Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology
(Autonomous Institute)

Faculty of Science and Technology

Board of Studies

Information Technology

Syllabus

Third Year B.Tech. Information Technology

(2023 Pattern)

(w.e.f. AY: 2025-26)

Institute Vision and Mission

Vision

To achieve Academic Excellence through Persistent and Synergic Collaborations amongst all Stakeholders.

Mission

- To ensure holistic development of students as lifelong learners and problem solvers through value-based quality education.
- To motivate faculty to attain the state-of-the-art knowledge and wisdom in their domain and be a facilitator towards co-creation of knowledge.
- To frame and deploy conducive and empowering policies for multifaceted growth of students, faculty and staff to make them contributors towards excellence.
- To partner with industry for mutually beneficial relations to generate employable and deployable workforce.
- To fulfill the aspirations of alumni, parents, society, region and nation at large by generating technically competent and contributing manpower.

Department Vision and Mission

Vision

To develop globally competent IT professionals through continuous learning.

Mission

- To provide graduates with the programming skills and domain knowledge.
- To collaborate with local, state, national, and international entities in education.
- To develop technically competent professionals with social values and ethics.
- To encourage faculty to acquire state-of-the art knowledge.

Program Educational Objectives	
PEO1	Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.
PEO2	Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.
PEO3	Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.
PEO4	Have commitment ethical practices, societal contributions through communities and life-long learning.
PEO5	Possess better communication, presentation, time management and team work skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

Program Outcomes		
PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development of Solutions	An ability to design, implement, and evaluate software or a software/hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigation of Complex Problems	An ability to identify, formulate, and provide essay schematic solutions to complex engineering /Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer- based systems with necessary constraints and assumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solutions for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security and social issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies /tools with the help of electives, profession along animations and extra- curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in the engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.

Program Specific Outcomes(PSO)	
PSO1	Students will be able to apply engineering principles and practices for the development and maintenance of software system.
PSO2	Students will be able to undertake a team project by following professional ethical practices.
PSO3	Students will be able to make successful career in IT industry meeting the requirement of industries.

SEMESTER-I

Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	IT23301	Theory of Computation	3		1	10	30	60	30			130	3		1	4
PCC	IT23302	Machine Learning	3	2		10	30	60		30		130	3	1		4
PEC	IT23303 to IT23305	Program Elective 1	3	2		10	30	60			30	130	3	1		4
MDM	MD23XXX	MDM	2	2		20	20	50	20			110	2	1		3
VEC	HS23301	Universal Human Values and Professional Ethics	2			10		60				70	2			2
OE	OE230XX	Open Elective	2					50				50	2			2
CEP	IT23306	Community Engineering. Project		4		10			30		30	70		2		2
AU	HS23302	Constitution of India	1													AU
	Total		16	10	1	70	110	340	80	30	60	690	15	5	1	21

SEMESTER-II

Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	IT23311	Computer Networks & Security	3	2		10	30	60		30		130	3	1		4
PEC	IT23312 to IT23314	Program Elective 2	3	2		10	30	60			30	130	3	1		4
PEC	IT23315 to IT23317	Program Elective 3	3	2		10	30	60		30		130	3	1		4
MDM	MD23XXX	Multi-disciplinary minor	2	2		20	20	50	20			110	2	1		3
VEC	HS23311	Environmental Studies	2			10		60				70	2			2
OE	OE230XX	Open Elective	2					50				50	2			2
VSEC	IT23318	Advanced Java Programming	1	2		10			30		30	70	1	1		2
AU	HS23312	Democracy, Election, and Governance	1													AU
	Total		17	10	0	70	110	340	50	60	60	690	16	5	0	21

Prof. S.A. Takale	Dr. C.B. Nayak	Prof. S.M. Bhosle	Prof. S.B. Lande
HoD – IT	Dean Autonomy	Dean Academics	Principal

VPKBIET BARAMATI Affiliated to S.P.P.U. Pune Id No./PU/PN/Engg/152/2008 PUNE (MS.)

Multidisciplinary Minor Courses			
Course Code	**Course Name**	**Course Code**	**Course Name**
AI23051	AI & Machine Learning	ET23053	Internet of Things
AI23052	Data Science	CE23051	Waste Management
AI23053	Generative AI (Sem V+)	CE23052	Green building & smart cities
CO23051	Cloud Computing	ME23051	3-D Printing
CO23052	High Performance Computing (Sem V+)	ME23052	Robotics & Automation
CO23053	Computer Graphics & Gaming	EL23051	Solar Technology
IT23051	Cyber security	EL23052	Industrial Automation
IT23052	Full Stack Development	GS23051	Nanotechnology
ET23051	Embedded Systems	GS23052	Linear Algebra and Statistics
ET23052	Drone Technology		

Open Elective Courses			
Course Code	**Course Name**	**Course Code**	**Course Name**
OE23001	Digital Marketing	OE23011	Biotechnology
OE23002	Professional Leadership	OE23012	International Relations
OE23003	Organizational Behavior	OE23013	Universal Human Values
OE23004	Industrial Management	OE23014	Education Technology
OE23005	Disaster Management	OE23015	Design Thinking
OE23006	Energy Economics & Management	OE23016	Accounting & Finance
OE23007	Operations Research	OE23017	Sustainability & Climate Change
OE23008	Intellectual Property Rights	OE23018	Agriculture Technology
OE23009	Cyber Laws	OE23019	Architectural Technology
OE23010	Bioinformatics		

