Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Artificial Intelligence**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 100/35	**L: 3 T: 1 P: _ Credits: 4**
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

COURSE OBJECTIVE:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

UNIT 1: Introduction: Overview of AI problems, AI problems as NP, Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI. The AI Ladder - The Journey for Adopting AI Successfully, Advice for a career in AI, Hotbeds of AI Innovation.

UNIT 2: Problem solving techniques: State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.

UNIT 3: Logic: Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm,

UNIT 4: Knowledge Representation schemes and reasoning: Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts

UNIT 5: Planning: The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

Text Books :

1. A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Book Publishing, 2019.
2. Artificial Intelligence: A modern approach by Stuart Russel, Pearson Education, 2010.
3. Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017.
4. Artificial Intelligence: A new synthesis by Nils and Nilson, Elsevier, 1997.
5. Artificial Intelligence by Luger, Pearson Education, 2002.
6. Artificial Intelligence by Padhy, Oxford Press, 2005.
7. https://www.edx.org/course/artificial-intelligence-ai
8. https://www.udemy.com/course/artificial-intelligence-az/

Reference Books :

1. Title Introduction to Artificial Intelligence and Expert Systems Author Dan W. Patterson Publisher Pearson Education Edition 1st Edition, 2015
2. 2Title Artificial Intelligence: A Modern Approach Author S. Russell and P. Norvig. Publisher Prentice Hall Edition 3rd Edition 2009

COURSE OUTCOME: At the end of this course students will:

1. Apply AI algorithms for solving practical problems
2. Describe human intelligence and AI
3. Explain how intelligent system works.
4. Apply basics of Fuzzy logic and neural networks.
5. Learn About Application and Analysis of planning approaches.

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Introduction to Machine Learning**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	L: 3 T: 1 P: 0 Credits: 4
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

Course Objectives

1. Understand the concept of Machine Learning.
2. Familiarize with Simple Linear Regression and Logistic Regression.
3. Appreciate the various nuances of Multiple Regressions and Model Building.
4. Identify and apply the Classification algorithms.
5. Apply the Clustering algorithms for developing applications.

UNIT- I Introduction: The Origins of Machine Learning, Uses and Abuses of Machine Learning, How do Machines Learn? -Abstraction and Knowledge Representation, Generalization, Assessing the Success of Learning, Steps to Apply Machine Learning to Data, Choosing a Machine Learning Algorithm - Thinking about the Input Data, Thinking about Types of Machine Learning Algorithms, Matching Data to an Appropriate Algorithm.

UNIT- II Simple Linear Regression: Simple Linear Regression Model Building, Estimation of Parameters Using Ordinary Least Squares, Interpretation of Simple Linear Regression Coefficients, Validation of Simple Linear Regression Model, Coefficient of Determination (R-squared) and Adjusted R-Squared, Spurious Regression, Hypothesis Test for Regression Coefficients (t-Test), Test for Overall Model: Analysis of Variance (F-Test), Residual Analysis

UNIT-III Regression & Model Building: Introduction, Ordinary Least Squares Estimation for Multiple Linear Regression, Multiple Linear Regression Model Building, Partial Correlation and Regression Model Building, Interpretation of Multiple Linear Regression Coefficients. Validation of Multiple Regression Model, Coefficient of Multiple Determination (R-Squared), Adjusted R-Squared, Statistical Significance of Individual Variables in Multiple Linear Regression: t-Test, Validation of Overall Regression Model: F-Test

UNIT-IV Classification Algorithms: What is Classification? General Approach to Classification, k-Nearest Neighbor Algorithm, Logistic. Regression, Decision Trees, Naive Bayesian Classifier, Ensemble Methods: Bagging, Boosting and AdaBoost and XBoost, Random Forests Support Vector Machines, Rough Set and Fuzzy Set Approaches, Classification Model Evaluation and Selection: Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value

UNIT-V Clustering Methods & Analysis: Overview of Some Basic Clustering Methods, Hierarchical Methods: Agglomerate versus Divisive Hierarchical Clustering, Distance Measures, Probabilistic Hierarchical Clustering, Multiphase Hierarchical Clustering Using Clustering Feature Trees, Partitioning Methods: k-Means Clustering, k-Medoids Clustering, Density-Based Clustering: DBSCAN - Density-Based Clustering.

