Corpus Structure: A Case Study, The Life Cycle of a Corpus, Acquiring Data.

Text Book:

1. Steven Bird, Evan Klein and Edward Loper, –Natural Language Processing with Python‖, O'Reilly Media, Inc., 2009.

Suggested Reading:

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2nd Edition, PearsonEducation, 2009.
2. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, 2ndEdition,Chapman and Hall/CRC Press, 2010.
3. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
4. Nitin Hardaniya, Jacob Perkins, –Natural Language Processing: Python and NLTK‖, Packt Publishers, 2016.

Web Resources:

1. https://pythonprogramming.net/tokenizing-words-sentences-nltk-tutorial/
2. http://www.nptelvideos.in/2012/11/natural-language-processing.html
3. https://github.com/keon/awesome-nlp

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
PGAIDS102T	Artificial Intelligence	L	P	
		4	-	4

Course Objectives:

1. To learn basics of AI and concept of Intelligent Agent.
2. To learn the various Searching techniques
3. To learn first order and second order predicate Logic to infer knowledge
4. To learn classical and real world planning approaches
5. To learn uncertainty and probabilistic reasoning models

Course Outcomes:

Upon completing this course, students will be able to:

6. Understand the basics of AI and concept of Intelligent Agent.
7. Compare the Searching techniques
8. Understand and apply the first order and second order predicate Logic to infer the knowledge
9. Analyze classical and real world planning approaches
10. Understand the uncertainty and apply the probabilistic reasoning models

Unit – I

Introduction: AI Definition, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art ; **Intelligent Agents :** Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents; **Solving Problems by Searching:** Problem- Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions

Unit - II

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments, **Adversarial Search:** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs; Alternative Approaches; **Constraint Satisfaction Problems:** Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs , Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Unit - III

Logical Agents : Knowledge-Based Agents, the Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic; **First-Order Logic:** Representation Revisited, Syntax and Semantics of First-Order Logic, Using First- Order Logic, Knowledge Engineering in First-Order Logic; **Inference in First-Order Logic:** Propositional Vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Unit - IV

Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches; **Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multiagent Planning; **Knowledge Representations:** Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World.

Unit - V

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using

Full Joint Distributions, Independence, Bayes‘ Rule and Its Use, The Wumpus World Revisited; **Probabilistic Reasoning:** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks, **Probabilistic Reasoning over Time:** Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models

Text Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Edition, 4thEdition.

Suggested Reading:

1. Rich, Knight, Nair: ‒Artificial intelligence‖, Tata McGraw Hill, Third Edition, 2009.
2. Nilsson, N., ―Artificial Intelligence: A New Synthesis‖, San Francisco, Morgan Kaufmann, 1998.
3. Kulkarni, Parag, Joshi, Prachi , ―Artificial Intelligence : Building Intelligent Systems‖, PHI, 2015.
4. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs19/
2. https://www.coursera.org/learn/ai-for-everyone

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGAIDS104/1T	Soft Computing	4	-	4

Course Objectives:

1. Learn about soft computing techniques, their applications and Be familiar with the design of neural networks and related algorithms.
2. Understand Fuzzy Logic, Various fuzzy systems and their functions.
3. Learn mathematical background for optimized genetic programming
4. Understand advanced soft computing techniques.
5. Introduce real time applications of soft computing techniques.

Course Outcomes:

After successful completion of the course, student will be able to:

1. Understand soft computing techniques and their role in building intelligent machines.
2. Demonstrate fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
3. Apply genetic algorithms to provide optimized solutions.
4. Explain rough set theory and swarm intelligence techniques to solve problems.
5. Build real time applications using soft computing techniques

UNIT-I

Introduction to soft computing: Concept of computing systems, classification of soft computing techniques, "Soft" computing versus "Hard" computing Characteristics of Soft computing, Applications of Soft computing techniques, Structure & functioning of biological brain & Neuron, and concept of learning/training. Model of an Artificial Neuron, transfer/activation functions, perceptron learning model, binary & continuous inputs, linear separability. **Multilayer Neural Networks:** Feed Forward network - significance, training, loss function, Back- Propagation algorithm, convergence & generalization, momentum, applications. Feedback network -Hopfield Nets: architecture, energy functions, training algorithms & examples, competitive learning, self-organizing maps.

UNIT-II

Fuzzy Logic: Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic -extension principle – fuzzy measures – measures of fuzziness -fuzzy integrals – fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making..