SEMESTER-I

Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	IT23301	Theory of Computation	3		1	10	30	60	30			130	3		1	4
PCC	IT23302	Machine Learning	3	2		10	30	60		30		130	3	1		4
PEC	IT23303 to IT23305	Program Elective 1	3	2		10	30	60			30	130	3	1		4
MDM	MD23XXX	MDM	2	2		20	20	50	20			110	2	1		3
VEC	HS23301	Universal Human Values and Professional Ethics	2			10		60				70	2			2
OE	OE230XX	Open Elective	2					50				50	2			2
CEP	IT23306	Community Engineering. Project		4		10			30		30	70		2		2
AU	HS23302	Constitution of India	1													AU
	Total		16	10	1	70	110	340	80	30	60	60	15	5	1	21

Elective -I		
Sr. No	Course Code	Elective 1 Course
1	IT23303	Design and Analysis of Algorithms
2	IT23304	Software Testing and Automation
3	IT23305	Python for Data Analytics

Prof. S.A. Takale
HoD – IT

Dr. C.B. Nayak
Dean Autonomy

Prof. S.M. Bhosle
Dean Academics

Prof. S.B. Lande
Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

Theory of Computation

Course Code : IT23301	Course Credits: 04	Course type: PCC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	-	1	10	30	60	30	-	-

Prerequisite Course Mapping:

1. Discrete Structures.
2. Data structures.

Future Course Mapping:

1. Principle of Compiler Design

Course Objectives:

1. To know the applicability of the model of computation to different problems.
2. To understand in detail the relationship among formal languages, formal grammars, and automata.
3. To learn the design of Finite Automata, Pushdown Automat, and Turing Machine for processing of formal languages.
4. To study the theory of computability and complexity for algorithm design.

Course Outcomes:

On completion of the course, students will be able to–

1. Design finite automata and its variants to Solve computing problems.
2. Formulate regular expressions for the regular languages and finite automata.
3. Identify types of grammar, Design and Simplify Context Free Grammar.
4. Design pushdown automata machine for the Context Free Language.
5. Design and analyze Turing machines for formal languages.
6. Understand decidable and undecidable problems, Analyze complexity classes.

UNIT No.	Syllabus	Hrs
I	**FINITE AUTOMATA** Basic Concepts: Symbols, Strings, Language, Formal Language. Finite Automata (FA): Formal definition and notations for FSM, Concept of state transition diagram and transition table for FA, Construction of DFA, NFA, NFA with epsilon moves. Conversion of NFA with epsilon moves to NFA, Conversion of NFA to DFA, and Conversion of NFA with epsilon moves to DFA, Minimization of FA, Equivalence of FAs, and Applications of FA. Finite State Machine with output: Moore and Mealy machines - Definition, Construction, Inter-Conversion.	7
II	**REGULAR EXPRESSIONS AND LANGUAGES** Regular Expressions (RE): Definition and Identities of RE, Operators of RE, Equivalence of two regular expressions, Equivalence of regular expressions and regular languages (RL), Conversion of RE to FA using direct method, Conversion of FA to RE using Arden's theorem, Pumping lemma for RLs, Closure properties of RLs, Applications of Regular Expressions.	7
III	**CONTEXT FREE GRAMMAR AND LANGUAGE** Grammar: Introduction and representation, Chomsky Hierarchy, Formal definition of Regular Grammar(RG), Conversions: LRG to RLG, RLG to LRG, RG to FA, FA to RG. Context Free Grammar (CFG): Definition of CFG, Derivation tree, sentential forms, Leftmost and Rightmost derivations, Ambiguous Grammar and unambiguous grammar, Context Free Language (CFL). Grammar Simplification, Normal forms: Chomsky Normal Form, Greibach Normal Form. Closure properties of CFL, Pumping lemma for CFL.	7

IV	**PUSHDOWN AUTOMATA AND POST MACHINE** Pushdown Automata(PDA) : Introduction and formal definition of PDA, Construction of Transition diagram and Transition table for PDA, Instantaneous Description of PDA, Equivalence of Acceptance by Final State & Empty stack, Deterministic PDA and Nondeterministic PDA, Context Free Language and PDA Conversion of CFG to PDA and PDA to CFG. Post Machine (PM): Definition and construction of Post Machine.	6
V	**TURING MACHINE** Turing Machine (TM): Formal definition of a Turing machine, Design of Turing machines, Variants of Turing Machines: Deterministic TM, Nondeterministic TM, Multi-tape TM, Universal Turing Machine, Halting problem of TM , Church-Turing thesis, Recursive Languages and Recursively Enumerable Languages, Post Correspondence Problem.	6
VI	**COMPUTATIONAL COMPLEXITY** Decidability: Decidable problems concerning regular languages, Decidable problems concerning context free languages, Un-decidability. Computational Complexity: Measuring Complexity, The Class P, Examples of problems in P, The Class NP, and Examples of problems in NP, Reducibility, Mapping Reducibility, Polynomial Time Reduction and NP Completeness. Satisfiability Problem, NP Completeness of the SAT Problem,	6

Text Books :

1. John C. Martin, "Introduction to Language and Theory of Computation", TMH, 3rd Edition, ISBN: 978-0070660489.
2. Vivek Kulkarni, "Theory of Computation", Oxford University Press,ISBN- 13 : 978-0198084587.

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman," Introduction to Automata Theory Languages and Computation", Addison-Wesley, ISBN 0-201-44124-1.
2. K.L.P Mishra, N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", Prentice Hall India, 2nd Edition.
3. Michael Sipser, "Introduction to the Theory of Computation", CENGAGE Learning, 3rd Edition ISBN-13:978-81-315-2529-6.
4. Daniel Cohen, "Introduction to Computer Theory", Wiley & Sons, ISBN 97881265133454.
5. Kavi Mahesh, "Theory of Computation: A Problem-Solving Approach", Wiley India, ISBN-1081265331106.