Text Books:

1. Tom M. Mitchell- Machine Learning - McGraw Hill Education, International Edition
2. C. M. Bishop. Pattern Recognition and Machine Learning. First Edition. Springer, 2006. (Second Indian Reprint, 2015). [Bishop]

Reference Books:

3. V.K. Jain, Machine Learning, Khanna Publishing House
4. Vinod Chandra S.S., Artificial Intelligence & Machine Learning, PHI
5. Introduction to Machine Learning with Python - Andreas C. Müller, Sarah Guido, **First** Edition O'Reilly Media, Inc.
6. Python for Everyone - Saurabh Chandrakar, Dr. Nilesh Bhaskarrao Bahadure bpb Publication ISBN: 9789355518170, eISBN: 9789355518156
7. Tom M. Mitchell, "Machine Learning", Mc Graw Hill, Indian Edition, 2017

Course Outcomes [After undergoing the course, students will be able to:]

1. Understand a wide variety of learning algorithms.
2. Understand how to evaluate models generated from data.
3. Apply the algorithms to a real problem.
4. Optimize the models learned and report on the expected accuracy.
5. Applying the optimized models.

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Theory of Computation**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 100/35	**L: 3 T: 1 P: _ Credits: 4**
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

COURSE OBJECTIVE:

1. Students will learn about a variety of issues in the mathematical development of computer science theory, particularly finite representations for languages and machines.
2. Students will gain a more formal understanding of algorithms and procedures
3. To illustrate finite state machines to solve problems in computing.
4. To explain the hierarchy of problems arising in the computer sciences.
5. To familiarize Regular grammars, context frees grammar.
6. To solve various problems of applying normal form techniques, push down automata and Turing Machines.

UNIT I - THE THEORY OF AUTOMATA : Introduction to automata theory, Examples of automata machine, Finite automata as a language acceptor and translator. Deterministic finite automata. Non deterministic finite automata, finite automata with output (Mealy Machine. Moore machine). Finite automata with ? moves, Conversion of NFA to DFA by Arden's method, Minimizing number of states of a DFA. My hill Nerode theorem, Properties and limitation of FSM. Two way finite automata. Application of finite automata.

UNIT II - REGULAR EXPRESSIONS : Regular expression, Properties of Regular Expression. Finite automata and Regular expressions. Regular Expression to DFA conversion & vice versa. Pumping lemma for regular sets. Application of pumping lemma, Regular sets and Regular grammar. Closure properties of regular sets. Decision algorithm for regular sets and regular grammar.

UNIT III - GRAMMARS: Definition and types of grammar. Chomsky hierarchy of grammar. Relation between types of grammars. Role and application areas of grammars. Context free grammar. Left most linear &right most derivation trees. Ambiguity in grammar. Simplification of context free grammar. Chomsky normal from. Greibach normal form, properties of context free language. Pumping lemma fro context free language. Decision algorithm for context tree language.

UNIT IV - PUSH DOWN AUTOMATA AND TURING MACHINE: Basic definitions. Deterministic pushdown automata and non deterministic push down automata. Acceptance of push down automata. Push down automata and context free language. Turing machine model. Representation of Turing Machine Construction of Turing Machine for simple problem's. Universal Turing machine and other modifications. Church's Hypothesis. Post correspondence problem. Halting problem of Turing Machine.

UNIT V - COMPUTABILITY: Introduction and Basic concepts. Recursive function. Partial recursive function. Partial recursive function. Initial functions, computability, A Turing model for computation. Turing computable functions, Construction of Turing machine for computation. Space and time complexity. Recursive enumerable language and sets.

