B. Tech. (Information Technology) Programme

SYLLABI

(Semester – 7)

CHAROTARUNIVERSITY OF SCIENCE AND TECHNOLOGY

IT448: DATA SCIENCE

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	0	6	5
Marks	100	50	0	150	

A. Outline of the Course:

Sr No.	Title of the unit	Minimum number of hours
1.	Introduction	10
2.	Data Pre-processing	12
3.	Data Warehouse & OLAP Technology	12
4.	Data Visualization	12
5.	Decision Tree & Random Forest	07
6.	Application of Data Science in Real World	07
	Total hours (Theory)	60
	Total hours (Lab)	30
	Total hours	95

B. Detailed Syllabus:

1.	**Introduction**	**06 hours**	**13.33 %**
1.1	Defining data science, Defining data science by its key components		
1.2	Exploring Data Engineering Pipelines and Infrastructure - Defining big data, Looking at some sources of big data, Distinguishing between data science and data engineering,		
1.3	Boiling Down Data with MapReduce and Hadoop, Identifying Alternative Big Data Solutions		
1.4	Seeing the benefits of business-centric data science, Incorporating Data-Driven Insights into the Business Process		
1.5	Distinguishing Business Intelligence and Data Science, Exploring Data Science in Business		
2.	**Data Pre-processing**	**12 hours**	**20 %**
2.1	Importance of Pre-processing the Data		
2.2	Data Cleaning		
2.3	Data Integration and Transformation		
2.4	Data Reduction		
2.5	Data Discretization and Concept Hierarchy Generation		
3.	**Data Warehouse and OLAP Technology**	**10 hours**	**16.64 %**
3.1	Introduction to Data Warehouse		
3.2	A Multidimensional Data Model		
3.3	Data Warehouse Architecture		
3.4	From Data Warehousing to Data Mining		
4.	**Data Visualization**	**08 hours**	**16.64 %**
4.1	Perfect type of data visualization		
4.2	Picking the right design style		
5.	**Decision Tree & Random Forest**	**05 hours**	**23.33 %**
5.1	Other Classification Methods		
5.2	Prediction		

5.3	Evaluating the Accuracy of a Classifier		
6.	**Application of Data Science in Real World**	**04 hours**	10.06 %
6.1	Application of data science in the field of Telecommunication		
6.2	Application of data science in the field of Energy		
6.3	Application of data science in the field of government		
6.4	Application of data science in the field of healthcare		

C. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, blackboard, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.
- Two internal exams will be conducted and an average of the same will be converted to the equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build anappreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

D. Student Learning Outcome:

Upon completion of this course, students will be able to do the following:

CO1	Students will able to understand important of data mining and its various concepts like data preprocessing, various classification algorithms etc.
CO1	A student will be able to develop a reasonably sophisticated data mining application.

CO1	A student is able to select methods and techniques appropriate for the task
CO1	A student is able to develop the methods and tools for the given task

Course Articulation Matrix:

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	2	2
CO2	2	2	2	-	1	-	-	-	-	1	-	1	2	3
CO3	1	1	3	-	3	-	-	-	-	-	-	3	2	1
CO4	1	1	3	-	3	-	-	-	-	-	-	3	2	1

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

E. Recommended Study Material:

❖ Text Books:

1. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
2. Paulraj Ponnian, "Data Warehousing Fundamentals", John Willey.

❖ Reference Books:

3. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.
4. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
5. Pieter Adriaans, Dolf Zantinge, "Data Mining", Pearson Education Asia

❖ Web Links:

1. http://www.dataminingblog.com
2. http://www.kdnuggest.com

IT449: CLOUD COMPUTING

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

D. Objective of the Course:

The main objectives for offering the course Advanced Computing are:

- To provide an overview of the basic concepts of cluster computing, grid computing and cloud computing.
- To highlight the advantage of deploying cluster computing and cloud computing.
- To illustrate the practical adoption of a cloud and cluster deployment through real life case studies.

E. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Fundamentals of Distributed Computing	06
2.	Understanding Cloud Computing Concepts	06
3.	Cloud Enabling Technologies	05
4.	Cloud Services Providers	04
5.	Understanding and Implementing Cloud Securities	04
6.	Cloud Computing : Cost Metrics ,QoS and SLA	04
7.	Fundamentals of Container Technology & Tools	08
8.	Fundamentals of Micro services and Automation Tools	08

