Maulana Abul Kalam Azad University of Technology, West Bengal*(Formerly West Bengal University of Technology)* **Syllabus for M. Tech in Artificial Intelligence**(Applicable from the academic session 2018-2019)

Code	Course Title	Hours per week			Credits
		L	T	P	
PGIT(AI)101	Program Core I- Mathematical foundations of Computer Science	3	0	0	3
PGIT(AI)102	Program Core II- Advances in Artificial Intelligence	3	0	0	3
PGIT(AI)103A/B/C	Program Elective I- Cloud Computing / Pattern Recognition / Data Preparation and Analysis	3	0	0	3
PGIT(AI)104A/B/C/D	Program Elective II- Logic Knowledge Representation & Reasoning / Expert Systems / Machine Learning /Data Visualization	3	0	0	3
PGIT(AI)105	Research Methodology and IPR	2	0	0	2
PGIT(AI)106A/B/C/D	Audit Course	2	0	0	0
PGIT(AI)192	Laboratory 1(Artificial Intelligence Lab)	0	0	4	2
PGIT(AI)193	Laboratory 2(Elective-1)	0	0	4	2
PGIT(AI)194	Laboratory 2(Elective-II)	0	0	4	2
Total Credits: 20					

M.Tech Sem- II

Code	Course Title	Hours per week			Credits
		L	T	P	
PGIT(AI)201	Program Core III – Advanced Algorithms	3	0	0	3
PGIT(AI)202	Program Core IV – Artificial Neural Networks	3	0	0	3

PGIT(AI)203A/B/C/D	Program Elective III – Natural Language Processing / Advanced Data Mining / Big Data Analytics/ Computational Intelligence	3	0	0	3
PGIT(AI)204 A/B	Program Elective IV– Geographical Information System / Soft Computing	3	0	0	3
PGIT(AI)205	Audit Course	2	0	0	0
PGIT(AI)292	Laboratory 3 (Based on Artificial Neural Network)	0	0	4	2
PGIT(AI)293	Laboratory 4 (Based on Elective III)	0	0	4	2
PGIT(AI)294	Laboratory 4 (Based on Elective IV)	0	0	4	2
PGIT(AI)295	Term Paper with Seminar	4	0	0	2
Total Credits: 20					

***Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.**

M.Tech III Sem*

Code	**Course Title**	**Hours per week**			**Credits**
		L	T	P	
PGIT(AI)301A/B/C/D	Program Elective V – Computer Vision & Robotics / Digital Signal Processing / Deep Learning/ Remote Sensing and GIS/	3	0	4	03

PGIT(AI)302A/B/C/D/E/F/G	**Open Elective** ● Business Analytics ● Project Management and Entrepreneurship ● Industrial Safety ● Operations Research ● Cost Management of Engineering Projects ● Composite Materials ● Waste to Energy	3	0	0	03
PGIT(AI)391	Laboratory 5(Based on Computer Vision	0	0	4	02
PGIT(AI)392	Dissertation-I /Industrial Project	0	0	20	10
Total Credits: 18					

*Students going for Industrial Project/Thesis will complete these courses through MOOCs.

M.Tech Sem-IV

	Course Title	**Hours per week**			**Credits**
		L	T	P	
PGIT(AI)491	Dissertation II	0	0	32	16
Total Credits: 16					

The program offers several elective courses, focusing on different aspects of Artificial Intelligence. A student can choose to do any course from given program elective set.

Audit course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge

4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

Name of the Course: M.Tech in Information Technology (AI) **Subject: Mathematical Foundation of Computer Science**			
Course Code: PGIT(AI)101	**Semester:1st**		
Duration:36 Hrs.	**Maximum Marks:100**		
Teaching Scheme	**Examination Scheme**		
Theory:3	End Semester Exam:70		
Tutorial:0	Attendance : 5		
Practical:0	Continuous Assessment: 25		
Credit:3			
Aim:			
Sl. No.			
1.	**To understand the basic notions of discrete and continuous probability.**		
2.	**To understand the methods of statistical inference, and the role that sampling distributions play in those methods.**		
3.	**To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.**		
Objective:			
Sl. No.			
1.	**To understand the mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.**		
2.	**To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.**		
3.	**To study various sampling and classification problems.**		
Pre-Requisite:			
Sl. No.			
1.	**Discrete Mathematics**		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
1	**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**	**7**	**12**
2	**Random samples, sampling distributions of estimators,**	**7**	**12**

	Methods of Moments and Maximum Likelihood		
3	**Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.**	**8**	**12**
4	**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**	**3**	**12**
5	**Information Technology Applications, Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.**	**7**	**12**
6	**Recent Trends in various distribution functions in the mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.**	**4**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
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**
Reference Books:			

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of	Total	No of	To answer	Marks per	Total Marks

		question to be set	Marks	question to be set		question	
A **B** **C**	**ALL** **ALL**	**10**	**10**	**5** **5**	**3** **3**	**15** **45**	**70**

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Name of the Course: M.Tech in Information Technology (AI) **Subject: Advances in Artificial Intelligence and Advances in Artificial Intelligence Lab**	
Course Code: PGIT(AI)102, PGIT(AI)192	**Semester: 1st**
Duration:36 Hrs.	
Teaching Scheme	**Maximum Marks:200**
Theory:3	**Examination Scheme**
Tutorial:0	**End Semester Exam**:70
Practical:4	Attendance : 5
Credit:3+2	Continuous Assessment: 25
	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:	
Sl. No.	
1.	In-depth understanding of Python for Data Science.
2.	Ability to read, understand and write code in Jupyter Notebook
3.	Skill to write program code in Python to solve real world problems.

Objective:	
Sl. No.	
1.	Programmatically download and analyze data
2.	Gain insight into the 'Roles' played by a Data Analyst and Data Scientist
3.	Using jupyter notebooks, master the art of writing code in python
4.	Understand the intuition behind Artificial Neural Networks

Pre-Requisite:	
Sl. No.	
1.	High school mathematics level
2.	Some knowledge of programming will be plus

Contents	**Hrs./week**

Chapter	Name of the Topic	Hours	Marks
01	Introduction to AI Motivations from History: "The Why.", Productive Curiosity: "The What.", Ideas worth Realizing: "The How.", What is the connection between artificial intelligence and machine learning, What are the types of learning , Fundamental aspects of a learning system, Application areas and applications of Artificial Intelligence	5	4
02	Data Structures in Python Introduction to Python Data Types, Numbers, Variable Assignments, Strings: Introduction to Strings, Indexing and Slicing with Strings, Indexing and Slicing with Strings, Print Formatting with Strings, List in Python, Dictionaries, Tuples, Sets, Booleans, Python Objects and Data Structures, Python Comparison Operators, Chaining Comparison Operators in Python with Logical Operators, Comparison Operators	8	12
03	Python Statements and Functions If Elif and Else Statements in Python, For Loops , While Loops, Useful operators, List Comprehensions, Functions, Function Arguments, Errors and Exception Handling, File Handling basics,	7	20
04	OOP & Python ecosystem for machine learning Introduction, Attributes and Class Keyword, Class object Attributes and Methods, Inheritance, Polymorphism, NumPy, Scipy, Pandas, Matplotlib	7	14
05	Biological foundations to intelligent systems Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.	9	20
	Sub Total:	36	70
	Internal Assessment Examination & Preparation of Semester Examination	4	30
	Total:	40	100

Practical:

Skills to be developed:

- Fundamental concepts of Artificial Intelligence
- Be able to identify the positive and the negative impact that AI will create
- Clearly define what is AI, Machine Learning and Deep Learning
- Learn how to code in Jupiter Notebooks and install packages in python
- Start coding in python and learn how to use it for Data analysis
- Understand the intuition behind Artificial Neural Networks

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

- Get a single string from two given strings, separated by a space and swap the first two characters of each string

- Create a dictionary named my_marks to store the marks you have secured in various

subjects. Use the subject names as keys. Use built-in functions to fetch the keys and values separately.

- Grade the values of my_marks dictionary according to the following conditions:
- if marks≥90, grade = O
- if marks<90 & marks≥80, garde = A
- if marks<80 & marks≥70, grade = B
- if marks<70 & marks≥60, grade = C
- if marks<60 & marks≥40, grade = D
- if marks<40, grade = F
- Create a nested dictionary to store the credentials of a person's contacts (like name, gender, residence, etc.). The dictionary should look like: my_name = {friend:{name: Naina, gender: F, city: Delhi}, cousin:{name: Abhi, gender: M, city: Bengaluru}, …} Print out the contents of these inner individual dictionaries in proper print statements.

- Write a Python program to check if a given key already exists in a dictionary.

- Write a Python program to sum all the items in a list

- Write a Python script to display the various Date Time formats.

- Write a Python program to create a class and compute the Area and the Perimeter of the circle

- Write a Python program to demonstrate the use of inheritance

Assignments:

- What is the difference between Artificial Intelligence, Deep Learning and Machine Learning?
- Ask a user to input a number in n. Print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys. Use for loop to judiciously automate the code
- Create two dictionaries and print a third dictionary by taking the union of their keys.
  For example:
  dict_1 = {a: 1, b: 1, o: 2, n: 1, s: 2, r: 2, u: 2, t: 1}
  dict_2 = {a: 2, d: 1, e: 4, n: 6, s: 7, q: 2, u: 3, x: 9}
  Hence,
  dict_3 = {a:[1,2], b:1, o:2, n:[1,6], s:[2,7], r: 2, u:[2,3], t: 1, d: 1, e: 4, q: 2, x: 9}
- What is the difference between list and Dictionary in Python?
- Explain Biological Neural Network and Artificial Neural network.
- Explain different types of Activation function in neural network with example,

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Ian Goodfellow , Yoshua Bengio , Aaron Courville	Deep Learning (Adaptive Computation and Machine Learning series)		MIT Press
Reference Books:			

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer
2.	Software: Python
3.	
4.	
5.	