Text Books :

1. Theory of Computer Science (Automata Language & Computation), K.L.P. Mishra and N. Chandrasekran, PHI.
2. Introduction to Automata theory. Language and Computation, John E. Hopcropt & Jeffery D. Ullman, NarosaPublishing House.

Reference Books :

1. Theory of Automata and Formal Language, R.B. Patel & P. Nath, Umesh Publication
2. An Introduction and finite automata theory, Adesh K. Pandey, TMH.
3. Theory of Computation, AM Natrajan. Tamilarasi, Bilasubramani, New Age International Publishers.
4. Finite Automata and Formal Languages: A Simple Approach, A.M. Padma Reddy, Pearson Education, India.

COURSE OUTCOME:

At the end of this course students will:

1. Design finite automata to accept a set of strings of a language.
2. Determine whether the given language is regular or not. .
3. Design context free grammars to generate strings of context free language.
4. Design push down automata and the equivalent context free grammars and Design Turing machine.
5. Distinguish between computability and noncomputability, Decidability and un-decidability

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Probability and Statistics**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 100/35	**L: 2 T: 1 P: _ Credits: 3**
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

Course Objectives :

1. To introduce the basic concepts of probability.
2. To introduce the basic concepts random variables.
3. To introduce the elementary concepts of descriptive and inferential techniques of statistical methodology.
4. To build the linear relationship between two variables and also to predict how a dependent variable changes based on adjustments to an independent variable.
5. To acquaint the knowledge of testing of hypothesis for samples which plays an important role in real life problems.

UNIT- I BASICS OF PROBABILITY: Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes'theorem and its applications.

UNIT- II RANDOM VARIABLES: Random Variables : Definition of discrete and continuous random variables, cumulative distribution function (c.d.f.) and its properties, probability mass function (p.m.f.) and probability density function (p.d.f.), Moments of Random a Variable - Mean and Variance. Moment Generating Function of a Random Variable (Definition & Properties). Bernoulli, Binomial, Poisson and Normal Distributions – Problems with Applications.

UNIT-III BASICS OF STATISTICS: Population, Sample, Attribute and Variable (Discrete and Continuous). Classification and Tabulation of Data. Graphical Representation of Data, Descriptive statistics: Measures of Central Tendency - Mean, Median, Mode. Dispersion and its Measures – Range, Quartile Deviation, Mean Deviation, Standard Deviation. Skewness and Kurtosis.

UNIT-IV CORRELATION AND REGRESSION: Correlation -Coefficient of correlation, Rank correlation, Regression-Regression coefficients, Lines of regression. Multiple correlation and regression- Coefficient of multiple Correlation, multiple regression, multiple linear regression equations.

UNIT-V : SAMPLING AND TESTING OF HYPOTHESIS: Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

Text Books:

1. Richard A. Johnson Irwin Miller and John E. Freund, ``Probability and Statistics for Engineers", Prentice Hall, New Delhi, 11th Edition, 2011.
2. P. Kousalya, "Probability, statistics and random processes", Pearson Education, 2013.

Reference Books:

1. Gupta S. C. And V.K. Kapoor (2020), Fundamental of Mathematical Statistics, S. Chand and Co., 12th Edition
2. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", vol. I & II, World Press.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co.Ltd.
4. Mukhopadhyay, P. (1999): Applied Statistics, New Central Book Agency.
5. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

Course Outcomes [After undergoing the course, students will be able :]

1. Provide very good insight which is essential for industrial applications by learning probability distributions.
2. Evaluate randomness in certain realistic situation which can be either discrete or continuous type and compute statistical constants of these random variables.
3. Compute and Interpret Measures of Central Tendency and Dispersion of Data; Construct and Analyze Graphical Displays to Summarize Data.
4. Identify regression models that describe the relationship between a dependent variable and one or more independent variables.
5. Analyze and interpret statistical inference using samples of a given size which is taken from a population.