Online Resources:

1. https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf
2. https://theory.cs.princeton.edu/complexity/book.pdf

NPTEL video lecture link :

1. https://nptel.ac.in/courses/106/104/106104148/
2. https://nptel.ac.in/courses/106/104/106104028/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23301	CO1	3	3	2	3	1				2	2		1
	CO2	3	3	2	3	1				2	2		1
	CO3	3	3	2	3	1				2	2		1
	CO4	3	3	2	3	1				2	2		1
	CO5	3	3	2	3	1				2	2		1
	CO6	3	3	2	2					2	2		1

Machine Learning

Course Code : IT23302	Course Credits: 04	Course type: PCC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
03	02	-	10	30	60	-	30	-

Prerequisite Course Mapping:

1. Basics of Statistics
2. Linear Algebra
3. Calculus
4. Probability

Future Course Mapping:

Deep Learning

Course Objectives:

1. To Understand the basic concepts of machine learning and apply them for the various problems
2. To learn various machine learning types and apply for different machine learning tasks
3. To learn to evaluate machine learning model
4. To Understand model hyper parameters, optimize the machine learning model and generalize it.

Course Outcomes:

CO1: Understand the basic concepts of machine learning and apply them for the various problems

CO2: Design classification models and their relevant applications, Analyse classification models performance.

CO3: Apply regression techniques to solve real world problem and **evaluate** regression model performance

CO4: Apply the tree-based and probabilistic machine learning algorithms

CO5: Apply unsupervised learning algorithms for real world problems.

CO6: Understand the fundamental concepts of Artificial Neural Network

UNIT No.	Syllabus	Teaching Hours
I	**Introduction:** Definition, Machine learning applications, Learning Tasks- Descriptive and Predictive Tasks, Types of Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning. Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality. Dataset Preparation: Training , Testing Dataset, Dataset Validation Techniques – Hold-out, k-fold Cross validation, Leave-One-Out Cross-Validation (LOOCV).	7
II	**Classification:** **Binary Classification:** Linear Classification model, Performance Evaluation- Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure **Multi-class Classification:** Model, Performance Evaluation Metrics – Per-class Precision and Per-Class Recall, weighted average precision and recall -with example, Handling more than two classes, Multiclass Classification techniques -One vs One, One vs Rest **Linear Models:** Introduction, Linear Support Vector Machines (SVM) –	7

	Introduction, Soft Margin SVM, Introduction to various SVM Kernels to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid. **Logistic Regression** – Model, Cost Function.	
III	**Regression** Introduction, Univariate Regression, multivariate regression, Regression model representation, Least-Square Method, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Linear Regression optimization with Gradient Descent. Estimating the values of the regression coefficients Introduction to Polynomial Regression: Generalization- Overfitting Vs. Underfitting, Bias Vs. Variance.	7
IV	**Tree based and probabilistic models** Tree Based Model: Decision Tree – Concepts and Terminologies, Impurity Measures -Gini Index, Information gain, Entropy, Tree Pruning -ID3/C4.5, Advantages and Limitations Probabilistic Models: Naïve Bayes Classifier	6
V	**Distance and Rule based models** Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), K-Nearest Neighbour for Classification and Regression, Clustering: K-means clustering Algorithm-with example, Hierarchical Clustering, Divisive Dendrogram for hierarchical clustering, Association Rule Mining: Introduction, Rule learning for subgroup discovery, Apriori Algorithm, Performance Measures – Support, Confidence, Lift.	6
VI	**Introduction to Artificial Neural Network** Biological Neuron, Introduction to ANN, McCulloch Pitts Neuron, backpropogation, perceptron, activation functions, Introduction to deep learning, Convolution neural network.	6

List of Practical Assignments:

1. Data preparation: Data preparation: Download heart dataset from kaggle.(https://www.kaggle.com/zhaoyingzhu/heartcsv) and perform operation on given dataset as : Find Shape,size, dimension of the dataset, Find Missing Values, Find data type of each column, Find Mean age of patients, Create subsets of the dataset, split dataset into training (75%)and test set (25%), visualize data.
2. Assignment on Classification technique : Implement binary/Multiclass classification using Support vector classifier using suitable dataset and Evaluate model.
3. Assignment on Regression technique: Apply Linear regression using suitable library function. Assess the performance of regression models using MSE, MAE and R-square metrics. Visualize regression model
4. Download graduate admission prediction dataset from kaggle.(https://www.kaggle.com/mohansacharya/graduate-admissions) . Apply Data transformation, Data-preprocessing techniques, prepare data. Build a machine learning model classifier using Decision tree to predict whether a student will get admission or not. Evaluate model.
5. Assignment on clustering: Download mall-customer dataset from kaggle. https://www.kaggle.com/shwetabh123/mall-customers). Apply clustering algorithms (based on the spending score) to find thee group of customers. Evaluate model
6. Assignment on Association Rule Learning: Download Market Basket Optimization dataset from link (https://www.kaggle.com/hemanthkumar05/market-basket-optimization) . This dataset comprises the list of transactions of a retail company over the period of one week. It contains a total of 7501 transaction records where each record consists of the list of items sold in one transaction. Using this record of transactions and items in each transaction, find the association rules between items.
7. Mini project: Develop a mini project in a group of 3-4 students for a machine learning task

Text Books :

1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press, 2004
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Tom M. Mitchell, "Machine Learning", McGraw-Hill, 2010

Reference Books:

1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.