UNIT-III

Genetic algorithm: concepts, creation of offspring, working principle, encoding, fitness functions, reproduction, genetic modeling. Generation cycle & convergence of GA, application areas of GA. **Hybrid Soft Computing Techniques and Applications**: Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

UNIT- IV

Advanced soft computing techniques: Rough Set Theory - Introduction, Set approximation, Rough membership, Attributes, optimization. SVM - Introduction, obtaining the optimal hyper plane, linear and nonlinear SVM classifiers. **Introduction to Swarm Intelligence**: What is swarm intelligence? Various animal behavior which have been used as examples, ant colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant-based routing, particle swarm

optimization.

UNIT V

Applications of Soft Computing: Image registration – Object recognition – Automated feature extraction –navigation – Integration of soft computing and GIS for flood forecasting and monitoring, Landslide susceptibility, Highway alignment, smart city planning, agriculture, solid waste disposal

Text Books:

1. S. N.Sivanandam and S.N.Deepa, ―Principles of Soft Computing‖, Wiley India Pvt Ltd, 2011.
2. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms,Synthesis & applications, PHI Publication

Suggested Reading:

1. George J. Klir, Ute St. Clair, Bo Yuan, Fuzzy Set Theory: Foundations and Applications Prentice Hall,1997.
2. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning Pearson Education India, 2013.

Web Resource:

1. https://nptel.ac.in/courses/106/105/106105173/
2. https://www.javatpoint.com/artificial-neural-network

https://www.javatpoint.com/fuzzy-logic

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGAIDS104/2T	Cloud Computing	4	-	4

Course Objectives:

1. To familiarize basic concepts of cloud computing and enabling technologies.
2. To introduce Auto-Scaling, capacity planning and load balancing in cloud.
3. To impart knowledge on issues related to security, privacy and compliance.
4. To introduce cloud management standards and programming models.
5. To deal with the concepts of Service oriented architecture and cloud database technology.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand different types of cloud computing concepts and the techniques.
2. Determine the issues related to scaling, capacity planning and load balancing.
3. Assess the cloud infrastructure, information security and compliance issues.
4. Analyse the Portability and Interoperability issues of cloud virtualization.
5. Evaluate the importance of SOA and cloud database technology.

UNIT-I

Introduction-Limitations of the Traditional Computing Approaches, Three Layers of Computing, Three Layers in Traditional Computing, The End of Traditional Computing, Influences behind Cloud Service Adoption. Benefits and challenges: Origin of the Term _Cloud Computing', Early Initiatives, Utility Computing, Metering and Billing in Cloud, Separation of Data Center Operation, Benefits of Cloud Computing, Challenges of Cloud Computing, How Cloud Computing Addresses Business Challenges, Ethical Issues in Cloud Computing, Cloud Computing: Network as Computer, Role of Web Service, Role of API, Ubiquitous Cloud, Confusion Between Cloud and Internet. Cloud computing services, Resource Virtualization, Resource pooling, sharing and provisioning.

UNIT-II

Scaling in cloud- Introduction to Scaling, Scaling in Traditional Computing, Scaling in Cloud Computing, Foundation of Cloud Scaling, Scalable Application , Scaling Strategies in Cloud, Auto-Scaling in Cloud, Types of Scaling , Performance and Scalability , the Resource Contention Problem , Cloud Bursting: A Scenario of Flexible Scaling, Scalability is a Business Concern

Capacity Planning- Capacity Planning, Capacity Planning in Computing, Capacity Planning in Cloud Computing, Approaches for Maintaining Sufficient Capacity, Steps for Capacity Planning

Load Balancing- Load Balancing , Importance of Load Balancing in Cloud Computing, Load Balancing in Cloud, Goals of Load Balancing, Categories of Load Balancing, Load Balancing Algorithms, Case study on Google cloud and Amazon Elastic Compute Cloud (EC2), File System and Storage.

UNIT-III

Content Delivery Network: CDN Service Operations, Evolution of CDN, Advantages of CDN, Disadvantages of CDN, CDN Service Provider, Security Reference Model

Security Issues- Cloud security, threats to Cloud Security, Infrastructure Security, Information Security, Identity Management and Access Control, Cloud Security Design Principles, Cloud Security Management Frameworks, Security-as-a-Service, Privacy and Compliance Issues.

UNIT-IV

Portability and Interoperability Issues- Challenges in the Cloud, The Issues in Traditional Computing, Addressing Portability and Interoperability in Cloud, Portability and Interoperability Scenarios, Machine Imaging or Virtual Machine Image, Virtual Appliance, Difference between

Virtual Machine Image and Virtual Appliance, Open Virtualization Format (OVF), Cloud Management and a Programming Model Case Study, Popular Cloud Services.