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	15	
C	ALL			5	3	45	70

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Data Preparation and Analysis and Data Preparation and Analysis Lab	
Course Code: PGIT(AI)103 C, PGIT(AI)193	**Semester:**
Duration:36 Hrs.	**Semester:1st**
Teaching Scheme	**Maximum Marks:200**

Theory:3	**Examination Scheme**
Tutorial:0	**End Semester Exam**:70
Practical:4	Attendance : 5
Credit:3+2	Continuous Assessment: 25
	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:

Sl. No.	
1.	Ability to read and understand execution, and write programs in Python
2.	Skill to source and export data from different sources
3.	Ability to manipulate data for analysis and modelling

Objective:

Sl. No.	
1	To develop executable Python code
2.	To systematically import and manipulate raw data
3.	To analyse and process data for modelling

Pre-Requisite:

Sl. No.	
1.	Higher-secondary Statistics

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Python Programming Language**	5	10
02	**Data import & export**	4	7.5
03	**Data interpretation by descriptive statistics**	4	7.5
04	**Data interpretation by visualization**	4	7.5
05	**Data preprocessing**	9	18
06	**Dimensionality reduction**	4	7.5
07	**Training , validation, testing**	3	6
08	**End to end dataflow pipeline**	3	6
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

1. Python programming skills
2. Data import/export skills
3. Data cleaning skills
4. Data manipulation skills
5. Data interpretation skills

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

1. Ask a user to input a number in n. Write a Python program to print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys. Use for loop to judiciously automate the code.
2. Write a Python program to create two dictionaries and print a third dictionary by taking the union of their keys.
3. Write a Python program to create a .csv file in your systems. Read the file with the csv package. Read files delimited by tab, colon, semicolon or any other standard delimiters.

4. Write a Python program to write a csv file using for loop to store the marks you had obtained in the B.Tech semesters. Ask the user for input.
5. Write a Python program to create a pandas Series with the departments in your college. Create a pandas Dataframe to fit in the above Series along with the names of the respective HODs and the overall student strength and the names of the CRs.
6. Write a Python program to import a .csv file using pandas dataframe. List out the column names and datatypes. Sort the dataframe created in question 3 using the marks obtained in Mathematics.
7. Write a Python program to create a pandas DataFrame with the marks obtained by you and your friends in 5 different subjects. Specify the names of the subjects as column headings and the indices as the roll numbers. Arrange the columns in an order of your choice for both of the dataframes.
8. Write a Python program to create a .csv file to store the following table:
   Movie Name, Year, Country, Genre, Director, Lead Actor, Revenue, Average Rating
9. Write a Python program to find out the mean revenue generated by the movies of the UK listed under .csv created in Assignment 8. Normalize the "Revenue" and the "Average Rating" column. One-hot encode the "Country" column.

Assignments (based on theory class):

1. Explain the DIKW pyramid.
2. Write a csv file using for loop to store the marks you had obtained in the B.Tech semesters. Ask the user for input. Read the csv file into a dictionary.
3. Create a pandas DataFrame with the marks obtained by you and your friends in 5 different subjects. Specify the names of the subjects as column headings and the indices as the roll numbers. Sort the dataframe created using the marks obtained in Mathematics.
4. Explain the Standardization, Normalization and Binarization with the help of an example.
5. Apply PCA to derive the new dataset from:
   Age 44 27 30 38 40 35 48 50
   Salary 72000 48000 54000 61000 58000 52000 79000 83000
6. Construct regular expressions to generate the following set of strings:
   a) Matches a string beginning with 'Where' and ending in a '?'.
   b) Matches any number in between 259 – 959
   c) Matches an email address where the username can contain letters, numbers and characters or only letters and numbers or only letters and characters but not only numbers and characters.

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
B. Lubanovic	Introducing Python		O'Reilly
Sheldon M Ross	Introduction to Probability and Statistics for Engineers and Scientists		Elsevier Academic Press
Reference Books:			
W McKinney	Python for Data Analysis		O'Reilly
Brockwell and Davis	Introduction to Time Series and Forecasting		Springer
G James, D Witten, T Hastie, R Tibshirani	An Introduction to Statistical Learning		Springer

A Geron	Hands-on Machine Learning with Scikit-Learn and Tensorflow		O'Reilly

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer
2.	Software : Python

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A		10	10				
B				5	3	15	70
C				5	3	45	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence)

Subject: Cloud Computing and Cloud Computing Lab

Course Code: PGIT(AI)103A, PGIT(AI)193	**Semester: 1st**
Duration: 36 Hours	**Maximum Marks:200**
Teaching Scheme	**Examination Scheme**

Theory:03	**End Semester Exam**:70
Tutorial:0	Attendance : 5
Practical:4	Continuous Assessment: 25
Credit: 3+2	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:	
Sl. No.	
1.	**Identify security aspects of each cloud model**
2.	**Develop a risk-management strategy for moving to the Cloud**
3.	**Implement a public cloud instance using a public cloud service provider**
4.	**Apply trust-based security model to different layer**
Objective:	
Sl. No.	
1.	**The student will also learn how to apply trust-based security model to real-world security problems.**
2.	**An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.**
3.	**Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.**
Pre-Requisite:	
Sl. No.	
1.	**Networking**
2.	**Distributed Computing**

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Cloud Computing** **Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing**	**4**	**10**
02	**Cloud Computing Architecture** **Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model** **Cloud Deployment Models** **Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise**	**11**	**14**
03	**Security Issues in Cloud Computing** **Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security** **Identity and Access Management** **Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management**	**4**	**14**

04	**Security Management in the Cloud** **Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS** **Privacy Issues** **Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations**	**8**	**14**
05	**Audit and Compliance** **Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud**	**5**	**14**
06	**ADVANCED TOPICS** **Recent developments in hybrid cloud and cloud security.**	**4**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Skills to be developed:
List of Practical:
Based on theory

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

1. John Rhoton,	**Cloud Computing Explained: Implementation Handbook for Enterprises,**	**Publication Date: November 2, 2009**	
2. Tim Mather,	**Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice),**	**ISBN-10: 0596802765,September 2009**	**O'Reilly Media,**

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	**Computer**

2.	

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**		**3**		**70**
B	**ALL**			**5**		**15**	
C	**ALL**			**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Machine learning and Machine learning Lab**			
Course Code:PGIT(AI)104C, PGIT(AI)194		**Semester: 1st**	
Duration:36 hours		**Maximum Marks:200**	
Teaching Scheme		**Examination Scheme**	
Theory:3		End Semester Exam:70	
Tutorial:0		End Semester Exam:70	
Practical:4		Attendance : 5	
Credit:3+2		Continuous Assessment: 25	
		Practical Sessional internal continuous evaluation:40	
		Practical Sessional external examination:60	
Aim:			
Sl. No.			
1.	**Extract features that can be used for a particular machine learning approach in various AI applications.**		
2.	**To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.**		
3.	**To mathematically analyse various machine learning approaches and paradigms.**		
Objective:			
Sl. No.			
1.	**To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various nodes.**		
2.	**To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.**		
3.	**Explore supervised and unsupervised learning paradigms of machine learning.**		
4.	**To explore Deep learning technique and various feature extraction strategies.**		
Pre-Requisite:			
Sl. No.			
1.	**Algorithm and Data Structure**		
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit 1:** **Supervised Learning (Regression/Classification)** ● **Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Nave Bayes** • **Linear models: Linear Regression, Logistic Regression, Generalized Linear Models** • **Support Vector Machines, Nonlinearity and Kernel Methods** • **Beyond Binary Classification: Multi-class/Structured Outputs, Ranking**	**9**	**10**
02	**Unsupervised Learning** • **Clustering: K-means/Kernel K-means**	**8**	**14**

	• **Dimensionality Reduction: PCA and kernel PCA** • **Matrix Factorization and Matrix Completion** • **Generative Models (mixture models and latent factor models)**		
03	**Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)**	**6**	**14**
04	**Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning**	**4**	**10**
05	**Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference**	**4**	**14**
06	**Recent trends classification applications.in various methods for learning techniques applications of machine learning.**	**5**	**8**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Skills to be developed:
Intellectual skills:

List of Practical

Based on Theory

Assignments: Based on Theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Reference Books:			
1. Kevin Murphy	**Machine Learning: A Probabilistic Perspective**		**MIT Press, 2012**
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman,	**The Elements of Statistical Learning,**		**Springer 2009 (freely available online)**
3.Christopher Bishop,	**Pattern Recognition and Machine**		**Springer, 2007.**

	Learning,		

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	**Computer**
2.	
3.	
4.	

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**	**5**	**3**	**15**	**70**
B	**ALL**						
C				**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Data Visualization and Data Visualization Lab	
Course Code: PGIT(AI)104D, PGIT(AI)194	
Duration:36 Hrs.	**Semester:1st**
Teaching Scheme	**Maximum Marks:200**
Theory:3	**Examination Scheme**
Tutorial:0	End Semester Exam:70
Practical:4	Attendance : 5
Credit:3+2	Continuous Assessment: 25
	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:	
Sl. No.	
1	Ability to create visualizations from data
2	Ability to gain a better understanding of data from visualizations
3	Skill to make sense of trends in data from visualizations

Objective:	
Sl. No.	
1	To understand the need and benefits of data visualization
2	To systematically create univariate and bivariate graphs from data
3	To analyse and draw conclusions from visualizations

Pre-Requisite:	
Sl. No.	
1	Fundamentals of Python Programming

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** About data visualization, The need for data visualization, Brief history of data visualization	2	2
02	**Statistical Preliminaries** Different types of data, Measures of Centrality, Measures of Dispersion, Measures of Association	4	8
03	**Univariate Visualizations** Stem-and-Leaf Plot, Pie Chart, Bar Graph, Histogram, Line Chart, Box Plot, Analysis and drawing conclusions	6	12
04	**Bivariate Visualizations** Scatter Plot, Bivariate Line Chart, Hex Plot, Analysis and drawing conclusions	4	8
04	**Python NumPy Library** NumPy and its advantages, NumPy n-dimensional array (ndarray), Creating ndarrays in NumPy, Slicing ndarrays, ndarray operations, Broadcasting	8	16
05	**Data Visualizations in Python** Plotting with matplotlib, Univariate graphs using matplotlib, Bivariate graphs using matplotlib, Plotting through pandas, Improving plot aesthetics	12	24
	Sub Total:	**36**	**70**

	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

1.Data interpretation skills using statistics
2.Data analysis skills from visualizations
3.Mathematical computation skills in Python
4.Visualization creation skills