Online Resources:

1. Introduction to Machine Learning: https://nptel.ac.in/courses/106/106/106106139/
2. Machine Learning: https://nptel.ac.in/courses/106/106/106106202/
3. Machine Learning for Science and Engineering applications: https://nptel.ac.in/courses/106/106/106106198/
4. Introduction to Machine Learning: https://nptel.ac.in/courses/106/105/106105152/
5. Deep Learning (Part-I): https://nptel.ac.in/courses/106/106/106106184/
6. Deep Learning: https://onlinecourses.nptel.ac.in/noc19_cs54/preview
7. Naive Bayes from Scratch: https://courses.analyticsvidhya.com/courses/naive-bayes
8. Getting Started with Neural Networks: https://courses.analyticsvidhya.com/courses/getting-startedwith-neural-networks
9. Sk-learn library: https://scikit-learn.org/stable/
10. Pandas library: https://pandas.pydata.org/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23302	CO1	2			1	2				1	1	1	1
	CO2	3	2	2	1	2				1	1	1	1
	CO3	3	2	2	1	3				2	1	1	1
	CO4	3	2	1	1	2				1	1	1	1
	CO5	3	2	3	2	3				1	1	1	2
	CO6	2			2								1

Elective 1: Design and Analysis of Algorithms

Course Code : IT23303	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	-	30

Prerequisite Course Mapping:

1. Data Structures
2. Discrete Mathematics
3. Basic Mathematics-Induction, Probability Theory

Future Course Mapping:

1. Distributed Computing
2. Advanced Algorithms

Course Objectives:

1. To understand the problem solving and problem classification.
2. To know the basics of computational complexity analysis of various algorithms.
3. To provide students with foundations to deal with a variety of computational problems using different design strategies.
4. To select appropriate algorithm design strategies to solve real world problems.
5. To understand the concept of nondeterministic polynomial algorithms.

Course Outcomes:

CO1: Evaluate computational complexity using asymptotic notations for various algorithms.
CO2: Apply Divide & Conquer as well as Greedy approach to design algorithms.
CO3: Understand and analyze optimization problems using dynamic programming.
CO4: Solve different problems using Backtracking.
CO5: Apply different methods of Branch and Bound strategy.
CO6: Classify and Analyze P, NP, NP-complete, NP-Hard problems.

UNIT No.	Syllabus	Teaching Hours
I	**Introduction:** Analysis of Algorithm, Efficiency- Analysis framework, asymptotic notations. Proof Techniques: Proof by induction, contradiction, direct proof, contraposition and so on, Introduction to Brute Force method & Exhaustive search, Analysis of Non-recursive and recursive algorithms: Solving Recurrences.	7
II	**Divide and conquer method and Greedy strategy:** Divide & Conquer method: Merge sort, Quick Sort. Binary search, Finding Max-Min, Large integer Multiplication. Greedy Method: MST for graph, Single-Source Shortest Paths: Dijkstra's Algorithm, Fractional Knapsack problem, Job Sequencing.	6
III	**Dynamic Programming:** General strategy, optimal substructure, 0/1 knapsack Problem, Bellman-Ford Algorithm, Multistage Graph problem, Optimal Binary Search Trees, Travelling Salesman Problem.	7
IV	**Backtracking:** General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Sum of subsets, Graph coloring, Hamiltonian Cycle, 0/1 Knapsack Problem.	7
V	**Branch and bound:** The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling sales person problem.	6
VI	**Classes of algorithms:** Computational Complexity: Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, NP Complete Problems.	6

List of Practical Assignments:

1. Write a program to implement a program using the Divide and Conquer approach (for e.g, Quick, Merge sort, Binary search, Strassen's method).
2. Write a program to implement an algorithm using Greedy method. (for e.g Prims, kruskal's, knapsack problem).
3. Write a program to implement an algorithm using Dynamic Programming also verify the complexity. (for e.g Chain matrix multiplication, Bellman-Ford Algorithm, Multistage Graph problem, Optimal Binary Search Trees, Travelling Salesman Problem).
4. Write a recursive program to find the solution using Backtracking approach. (n queens, Graph coloring, Hamiltonian Cycle, 0/1 Knapsack Problem).
5. Write a program to find the solution using Branch and Bound approach (0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling sales person problem, Job scheduling Problem).
6. **Mini Projec**t: Identify a real-life problem, select an appropriate algorithmic design strategy (such as Divide & Conquer, Greedy, Dynamic Programming, Backtracking, or Branch & Bound), implement the algorithm, and analyze its performance in terms of time complexity, space complexity, and efficiency. Prepare a brief report covering :
   A. Problem definition & real-world relevance
   B. Algorithmic strategy selection with justification
   C. Implementation details and challenges faced
   D. Complexity analysis and performance evaluation
   E. Comparison with other possible techniques
   F. Conclusion & future scope

Prepare a Presentation Summarizing key findings and demonstrating the solution.

Text Books :

1. Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN: 81-203-2141-3.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford, ISBN 10 : 0-19-809369-1.

Reference Books:

1. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9.
2. R. C. T. Lee, SS Tseng, R C Chang, Y T Tsai, Introduction to Design and Analysis of Algorithms, A Strategic approach, Tata McGraw Hill, ISBN-13: 978-1-25-902582-2. ISBN-10: 1-25-902582-9.
3. Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson, ISBN 81- 7758-835-4.
4. Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244-3.

Online Resources:

1. https://archive.nptel.ac.in/courses/106/101/106101060/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23303	CO1	3	3	2	2							1	2
	CO2	3	3	3	3		2		1	1		1	2
	CO3	3	3	3	3	1	2		1	1		1	3
	CO4	2	3	3	3	2			1	1		1	2
	CO5	2	2	3	3	2			1	1		1	2
	CO6	3	2	2	3		2		1			1	3

Elective 1: Software Testing and Automation

Course Code : IT23304	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	-	30

Prerequisite Course Mapping:
1. Software Engineering

Future Course Mapping:
1. Software Test Engineer

Course Objectives:
1. Learn to apply the testing strategies and methodologies in projects.
2. To understand test management strategies and tools for testing.
3. A keen awareness of the open problems in software testing and maintenance.
4. To explain quality assurance and various automated testing tools used in quality management.
5. To learn in detail about various quality assurance models.
6. To understand the audit and assessment procedures to achieve quality.