UNIT-V

Service-Oriented Architecture: The Pre-SOA Era, Role of SOA in Cloud Computing, Service-Oriented Architecture, Goal of System Designing, Service Represents Business Functionality, Open Standard Implementation, Benefits of SOA, SOA and Cloud Computing.

Database Technology: Database in Cloud, Data Models, Database-as-a-Service, Relational DBMS in Cloud, Non-relational DBMS in Cloud.

Text Book:

1. Sandeep Bhowmik, –Cloud Computing‖, Cambridge University Press, 2017.

Suggested Reading:

1. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, –Distributed and Cloud Computing from Parallel Processing to the Internet of Things‖, Elsevier, 2012.
2. Barrie Sosinsky‖ Cloud Computing Bible‖, Wiley-India, 2010
3. Ronald L. Krutz, Russell Dean Vines ―Cloud Security: A Comprehensive Guide to Secure Cloud Computing‖, Wiley- India,2010
4. John W. Rittenhouse, James F. Ransome, "Cloud Computing: Implementation, Management, and Security",CRC Press, 2009.

Web Resources:

1. https://nptel.ac.in/courses/106105167/1

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
Elective –2 (Open) PGAIDS105/1T	Business Analytics	4	-	4

Course Objectives:

1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

Course Outcomes:

Upon completing this course, students will be able to:

1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

UNIT-I

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DDdecision making and future.

UNIT-II

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

UNIT-III

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt‘s method, Holt-Winter model, Croston‘s forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil‘s coefficient

UNIT-IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming(LP) and LP model building,

UNIT-V

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

Text Books:

1. U Dinesh Kumar, ―Data Analytics‖, Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, ―Business analytics Principles, Concepts, and Applications with SAS‖, Associate Publishers, 2015

Suggested Reading:

1. S. Christian Albright, Wayne L. Winston, ―Business Analytics - Data Analysis and Decision Making‖, 5th Edition, Cengage, 2015

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
Elective –2 (Open) PGAIDS105/2T	OPTIMIZATION TECHNIQUES	4	-	4

Objectives: The students will

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

Outcomes:

Upon completing this course, students will be able to:

1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queuing and inventory concepts in industrial applications
5. Apply sequencing models in industries

UNIT – I

Operations Research: Definition, scope, Models, Linear programming problems (LPP), Formulation, Graphical Method, and Simplex Method

UNIT – II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel‘s Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT – III

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson‘s rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float

UNIT – IV

Queuing Theory and Inventory:: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT – V

Sequencing Models: Introduction, Objectives, General assumptions, processing ‗n‘ jobs through two Machines, processing ‗n‘ jobs through three machines

Text Books:

1. H.A. Taha, ―Operations Research, An Introduction‖, PHI, 2008
2. H.M. Wagner, ―Principles of Operations Research‖, PHI, Delhi, 1982
3. J.C. Pant, ―Introduction to Optimisation: Operations Research‖, Jain Brothers, Delhi, 2008

Suggested Reading:

1. Hitler Libermann, ―Operations Research‖, McGraw Hill Pub. 2009
2. Pannerselvam, ―Operations Research‖, Prentice Hall of India 2010
3. Harvey M Wagner, ―Principles of Operations Research‖, Prentice Hall of India 2010

Course Code	Course	Teaching Scheme		
	Research Methodologyand IPR	Hours Per Week		Credits
		L	P	
		2	-	2

Course Objectives:

To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes:

At the end of the course, student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II

Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT - III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, ―Research Methodology, Methods & Technique‖; New Age International Publishers,2004
2. R. Ganesan, –Research Methodology for Engineers‖, MJP Publishers, 2011

3. Y.P. Agarwal, –Statistical Methods: Concepts, Application and Computation‖, Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Ajit Parulekar and Sarita D‘ Souza, –Indian Patents Law – Legal & Business Implications‖; Macmillan India ltd , 2006
2. B. L.Wadehra; –Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications‖; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; ―Law of Copyright and Industrial Designs‖; Eastern law House, Delhi 2010

Course Code	Course	Teaching Scheme		
		Hours Per Week		Credits
		L	P	
PGAC105T	Value Education	2	-	2

Course Objectives:

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes:

Upon completing this course, students will be able to:

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality,non-violence and universal brotherhood.

UNIT I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT IV

Values in Holy Books : Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Suggested Reading:

1. Chakroborty, S.K. –Values & Ethics for organizations Theory and practice‖, Oxford University Press, New Delhi, 1998.
2. Jaya Dayal Goyandaka, –Srimad Bhagavad Gita‖, with Sanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.