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Artificial Intelligence Lab**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 40/20	L: 0 T: 0 P: 2 Credits: 1

Course Objectives:

- To provide skills for designing and analyzing AI based algorithms.
- To enable students to work on various AI tools.
- To provide skills to work towards solution of real life problems

List of Experiments: (Each student should perform, at least, 10 experiments.)

1. Write a prolog program to find the rules for parent, child, male, female, son, daughter, brother, sister, uncle, aunt, ancestor given the facts about father and wife only.
2. Write a program to find the length of a given list
3. Write a program to find the last element of a given list
4. Write a program to delete the first occurrence and also all occurrences of a particular element in a given list.
5. Write a program to find union and intersection of two given sets represented as lists.
6. Write a program to read a list at a time and write a list at a time using the well defined read & write functions.
7. Write a program given the knowledge base,
   If x is on the top of y, y supports x.
   If x is above y and they are touching each other, x is on top of y.
   A cup is above a book. The cup is touching that book. Convert the following into wff's, clausal form; Is it possible to deduce that `The book supports the cup'.
8. Write a program given the knowledge base,
   If Town x is connected to Town y by highway z and bikes are allowed on z, you can get to y from x by bike.
   If Town x is connected to y by z then y is also connected to x by z.
   If you can get to town q from p and also to town r from town q, you can get to town r from town p.
   Town A is connected to Town B by Road 1. Town B is connected to Town C by Road 2.
   Town A is connected to Town C by Road 3. Town D is connected to Town E by Road 4.
   Town D is connected to Town B by Road 5. Bikes are allowed on roads 3, 4, 5.
   Bikes are only either allowed on Road 1 or on Road 2 every day. Convert the following into wff's, clausal form and deduce that `One can get to town B from town D'.
9. Solve the classical problems for demonstrating AI search heuristics: (Water Jug problem, Monkey Banana problem, Missionary Cannibals problem, Travelling Salesman Problem and alike).
10. Solve the classical Crypt arithmetic problems in AI: (DONALD + GERALD = ROBERT, CROSS + ROADS = DANGER, SEND + MORE = MONEY and alike).
11. Solve the classical Blocks World Problem demonstrating Planning Problem-solving simulation in AI.
12. Write a program to search any goal given an input graph using AO* algorithm.

List of Equipments/Machine required: PC with Wndows XP Operating System, Visual prolog compiler

Recommended Books :

1. Ivan Bratko : Logic & prolog programming.
2. Carl Townsend : Introduction to Turbo Prolog, BPB, Publication.
3. W.F. Clocksin & Mellish : Programming in PRLOG, Narosa Publication House

Laboratory Outcomes [After undergoing the course, students will be able to:]

1. Acquire an overview of logic constructs for performing inferencing techniques. (First Order Predicate Calculus) in toy problems /classical problems using PROLOG / LISP syntax.
2. Gain confidence in drafting production rules (iterative / recursive) for an AI simulating code, given a story domain.
3. Understand, on how to use different data structures (lists, trees, stacks and queues) for solving routing problems and implementing heuristic searches.
4. Gain exposure to deal with situations that crop up syntax / compile-time / run-time errors.
5. Simulate game playing / puzzle problems using general solution in PROLOG / LISP syntax.

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Machine Learning Laboratory**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 40/20	L: 0 T: 0 P: 2 Credits: 1
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

Course Objectives

1. To introduce classical and foundational concepts, results, methodologies and applications in machine learning
2. To develop abilities for developing a solution for a given problem
3. The knowledge of using machine learning to make predictions
4. The underlying mathematical relationships within and across machine learning algorithms
5. Paradigms of supervised and un-supervised learning.