Course Outcomes:
On completion of the course, the learner will be able to
CO1: Understand the basics of testing
CO2: Understand the levels of testing
CO3: Explore the test automation concepts, tools.
CO4: Apply the standard metrics to measure the software quality.
CO5: Choose appropriate quality assurance models and develop quality.
CO6: Ability to conduct formal inspections, record and evaluate results of inspections

UNIT No.	Syllabus	Teaching Hours
I	**SOFTWARE TESTING BASICS** Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.	7
II	**TESTING TECHNIQUES AND LEVELS OF TESTING** Types of Testing - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing	7
III	**SOFTWARE TEST AUTOMATION AND AUTOMATION TESTING** What is automation testing, Automated Testing Process, Automation Frameworks, Benefits of automation testing, Selection of automation testing tools. Selenium Automation Tools: Selenium's Tool Suite- Selenium IDE, Selenium RC, Selenium Web driver, Selenium Grid. Automation Tools: SoapUI, Robotic Process Automation (RPA), Tosca, Appium.	8
IV	**QUALITY METRICS AND SOFTWARE QUALITY ASSURANCE** Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment. SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools.	6
V	**QUALITY ASSURANCE MODEL**	6

	Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE.	
VI	**SOFTWARE QUALITY ASSURANCE TRENDS** Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their effect on Software Quality	5

List of Practical Assignments:

1) Prepare Software requirement specifications for any project or problem statement
2) Write TEST Scenario for the Gmail Login Page.
3) Write Test cases in Excel sheets for Social Media applications, websites, or web applications.
Develop a Defect Report after testing
4) Installation of Selenium grid and Selenium Web driver Java Eclipse (automation tools).
5) Test any existing website application (IRCTC, Online Shopping Site, Airline reservation Site) using automated tool.
6)**Mini Project**: Create a small application by selecting the relevant system environment/platform and programming languages. Narrate a concise Test Plan consisting of features to be tested and bug taxonomy. Prepare Test Cases inclusive of Test Procedures for identified Test Scenarios. Perform selective Black-box and White-box testing covering Unit and Integration test by using suitable Testing tools. Prepare Test Reports based on Test Pass/Fail Criteria and judge the acceptance of the application developed.

OR

Mini Project: Create a small web-based application by selecting the relevant system environment/platform and programming languages. Narrate a concise Test Plan consisting of features to be tested and bug taxonomy. Narrate scripts in order to perform regression tests. Identify the bugs using Selenium WebDriver and IDE and generate test reports encompassing exploratory testing.

Text Books :

1. Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing: Principles and Practices Pearson.
2. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley.

Reference Books:

1. Aditya P. Mathur, Foundations of Software Testing, Pearson.
2. Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press.
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Auerbach Publications.
4. William Perry, Effective Methods of Software Testing, Wiley Publishing, Third Edition.
5. Renu Rajani, Pradeep Oak, Software Testing – Effective Methods, Tools and Techniques, Tata McGraw Hill.
6. Stephen Kan, Metrics and Models in Software Quality, Addison – Wesley, Second Edition.
7. S.A.Kelkar, Software quality and Testing, PHI Learing, Pvt, Ltd.
8. Watts S Humphrey, Managing the Software Process ,Pearson Education Inc.

Online Resources:

1. **NPTEL Course on Software Testing**
   Link: https://onlinecourses.nptel.ac.in/noc24_cs47/preview

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23304	CO1	2		1									
	CO2	2		1		2							
	CO3	1	1	2		3							2
	CO4	1			1	2			1				1
	CO5			2									
	CO6	2											1

Elective 1: Python for Data Analytics

Course Code : IT23305	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	-	30

Prerequisite Course Mapping:

1. Database Management Systems
2. Probability and statistics

Future Course Mapping:

Data Science and Big Data Analytics

Course Objectives:

1. To know the basics of python
2. To understand data analytics process
3. To learn data preparation and data visualization techniques
4. To learn predictive analytics

Course Outcomes: On completion of the course, students will be able to–

CO1: Understand python structures for data manipulation
CO2: Analyze data using panda's library.
CO3: Understand data preparation techniques and data transformers
CO4: Apply data visualization techniques
CO5: Analyze time series data and data analysis
CO6: Construct data models for predictive analytics

UNIT No.	Syllabus	Teaching Hours
I	**Introduction to Python Numpy** Introduction to Python and IDEs, Data types, Data structure and Sequences: Tuple, list and Dictionary, Built in sequence functions, Functions: Namespace, Scope and local functions, returning multiple values, Anonymous (lambda) functions, Numpy ndarray: A multidimensional array, data types for ndarrays, arithmetic with ndarrays, basic indexing and slicing, reshaping arrays, Transposing arrays and swapping axes, pseudorandom Number generator, linear algebra using numpy, Introduction to Data analytics	7
II	**Data Analysis using Pandas** Introduction to pandas, Pandas Series, DataFrame, Index Objects, Indexing, Arithmetic's, Summarizing and computing descriptive statistics: correlation and covariance, unique values, value count. Data Loading , Storage and File formats: Reading writing data from files, Excel file, JSON, HTML Web scrapping, database, interacting with web API.	7
III	**Data Preprocessing** Handling missing values, Data transformation: Removing duplicates, Transforming data using function or mapping, Discretization and binning, Detecting and filtering outliers, Computing indicator / Dummy variables, Categorical Data. Data wrangling: Hierarchical indexing , Combining and merging datasets.	7

IV	**Data Visualization** Introduction to matplotlib and seaborn library, Figures and subplots, color, marker and line styles, ticks, legend, saving plot to file, Plotting with pandas and seaborn: Line plots, Bar plots, Histogram, scatter plots.	6
V	**Data Aggregation and Time Series** Iterating over groups, Grouping with dictionaries and series, functions, Grouping by Index levels, Time series, Date ranges, frequencies, Time zone analysis, Resampling and frequency conversions. Data analysis using database.	6
VI	**Introduction to Machine Learning using scikit-learn** Introduction to machine learning, Types of machine learning, Classification, regression, clustering. Supervised Learning with scikit-learn, Predictive modeling.	6

List of Practical Assignments:

1. Write a program in python to create list, dictionary, ndimarry and perform various operations on it
2. Write a program in python to create a data frame for a suitable application and perform operations such as indexing, data summarization, statistics
3. Write a program in python to perform web scraping for ecommerce website
4. Write a program in python to read a dataset and perform different types of visualization (1D, 2D, Multidimensional etc) using matplotlib/seaborn library.
5. Write a program in python to perform data aggregation
6. Develop exploratory data analysis applications using machine learning.