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

F. Detailed Syllabus:

1. Fundamentals Distributed Computing — **06 hours** — **14 %**

1.1 History of Computing , Elements of Distributed Computing, Parallel Computing

1.2 Scalable Parallel Computer Architecture, Symmetric Multi-Processor

1.3 Cluster Computing , Architecture and Applications

1.4 Load Balancing in Cluster Computing.

1.5 Resource Management and Scheduling in Cluster Computing

1.6	Programming Environments and Tools : Cluster Computing		
1.7	Setting up the Cluster , Monitor & security		
1.8	Implementing RPC and Web-services		
1.9	Grid Computing and Architecture		
2.	**Understanding Cloud Computing Concepts**	**06 hours**	**14 %**
2.1	History of cloud computing,		
2.2	Technology Innovations: Clustering, Grid ,Utility & Virtualization		
2.3	Cloud characteristics		
2.4	Cloud delivery Models & Deployment Models		
2.5	Cloud Storage , Virtual Private Cloud		
2.6	Challenges of Cloud Computing		
3.	**Cloud Enabling Technologies**	**05 hours**	**12 %**
3.1	Data Center Technology		
3.2	Virtualization Technology		
3.3	Case Study of Cloud Enabling Technologies		
4.	**Cloud Services Providers**	**04 hours**	**10 %**
4.1	Deploying and Accessing cloud services		
4.2	Securing Cloud Services		
4.3	Comparing Cloud Service Providers		
4.4	Amazon Web services, Google Cloud Platform ,		
4.5	Microsoft Azure, Salesforce etc.		
5.	**Understanding and Implementing Cloud Securities**	**04 hours**	**10 %**
5.1	Basic Terms: Confidentiality , Integrity, authenticity, Availability, Risk, Threat		
5.2	Cloud Security Threats		
5.3	Cloud Security Mechanisms		
5.4	Case Studies: AWS (Cloud Security)		
6.	**Cloud Computing : Cost Metrics ,QoS and SLA**	**04 hours**	**08%**
6.1	Cost Metrics : Network, Computing , Storage		
6.2	QoS(Quality of Service) and QoS Metrics , SLA (Service Level Agreement)		
7.	**Fundamentals of Container Technology & Tools**	**08 hours**	**16 %**
7.1	Understanding Basic Terms : Cgroups, Namespace, Layered File System etc.		
7.2	Understanding & Implementing Container.		
7.3	Virtual Machine vs Containers		
7.4	Pros and Cons of Container Technology		

7.5	Fundamentals of Docker.		
7.6	Docker networking and storage		
7.7	Docker Compose		
7.8	Introduction to Container Orchestration and Tool: Kubernets		
8.	**Fundamentals of Micro services and Automation Tools**	**08 hours**	**16 %**
8.1	Introduction to Micro Services and need of Micro Services		
8.2	Micro Services Architecture and Concepts/Components		
8.3	Pros and Cons/Challenges and Applications of Micro Services		
8.4	Introduction to DevOps and CI/CD		
8.5	Introduction to Ansible : Infrastructure/Platform Automation		
8.6	Introduction to Jenkins : CI/CD Automation		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Student Learning Outcome:

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

CO1	Understand and learn the concept of Grid, Cluster and Cloud Computing.
CO2	To solve the problems using Grid, Cluster and Cloud Computing.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	3	-	-	-	1	-	1	2	3	3
CO2	2	3	3	1	3	-	-	-	1	-	2	3	3	3

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

F. Recommended Study Material:

Text Books:

3. Erl, Thomas, Ricardo Puttini, and Zaigham Mahmood. Cloud computing: concepts, technology & architecture. Pearson Education, 2013.
4. JUDITH, S. HURWITZ. CLOUD COMPUTING FOR DUMMIES. JOHN WILEY & Sons, 2019.
5. Mastering Cloud Computing. Rajkumar Buya.

Reference Books:

1. Ronald Krutz, Cloud Security, Wiley India.
2. Bernard Golden, Virualization for Dummies, Wiley India.

Web Materials:

1. www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf
2. https://cloud.google.com/gcp/
3. https://aws.amazon.com/
4. https://azure.microsoft.com/en-us/

IT443: LANGUAGE PROCESSOR

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	0	6	5
Marks	100	50	0	150	

A. Outline of the Course:

Sr No.	Title of the unit	Minimum number of hours
1.	Introduction to Language Processor	04
2.	Macros and Macro Preprocessors	04
3.	Finite Automata and Grammar	14
4.	Analysis Phase of Compiler	20
5.	Synthesis Phase of Compiler	10
6.	Assemblers	08
	Total hours (Theory)	60
	Total hours (Lab)	30
	Total hours	90