Hardware requirement: i5 Processor, 8GB RAM, Internet Connection

Software Environment: IDE recommended PYCHARM (Recommended), JUPYTER, VISUAL STUDIO

1. Introduction to pandas
2. Introduction to NumPy
3. Wine Quality Prediction
4. Housing Price Prediction
5. Air Quality Prediction
6. Bank Marketing
7. Liver Disease Prediction
8. Heart Disease Prediction
9. Credit Default Prediction
10. Car Price Prediction
11. Media Content Problem
12. Online Retail Case Study
13. Airline Passengers Prediction
14. Energy Efficiency Analysis
15. Stock Price Prediction
16. Car Evaluation
17. Movie Sentiment Analysis
18. Program to demonstrate Simple Linear Regression
19. Program to demonstrate Logistic Regression using SCIKIT learn
20. Program to demonstrate Multiple Linear Regression
21. Program to demonstrate k-Nearest Neighbor flowers classification
22. Program to demonstrate Naive- Bayes Classifier
23. Program to demonstrate K-Medoid clustering algorithm
24. Program to demonstrate DBSCAN clustering algorithm
25. Program to demonstrate SVM based classification

Recommended Books:

1. Richard Duda, Peter Hart, David Stork, Pattern Classification, 2nd Ed, John Wiley & Sons, 2001. ISBN 9788126511167
2. Christopher Bishop. Pattern Recognition and Machine Learning. ISBN 0387310738.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman. Elements of Statistical Learning. ISBN 0387952845.
4. Tom Mitchell. Machine Learning. McGraw-Hill. ISBN 0070428077.
5. Shai Shalev-Shwartz, and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014. ISBN 978-1-107-05713-5.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Data Analytics Using R Programming Lab**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 40/20	L: 0 T: 0 P: 2 Credits: 1

Course Objective:

1. Students will be able to define artificial intelligence and explain its history and development.
2. Students will be able to describe the different types of artificial intelligence and their applications.
3. Students will be able to use artificial intelligence tools and techniques to solve problems.

List of Experiments:

1. Image Classification
   A. Train/Design an image classifier to identify different types of animals?
   B. Train/Design an image classifier to identify different types of objects?
   C. Train/Design an image classifier to identify different types of faces?
2. Natural Language Processing
   A. Train/Design an NLP model to translate text from one language to another?
   B. Train/Design an NLP model to summarize a text document?
   C. Train/Design an NLP model to answer questions posed in natural language?
3. Speech Recognition
   A. Train/Design a speech recognition model to transcribe audio recordings of lectures or meetings?
   B. Train/Design a speech recognition model to transcribe audio recordings of songs?
   C. Train/Design a speech recognition model to transcribe audio recordings of conversations?
4. Machine Translation
   A. Train/Design a machine translation model to translate news articles from English to Spanish?
   B. Train/Design a machine translation model to translate books from English to French?
   C. Train/Design a machine translation model to translate movies from English to Chinese?
5. Question Answering
   A. Train/Design a question answering model to answer questions about the history of the United States?
   B. Train/Design a question answering model to answer questions about the science of climate change?
   C. Train/Designa question answering model to answer questions about the art of painting?
6. Recommendation Systems
   A. Train/Design a recommendation system to recommend movies to users based on their past viewing history?
   B. Train/Design a recommendation system to recommend books to users based on their past reading history?
   C. Train/Design a recommendation system to recommend products to users based on their past purchase history?
7. Fraud Detection
   A. Train/Design a fraud detection model to identify fraudulent credit card transactions?
   B. Train/Design a fraud detection model to identify fraudulent insurance claims?
   C. Train/Design a fraud detection model to identify fraudulent tax returns?
8. Self-Driving Cars
   A. Train/Design a self-driving car to navigate a city without hitting any obstacles?
   B. Train/Design a self-driving car to park itself in a tight spot?
   C. Train/Design a self-driving car to follow a route without getting lost?