Text Books :

1. Wes McKinney , Python for Data Analysis by, O'Reilly ,978-1-098-10403-0
2. Python: Data Analytics and Visualization, Packt Publishing Ltd.,ISBN: 978-1-78829-009-8
3. Fabio Nelli, Python Data Analytics, Apress.

Reference Books:

1 . Ken Black, Business Statistics for Contemporary Decision Making. "John Wiley & Sons, Inc

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23305	CO1	1	1	1	1	2				2		1	1
	CO2	3			2	3				2			1
	CO3	1		2	2	2				2			2
	CO4	1	2		1	3				2			1
	CO5	1	2		2	2				2			1
	CO6	1	1	1		2				2			

Universal Human Values and Professional Ethics

Course Code : HS23301	Course Credits: 02	Course type: VEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
2	-	-	10	-	60	-	-	-

Course Objectives:

This course is intended to:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education and profession ethics to the young enquiring minds..

Course Outcomes: On completion of the course, students will be able to–

CO1: Understand the concept of **value education, self-exploration, happiness, and prosperity,** and apply these principles for holistic personal development.

CO2: Recognize the **co-existence of the self and the body,** differentiate their needs, and develop a **balanced approach towards physical and mental well-being**

CO3: Analyze the **importance of trust, respect, justice, and relationships** in family and social interactions and apply these values to foster harmony in society

CO4: Comprehend the **interconnectedness of all living beings and the environment,** and develop a responsible attitude towards sustainable living and ecological balance

CO5: Apply **ethical principles, human values, and professional ethics** in their career, decision-making, and social responsibilities to contribute towards a value-based society.

UNIT No.	Syllabus	Teaching Hours
I	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	5
II	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	5
III	**Harmony in the Family and Society:** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation,	5

	Other Feelings, Justice in Human-toHuman Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	
IV	**Harmony in the Nature/Existence :** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	5
V	**Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	6

Text Books :

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2. The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
3. Professional Ethics and Human Values, Premvir Kapoor, Khanna Book Publishing

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Rediscovering India - by Dharampal
9. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
10. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972
11. Limits to Growth – Club of Rome's report, Universe Books.
12. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
13. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
14. A N Tripathy, 2003, Human Values, New Age International Publishers.
15. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
16. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
17. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
18. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
19. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Online Resources:

1. Value Education websites,
2. https://www.uhv.org.in/uhv-ii,
3. http://uhv.ac.in,
4. http://www.uptu.ac.in
5. Story of Stuff,
6. http://www.storyofstuff.com

7. Al Gore, An Inconvenient Truth, Paramount Classics, USA
8. Charlie Chaplin, Modern Times, United Artists, USA
9. IIT Delhi, Modern Technology – the Untold Story
10. Gandhi A., Right Here Right Now, Cyclewala Productions
11. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
12. https://fdp-si.aicte-india.org/8dayUHV_download.php
13. https://www.youtube.com/watch?v=8ovkLRYXIjE
14. https://www.youtube.com/watch?v=OgdNx0X923I
15. https://www.youtube.com/watch?v=nGRcbRpvGoU
16. https://www.youtube.com/watch?v=sDxGXOgYEKM

Prof. R.K. Shastri	Dr. C. B. Nayak	Prof. S.M. Bhosle	Prof. S.B. Lande
BOS Chairman – HSSM	Dean Autonomy	Dean Academics	Principal

Principal
Vidya Prabhishnan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune Id No. / PU / PN / Engg. / 152 / 2008
PUNE (M.S.)

Community Engineering Project

Course Code : IT23306	Course Credits:02	Course type: CEP

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
-	4	-	10	-	-	30	-	30

Prerequisite Course Mapping:

1. JAVA, C++
2. Database Management system, Web Technology.

Future Course Mapping:

Project

Course Objectives:

1. o learn the various processes involved in project development.
2. To provide Community service to enable the students to acquire life skills and knowledge
3. To provide a service to society through education.
4. To engage students with the community and to develop civic and social responsibility skills among students, so that students become more aware of what their community needs.

Course Outcomes:

CO1: Identify and choose real life problems through field trips, awareness camps, surveys.
CO2: Solve problems through collaboration .
CO3: Apply engineering knowledge to formulate the problem statement.
CO4: Develop and design prototype/software/app.
CO5: Tackle technical challenges for solving real world problems with team efforts.
CO6: Evaluate the solution based on the criteria specified.

Introductory information:

The project can be application oriented and/or will be based on some real life problems in the society. The student will take a project which will involve the problem identification, analysis, design of a system in the area of the identified domain. The outcome of such projects is evaluated on the basis of economical, societal, environmental, demographic feasibility and implementation. The project will be preferably by a group of 3-4 students who will jointly work and implement the project.

Guidelines to Faculty and Students:

1. The Head of the department / Project coordinator shall constitute a review committee
2. There shall be two reviews.
3. Project committee should finalize the scope of the project/field work.
4. Project will be reviewed by the project review committee. For sponsored projects, an employee of the sponsoring organization may be one of the members of the review committee.
5. Every student of the project group shall make a presentation on the progress made by them before the committee during each review.
6. The record of the remarks/suggestions of the review committee (project diary) should be properly maintained and should be made available at the time of examination
7. Project report must be checked for plagiarism
8. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner.