B. Detailed Syllabus:

1. Introduction to Language Processor **04 hours 05 %**

1.1 Introduction

1.2 Language processing activities

1.3 Fundamental of language processing

1.4 Fundamental of language Specification

1.5 Introduction to preprocessor, compiler and assembler

2. Macros and Macro Preprocessors **04 hours 05 %**

2.1 Macro definition and call

2.2 Macro Expansion, Nested Macro Calls

2.3 Design of macro preprocessor

3. Finite Automata and Grammar **14 Hours 25 %**

3.1 Basic Definition, Regular Expression, Regular Language,Finite Automata : NFA and DFA

3.2	Non Determinism Finite Automata, Conversion from NFA to DFA		
3.3	□- Non Determinism Finite Automata, Conversion of NFA-□ to NFA		
3.4	Minimization of DFA		
3.5	Introduction to Grammar, Types of Grammars		
3.6	Context Free Grammars, Derivations and Languages, Relationship between derivation and derivation trees		
3.7	Ambiguity Unambiguous CFG and Algebraic Expressions Bacos Naur Form (BNF), Normal Form – CNF, GNF		
4.	**Analysis Phase of Compiler**	**20 hours**	**40 %**
4.1	Introduction to Lexical analysis, Role of the lexical analyzer		
4.2	Specification of tokens, Recognition of tokens		
4.3	Lexical analyzer generators		
4.4	Role of the parser		
4.5	Top-down parsing, Bottom- up parsing		
4.6	Syntax-Directed Definitions		
4.7	Bottom-Up Evaluation of S-Attributed Definitions and L-Attributed Definitions		
4.8	Top Down Translation and Bottom-Up Evaluation of Inherited Attributes		
5.	**Synthesis Phase of Compiler**	**10 hours**	**15 %**
5.1	Intermediate Languages, Declarations, Assignment Statements, Intermediate code generation techniques		
5.2	The Principal Sources of Optimization		
5.3	Machine Independent and machine dependent codeoptimization techniques		
5.4	Issues in the Design of a Code Generator		
1.	**Assemblers**	**08 hours**	**10 %**
1.1	Elements of assembly language programming		
1.2	Overview of the assembly process		
1.3	A simple Assembly Scheme		
1.4	Design of two pass assembler		

C. Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations andblack board – mix of both.

- Assignments based on above course content will be given to the students at theend of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge ofstudents for particular topic.

D. Student Learning Outcome:

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

CO1	Analyze the functionalities of language processors.
CO2	Simulate Compilation process using tools such as LEX and YACC.
CO3	Analyze and generate the different parsing techniques.
CO4	Perform optimization at different level of program.

Course Articulation Matrix:

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	3	-	-	-	-	-	-	-	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	3	1
CO3	2	3	2	2	-	-	-	-	-	-	-	-	3	2
CO4	3	3	2	3	-	-	-	-	-	-	-	-	3	2

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

F. Recommended Study Material:

❖ **Text Books:**

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Pearson Education Asia.
2. D. M. Dhamdhere, "System Programming and Operating Systems", Tata McGraw-Hill.
3. John c martin, "Introduction to Languages and the Theory of Computation", The McGraw -Hill.

❖ **Reference Books:**

4. Allen I. Holub "Compiler Design in C", Prentice Hall of India.
5. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", BenjaminCummings.
6. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill

7. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Buildingwith C”, PHI.
8. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning.
9. Compiler Construction by Kenneth. C. Louden, Vikas Pub.

❖ **Web Materials:**

1. http://compilers.iecc.com/crenshaw
2. http://www.compilerconnection.com
3. http://dinosaur.compilertools.net
4. http://pltplp.net/lex-yacc

IT444: INTERNET OF THINGS

Credit Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	2	0	5	4
Marks	100	50	0	150	

A. Outline of the Course:

Sr No.	Title of the unit	Minimum Number of Hours
1.	Introduction of IoT	05
2.	IoT Architecture and Protocols	12
3.	Enabling Technologies	10
4.	Emerging Challenges	10
5.	Opportunities for the Developing World	06
6.	IoT Tools and Data Analytics	02
	Total hours (Theory)	45
	Total hours (Lab)	30
	Total hours	75