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

1. Write a Python program to create a 1D Numpy array having integers from 1 to 100, and extract all multiples of 7 from it.
2. Write a Python program to create a 1D Numpy array having 36 random elements from the standard normal distribution. From this array, create another array having 9 rows and 4 columns.
3. Write a Python program to create a matrix of order 4x5 having randomly selected integers in the range [1,100]. Compute the mean of the elements of this matrix without using the mean and sum functions of Numpy.
4. Write a Python program to create a zero matrix of order 10x10. From this matrix, create
    a) an identity matrix of order 10.
    b) a diagonal matrix with elements 4, 7, 2, 9, 1, -4, -7, -2, -9, -1 along the principal diagonal.
5. The sales for the years 2017, 2018 and 2019 are given in the 'Sales Data' file. Write a Python program to plot the data in a single line chart and comment regarding the general trend and the sales across different months.
6. The 'Heights' dataset contains the heights in inches for boys and girls in a class of 40 students. Write a Python program to construct box plots for heights of boys and girls on a single scale. State which box plot has the wider spread for the middle 50% of the data, and which one is skewed.
7. Write a Python program to import the 'Pokemon' dataset, and plot a bar graph for the number of pokemon of each type having
    a) speed less than 50
    b) attack more than 90
8. Write a Python program to import the FIFA dataset. Plot histograms for the following attributes and comment regarding their distribution:
    a) Overall
    b) Age
    c) Shot Power
9. Write a Python program to Import the 'Housing Sales' dataset. Plot scatter plots between the following attributes and write down some conclusions regarding the correlation between them:
    a) 1stFlrSF and SalePrice
    b) 2ndFlrSF and SalePrice
    c) GarageArea and SalePrice

Assignments (based on theory classes):

1. Write a Python program to create a 1D numpy array having 30 distinct elements, and change it to a 5×6 matrix.
2. Write a Python program to create a 4×4 zero matrix and replace the entries along the principal diagonal by 9,8,-5,4.
3. What is numpy.random.rand() used for? Explain with an example.
4. Write a Python program to create a numpy array having 8 equi-spaced elements, starting at 4 and ending at 128.
5. Consider the following data:

Heights (in inches) for boys:

66; 66; 67; 67; 68; 68; 68; 68; 68; 69; 69; 69; 70; 71; 72; 72; 72; 73; 73; 74

Heights (in inches) for girls:

61; 61; 62; 62; 63; 63; 63; 65; 65; 65; 66; 66; 66; 67; 68; 68; 68; 69; 69; 69

On a single scale, construct box plots for heights of boys and girls. State which box plot has the wider spread for the middle 50% of the data.

6. Explain broadcasting in Python with examples.
7. Consider a dataset named Banking, of csv format, having the following attributes: Customer ID, Age, Job, Marital Status, Education, Balance

   Write code to execute the following in Python:

   a) Import the dataset in pandas.
   b) Give a short statistical summary of the data. Does this summary include the mode of the attributes?
   c) Find the unique values of Education attribute.
   d) Plot a bar graph showing the counts of different Job categories.
   e) Plot a bar graph showing the counts of different Job categories for entries having Age between 30 and 50.
   f) Plot a histogram to show the distribution of the Balance attribute.
   g) Plot a scatter plot between Age and Balance. Can you comment on the correlation between the variables by looking at this plot?
8. Explain, with the help of examples, how to improve plot aesthetics by changing colours, changing layout and adding annotations in matplotlib.pyplot.

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Sheldon M Ross	Introduction to Probability and Statistics for Engineers and Scientists		Elsevier Academic Press
B. Lubanovic	Introducing Python		O'Reilly
Reference Books:			
Murray R. Spiegel, Larry J. Stephens	Schaum's Outlines on Statistics		McGraw-Hill
Eric Matthes	Python Crash Course		No Starch Press
Ivan Idris	Numpy Beginner's Guide		Packt Publishing

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				

B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Pattern Recognition and Pattern Recognition Lab			
Course Code: PGIT(AI)103B, PGIT(AI)193			
Duration:36 Hrs.		**Semester:1st**	
Teaching Scheme		**Maximum Marks:200**	
Theory:3		**Examination Scheme**	
Tutorial:0		End Semester Exam:70	
Practical:4		Attendance : 5	
Credit:3+2		Continuous Assessment: 25	
		Practical Sessional internal continuous evaluation:40	
		Practical Sessional external examination:60	
Aim:			
Sl. No.			
1.	Ability to Understand and apply both supervised and unsupervised classification methods to detect and characterize patterns in real-world data		
Objective:			
Sl. No.			
1.	Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms		
2.	Understand the basic methods of feature extraction, feature evaluation, and data mining.		
Pre-Requisite:			
Sl. No.			
1.	Fundamentals of Programming		
2.	**Mathematics**		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit 1:** Introduction to pattern recognition : Basic concepts- Definitions, data sets for Pattern Recognition, Structure of a typical pattern recognition system. Different Paradigms of Pattern Recognition. Representations of Patterns and Classes. Metric and non-metric proximity measures.	6	14
02	Unit 2: Features selection Feature vectors - Feature spaces - Different approaches to Feature Selection-Branch and Bound Schemes. Sequential Feature Selection.	6	14
03	Unit 3: Features extraction Principal Component Analysis (PCA), Kernel PCA	6	14
04	Unit 4: Pattern classification Pattern classification using Statistical classifiers - Bayes' classifier - Classification performance measures – Risk and error probabilities. Linear Discriminant Function, Mahalanobis Distance, K-NN Classifier, Fisher's LDA, Single Layer Perceptron, Multi-layer Perceptron, Training set, test set; standardization and normalization	12	14
04	Unit 5:	6	14

	Clustering Basics of Clustering; similarity / dissimilarity measures; clustering criteria. Different distance functions and similarity measures. K-means algorithm, K-medoids, DBSCAN		
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Assignments (based on theory classes):
List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Sheldon M Ross	Introduction to Probability and Statistics for Engineers and Scientists		Elsevier Academic Press
B. Lubanovic	Introducing Python		O'Reilly
Reference Books:			
Murray R. Spiegel, Larry J. Stephens	Schaum's Outlines on Statistics		McGraw-Hill
Eric Matthes	Python Crash Course		No Starch Press
Ivan Idris	Numpy Beginner's Guide		Packt Publishing

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	**70**
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:		
Practical Internal Sessional Continuous Evaluation		
Internal Examination:		
Continuous evaluation		**40**
External Examination: Examiner-		
Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Knowledge Representation & Reasoning and Knowledge Representation & Reasoning Lab			
Course Code: PGIT(AI)104A,PGIT194			
Duration:36 Hrs.		**Semester:1st**	
Teaching Scheme		**Maximum Marks:200**	
Theory:3		**Examination Scheme**	
Tutorial:0		End Semester Exam:70	
Practical:4		Attendance : 5	
Credit:3+2		Continuous Assessment: 25	
		Practical Sessional internal continuous evaluation:40	
		Practical Sessional external examination:60	
Aim:			
Sl. No.			
1.	Ability to learn key techniques of the Knowledge Representation & Reasoning		
Objective:			
Sl. No.			
1.	Familiarize students with the basic and advanced techniques of Knowledge Representation & Reasoning		
2.	to learn key techniques of the Knowledge Representation & Reasoning		
Pre-Requisite:			
Sl. No.			
1.	Discrete mathematics, Set theory; Complexity theory		
2			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit 1:** Introduction, Propositional Logic Language,Semantics and Reasoning,Syntax and Truth Values,Valid Arguments and Proof Systems, Rules of Inference and Natural Deduction,Axiomatic Systems and Hilbert Style Proofs, The Tableau Method, The Resolution Refutation Method	**4**	**10**
02	**Unit 2**: First Order Logic (FOL) Syntax,Semantics,Entailment and Models,Proof Systems, Forward Chaining, Unification, Forward Chaining Rule Based Systems, The Rete Algorithm,Programming in	**4**	**10**
03	**Unit 3:** Representation in FOL Skolemization,Knowledge Representation,Properties and Categories, Reification and Abstract Entities, Resource Description Framework (RDF), The Event Calculus: Reasoning About Change	**4**	**10**
04	**Unit 4:** Mapping Natural Language to FOL Understanding = Fulfilling Expectations, Conceptual Dependency (CD) Theory, Understanding Language, ConceptualAnalysis: Mapping English to CD Theory	**4**	**10**
05	**Unit 5:** Programming in Logic Deductive Retrieval in Backward Chaining, Logic 3 NPTEL http://nptel.ac.in Computer Science and Engineering Pre-requisites: Some exposure to formal languages,	**5**	**10**

	logic and programming Coordinators: Prof. Deepak Khemani Department of computer ScienceIIT Madras Programming,Prolog, Depth First Search and Efficiency Issues, Controlling Search, The Cut Operator in Prolog		
06	**Unit 6:** Theorem Proving in FOL Incompleteness of Forward and Backward Chaining, The Resolution Refutation Method for FOL, Clause Form and The Resolution Rule, FOLwith Equality, Complexity Knowledge Structures Semantic Nets using Frames,Scripts,ScriptApplier Mechanism (SAM), Goals,Plans and Actions,Plan Applier Mechanism (PAM):Expectations and Recognition,PAM: Top Down and Bottom Up Reasoning	**5**	**5**
07	**Unit 7:** Ontology and Description Logics A Description Logic, Normalisation,Structure Matching, Classification,A-box Reasoning,Extensions,ALC, Further Extensions. Unit 10: Inheritance Taxonomies and Inheritance,Beliefs, Credulous and Skeptical Reasoning	**4**	**5**
08	**Unit 8:** Default Reasoning Introduction to Default Reasoning, Circumscription, Minimal Models, The Event Calculus Revisited, Default Logic, Autoepistemc Logic. Reasoning in Multi-agent Systems Epistemic Logic:Kripke Semantics in a MultiAgent Scenario, The Muddy Children Puzzle	**6**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Assignments (based on theory classes):
List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Schank, Roger C., Robert P.Abelson	Goals, and Understanding:An Inquiry into Human Knowledge Structures.		
R. C.Schank and C.K. Riesbeck	Inside Computer Understanding: Five Programs Plus Miniatures, Lawrence Erlbaum, 1981.		
Reference Books:			
Murray Shanahan	A Circumscriptive Calculus of Events.Artif. Intell		

List of equipment/apparatus for laboratory experiments:			
Sl. No.			
1.	Computer		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	**70**
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:		
Practical Internal Sessional Continuous Evaluation		
Internal Examination:		
Continuous evaluation		**40**
External Examination: Examiner-		
Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Expert Systems and Expert Systems Lab			
Course Code: PGIT(AI)104B,PGIT194			
Duration:36 Hrs.		**Semester:1st**	
Teaching Scheme		**Maximum Marks:200**	
Theory:3		**Examination Scheme**	
Tutorial:0		End Semester Exam:70	
Practical:4		Attendance : 5	
Credit:3+2		Continuous Assessment: 25	
		Practical Sessional internal continuous evaluation:40	
		Practical Sessional external examination:60	
Aim:			
Sl. No.			
1.	Ability to learn key techniques of the Expert Systems		
Objective:			
Sl. No.			
1.	Familiarize students with the basic and advanced techniques of Expert Systems		
2.	to learn key techniques of the Expert Systems		
Pre-Requisite:			
Sl. No.			
1.	Discrete mathematics, Set theory; Complexity theory		
2			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit 1:** Overview of AI : What is AI? The importance of AI, Early works in AI, AI and Related fields. Knowledge: Importance of Knowledge, knowledge-based system representation, organization, manipulation, acquisition.	**4**	**10**
02	**Unit 2**: Search Techniques: Problem Solving, State space search, Blind search: Depth first search, Breadth first search, informed search: Heuristic search, Hill climbing search, Best first search, A*, AO*, Constraint satisfaction. Game Playing: Minimax search, Alpha – beta pruning.	**4**	**10**
03	**Unit 3:** Knowledge Representation:	**4**	**10**