Group Structure:

Group structure should enable students to work in mentor–monitored groups. The students plan, manage and complete a project activity.

1. There should be a team of 3 to 4 students who will work cohesively.
2. A guide should be assigned to individual groups who will help them with the learning and development process.

Selection of Project/Problem:

1. The project scope/topic can be from any social problems, but selection related to IT technical aspects is desirable.
2. Project/problem requiring solutions through conceptual model development and use of software tools should be preferred.
3. Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving / implementation of project/problem.
4. Problems may require in depth study of social / Domain problems.
5. Hands-on activities, organizational and field visits, interacting with research institutes and expert consultation should be included in the approach to make students aware of the latest technologies.

Project report contains:

1. Certificate
2. Certificate sponsoring organization (If any)
3. Acknowledgement
4. Abstract
5. List of Abbreviations (As applicable)
6. List of Figures (As applicable)
7. List of Graphs (As applicable)
8. List of Tables (As applicable)
9. Introduction
10. Need/Importance
    a. Forms of community service
    b. Ways to participate in community
11. Literature Survey
12. Problem Statement and Objective
13. Proposed System
    a. Algorithm
    b. Design details
14. System Architecture
15. Project Plan / Activities planned
16. System Implementation-code documentation
17. Test Cases
18. GUI/Working modules
19. Activities conducted
20. Experimental Results in suitable format
21. Conclusion and Future work
22. References

Appendices

a) Plagiarism Report of Paper and Project report
b) Tools used / Hardware Components specifications (If any)

Evaluation Criteria:

Following criteria and weightage is suggested for evaluation of Project Term Work.

1. Originality of Problem Statement: 10% (03 Marks)
2. Depth of Understanding the Problem Statement: 10% (03 Marks)
3. Literature Survey/ Field work with identified gaps: 10% (04 Marks)
4. Design and Analysis of Algorithm / Model / Architecture / System: 40% (12 Marks)
5. Presentation Skill: 10% (03 Marks)
1. Report preparation : 10% (05 Marks)

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23306	CO1	1	3	3	2	1	3	1	1	3	2	1	1
	CO2		3	3	1	1	2	1	1	3	2	2	1
	CO3	2	1		1		1		1	2	1	2	1
	CO4	3	2	3	1	2	2	1	1	3	2	2	2
	CO5	1	2	2	1	3	1	1	2	2	1	2	1
	CO6	2	2		1	2			1	1	1	1	1

Constitution of India

Course Code : HS23302	Course Credits: AU	Course type: AUDIT

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
1	-	-	-	-	-	-	-	-

Course Objectives:

The primary objectives of this course are to:

1. Familiarize students with the salient features, structure, and significance of the Constitution, including the principles enshrined in the Preamble.
2. Provide an understanding of fundamental rights and duties, their scope, significance, and role in ensuring justice, equality, and freedom in a democratic society
3. Explain the concept of Directive Principles of State Policy (DPSP) and their role in governance, emphasizing their interrelationship with Fundamental Rights.
4. Analyze emergency provisions and constitutional amendments, discussing their implications on Indian democracy and governance.
5. Encourage a comparative understanding of the Indian Constitution with other constitutions worldwide, fostering awareness of global governance models.

Course Outcomes: On completion of the course, students will be able to–

CO1: Describe the salient features and basic structure doctrine of the Constitution and Interpret the values enshrined in the Preamble

CO2: Comprehend Fundamental Rights and Duties of Indian Citizens.

CO3: Analyze the Role of Directive Principles of State Policy (DPSP) in Governance.

UNIT No.	Syllabus	Teaching Hours
I	**Introduction to the Constitution of India** Historical Perspective and Making of the Indian Constitution, Salient Features of the Constitution, Preamble and its Significance, Basic Structure of the Constitution, Emergency Provisions in the Indian Constitution, Important Amendments to the Constitution.	5
II	**Fundamental Rights and Duties** Fundamental Rights: Meaning, Scope, and Significance, Right to Equality, Freedom, Protection from Exploitation, Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Fundamental Duties of Indian Citizens	4
III	**Directive Principles and Governance** Directive Principles of State Policy: Meaning and Purpose, Relationship between Fundamental Rights and Directive Principles, Role of Directive Principles in Policy Formulation, Comparison with Other Constitutions	4

Evaluation and Assessment

Since this is an audit course, there is a mandatory internal evaluation which can be based on the following:

- **Assignments & Reports**– Writing about a constitutional provision or case study.
- **Quiz/MCQs** – To test basic understanding of the Constitution.
- **Group Discussion/Presentation** – On relevant topics like Fundamental Rights or Constitutional Amendments.

Text Books :

1. **M. Laxmikanth**, *Indian Polity*, McGraw Hill Education, 6th Edition, 2020.
2. **D.D. Basu**, *Introduction to the Constitution of India*, LexisNexis, 25th Edition, 2021.
3. **Subhash Kashyap**, *Our Constitution: An Introduction to India's Constitution and Constitutional Law*, National Book Trust, 2019.
4. **J.N. Pandey**, *The Constitutional Law of India*, Central Law Agency, 2020.
5. **Bare Act**, *Constitution of India*, Government of India Publications.