B. Detailed Syllabus:

1.	**Introduction of IoT**	**05 Hours**	**11 %**
1.1	Introduction		
1.2	Towards ubiquity		
1.3	A question of vision		
1.4	Why the Internet of Things is important		
1.5	M2M Vs. IoT		
2.	**IoT Architecture and Protocols**	**12 Hours**	**27%**
2.1	IoT Protocols, Network Layers of IoT Architecture		
2.2	IoT Threats, Security in IoT/M2M, Privacy		
2.3	Proposed IoT/M2M Security Framework		
3.	**Enabling Technologies**	**10 Hours**	**22 %**
3.1	Introduction		
3.2	Tagging things: RFID		
3.3	Feeling things: Sensor technologies, Thinking things: Smart technologies, Shrinking things: Nanotechnology		
4.	**Emerging Challenges**	**10 Hours**	**22 %**
4.1	Introduction		
4.2	Standardization and harmonization		
4.3	Privacy implications		
4.4	Socio-ethical considerations		
5.	**Opportunities for the Developing World**	**06 Hours**	**13 %**
5.1	Introduction		
5.2	Developing economies as users and innovators		
5.3	Space for the state in enabling the Internet of Things		
5.4	Common development goals and the World Summit on the Information Society		
6.	**IoT Tools and Data Analytics**	**02 Hours**	**05 %**
6.1	Tools in IoT, Data Analytics in IoT, IoT Physical Systems		

C. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will bediscussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHPetc.
- The course includes a laboratory, where students have an opportunity to build anappreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

D. Student Learning Outcome:

Upon completion of this course, students will be able to do the following:

CO1	Understand the basic concepts Internet of Things and how to integrate enabling technologies
CO2	Correlate IoT protocol stack with security and privacy issues
CO3	Applying concepts to integrate IoT with other thrust areas like Big Data, Cloud, Block chain etc.
CO4	Integration of Existing technology for development of IoT Smart Applications

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	1	-	-	-	-	-	-	-	2	2
CO2	2	1	-	-	1	-	-	2	-	-	-	-	1	1
CO3	2	2	3	2	2	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	-	2	-	3	1	1	1	3	3

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

E. Recommended Study Material:

- **Text Books:**
  1. "Internet of Things: Converging Technologies for Smart Environments andIntegrated Ecosystems", Ovidiu Vermesan, Peter Friess, River Publishers.
- **Reference Books:**
  2. Internet of Things: A hands on approach by Arshdeep Bahga and VijayMadisetti.
  3. Research papers from IEEE, Springer etc.
  4. The Internet of Things-ITU.
- **Web Materials:**
  1. http://www.vs.inf.ethz.ch/res/show.html?what=iot – For Research Papers
  2. www.ieee.org – For standards and technical research papers

IT471: FOUNDATION OF MODERN NETWORKING

[Elective-III]

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Elements of Modern Networking	07
2	Requirements and Technology	**10**
3	SDN: Background and Motivation	**10**
4	SDN Data Plane and OpenFlow	**05**
5	SDN Control Plane&SDN Application Plane	**13**
	Total hours (Theory)	**45**
	Total hours (Lab)	**30**
	Total hours	**75**

B. Detailed Syllabus:

1. Elements of Modern Networking **07 Hours 16%**

The Networking Ecosystem, Example Network Architectures, Ethernet, Wi-Fi, 4G/5G Cellular, Network Convergence, UnifiedCommunications

2. Requirements and Technology **10 Hours 22%**

Types of Network and Internet Traffic, Demand: Big Data, CloudComputing, and Mobile Traffic, Requirements: QoS and QoE, Routing, Congestion Control, SDN and NFV, Modern Networking Elements

3. SDN: Background and Motivation **10 Hours 22%**

Evolving Network Requirements, The SDN Approach, SDN- and NFV-Related Standards

4. SDN Data Plane and OpenFlow **05 Hours 11%**

SDN Data Plane, OpenFlow Logical Network Device, OpenFlow Protocol

5. SDN Control Plane&SDN Application Plane **13 Hours 29%**

SDN Control Plane Architecture, ITU-T Model, OpenDaylight, REST, Cooperation and Coordination Among Controllers, SDN ApplicationPlane Architecture, Network Services Abstraction Layer, Traffic Engineering, Measurement and Monitoring, Security, Data Center Networking, Mobility and Wireless, Information-Centric Networking

C. Student Learning Outcomes:

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

CO1	Explain and discuss the basic concepts and architecture of SDN
CO2	Compare and contrast conventional networking approaches and SDN
CO3	Evaluate the pros and cons of applying SDN in WAN and data centers
CO4	Analyse and apply implementation of SDN through Open Flow Switches
CO5	Implement, troubleshoot and debug SDNs through hands on illustrations

D. Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	P O 11	PO12	PSO1	PSO2
CO1	2	1	3	2	2	-	-	-	1	-	2	-	2	2
CO2	1	2	2	2	1	-	-	-	-	-	-	-	1	-
CO3	-	1	1	1	-	-	-	-	-	-	-	-	1	1

CO4	1	2	1	2	-	-	-	-	-	-	-	-	-	1
CO5	1	2	2	3	-	-	-	-	2	-	-	-	1	2

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3:

Substantial (High)If there is no correlation,

put "-"