	Predicate Logic (well formed formulas, quantifiers, Prenex Normal Form, Skolemization , Unification, Modus pones, Resolution refutation – various strategies), Rule Based Systems (Forward reasoning: Conflict resolution , Conflict resolution, backward reasoning: Use of No. Backtracking, Structured Knowledge Representations (Semantic Net: slots, inheritance, Frames: exceptions and defaults handling. Conceptual Dependency formalism, Object oriented representations.		
04	**Unit 4:** Handling uncertainty: Probabilistic reasoning: Bayes Net, Dempster Shafer Theory, Use of certainty Factors, Fuzzy Logic, Non monotonic reasoning, Dependency directed backtracking, Truth maintenance systems, Learning : Concept of learning, Learning automation, The Genetic algorithm, Learning by induction, Neural Networks: Hopfield Networks, Perceptrons-Learning algorithm, Back propagation Network, Boltzman Machine, Recurrent Networks.	**4**	**10**
05	**Unit 5:** Planning: Components of Planning System, Plan Generation Algorithms: Forward state propagation, Backward state propagation, Nonlinear planning using constraint posting, Natural Language Processing: Syntactic analysis, Top down and bottom up parsing, Augmented Transition Networks, Semantic analysis, case grammars.	**5**	**10**
06	**Unit 6:** Expert System: Need and Justification for expert systems- cognitive problems, Expert System Architectures(Rule based systems, Non production system,	**5**	**5**

	knowledge acquisition, Case studies: MYCIN , R1.		
07	**Unit 7:** Ontology and Description Logics A Description Logic, Normalisation,Structure Matching, Classification,A-box Reasoning,Extensions,ALC, Further Extensions. Unit 10: Inheritance Taxonomies and Inheritance,Beliefs, Credulous and Skeptical Reasoning	**4**	**5**
08	**Unit 8:** Default Reasoning Introduction to Default Reasoning, Circumscription, Minimal Models, The Event Calculus Revisited, Default Logic, Autoepistemc Logic. Reasoning in Multi-agent Systems Epistemic Logic:Kripke Semantics in a MultiAgent Scenario, The Muddy Children Puzzle	**6**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Assignments (based on theory classes):
List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Joseph C. Giarratano	Expert systems		
D. A. Waterman	A Guide to Expert System		

Reference Books:

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	**70**
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Research Methodology and IPR**			
Course Code: PGIT(AI)105		**Semester: 1st**	
Duration: 36 hours		**Maximum Marks:100**	
Teaching Scheme		**Examination Scheme**	
Theory:2		End Semester Exam:70	
Tutorial:0		End Semester Exam:70	
Practical:0		Attendance : 5	
Credit: 2		Continuous Assessment: 25	
Aim:			
Sl. No.			
1.	**Understand research problem formulation.**		
2.	**Analyze research related information**		
3.	**Follow research ethics**		
Objective:			
Sl. No.			
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 emphasise 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.**		
Pre-Requisite:			
Sl. No.			
3.			
4.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors**	**6**	**14**

	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.		
02	**Effective literature studies approaches, analysis Plagiarism, Research ethics**	**6**	**10**
03	**Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.**	**6**	**14**
04	**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.**	**6**	**14**
05	**Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.**	**6**	**14**
06	**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.**	**6**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Skills to be developed:
List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)
Based on theory
Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

1. StuartMelvilleandWayneGoddard,	**"Researchmethodology: an introduction for science & engineering students'"**		
WayneGoddardand StuartMelville,	**"ResearchMethodology: An Introduction"**		
Ranjit Kumar,	**"Research Methodology: A Step by Step Guide for**	**2nd Edition,**	

	beginners"		
T. Ramappa, S. Chand,	**"Intellectual Property Rights Under WTO",**	**2008**	
Robert P. Merges, Peter S. Menell, Mark A. Lemley,	**" Intellectual Property in New Technological Age",**	**2016.**	
Asimov,	**"Introduction to Design", Prentice Hall,**	**1962.**	
Mayall,	**"Industrial Design",**		**McGraw Hill, 1992.**
Halbert,	**"Resisting Intellectual Property",**		**Taylor & Francis Ltd ,2007.**
Niebel,	**"Product Design",**		**McGraw Hill, 1974.**

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1	
2	
3	

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**All**	**10**	**10**	**5**	**3**	**15**	**70**
B	**All**			**5**	**3**	**45**	
C	**All**						

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** English for research paper writing	
Course Code:PGIT(AI)106A	**Semester: 1st**
Duration: 24 hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**
Theory:02	End Semester Exam:70
Tutorial:	End Semester Exam:70
Practical:	Attendance : 5
Credit:0	Continuous Assessment: 25

Aim:			
Sl. No.			
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 Ensure the good quality of paper at very first-time submission**		
Objective:			
Sl. No.			
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 Ensure the good quality of paper at very first-time submission**		
Pre-Requisite:			
Sl. No.			
1.	**Basic Knowledge of English**		
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness**	**4**	**14**
02	**Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts.Introduction**	**4**	**14**
03	**Review of the Literature, Methods, Results, Discussion, Conclusions, TheFinal Check.**	**4**	**10**
04	**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,**	**4**	**4**
05	**skills are needed when writing the Methods, skills needed when writingthe Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions**	**4**	**14**
06	**useful phrases, how to ensure paper is as good as it could possibly bethe first- time submission**	**4**	**14**
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**
Assignments: Based on theory			

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher

Reference 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'sbook.**
4. **Adrian Wallwork,**	**English for Writing Research Papers,**		**Springer New York Dordrecht Heidelberg London, 2011.**

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Disaster management**	
Course Code:PGIT(AI)106B	**Semester: 1st**
Duration:24 hrs	**Maximum Marks:100**

Teaching Scheme	**Examination Scheme**
Theory:02	End Semester Exam:70
Tutorial:0	End Semester Exam:70
Practical:0	Attendance : 5
Credit: 0	Continuous Assessment: 25

Aim:	
Sl. No.	
1.	**learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.**
2.	**critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or thecountries they work in**
3.	

Objective:	
Sl. No.	
1.	**learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.**
2.	**critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or thecountries they work in**
3.	**critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.**
4.	**develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.**

Pre-Requisite:	
Sl. No.	
1.	
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** **Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. 4** **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.**	**4**	**16**
02	**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**	**4**	**17**
04	**Disaster Preparedness And Management** **Preparedness: Monitoring Of Phenomena Triggering A**	**4**	**15**

	Disaster Or Hazard; Evaluation Of Risk:ApplicationOf Remote Sensing, Data FromMeteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.		
05	**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.**	**4**	**8**
06	**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.**	**4**	**14**
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

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

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				

B C	ALL ALL			5 5	3 3	5 15	70

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Sanskrit for technical knowledge**			
Course Code:PGIT(AI)106C			
Duration: 24 hours		**Semester: 1st**	
Teaching Scheme		**Maximum Marks:100**	
Theory:02		**Examination Scheme**	
Tutorial:0		End Semester Exam:70	
Practical:0		End Semester Exam:70	
Credit: 0		Attendance : 5	
		Continuous Assessment: 25	
Aim:			
Sl. No.			
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**		
Objective:			
Sl. No.			
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**		
6.	**huge knowledge from**		
Pre-Requisite:			
Sl. No.			
1.			
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	• **Alphabets in Sanskrit,** • **Past/Present/Future Tense,** • **Simple Sentences**	**8**	**25**

02	• **Order** • **Introduction of roots** • **Technical information about Sanskrit Literature**	**8**	**25**
03	• **Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics**	**8**	**20**
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

1. Dr.Vishwas, Samskrita-Sansthanam, New Delhi Publication	**"Abhyaspustakam" –**		**Bharti Publication, New Delhi**
2. Prathama Deeksha-	**"Teach Yourself Sanskrit"**		**VempatiKutumbshastri, Rashtriya Sanskrit**
3. Suresh Soni,	**"India's Glorious Scientific Tradition"**		**Ocean books (P) Ltd., New Delhi.**

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each**	**Question to be**	**Question to be**

		question	set	answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:			
Practical Internal Sessional Continuous Evaluation			
Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments	**10**		
On Spot Experiment	**40**		
Viva voce	**10**		**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Value education			
Course Code: PGIT(AI)106D	**Semester: 1st**		
Duration: 36 hours	**Maximum Marks:100**		
Teaching Scheme	**Examination Scheme**		
Theory:02	End Semester Exam:70		
Tutorial:0	End Semester Exam:70		
Practical:0	Attendance : 5		
Credit:0	Continuous Assessment: 25		
Aim:			
Sl. No.			
1.	**Knowledge of self-development**		
2.	**Learn the importance of Human values**		
3.	**Developing the overall personality**		
Objective:			
Sl. No.			
1.	**Understand value of education and self- development**		
2.	**Imbibe good values in students**		
3.	**Let the should know about the importance of character**		
Pre-Requisite:			
Sl. No.			
1.			
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	• **Values and self-development –Social values and**	**6**	**10**

	individual attitudes. Work ethics, Indian vision of humanism. • **Moral and non- moral valuation. Standards and principles.** • **Value judgements**		
02	• **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**	**6**	**20**
03	• **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**	**6**	**20**
04	• **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**	**6**	**20**
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:			
Chakroborty, S.K.	**"Values and Ethics for organizations Theory and practice"**		**Oxford University Press, New Delhi**

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Semester II

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Advanced Algorithms	
Course Code: PGIT(AI)201	**Semester: 2nd**
Duration: 36Hours	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3	End Semester Exam: 70
Tutorial: 0	Attendance: 05
Practical: 0	Internal Assessment: 25
Credit: 3	

Aim:	
Sl. No.	
4.	Ability to read and understand of different methods to analyze the complexity/performance of different algorithms.
5.	Understanding of various algorithms in-depth.
6.	Understanding of recent activities in the field of the advanced data structure.