Text Books

1. R for Data Science by Hadley Wickham and Garrett Grolemund
2. Introduction to Statistical Learning with R by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
3. Data Science with R by Christian Robert and George Casella
4. **Artificial Intelligence: A Modern Approach** by Stuart Russell and Peter Norvig
5. **Machine Learning** by Andrew Ng
6. **Deep Learning** by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

Course Outcome: Upon completion of this course, students will be able to:

1. Define artificial intelligence and explain its history and development.
2. Describe the different types of artificial intelligence and their applications.
3. Use artificial intelligence tools and techniques to solve problems.

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **MINOR PROJECT PHASE-I**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 40/20	L: 0 T: 0 P: 2 Credits: 1
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

Pre-requisite: Knowledge of Minimum 2 Subjects & Laboratory

Course Objectives:

1. Acquire the knowledge of Computer Engineering and apply this knowledge to develop a Project Model.
2. Understand and analyse the Engineering Problem
3. Prepare a well-organized Documentation for the Project Developed

Guidelines for Project:

Project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students.

In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

Project Work Phase - 1:

A committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide, shall award the Sessional marks.

The sessional marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

- Student has to Identify and formulate problem
- Students has to survey minimum 5 Research Papers of Reputed Publication
- Proposed Methodology and Objectives of the Project should be defined
- Adopt appropriate method to design selected problem
- Concerned guide and Review Committee will conduct timely evaluation of the project for SESSIONAL assessment.
- At the end of the semester students has to prepare and submit a well-organized project report.

Course Outcomes: [After undergoing the course, students will be able to:]

1. Demonstrate skill to identify and formulate the given problems.
2. Apply basic engineering knowledge learnt in developing system individually or in-group
3. Evaluate current research status by conducting literature survey.
4. Design and develop real time applications
5. Apply the programming language for the implementation of the project and prepare well-organized report.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G)

Program / Semester: **B. Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Internet of Things** (Professional Elective - I)	Course Code:
Total / Minimum-Pass Marks(End Semester Exam):**100 / 35**	L: 2 T: 0 P: 0 Credits: 2
Class Tests & Assignments to be conducted: 2 each	Duration (End Semester Exam): **03 Hours**

Course Objectives:

1. To study the fundamentals about IoT.
2. To study about the functional blocks and IoT Access technologies.
3. To study the design methodology and different IoT hardware platforms.
4. To study the basics of IoT Data Analytics and supporting services.
5. To study about various IoT case studies.

UNIT I: FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT.

Unit II: FUNCTIONAL BLOCK and IoT PROTOCOLS: Sensors, Actuators, Smart Objects, Connecting Smart Objects. **Access Technology:** Physical layer, MAC layers, Topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN. **IP as the IoT Network Layer:** IP versions, Constrained Nodes and Constrained Networks, 6LoWPAN, IoT Application Transport Methods: SCADA, **IoT Application Layer Protocols:** CoAP and MQTT.

UNIT III: DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details

UNIT IV: DATA ANALYTICS AND SUPPORTING SERVICES: Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring and storage, organizing the data. **Supporting Services:** Cloud computing paradigm for data collection, storage and computing, everything as a service and Cloud Service Models.

UNIT V: IoT CASE STUDIES: IoT/IIOT Applications in the Premises, Supply-Chain and Customer Monitoring, IoT applications for smart homes, cities, Environment Monitoring and Agriculture. **CASE STUDY:** Smart City Streetlights Control and Monitoring.

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015 3. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education

Reference Books:

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012.
2. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.

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

1. Understand the basics of IoT.
2. Implement the state of the Architecture of an IoT.
3. Understand design methodology and hardware platforms involved in IoT.
4. Understand how to analyze and organize the data.
5. Compare IOT Applications in real world.