E. Recommended Study Material:

❖ Text Books:

1. William Stallings, Florence Agboma, Sofiene Jelassi "Foundations of Modern Networking, SDN, NFV, QoE, IoT, and Cloud"; Pearson Publisher, ISBN-13: 978-0- 13-417539-3
2. Behrouz A. Forouzan, "TCP/IP Protocol Suite.", Fourth Reprint, 2003;Tata McGraw Hill ISBN: 0-07-049551-3

❖ Reference Books:

1. Douglas E. Comer and David L. Stevens, "Internetworking with TCP/IP Volume-2, Design, Implementation and Internals ", Prentice Hall

❖ Web Materials:

1. https://www.sdxcentral.com/
2. https://sdn.ieee.org/standardization
3. https://trac.ietf.org/trac/irtf/wiki/sdnrg
4. https://www.opennetworking.org/sdn-resources/openflow
5. https://www.opendaylight.org/
6. https://www.opennetworking.org/

IT473: ARTIFICIAL INTELLIGENCE
[Elective-III]

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	2	0	5	4
Marks	100	50	0	150	

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to AI, Problems and Search, Heuristic Techniques	10
2.	Logic in Intelligent System	10
3.	Knowledge Representation	06
4.	Learning	07
5.	Uncertainty	06
6.	Planning and Advanced Topics	06
	Total hours (Theory)	45
	Total hours (Lab)	30
	Total hours	75

B. Detailed Syllabus:

1.	**Introduction to AI, Problems and Search, Heuristic Techniques** Problem representation; State Space Search; A* Algorithm andits Properties; AO* search, Minimax and alpha-beta pruning, AI in games.	**10 Hours**	**22%**
2.	**Logic in Intelligent System** Predicate Logic & Propositional Logic, Resolution, Formal Systems; Notion of Proof, Decidability, Soundness, Consistency and Completeness; Predicate Calculus (PC), Resolution Refutation.	**10 Hours**	**22%**
3.	**Knowledge Representation** PC based Knowledge Representation, Intelligent Question Answering, Semantic Net, Frames, Script, Conceptual Dependency, Ontologies, Basics of Semantic Web.	**06 Hours**	**13%**
4.	**Learning** Learning from Examples, Decision Trees, Neural Nets, Hidden Markov Models, Reinforcement Learning, and LearnabilityTheory.	**07 Hours**	**16%**
5.	**Uncertainty** Formal and Empirical approaches including Bayesian Theory, Fuzzy Logic, Non-monotonic Logic, Default Reasoning.	**06 Hours**	**13%**
6.	**Planning and Advanced Topics** **Planning:** Blocks World, STRIPS, Constraint Satisfaction, Basics of Probabilistic Planning. **Advanced Topics:** Introduction to topics like Computer Vision, Expert Systems,Natural Language Processing, Big data, Neuro Computing, Robotics, Web Search.	**06 Hours**	**14%**

C. Instructional Method and Pedagogy:

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHPetc.

- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build anappreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

D. Student Learning Outcome:

Upon completion of this course, students will be able:

CO1	To solve difficult and complex problem of computer science using AI techniques.
CO2	To select any R&D field related to application of AI.
CO3	To understand soft computing and machine learning courses.
CO4	To develop software solution as per need of today's IT edge which requires high automation and less human intervention.
CO5	To demonstrate working knowledge in Python in order to write and explore more sophisticated Python programs
CO6	To apply knowledge representation, reasoning, and machine learning techniques to real-world problems

Course Articulation Matrix:

	PO 01	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	3	2	2	-	-	-	-	-	3	2
CO2	2	2	2	3	2	-	-	-	-	-	3	1

CO3	3	3	3	3	2	-	-	-	-	-	3	2
CO4	2	2	2	1	2	-	-	-	-	-	3	2
CO5	3	2	2	3	3	-	-	-	-	2	2	2
CO6	2	2	2	3	3	-	-	-	-	-	3	2

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

E. Recommended Study Material:

❖ **Text Books:**

1. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rdedition, Pearson, 2010.
2. Elaine Rich & Kevin Knight, "Artificial Intelligence", McGraw-HillScience/Engineering/Math; 2nd edition

❖ **Reference Books:**

1. Nilsson, N.J., "Artificial Intelligence, a New Approach", Morgan Kaufmann, 2000.
2. Mitchell, T., "Machine Learning", McGraw-Hill, 1997.

❖ **Papers:**

1. Journals: Artificial Intelligence, Artificial Intelligence Programming, Machine Learning,IEEE Expert, Data and Knowledge Engineering, Pattern Recognition etc.
1. Conferences: AAAI, IJCAI, UAI, ICML, ACL etc.