7.	Ability to to write different algorithms in real life applications.		
Objective:			
Sl. No.			
4.	Introduce students to the advanced methods of designing and analyzing algorithms.		
5.	The student should be able to choose appropriate algorithms and use it for a specific problem.		
6.	To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.		
7.	Students should be able to understand different classes of problems concerning their computation difficulties.		
8.	To introduce the students to recent developments in the area of algorithmic design.		
Pre-Requisite:			
Sl. No.			
5.	Understanding of basic Data Structures		
6.	Understanding of Discrete Mathematics		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	**6**	**10**
02	Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	**6**	**14**
03	Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	**6**	**14**
04	Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm	**6**	**14**
05	Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	**6**	**14**

06	Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	**6**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
H.coreman	**Advance Algorithm**		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Name of the Course M.Tech. in Information Technology (Artificial Intelligence)

Subject: Artificial Neural Networks

Course Code: PGIT(AI)202, PGIT(AI)292	**Semester: 2 nd**
Duration: 36Hrs.	**Maximum Mark**s: 200
Teaching Scheme	**Examination Scheme**
Theory: 3	End Semester Exam: 70

Tutorial: 0		Teacher's Assessment: 5	
Practical: 4		Internal Assessment: 25	
Credit: 3+2		Practical Sessional internal continuous evaluation: 40	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1	In-depth understanding of various concepts of artificial neural network (ANN), Deep Neural Network (DNN) and Convolutional Neural Network (CNN).		
2	Ability to understand computational complexity of a neural network.		
3	Ability to understand the techniques of hyper parameter tuning.		
4.	Ability to utilize ANN, DNN and CNN in solving real-time Artificial Inteligence (AI) led decision making problems.		
Objective:			
Sl. No.			
1	To study a computational model of the human neural system and its applications		
2	To explore Deep learning technique and various feature extraction strategies.		
3			
Pre-Requisite:			
Sl. No.			
1	Understanding basic concepts of linear algebra.		
2	Understanding basic concepts of machine learning.		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Biological neuron, artificial neuron as a computational model of a neuron, activation functions, architectures for ANNs, linear neural networks, Hebbs learning law	6	18
02	Non-linear neural networks: Perceptron- learning law, convergence theorem; multilayer feed forward neural networks-structure, activation functions, error back propagation learning, delta learning law, generalized delta rule, learning factors, convergence criteria, momentum factor in learning, conjugate gradient method for learning, universal approximation theorem, cross validation method for selecting the architecture, bias-	15	16

	variance dilemma		
03	Statistical learning theory, principle of empirical risk minimization, Radial basis function networks: RBF networks for function approximation, RBF networks for pattern classification, Support vetcor machines: SVM for linearly separable classes, SVM for linearly non-separable classes, SVM for nonlinearly separable classes using kernels, multi-class pattern classification using SVMs	4	10
04	Feedback neural networks: Problem of pattern storage and retrieval, discrete Hopfiled networks, dynamical systems, energy function of hopfield model, energy analysis of hopfiled model.	6	10
05	Introduction to deep neural networks, convolution neural networks, recurrent neural networks, Boltzman machine	5	16
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

1.Ability to implement solve any AI led problems using neural networks.
2.Ability to learn hyper parameters tuning strategies.
3.Ability to perform a comparative study of different neural networks for a given problem.

List of Practical:

1. Write a Python program to implement the basic unit (neuron) of a neural network.

2. Write definitions for different activation functions and their derivatives in python.

3. Write definitions for different loss (cost) functions and their derivatives in python.

4. Implement the back propagation algorithm from scratch.

5. Implement a simple neural network to solve the XOR problem from scratch.

6. Write a program in KERAS to implement an ANN that predicts insurance cost for a customer (Dataset will be provided).

7. Develop a machine learning (ML) model that predicts houses rent in different cities in a

given

country (Dataset will be provided).

8. Implement a supervised ANN model to correctly predict the flower species from the measured

Attributes.

9. Implement a supervised ANN model to correctly predict the flower species from the measured

Attributes.

10. Implement a supervised model through convolutional neural network to classify hand-written

Digits (Dataset: MNIST to be used).

Assignments:

1. Explain the working principle of the basic unit (neuron) of a neural network.

2. Explain how the learnable parameters of an ANN are updated through back propagation

algorithm in details.

3. Write definitions of different activation and loss (cost) functions used in ANN. Also find their

derivatives.

4. Discuss the strategies to prevent over-fitting and under-fitting problems often encounter in a

deep neural network .

5. Discuss vanishing gradient problem often occurred during training of a deep neural network.

Also, discuss how the problem can be overcome.

6. Discuss how a multi-class pattern classification can be implemented using Support Vector

Machine (SVM).

7. Describe how a discrete Hopfiled network can be used as a feedback neural network.

8. Describe the process of convolution operation. How the convolutional operations can be used in

deep neural network for pattern classification.

List of Books

Text Books:

Name of Author	**Title of the Book**	Edition/ISSN/ISBN	**Name of the Publisher**
Simon S. Haykin,	Neural Networks and Learning Machines	3rd Edition	Prentice Hall
Sathish Kumar	Neural Networks: A Classroom Approach	3rd Edition	Tata McGraw Hill
Reference Books:			
B. Yegnanarayana	Artificial Neural Networks	1st Edition	Prentice Hall India Learning Pvt. Ltd
Snehashish Chakraverty and Susmita Mall	Artificial neural networks for engineers and scientists: solving ordinary differential equations	ISBN 9781498781381	CRC Press
Tariq Rashid	Make Your Own Neural Network: A Gentle Journey Through the Mathematics of Neural Networks, and Making Your Own Using the Python Computer Language	ISBN 1530826608, 9781530826605	CreateSpace Independent Publishing Platform

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer

End Semester Examination Scheme. **Maximum Marks-70.** **Time allotted- 3hrs.**

Group	**Unit**	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Natural Language Processing	
Course Code: PGIT(AI)203A	**Semester: I**
Duration: 36 Hrs.	**Maximum Marks: 200**
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam: 70**
Tutorial: 0	**Attendance : 5**
Practical: 4	**Continuous Assessment: 25**
Credit: 3 + 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	After completion of course, students would be able to:
2.	Understand the semantic for language processing.
3.	Apply NLP for language processing.

Objective:

Sl. No.	
1.	Gain an in-depth understanding of the computational properties of natural languages.
2.	Understanding semantics and pragmatics of English language for processing
3.	How key concepts from NLP are used to describe and analyze language
4	POS tagging and context free grammar for English language.
5	Gain an in-depth understanding of the computational properties of natural languages.

Pre-Requisite:

Sl. No.	
1.	UG level course in Algorithm Design and Analysis

Contents	**Hrs./week**

Chapter	Name of the Topic	**Hours**	**Marks**
01	Introduction- Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes.	**6**	**10**
02	Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML, Management of linguistic data with the help of GATE, NLTK. Regular expressions, Finite State Automata, word recognition, lexicon.	**6**	**12**
03	Morphology, acquisition models, Finite State Transducer. N-grams, smoothing, entropy, HMM, ME, SVM, CRF. Part of Speech tagging- Stochastic POS tagging, HMM.	**6**	**10**
04	Handling of unknown words, named entities, multi word expressions. A survey on natural language grammars, lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax. Parsing- Unification, probabilistic parsing, TreeBank.	**6**	**20**
05	Semantics- Meaning representation, semantic analysis, lexical semantics, WordNet Word Sense Disambiguation- Selectional restriction, machine learning approaches, dictionary based approaches. Discourse- Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure.	**6**	**15**
06	Applications of NLP- Spell-checking, Summarization Information Retrieval- Vector space model, term weighting, homonymy, polysemy, synonymy, improving user queries. Machine Translation– Overview.	**6**	**3**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

1. Understanding NLP problem.
2. Familiar with different ML/AI model used for NLP.
3. Uses of NLTK

Practical & projects:

1. Build your own segmentation model for text to sentence and sentence to word.
2. Introduce NLTK library for natural language processing.
3. Build a spell checker using edit distance algorithm for a limited vocabulary.
4. Spam and Ham identification using Naïve based algorithm.
5. Build a Parts of speech tagger from look-up-table.
6. Build a Parts of speech tagger from using N-gram model.
7. Build a Parts of speech tagger using HMM model.
8. Sentiment analysis using Naïve based algorithm.
9. Context identification using SVM.
10. Introduce RNN in Sentiment analysis.

Assignments:

1. Explain different prepressing steps need for NLP.
2. State Naïve based assumption. Explain Naïve based algorithm.
3. What is parts of speech? Explain pos tagger using Veterbi algorithm.
4. Explain edit distance algorithm. Give its application.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
5. Daniel Jurafsky 6. James H. Martin	7. An Introduction to Natural Language Processing, 8. Computational Linguistics, and Speech Recognition	9. Third Edition draft	10. Tata McGraw-Hill
11. Gary J. Bronson	12. A First Book of ANSI C	13. 4th Edition	14. ACM

Reference Books:

James A	Natural language Understanding 2e		Pearson Education, 1994
Bharati A., Sangal R., Chaitanya V.	Natural language processing: a Paninian perspective		PHI, 2000
Siddiqui T., Tiwary U. S.	Natural language processing and Information retrieval		OUP, 2008

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**

C	**ALL**	**15**	**5**	**3**
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Continuous evaluation				**40**
External Examination: Examiner-				
Signed Lab Assignments			**10**	
On Spot Experiment			**40**	
Viva voce			**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence**)** **Subject:** Advanced Data Mining	
Course Code: PGIT(AI)203A, PGIT(AI)293	**Semester:** 2nd
Duration: 36 Hrs.	Maximum Marks: 200
Teaching Scheme	Examination Scheme
Theory: 3	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical: 4	Continuous Assessment: 25
Credit: 3 + 2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	Students should be able to understand different classes of problems concerning their computation difficulties
2.	Ability to introduce the students to recent developments in the area of algorithmic design.

Objective:	
Sl. No.	
1.	Introduce students to the advanced methods of designing and analyzing algorithms.
2.	The student should be able to choose appropriate algorithms and use it for a specific problem.

Pre-Requisite:	
Sl. No.	
1.	Understanding of basic logic and programming.