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Introduction to Toolkits for Machine Learning** (Professional Elective - I)	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	L: 2 T: 0 P: 0 Credits: 2
Class Tests & Assignments to be conducted: **2 Each**	**Duration (End Semester Exam): 03 Hours**

Course Objectives

1. To introduce the use of various Machine Learning Toolkits.
2. To introduce the use of Exploratory Data Analysis for performing various data processing activities.
3. To introduce the use of the Seaborn library for data visualization activities.
4. To introduce the concept of Ensemble Learning techniques.
5. To introduce the use of Scikit-Learn Library for data analysis.

Unit 1: Introduction to Machine Learning Toolkits

Definition and purpose of machine learning toolkits, simplification process of toolkits, Overview of different types of machine learning toolkits such as models and techniques; Data Pre-processing and Feature Engineering- Exploring various pre-processing techniques, data scaling, handling missing values, and one-hot encoding, Feature selection and extraction methods, Model Evaluation and Performance Metrics.

Unit 2: Exploratory Data Analysis

Exploratory Analysis: Descriptive and comparative statistics, EDA explained using sample Data set; Exploratory Graphs: 3D scatter plot, Pair plot, and limitations, Histogram and introduction to PDF, Univariate analysis using PDF, Mean, variance, standard deviation, Box-plot with whiskers.

Unit 3: Data Visualization using Seaborn

Visualization: various plots viz multiple, categorical, distribution, Regression; Seaborn-Statistical Estimation; Time Series, Geo-location Data, Correlations and Connections, Hierarchies, Networks, Interactivit.

Unit 4: Ensembles Methods

Introduction to Ensembles Methods, Types of ensemble methods viz stacking, blending, bagging, boosting and its impact on bias and variance, C5.0 boosting, Random Forest, Gradient Boosting Algorithm (GBM), AdaBoost: Adaptive Boosting, Extreme Gradient Boosting (XGBoost), LightGBM.

Unit 5: Scikit-Learn (Open Source Data Analysis Library)

Overview of scikit-learn, Supervised Learning Models with scikit-learn viz linear regression, logistic regression, decision trees, and support vector machines; Introduction to unsupervised learning algorithms using scikit-learn library viz k-means, Hierarchical clustering, DBSACN, and Principal Component Analysis; Measuring classification and Clustering Performance parameters.

Text Books:

1. Data Mining Concepts and Techniques. Jiawei Han, Micheline Kamber and Jian Pei. Morgan Kaufmann
2. Publisher is an imprint of Elsevier.
3. Machine Learning in Action. Peter Harrington, Manning Publications, 2012.
4. Introduction to Machine Learning (3e), Ethem Alpaydin, MIT Press.

Reference Books:

1. Python Data Analytics– Fabio Nelli, Apress.
2. Python for Data Analysis, Wes McKinney, O'Reilly.
3. Foundations of Machine Learning(2e), Mohri Mehryar, Afshin Rostamizadeh, and Ameet Talwalkar,MIT Press.

Course Outcomes [After undergoing the course, students will be able to:]

1. Use various Machine Learning Toolkits available in Python.
2. Apply the concept of Exploratory Data Analysis for performing various data processing activities.
3. Apply the use of the Seaborn library for data visualization activities.
4. Apply the Ensemble Learning techniques.
5. Apply the Scikit-Learn Library for data analysis and data handling activities.

Program / Semester: **B. Tech (V)**	Branch: **Artificial Intelligence**
Subject:– Image Processing and Computer Vision (Professional Elective - I)	Course Code:
Total / Minimum-Pass Marks (End Semester Exam):**100 / 35**	L: 2 T: 0 P: 0 Credits: 2
Class Tests & Assignments to be conducted: 2 each	Duration (End Semester Exam): **03 Hours**

Course Objectives:

1. Apply skills for automatic analysis of digital images to construct representations ofphysical objects and scenes.
2. Design and implement real-life problems using Image processing and computer vision.