❖ **Web Materials:**

2. http://www-formal.stanford.edu/jmc/whatisai/whatisai.html
3. http://www.webopedia.com/TERM/A/artificial_intelligence.html

IT474 BLOCKCHAIN TECHNOLOGIES
(Elective – III)

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	2	-	5	4
Marks	100	50	-	150	

F. Outline of the Course:

Sr No.	Title of the Unit	Minimum number of hours
1.	Introduction to Cryptography and Blockchain	07
2.	Cryptocurrencies	07
3.	Decentralized Applications	14
4.	Hyperledger Fabric	14
5.	Privacy, Security issues and Use Cases of Blockchain	03
	Total hours (Theory)	45
	Total hours (Lab)	30
	Total hours	75

G. Detailed Syllabus:

1.	**Introduction to cryptography and Blockchain** Public Key Cryptography, Hashing, Digital signature, History and Introduction to Blockchain, Types of Blockchain: Private and Public, Permissioned and Permission-less, Distributed Ledger	**07 hours**	**16 %**
2.	**Cryptocurrencies** Introduction to crypto primitives and various crypto-currencies, Bitcoin, Bitcoin consensus, Proof of Work, Proof of Stack, Bitcoin Script	**07 hours**	**16 %**
3.	**Decentralized Applications** Introduction to Ethereum, Smart Contracts, Mining, The consensus problem - Asynchronous Byzantine Models of fault tolerance, Decentralized Applications (Dapps) Platform & Ethereum Client - Geth, Solidity	**14 hours**	**31 %**
4.	**Hyperledger Fabric** Introduction to Permissioned Blockchain: Hyperledger Fabric, Microsoft Azure's Blockchain as a Service	**14 hours**	**31 %**
5.	**Privacy, Security issues and Use Cases of Blockchain** Privacy and Security issues in Blockchain like Zero- knowledge proof, double spending, selfish mining, 51% Attacks, potential disruptions with blockchain and other attacks. Use Cases of Blockchain: IOT, HealthCare Sector, Supply-Chain, Land Registry, and other use cases	**03 hours**	**07%**

H. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will bediscussed.
- Lectures will be conducted with the aid of multi-media projector, black board etc.
- Attendance is compulsory in lectures and laboratory.

- Marks will be given based on continues evaluation, i.e. Unit Tests/Surprise tests/Quizzes/Seminar and Assignments based on course content will be given to the students at the end of each unit/topic.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

l. Course Outcome (COs):

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

CO1	To explain the basics of modern cryptography including symmetric keycryptography, public key cryptography, secure hash and digital signature.
CO2	To learn basic concepts of Blockchain & various Cryptocurrencies.
CO3	To learn & implement Ethereum, Smart Contracts & Permissioned Blockchain,hyper ledger.
CO4	To learn Privacy, Security issues in Blockchain & various use cases

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	-	1	1	-	-	-	3	3
CO2	3	2	3	3	3	-	-	-	2	-	2	2	3	3
CO3	3	2	3	3	3	-	-	-	2	-	2	2	3	3
CO4	3	3	3	2	3	-	-	-	3	-	3	3	1	1

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

J. Recommended Study Material:

Text Books:

4. Imran Bashir, “Mastering Blockchain”, Packt Second Edition, 2018
5. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, “Blockchain by Example”, Packt

Reference Books:

6. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction” , Princeton University Press
7. William Mougayar, Vitalik Buterin, “The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology”, Wiley
8. Pethuru Raj Ganesh Chandra Deka, “Blockchain Technology: Platforms, Tools and Use Cases”, Elsevier Academic Press
9. Chris Dannen, “Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners”, Apress
10. Ghassan Karame, Elli Androulaki, “Bitcoin and Blockchain Security”, Artech
11. Sean Stein Smith, “Blockchain, Artificial Intelligence and Financial Services: Implications and Applications for Finance and Accounting Professionals”, Springer
12. Rodrigo da Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh, “Blockchain Technology for Industry 4.0: Secure, Decentralized, Distributed and Trusted Industry Environment”, Springer

Reference Links/ e-content:

1. https://www.coursera.org/learn/blockchain-basics2.

https://nptel.ac.in/courses/106/105/106105184/

3. https://nptel.ac.in/courses/106/104/106104220/
8. https://www.ibm.com/in-en/cloud/blockchain-platform
9. https://medium.com/blockchain
10. https://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=blockchain
11. https://www.springer.com/gp/search?query=blockchain&submit=Submit

IT450: SOFTWARE GROUP PROJECT - IV

Credits and Hours:

Teaching Scheme	Theory	Project	Tutorial	Total	Credit
Hours/week	0	4	0	4	2
Marks	0	100	0	100	

A. Outline of the Course:

- Student at the beginning of a semester may be advised by his/her supervisor (s) for recommended courses.
- Students are required to get approval of project definition from the department.
- After approval of project definition students are required to report their project work weekly to respective internal guide.
- Project will be evaluated at least once per week in laboratory during the semesterand final submission at the end of the semester as a part of continuous evaluation.
- Project work should include whole SDLC of development of software / hardwaresystem as a solution of particular problem by applying principles of Software Engineering.
- Students have to submit project with following listed documents at the time of final submission.
    a. Project Synopsis
    b. Software Requirement Specification
    c. SPMP
    d. Final Project Report/paper
    e. Project Setup file with Source code [Uploaded on GitHub]
    f. Project Presentation (PPT)
    g. Video Recording (Per Project)A student has to produce some usefuloutcome by conducting experiments or project work.
- A student has to produce some useful outcome by conducting experiments orproject work.

Total hours (Theory): 00
Total hours (Lab): 60
Total hours: 60

B. Instructional Method and Pedagogy:

13. Project Groups would be form of maximum two students.
14. Inter batch group formation is not permitted due to difficulties in progress tracking.
15. Students are advised to choose innovative and challenging definitions.
16. Batch wise project definitions must be unique.
17. Any management system would not be encouraged.
18. Tools like GitHub would be used to track the progress of project development by theconcern faculty. Concerned guide will demonstrate the working of GitHub Tool.
19. Student has to prepare report at end of semester as part of submission.
20. Report structure is finalized for semester end submission.
21. To have a better outcome as well as progress tracking at the end of semester, it is decided that students have to appear for two internal reviews, which will help them to get more insight in the project.
22. To maintain similarity below 40%, Students have to submit project's final document to concern SGP guide for plagiarism check before 15 days of external exam.
23. Students have to attach plagiarism report in final spiral bound with duly signed by SGP guide.
24. Students have to bring internal review card hard copy on the day of internal review exam, after that they will bring filled review card on the day of external review.

C. Student Learning Outcome:

After the completion of the course students will able to

CO1	Identify a range of solutions, critically evaluate and justify proposed design solution.
CO2	Manage learning & self-development including development of organizational skills, time management, effective use of scientific literature and discriminating use of Web resources.
CO3	Apply a wide range of principles and tools available to the software developer such as choice of the algorithm, language, software libraries etc.
CO4	Write and test programs using appropriate test cases.
CO5	Solve communication issues in large, complex software projects and Structure & communicate ideas effectively orally. Also Prepare & deliver coherent and structuredverbal and written technical reports.
CO6	Evaluate system in terms of general quality attributes and possible trade-offs presented within the given problem/system.

Course Articulation Matrix:

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	-	2	2	2	2	-	1	3	3	2
CO2	3	3	1	2	1	2	2	2	2	-	1	3	3	2
CO3	3	1	3	3	3	1	2	2	3	-	2	3	3	2
CO4	3	1	1	3	1	-	-	1	2	-	2	2	2	2
CO5	3	-	-	-	-	-	2	3	3	3	3	2	2	1
CO6	3	2	1	2	1	-	-	1	2	-	1	1	3	1

D. Recommended Study Material:

❖ Reference book:

1. John M Nicolas, Project Management for Business, Engineering and Technology,Elsevier.
2. Sanjay Mohapatra, Software Project Management, Cengage Learning
3. Clive L. Dym, Patrick Little, Elizabeth J. Orwin, "Engineering Design – A ProjectBased Introduction", Wiley India Pvt. Ltd.
4. B. Hughes & M. Cotterell, "Software Project Management", Tata Mcgraw Hills.

❖ Web Materials:

1. https://status.net/templates/project-report/
2. https://www.tutorialspoint.com/software_engineering/software_project_manageme nt.htm
3. https://www.geeksforgeeks.org/coding-standards-and-guidelines/
4. https://www.altexsoft.com/blog/engineering/8-ways-to-improve-software-testing-through-planning-work-environment-automated-testing-and-reporting/
5. https://nptel.ac.in/courses/106/105/106105218/
6. https://www.youtube.com/watch?v=T3q6QcCQZQg
7. https://www.scribbr.com/category/research-paper/

IT446: SUMMER INTERNSHIP-II

Credit and Hours:

Teaching Scheme	Project	Total	Credit
Hours	90	90	3
Marks	150	150	

A. Instructional Method and Pedagogy:

- Summer internship shall be at least 90 hours during the summer vacation only.
- Department/Institute will help students to find an appropriate company/industry/organization for the summer internship.
- The student must fill up and get approved a Summer Internship Acceptance formby the company and provide it to the Coordinator of the department within the specified deadline.
- Students shall commence the internship after the approval of the department Coordinator. Summer internships in research centers is also allowed.
- During the entire period of internship, the student shall obey the rules and regulations of the company/industry/organization and those of the University.
- Due to inevitable reasons, if the student will not able to attend the internship for few days with the permission of the supervisor, the department Coordinator should be informed via e-mail and these days should be compensated later.
- The student shall submit two documents to the Coordinator for the evaluation ofthe summer internship:
    - Summer Internship Report
    - Summer Internship Assessment Form
- Upon the completion of summer internship, a hard copy of “Summer Internship Report” must be submitted through the presentation to the Coordinator by the first day of the new term.
- The report must outline the experience and observations gained through practical internship, in accordance with the required content and the format described in this

guideline. Each report will be evaluated by a faculty member of the department ona satisfactory/unsatisfactory basis at the beginning of the semester.

- If the evaluation of the report is unsatisfactory, it shall be returned to the student for revision and/or rewriting. If the revised report is still unsatisfactory the student shall be requested to repeat the summer internship.

C. Format of Summer Internship Report:

The report shall comply with the summer internship program principles. Main headingsare to be centered and written in capital boldface letters. Sub-titles shall be written in small letters and boldface. The typeface shall be Times New Roman font with 12pt. All the margins shall be 2.5cm. The report shall be submitted in printed form and filed. An electronic copy of the report shall be recorded in a CD and enclosed in the report. Eachreport shall be bound in a simple wire vinyl file and contain the following sections:

- Cover Page
- Page of Approval and Grading
- Abstract page: An abstract gives the essence of the report (usually less than one page). Abstract is written after the report is completed. It must contain the purpose and scope of internship, the actual work done in the plant, and conclusions arrived at.
- TABLE OF CONTENTS (with the corresponding page numbers)
- LIST OF FIGURES AND TABLES (with the corresponding page numbers)
- DESCRIPTION OF THE COMPANY/INDUSTRY/ORGANISATION: Summarize the work type, administrative structure, number of employees (how many engineers, under which division, etc.), etc. Provide information regarding
    - Location and spread of the company
    - Number of employees, engineers, technicians, administrators in thecompany
    - Divisions of the company
    - Your group and division
    - Administrative tree (if available)
    - Main functions of the company

    - Customer profile and market share
- INTRODUCTION: In this section, give the purpose of the summer internship, reasons for choosing the location and company, and general information regarding the nature of work you carried out.
- PROBLEM STATEMENT: What is the problem you are solving, and what are thereasons and causes of this problem.
- SOLUTION: In this section, describe what you did and what you observed duringthe summer internship. It is very important that majority of what you write should be based on what you did and observed that truly belongs to the company/industry/organization.
- CONCLUSIONS: In the last section, summarize the summer internship activities. Present your observations, contributions and intellectual benefits. If this is yoursecond summer internship, compare the first and second summer internships and your preferences.
- REFERENCES: List any source you have used in the document including books,articles and web sites in a consistent format.
- APPENDICES: If you have supplementary material (not appropriate for the main body of the report), you can place them here. These could be schematics, algorithms,drawings, etc. If the document is a datasheet and it can be easily accessed from the internet, then you can refer to it with the appropriate internet link and document number. In this manner you don't have to print it and waste tons of paper.

B. Learning outcomes:

After completion of the course students, will able:

- To apply knowledge and skills learned in company/industry/organization to real-world problems.
- To solve engineering problems.
- To function in a team work.
- To work with teammates from other disciplines.
- To use experience related to professional and ethical issues in the workenvironment.
- To explain the impact of engineering solutions developed in a project, in a global,economic, environmental, and societal context.

- To finds relevant sources (e.g., library, Internet, experts) and gather information.
- To demonstrate knowledge of contemporary issues related with engineering ingeneral.
- To use new tools and technologies

C. Student Learning Outcome:

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

CO1	Demonstrate ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
CO2	Cultivate an understanding of their multidisciplinary interest, including the skills, responsibilities and career path of professionals through practice-oriented and 'hands-on' working experience.
CO3	An exhibit foresight, independent thinking, resourcefulness, and the ability to make decisions.
CO4	Develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in an industry.

Course Articulation Matrix:

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	-	-	-	-	-	-	-	-	3	2
CO2	1	2	3	2	-	-	-	-	-	-	-	-	1	1
CO3	1	1	2	-	-	-	-	2	2	3	-	-	2	1
CO4	-	-	-	-	-	-	-	-	-	-	-	-	1	3