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01		**6**	**10**

	Introduction, Incremental & Stream Data Mining · Incremental Algorithms for Data Mining · Characteristics of Streaming Data · Issues and Challenges · Streaming Data Mining Algorithms · Any time stream Mining		
02	Distributed computing solutions for data mining · MapReduce/Hadoop and Spark · Cluster Computing	**6**	**14**
03	Mining Complex Structures · Algorithmic Development Issues · Mining trees o Tree Model Guided Framework o TMG framework for mining ordered & unordered subtrees o Tree Mining Applications · Mining Graphs o Approaches to graph mining	**6**	**14**
04	Sequence Mining · Characteristics of Sequence Data · Problem Modelling · Sequential Pattern Discovery · Timing Constraints · Applications in Bioinformatics	**6**	**14**
05	Text Mining · Text Classification · Vector Space Model · Flat and Hierarchical Clustering. Web Search · Crawling & Indexing · Hyperlink Analysis	**6**	**14**

	· Page Rank algorithm · Web Search and Information Retrieval · Case Study: Query Recommender System		
06	Multivariate Time Series (MVTS) Mining · Importance of MVTS data · Sources of MVTS data · Mining MVTS data o Sign Language Data o Agro-meteorological Data	**6**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Practical:

1. Based on theory lectures.

Assignments:

Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Hadzic F., Tan H. & Dillon T. S	Mining data with Complex Structures		Springer.
Yates R. B. and Neto B. R	"Modern Information Retrieval" Pearson Education		

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence)

Subject: Soft Computing	
Course Code: PGIT(AI)204B, PGIT(AI)294	**Semester:** 2nd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	Cover the concepts of Fuzzy logic (FL), Artificial Neural Networks (ANNs) and Genetic Algorithm (GA).
2.	Ability to apply Soft Computing techniques to solve a number of real life problems.
3.	Provide exposure to theory as well as practical systems and software used in soft computing.

Objective:

Sl. No.	
1.	To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2.	To implement soft computing based solutions for real-world problems.
3.	To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.

Pre-Requisite:

Sl. No.	
1.	Understanding of basic mathematical logic.

Contents	**Hrs./week**

Chapter	Name of the Topic	Hours	Marks
01	**INTRODUCTION TO SOFT COMPUTING:** Evolution of Computing, Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics	**7**	**10**
02	**FUZZY LOGIC:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	**9**	**17**
03	**NEURAL NETWORKS:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks	**10**	**17**
04	**GENETIC ALGORITHMS:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.	**5**	**12**
05	Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.	**5**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Practical:

1. Write a program in MATLAB to plot various membership functions.
2. Use Fuzzy toolbox to model tip value that is given after a dinner which can be-not good, satisfying, good and delightful and service which is poor, average or good and the tip value will range from Rs. 10 to 100.
3. Implement FIS Editor.
4. Generate AND, NOT function using McCulloch-Pitts neural net by MATLAB program.
5. Write a MATLAB program for Perceptron net for an AND function with bipolar inputs and targets.
6. Write a MATLAB program for Hebb Net to classify two dimensional input patterns in bipolar with their given targets.
7. Write a MATLAB Program on Back propagation neural network.
8. Write the algorithm of Genetic Algorithm

Assignments:

Based on theory Lecture.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani	Neuro-Fuzzy and Soft Computing		Prentice:Hall of India, 2003.
George J. Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic: Theory and Applications		Prentice Hall, 1995.

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**

B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:			
Practical Internal Sessional Continuous Evaluation			
Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Big Data Analytics	
Course Code: PGIT(AI)203C, PGIT(AI)293	**Semester:** 2 nd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	Ability to Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tool.
Objective:	
Sl. No.	
1.	Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tool.
Pre-Requisite:	
Sl. No.	
1.	Data Structure, Computer Architecture and Organization

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big	**6**	**14**

	data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics		
02	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations	**6**	**14**
03	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structureesonance architectures, Advances in Neural networks	**6**	**14**
04	MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output format	**6**	**14**
05	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration	**6**	**10**
06	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	**6**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Practical:

1.Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Hadzic F., Tan H. &	Mining data with		Springer

Dillon T. S	Complex Structures"		
Yates R. B. and Neto B. R.	Modern Information Retrieval		Pearson Education
Tan P. N., Steinbach M & Kumar V	Introduction to Data Mining		Pearson Education

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Computational Intelligence	
Course Code: PGIT(AI)203D, PGIT(AI)293	**Semester:** 2 nd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1	Gain comprehensive theoretical knowledge as well as practical skills related to the design, implementation and analysis of CI approaches, algorithms and methods.
2	Explain, critically review, and discuss research papers in areas of CI; independently analyse research papers in areas of CI and write literature review papers on topics of CI
	.

Objective:	
Sl. No.	
1	Gain comprehensive theoretical knowledge as well as practical skills related to the design, implementation and analysis of CI approaches, algorithms and methods.
2	Explain, critically review, and discuss research papers in areas of CI; independently analyse research papers in areas of CI and write literature review papers on topics of CI
3.	Discuss and argue about current topics in CI;

Pre-Requisite:	
Sl. No.	

1.	Should have knowledge of high level programming language (like C,C++, or Java).		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to Computational Intelligence	**6**	**14**
02	Artificial Neural Networks	**6**	**14**
03	Genetic Algorithms	**6**	**14**
04	Swarm Optimization	**6**	**10**
05	Fuzzy Systems..	**6**	**4**
06	Hybridization of CI Algorithms	**6**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

List of Practical:

Based on theory lectures.

Assignments:

Based on theory.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Andries P.	**Computational Intelligence: An**		

Engelbrecht	**Introduction**		

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Geographical Information System	
Course Code: PGIT(AI)204A	**Semester:** 2nd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1	To Introduce the technology and principles of Satellite Imaging
2	To makePotential of remote sensing and GIS is solving problems in water resources through case studies.

Objective:

Sl. No.	
1.	To teach the principles and applications of remote sensing, GPS and GIS in the context of water resources. At the end of the course, the student will appreciate the importance of remote sensing and GIS in solving the spatial problems in water resources.

Pre-Requisite:

Sl. No.	

Contents		**Hrs./week**	
Chapter	Name of the Topic	**Hours**	**Marks**

01	Introduction, Geographical concepts and Terminology, Difference between Image Processing system and GIS, Utility of GIS.	**7**	**10**
02	Various GIS packages and their salient features, Essentials components of GIS, Data acquisition through scanners and digitizers	**9**	**17**
03	Raster and Vector Data: Introduction, Descriptions: Raster and Vector data, Raster Versus Vector, Raster to Vector conversion, Remote Sensing Data in GIS, Topology and Spatial Relationships, Data storage verification and editing	**10**	**17**
04	Data preprocessing, Georeferencing, Data compression and reduction techniques, Runlength encoding, Interpolation of data, Database Construction, GIS and the GPS, Data Output Database structure, Hierarchical data, Network systems, Relational database, Database management, Data manipulation and analysis	**5**	**12**
05	Spatial and mathematical operations in GIS, Overlay, Query based, Measurement and statistical modelling, Buffers, Spatial Analysis, Statistical Reporting and Graphing Programming languauges in GIS, Virtual GIS, Web GIS Application of GIS to various natural resources mapping and monitoring and engineering problems.	**5**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of Practical:

1.Based on theory lectures.

Assignments:

1. Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Burrough, P.A. and Mc Donnel, R.A	Principles of Geographic Information System		Oxford University Press. 2000 .
Chrisman, Nicholas R	Exploring Geographic Information Systems		John Wiley. 2002

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Continuous evaluation				**40**
External Examination: Examiner-				
Signed Lab Assignments			**10**	
On Spot Experiment			**40**	
Viva voce			**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Constitution of India**	
Course Code:PGIT(AI)205A	**Semester: 2nd**
Duration: 24 Hours	**Maximum Marks:** 100
Teaching Scheme	**Examination Scheme**
Theory:02	**End Semester Exam:** 70
Tutorial:	**Attendance :** 5
Practical:	**Continuous Assessment:** 25
Credit: 0	

Aim:	
Sl. No.	
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.**
Objective:	
Sl. No.	
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 BolshevikRevolution in 1917 andinitial drafting of the Indian Constitution.**
Pre-Requisite:	
Sl. No.	
1.	
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**History of Making of the Indian Constitution:** HistoryDrafting Committee, (Composition & Working)	**4**	**14**
02	**Philosophy of the Indian Constitution:** Preamble Salient Features	**4**	**14**
03	**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	**4**	**14**

	• Fundamental Duties.		
04	**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	**4**	**14**
05	**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: ZilaPachayat. • Elected officials and their roles, CEO ZilaPachayat: Position and role. • Block level: Organizational Hierarchy (Different departments), • Village level: Role of Elected and Appointed officials, • Importance of grass root democracy	**4**	**4**
06	**Election Commission:** • Election Commission: Role and Functioning. • Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women.	**4**	**10**
07			
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**

Practical:
List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference 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.**

List of equipment/apparatus for laboratory experiments:

Sl. No.	
6.	
7.	
8.	
9.	
10.	

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Pedagogy Studies**	
Course Code:PGIT(AI)205B	**Semester: 2nd**
Duration: 24 Hours	**Maximum Marks:** 100

Teaching Scheme	**Examination Scheme**
Theory:02	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit:0	

Aim:	
Sl. No.	
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?**

Objective:	
Sl. No.	
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.**
3.	

Pre-Requisite:	
Sl. No.	
1.	
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**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.	**4**	**14**
02	**Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.** • Curriculum, Teacher education.	**4**	**14**
03	**Evidence on the effectiveness of pedagogical practices** • Methodology for the in-depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) 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.	**4**	**14**
04	**Professional development: alignment with classroom practices and follow-up support**	**4**	**14**

	• Peer support • Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes		
05	**Research gaps and future directions** • **Research design** • **Contexts**	**4**	**4**
06	**Pedagogy** • Teacher education • Curriculum and assessment • Dissemination and research impact.	**4**	**10**
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**

Practical:

Assignments:
Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference 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**		**Oxford and Boston:**

	pedagogy: International comparisons in primary education.		**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.**		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Stress management by Yoga**	
Course Code:PGIT(AI)205C	**Semester: 2nd**
Duration: 24 Hours	**Maximum Marks:** 100
Teaching Scheme	**Examination Scheme**
Theory:02	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit: 0	

Aim:	
Sl. No.	
1.	**Develop healthy mind in a healthy body thus improving social health**
2.	**Improve efficiency**
3.	

Objective:	
Sl. No.	
1.	**To achieve overall health of body and mind**
2.	**To overcome stress**
3.	

Pre-Requisite:	
Sl. No.	
1.	
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Definitions of Eight parts of yog. (Ashtanga)**	**8**	**20**
02	**Yam and Niyam. Do`s and Don't's in life.** i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	**8**	**30**
03	**Asan and Pranayam** i) Various yog poses and their benefits for mind & body ii) Regularization of breathing techniques and its effects- Types of pranayam	**8**	**20**
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:			
1. Janardan Swami Yogabhyasi Mandal, Nagpur	**'Yogic Asanas for Group Tarining-Part-I"**		
2.Swami Vivekananda, AdvaitaAshrama	**"Rajayoga or conquering the Internal Nature"**		**(Publication Department), Kolkata**

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
11.	
12.	
13.	
14.	
15.	