UNIT 1: Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc. Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT 2: Depth estimation and Multi-camera views, Multiple View Geometry Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

UNIT 3: Feature Extraction Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT 4: Image Segmentation Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection. Pattern Analysis Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

UNIT 5: Motion Analysis Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation. Shape from X Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Reference Books:

1. Digital Image Processing using MATLAB, By: Rafael C. Gonzalez, Richard Eugene Woods,2nd Edition, Tata McGraw-Hill Education 2010
2. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag LondonLimited 2011.
3. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

Program / Semester: **B.Tech (V)**	Branch: **Artificial Intelligence**
Subject: **Bio-Informatics** (Professional Elective - I)	Course Code:
Total / Minimum-Pass Marks(End Semester Exam):100 / 35	L: 2 T: 0 P: 0 Credits: 2
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

1. To introduce the basics of Bio-Informatics.
2. To introduce the Alignments and Sequences.
3. To introduce the basics of Hidden Marcov Models.
4. To introduce the Protein Classification and structure validation.
5. To introduce the concepts of Drug Recovery.

UNIT- I Bioinformatics-introduction: Application, Data Bases and Data Management, Central Dogma; information search and Data retrieval, Genome Analysis and Gene mapping- Analysis, Mapping, Human Genome Project (HGP)..

UNIT- II Alignment of Pairs and Sequences: Alignment of Multiple Sequences and Phylogenetic Analysis; Tools for similarity Search and Sequence Alignment- FASTA BLAST, Longest Commons Subsequences-Global Sequence Alignment, Scoring Alignment, Local Sequence Alignment, Alignment with Gap Penalties, Multiple Alignment.

UNIT-III Profiles and Hidden Marcov Models (HMMs); Gene Identification and Prediction-Basics, Pattern Recognition, Methods and Tools; Gene Expression and Micro arrays.

UNIT-IV Protein Classification and Structure Visualization; Protein Structure Prediction; Proteomics; Computational methods-Analysis of Pathways, Metabolic Network Properties, Metabolic Control Analysis, Stimulation of Cellular Activities, Biological Mark Up Languages.

UNIT-V Drug Discovery-Introduction, Technology and Strategies, Cell Cycle, G-protein, Coupled, Receptors. Computer Aided Drug Design- Introduction, Drug Design Approaches, Designing methods, ADME-Tox Property Prediction.

Text Books:

1. BIOINFORMATICS by S.C. Rastogy, 2nd Edition, Prentice Hall of India.
2. BIOINFORMATICS by V. R Srinivas, Prentice Hall of India

Reference Books:

1. BIOINFORMATIC COMPUTING by Bergeron, MIT Press.
2. Evolutionary. Computation in Bioinformatics, Gary B. Fogel, David W. Corne (Editors), 2002.
3. Introduction to Bioinformatics, Arthur M. Lesk, 2002, Oxford University Press.

Course Outcomes [After undergoing the course, students will be able to:]

1. Have working knowledge of basic bioinformatics tools.
2. Get knowledge of databases such as GenBank, BLAST, multiple alignment, and phylo- genetic tree construction.
3. Understand the basic theory behind these procedures.
4. Critically analyze the results of their analysis using such tools.

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Program / Semester: B.Tech (V)	Branch: **Artificial Intelligence**
Subject: **Environmental Science**	Course Code:
Total / Minimum-Pass Marks (End Semester Exam): 10	L : 0 T: 0 P: 2 Credits: -
Class Tests & Assignments to be conducted: 2 each	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations

UNIT - I Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT – II Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefitsand problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT – III Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optionalvalues. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT – IV Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards.**Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

UNIT – V Environmental Policy,: Environmental Protection act, Legal aspects Air Act- 1981,Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedicalwaste management and handling rules, hazardous waste management and handling rules.

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha forUniversity Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

Course Outcomes:

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

1. Demonstrate an understanding of basic concept of ecosystem.
2. Demonstrate an awareness of importance of natural resources.
3. Demonstrate an awareness of biotic resources.
4. Understand the pollution caused by different sources.
5. Understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.