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Personality development through life enlightenment skills**	
Course Code:PGIT(AI)205D	**Semester: 2nd**
Duration: 24 Hours	**Maximum Marks:** 100
Teaching Scheme	**Examination Scheme**
Theory:02	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit:0	

Aim:	
Sl. No.	
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.**

Objective:	
Sl. No.	
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**

Pre-Requisite:	
Sl. No.	
1.	
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**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)	**8**	**20**
02	• Verses- 71,73,75,78 (do's) • Approach to day to day work and duties. • Shrimad BhagwadGeeta : 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.	**8**	**20**
03	• Statements of basic knowledge. • Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,	**8**	**30**

	• Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37,38,63		
	Sub Total:	**24**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**28**	**100**

Assignments:

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

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

List of equipment/apparatus for laboratory experiments:

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Term Paper with Seminar	
Course Code: PGIT(AI)295	**Semester: 4th**
Duration:24 hrs	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme100**
Theory:0	End Semester Exam:
Tutorial:0	Teacher's Assessment:0
Practical:04	Internal Assessment:0
Credit:2	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60
Contents Students will do projects on application areas of latest technologies and current topics of societal relevance.	

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Computer Vision & Robotics	
Course Code: PGIT(AI)301A, PGIT(AI)391	**Semester:** 3rd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60
Aim:	
Sl. No.	

1.	To Study the image formation models and feature extraction for computer vision Identify the segmentation and motion detection and estimation techniques		
Objective:			
Sl. No.			
1.	ToDevelop small applications and detect the objects in various applications		
Pre-Requisite:			
Sl. No.			
1.	Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**ImageFormationModels** • Monocular imaging system • Orthographic & Perspective Projection • Camera model and Camera calibration • Binocular imaging systems, Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Stereo vision	**6**	**14**
02	FeatureExtraction • Image representations (continuous and discrete) • Edge detection, Edge linking, corner detection, texture, binary shape analysis, boundary pattern analysis, circle	**6**	**14**

	and ellipse detection, Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.		
03	ShapeRepresentationandSegmentation • Deformable curves and surfaces • Snakes and active contours • Level set representations • Fourier and wavelet descriptors • Medial representations • Multi-resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation	**6**	**14**
04	MotionDetectionandEstimation • Regularization theory • Optical computation • Stereo Vision • Motion estimation, Background Subtraction and Modelling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation • Structure from motion, Motion Tracking in Video	**6**	**14**
05	Objectrecognition • Hough transforms and other simple object recognition methods • Shape correspondence and shape matching • Principal component analysis • Shape priors for recognition	**6**	**10**
06	ApplicationsofComputerVision Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, CBIR, CBVR, Activity Recognition, computational photography, Biometrics	**6**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**
Practical:			

List of Practical:

2. Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
D. Forsyth and J. Ponce	Computer Vision		

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**

C	**ALL**	**15**	**5**	**3**
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Continuous evaluation				**40**
External Examination: Examiner-				
Signed Lab Assignments			**10**	
On Spot Experiment			**40**	
Viva voce			**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Digital Signal Processing	
Course Code: PGIT(AI)301B, PGIT(AI)391	**Semester:** 3rd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	Able to Integrate computer-based tools for engineering applications
2.	Able to Design, implementation, analysis and comparison of digital filters for processing of discrete time signals

Objective:

Sl. No.	
1.	To make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
2.	To make students aware about the meaning and implications of the properties of systems and signals.

Pre-Requisite:

Sl. No.	
1.	Mathematics, Electric Circuit Theory

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit 1:**	**6**	**14**

	LTI Discrete-Time Systems in the Transform Domain: Types of Linear-Phase transfer functions, Simple digital filters, Complementary Transfer Functions. Realization of Structures for Filters and Design: All pass filters, Tunable IIR Digital filter, IIR tapped Cascaded Lattice Structures, FIR Cascaded lattice Structures, Parallel All pass realization of IIR Transfer Functions, State Space Structures, Computational Complexity of Digital filter Structures, Design of IIR filter using pade' approximation, Design of computationally Efficient FIR Filters.		
02	DSP Algorithms: Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, and Linear filtering approach to Computation of DFT using Chirp Z-Transform	**6**	**14**
03	DSP Processor TMS 320C67XX: TMS 320C67XX Architecture, overview, memory management, I/O management, On-chip resources, programming considerations, Real-time implementations, Application using ALP on TMS 320C67XX for basic DSP algorithms (preferably fixed point).	**6**	**14**
04	Analysis of Finite Word length Effect in Fixed-Point DSP Systems: The Quantization Process and errors, Quantization of fixed-point Numbers, Analysis of Coefficient quantization effects, A/D conversion Noise Analysis, Analysis of Arithmetic Round of errors, Dynamic range scaling, Signal to Noise ratio in Low-order IIR Filters, Limit cycle in IIR Digital filters, Finite word length effects in IIR & FIR digital filters, Round of errors in FFT algorithms.	**6**	**14**
05	Analysis of Finite Word length Effect in Fixed-Point DSP Systems: The Quantization Process and errors, Quantization of fixed-point Numbers, Analysis of Coefficient quantization effects, A/D conversion Noise Analysis, Analysis of Arithmetic Round of errors, Dynamic range scaling, Signal to Noise ratio in Low-order IIR Filters, Limit cycle in IIR Digital filters, Finite word length effects in IIR & FIR digital filters, Round of errors in FFT algorithms.	**6**	**10**
06	Applications of Digital Signal Processing: Dual Tone Multi-frequency Signal Detection using Goertzel algorithm, Spectral Analysis of Non-stationary Signals, Musical Sound Processing, Over Sampling A/D Converter, Over Sampling D/A Converter, Clock recovery for data communication.	**6**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**

	Total:	**40**	**100**

Practical:

Skills to be developed:

List of Practical:

3. Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Sanjit K Mitra	Digital Signal Processing		Tata McGraw Hill Publications
J.G. Proakis, D.G. Manolokis, D. Sharma	Digital Signal Processing Principles, Algorithms, and Applications		Pearson Education.

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.

- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Deep Learning	
Course Code: PGIT(AI)301C PGIT(AI)391	**Semester:** 3rd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60

Aim:	
Sl. No.	
1.	

Objective:	
Sl. No.	
1.	Apply deep learning approach to solve real life complex problem.

Pre-Requisite:	
Sl. No.	
1.	Artificial Intelligence, Probability and Statistics, Linear Algebra

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction Feedforward Neural networks. Gradient descent and the backpropagation algorithm. Unit saturation, aka the vanishing gradient problem, and ways to mitigate it. RelU	6	14

	Heuristics for avoiding bad local minima. Heuristics for faster training. Nestors accelerated gradient descent. Regularization. Dropout. Convolutional Neural Networks Architectures, convolution / pooling layers Recurrent Neural Networks LSTM, GRU, Encoder Decoder architectures Deep Unsupervised Learning		
02	Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM Attention and memory models, Dynamic memory networks	6	14
03	Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics	6	14
04	Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-ofWords model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning	6	14
05	Dialogue Generation with LSTMs Applications of Dynamic Memory Networks in NLP	6	10
06	Recent Reseearch in NLP using Deep Learning: Factoid Question Asnwering, similar question detection, Dialogue topic tracking, Neural Summarization, Smart Reply	6	4

	Sub Total:	36	70
	Internal Assessment Examination & Preparation of Semester Examination	4	30
	Total:	40	100

Practical:

Skills to be developed:

List of Practical:

4. Based on theory lectures.

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville	Deep learning."		MIT Press book
Bengio, Yoshua.	Learning deep architectures for AI." Foundations and trends in Machine Learning		

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70

C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Remote Sensing and GIS	
Course Code: PGIT(AI)301D, PGIT(AI)391	**Semester:** 3rd
Duration: 36 Hrs.	**Maximum Marks:** 200
Teaching Scheme	**Examination Scheme**
Theory: 3	**End Semester Exam:** 70
Tutorial: 0	**Attendance :** 5
Practical: 4	**Continuous Assessment:** 25
Credit: 3 + 2	**Practical Sessional internal continuous evaluation:** 40
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	To apply remote sensing to solve various real life problem

Objective:

Sl. No.	
1.	To apply remote sensing to solve various real life problem

Pre-Requisite:

Sl. No.	
1.	Basic Programming Knowledge , Image Processing

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Physics Of Remote Sensing:Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in	**6**	**14**

	Remote sensing.		
02	Module 2 Data Acquisition:Types of Platforms–different types of aircrafts-Manned and Unmanned space crafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRDetc.	**6**	**14**
03	Scattering System: Microwave scatterometry,types of RADAR –SLAR –resolution –rangeand azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave imagestopographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications. Texture Segmentation	**6**	**14**
04	Thermal And Hyper Spectral Remote Sensing:Sensors characteristics-principle of spectroscopy-imaging spectroscopy–fieldconditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.	**6**	**14**
05	Data Analysis:Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basicprinciples of data processing –Radiometric correction–Image enhancement–Imageclassification–Principles of LiDAR, Aerial Laser Terrain Mapping.	**6**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

List of Practical:

5. Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Lillesand. T.M. and Kiefer. R.W	Remote Sensing and Image interpretation		John Wiley & Sons
John R. Jensen	Introductory Digital Image Processing: A Remote Sensing Perspective		Prentice Hall,
Richards, John A., Jia, Xiuping	Remote Sensing Digital Image Analysis		, Springer-Verlag Berlin Heidelberg, 2013.

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective

questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Business Analytics**	
Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:** Business Analytics	
Course Code:PGIT(AI)302A	**Semester: 3rd**
Duration: 36 Hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**
Theory:03	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit: 03	

Aim:	
Sl. No.	
1.	**Understand the role of business analytics within an organization.**
2.	**Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.**
3.	**To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.**
4.	**To become familiar with processes needed to develop, report, and analyze business data.**
5.	**Use decision-making tools/Operations research techniques.**
6	**Mange business process using analytical and management tools.**
7.	**Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.**

Objective:	
Sl. No.	
1.	**Students will demonstrate knowledge of data analytics.**
2.	**Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.**
3.	**Students will demonstrate the ability to use technical skills in predicative and prescriptive modelling to support business decision-making.**
4.	**Students will demonstrate the ability to translate data into clear, actionable insights.**

Pre-Requisite:	
Sl. No.	
1.	**Basic Programming, Mathematics**
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit1:** **Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.** **Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.**	**6**	**14**

02	**Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.**	**6**	**14**
03	**Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.**	**6**	**14**
04	**Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.**	**6**	**14**
05	**Decision Analysis: Formulating Decision Problems, Decision Strategies with the without OutcomeProbabilities,Decision Trees, The Value ofInformation, Utility and Decision Making.**	**6**	**10**
06	**Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.**	**6**	**4**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

1.Marc J. Schniederjans, Dara G. Schniederjans,	**Business analytics Principles, Concepts, and Applications**		**Pearson FT Press.**

Christopher M. Starkey,			
2.James Evans,	**Business Analytics**		**persons Education.**

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence)
Subject: Project Management and Entrepreneurship

Course Code:PGIT(AI)302B	**Semester: 3rd**
Duration: 36 Hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**
Theory:03	**End Semester Exam:** 70

Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit: 03	

Aim:	
Sl. No.	
1.	**Understand the role of Project management within an organization.**
2.	**Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.**
Objective:	
Sl. No.	
1.	**Students will aware about entrepreneurship and project management.**
2.	**Students will understand steps of project management and exact role of Entrepreneur**
Pre-Requisite:	
Sl. No.	
1.	**Principle of Management**
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit1:** Meaning of Entrepreneurship - characteristics, functions and types of entrepreneurship - Entrepreneur - Role of entrepreneurship in economic development.	**6**	**14**
02	Factors affecting entrepreneur growth - economic – non-economic. Entrepreneurship development programmes - need - objectives – course contents - phases - evaluation. Institutional support to entrepreneurs.	**6**	**14**
03	Project Management: Meaning of project - concepts - categories - project life cycle, phases - characteristics of a project – project manager - role and responsibilities of project manager.	**6**	**14**
04	Project identification - selection - project formulation – contents of a project report - planning commission guidelines for formulating a project - specimen of a project report.	**6**	**14**
05	Source of finance for a project - Institutional finance supporting projects project evaluation - objectives - types - methods.	**12**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
C.B.Gupta & N.P. Srinivasan	Entrepreneurial Development		
S.Choudhury	Project Management		

Reference Books:			
S.S.Khanka	Entrepreneurial Development		
Denis Lock	Project Management		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Industrial Safety**	
Course Code:PGIT(AI)302C	**Semester: III**
Duration: 36 Hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**

Theory:03	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit: 03	

Aim:	
Sl. No.	
1	**Understand the role of Industrial Safety in an organization.**
2	**Analyze Industrial Safety in various aspect.**
3.	

Objective:	
Sl. No.	
1.	**Mange Industrial Safety using analytical and management tools.**
2.	**To become familiar with processes needed to develop, report, and analyze Industrial Safety data.**
3.	

Pre-Requisite:	
Sl. No.	
1.	**Basic Electrical Knowledge**
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.**	**6**	**14**
02	**Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.**	**6**	**14**
03	**Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.**	**6**	**14**
04	**Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,**	**6**	**14**

	vi. Electrical motors, Types of faults in machine tools and their general causes.		
05	**Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance**	**6**	**14**
06			
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

1.Higgins & Morrow,	**Maintenance Engineering Handbook,**		**Da Information Services.**
2.H. P. Garg,	**Maintenance Engineering,**		**S. Chand and Company.**
3.Audels,	**Pump-hydraulic Compressors,**		**Mcgrew Hill Publication.**
4.Winterkorn, Hans,	**Foundation Engineering Handbook,**		**Chapman & Hall London.**

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70

C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Operations Research**	
Course Code:PGIT(AI)302D	**Semester: 3rd**
Duration: 36 Hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**
Theory:03	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit: 03	

Aim:	
Sl. No.	
1.	**Ablility to apply the dynamic programming to solve problems of discreet and continuous variables.**
2.	**Students should able to apply the concept of non-linear programming**
3.	

Objective:	
Sl. No.	
1.	**Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.**
2.	**Students should able to apply the concept of non-linear programming**
3.	
4.	

Pre-Requisite:			
Sl. No.			
1.	**Basic Mathematics, Programming Fundamentals.**		
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models**	**7**	**14**
02	**Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming**	**8**	**14**
03	**Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT**	**7**	**14**
04	**Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.**	**7**	**14**
05	**Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game TheorySimulation**	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference 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**
4.Hitler	**Libermann Operations Research**		**McGraw Hill Pub. 2009**
5.Pannerselvam,	**Operations Research**		**Prentice Hall of India 2010**
6.Harvey M Wagner,	**Principles of Operations Research**		**Prentice Hall of India 2010**

List of equipment/apparatus for laboratory experiments:

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence)
Subject:Cost Management of Engineering Projects

Course Code:PGIT(AI)302E	**Semester: 3rd**
Duration: 36 Hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**
Theory:03	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit: 03	

Aim:

Sl. No.	
1.	**Understand the role of Cost Management of Engineering Projects.**

2.	**Analyze data using statistical and data mining techniques and understand relationships between the underlying Cost Management of Engineering Projects.**		
Objective:			
Sl. No.			
1.	**To gain an understanding of how managers use business analytics to formulate and solve business problems and to support Cost Management of Engineering Projects.**		
2.	**To become familiar with processes needed to develop, report, and analyze Cost Management data.**		
Pre-Requisite:			
Sl. No.			
1.	**Basic Management knowledge**		
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction and Overview of the Strategic Cost Management Process**	**4**	**4**
02	**Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.**	**6**	**6**
03	**Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities.**	**6**	**10**
04	**Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis.**	**8**	**20**
05	**Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis.**	**3**	
06	**Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.**	**5**	**20**
07	**Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems,**	**2**	**10**

	Assignment problems, Simulation, Learning Curve Theory.		
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**

Reference Books:

1.	**Cost Accounting A Managerial Emphasis,**		**Prentice Hall of India, New Delhi**
2. Charles T. Horngren and George Foster,	**Advanced Management Accounting**		
3. Robert S Kaplan Anthony A. Alkinson,	**Management & Cost Accounting**		
4. Ashish K. Bhattacharya,	**Principles & Practices of Cost Accounting A. H.**		**Wheeler publisher**
5. N.D. Vohra,	**Quantitative Techniques in Management,**		**Tata McGraw Hill Book Co. Ltd.**

List of equipment/apparatus for laboratory experiments:

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**

B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:			
Practical Internal Sessional Continuous Evaluation			
Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments	**10**		
On Spot Experiment	**40**		
Viva voce	**10**		**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject:Composite Materials**			
Course Code:PGIT(AI)302F		**Semester: III**	
Duration: 36 Hours		**Maximum Marks:100**	
Teaching Scheme		**Examination Scheme**	
Theory:03		**End Semester Exam:** 70	
Tutorial:0		**Attendance :** 5	
Practical:0		**Continuous Assessment:** 25	
Credit: 03			
Aim:			
Sl. No.			
1.	**Understand the role of Composite Materials**		
2.	**Analyze various effect of Composite Materials.**		
3.			
Objective:			
Sl. No.			
1.	**To gain an understanding Composite Materials**		
2.	**To become familiar with processes needed to develop, report, and analyze Composite Materials data.**		
3.			
Pre-Requisite:			
Sl. No.			
1.	**Basic chemistry.**		
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of**	**7**	**14**

	reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.		
02	**REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.**	**7**	**14**
03	**Manufacturing of Metal Matrix Composites: 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.**	**7**	**14**
04	**Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.**	**8**	**14**
05	**Strength: 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.**	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments: Based on theory

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
1. R.W.Cahn	**Material Science and Technology**	**Vol 13**	**VCH, West Germany.**
2.WD Callister, Jr., Adapted by R. Balasubramaniam,	**Materials Science and Engineering, An introduction.**	**Indian edition, 2007.**	**John Wiley & Sons, NY,**

Reference Books:

1. Lubin.	**Hand Book of Composite Materials**		
2. K.K.Chawla.	**Composite Materials**		
3. Deborah D.L. Chung.	**Composite Materials Science and Applications**		
4.Danial Gay, Suong	**Composite Materials**		

V. Hoa, and Stephen W. Tasi.	**Design and Applications**		

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence)
Subject:Waste to Energy

Course Code:PGIT(AI)302G	**Semester: 3rd**
Duration: 36 Hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**
Theory:03	**End Semester Exam:** 70
Tutorial:0	**Attendance :** 5
Practical:0	**Continuous Assessment:** 25
Credit: 03	

Aim:

Sl. No.	
1.	**Understand the role of Waste to Energy.**

2.	**Analyze data how to convert Waste to Energy.**		
3.			
Objective:			
Sl. No.			
1.	**To gain an understanding to solve environmental problems and to support Waste to Energy.**		
2.	**To become familiar with processes needed to develop, report, and analyze Waste to Energy.**		
3.			
Pre-Requisite:			
Sl. No.			
1.	**Basic Environmental science**		
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors**	**7**	**14**
02	**Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.**	**7**	**14**
03	**Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.**	**7**	**14**
04	**Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.**	**7**	**14**
05	**Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.**	**8**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**
Practical: **Assignments: Based on theory** **List of Books**			

Text Books:			
Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Reference Books:			
1.Desai, Ashok V.,	**Non-Conventional Energy,**		**Wiley Eastern Ltd., 1990.**
2.Khandelwal, K. C. and Mahdi, S. S.,	**Biogas Technology - A Practical Hand Book -**	**Vol. I & II,**	**Tata McGraw Hill Publishing Co. Ltd., 1983.**
3.Challal, D. S.,	**Food, Feed and Fuel from Biomass,**		**IBH Publishing Co. Pvt. Ltd., 1991.**
4.C. Y. WereKo-Brobby and E. B. Hagan,	**Biomass Conversion and Technology,**		**John Wiley & Sons, 1996.**

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
16.	
17.	
18.	
19.	
20.	

End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	**Chapter**	**Marks of each question**	**Question to be set**	**Question to be answered**
A	**ALL**	**1**	**10**	**10**
B	**ALL**	**5**	**5**	**3**
C	**ALL**	**15**	**5**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: M.Tech. in Information Technology (Artificial Intelligence) **Subject: Dissertation-I /Industrial Project**	
Course Code:PGIT(AI)392	**Semester: 3rd**
Teaching Scheme	**Examination Scheme100**
Theory:0	End Semester Exam:
Tutorial:0	Teacher's Assessment:0
Practical:20	Internal Assessment:0
Credit:10	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Content

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.

The viva-voce examination will be based on the above report and work.

Name of the Course: **Subject: Dissertation II**	
Course Code: PGIT(AI)491	**Semester: 4th**
Duration:	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme100**
Theory:0	End Semester Exam:
Tutorial:0	Teacher's Assessment:0
Practical:32	Internal Assessment:0
Credit:16	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Guidelines for DissertationPhase–IandII

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred

literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.

Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.

Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work