Prof. R.K. Shastri	Dr. C. B. Nayak	Prof. S.M. Bhosle	Prof. S.B. Lande
BOS Chairman – HSSM	Dean Autonomy	Dean Academics	Principal

SEMESTER-II

Course Type	Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	IT23311	Computer Networks & Security	3	2		10	30	60		30		130	3	1		4
PEC	IT23312 to IT23314	Program Elective 2	3	2		10	30	60			30	130	3	1		4
PEC	IT23315 to IT23317	Program Elective 3	3	2		10	30	60		30		130	3	1		4
MDM	MD23XXX	Multi-disciplinary minor	2	2		20	20	50	20			110	2	1		3
VEC	HS23311	Environmental Studies	2			10		60				70	2			2
OE	OE230XX	Open Elective	2					50				50	2			2
VSEC	IT23318	Advanced Java Programming	1	2		10			30		30	70	1	1		2
AU	HS23312	Democracy, Election, and Governance	1													AU
	Total		**17**	**10**	**0**	**70**	**110**	**340**	**50**	**60**	**60**	**60**	**16**	**5**	**0**	**21**

Elective –II		
Sr. No	**Course Code**	**Elective II Course**
1	IT23312	Compiler Design
2	IT23313	Full Stack
3	IT23314	Introduction to Artificial Intelligence

Elective -III		
Sr. No	**Course Code**	**Elective III Course**
1	IT23315	Introduction to Internet of Things
2	IT23316	Cyber Security
3	IT23317	Deep Neural Network

Prof. S.A. Takale
HoD – IT

Dr. C.B. Nayak
Dean Autonomy

Prof. S.M. Bhosle
Dean Academics

Prof. S.B. Lande
Principal

VPKBIET BARAMATI Affiliated to S.P.P.U. Pune Id No./PU/PN/Engg./152/2000 PUNE (MS.)

Computer Networks and Security

Course Code : IT23311	Course Credits: 04	Course type: PCC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	30	-

Prerequisite Course Mapping:
Basics of Computer Networks
Data Communication

Future Course Mapping:
Distributed Computing
Advanced Network Security

Course Objectives:
1. To understand the fundamental concepts of networking standards, protocols and technologies.
2. To Understand wireless network and different wireless standards.
3. To learn Adhoc and Wireless Sensor Networks.
4. To study application layer services, responsibilities and protocol.
5. To learn the fundamental concepts of Network Security.
6. To apply basic cryptographic techniques in application development.

Course Outcomes:
CO1: Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies.
CO2: Apply concepts of wireless network and different wireless standards.
CO3: Recognize the Adhoc Network's MAC layer, routing protocol and Sensor network architecture.
CO4: Explain Responsibilities, services offered and protocol used at the application layer of the network.
CO5: Understand network security threats, security services, and countermeasures.
CO6: Apply basic cryptographic techniques in application development.

UNIT No.	Syllabus	Teaching Hours
I	**Introduction:** Types of Networks: Local area networks (LAN), Metropolitan area networks (MAN), Wide area networks (WAN), Wireless networks, Networks Software, Protocol, Design issues for the Network layers. Network Models: The OSI Reference Model, TCP/IP Model, Network Topologies, Types of Transmission Medium. Network Architectures: Client-Server, Peer To Peer, Hybrid. Network Devices: Bridge, Switch, Router, Gateway, Access Point.	6
II	**Wireless Standards:** Wireless LANs: Fundamentals of WLAN, Design goals, Characteristics, Network Architecture, IEEE 802.11: components in IEEE 802.11 network, Physical Layer, MAC Sub Layers : DCF, PCF, Hidden and exposed station problem, Frame format,Bluetooth: Architecture Layers, operational states.	6
III	**Adhoc AND Wireless Sensor Networks:** Infrastructure Network and Infrastructure-less Wireless Networks, Issues in Adhoc Wireless Network, Classification Adhoc Network Routing Layer: Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks – Classifications of Routing Protocols. Applications of Sensor Network, Comparison with Ad Hoc Wireless Network, Sensor node architecture Issues and Challenges in Designing a Sensor Network, Classification of sensor network protocols, SENSOR NETWORK ARCHITECTURE: Layered Architecture, Clustered Architecture	7
IV	**Application Layer:** Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME,POP3, Webmail, FTP, TELNET, DHCP, SNMP.	6

V	**Network Security:** Introduction, Security services, Need of Security, Key Principles of Security, Threats and Vulnerabilities, Types of Attacks, Security Policy and mechanisms, Operational Model of Network Security, Symmetric and Asymmetric Key Cryptography.	7
VI	**Cryptographic Algorithms:** Symmetric key algorithms: Data Encryption Standards, Advanced Encryption Standard, Public Key Encryption and Hash function: RSA Digital signatures, Digital Certificates and Public Key Infrastructure: Private Key Management, Diffie Hellman key exchange.	7

List of Practical Assignments:

1. Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.
2. Setup a WAN which contains wired as well as wireless LAN by using a packet tracer tool. Demonstrate transfer of a packet from LAN 1 (wired LAN) to LAN2 (Wireless LAN).
3. Implement a client and a server on different computers using python. Perform the communication between these two entities by using RSA cryptosystem.
4. Implement a client and a server on different computers using python. Perform the encryption of message of sender between these two entities by using DES Algorithm and use the Diffie Hellman method for exchange of keys.
5. Study and Analyze the performance of HTTP, HTTPS and FTP protocol using Packet tracer tool.
6. Capture packets using Wireshark, write the exact packet capture filter expressions to accomplish the following and save the output in file:
   a. Capture all TCP traffic to/from Facebook, during the time when you log in to your Facebook account.
   b. Capture all HTTP traffic to/from Facebook, when you log in to your Facebook account.

Text Books :

1.Fourauzan B.,"Data Communications and Networking",5thEdition,TataMcGraw-Hill,Publications, ISBN:0–07 – 058408 – 7.
2.Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson India, 2012.

Reference Books:

1. Kurose, Ross, "Computer Networking a Top Down Approach Featuring the Internet", Pearson, ISBN-10: 0132856204
2. L. Peterson and B. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan-Kaufmann, 2012.
3. Douglas E. Comer & M.S Narayanan, "Computer Network & Internet", Pearson Education
4. William Stallings, "Cryptography and Network Security: Principles and Practice", 4th Edition
5. Pachghare V. K., "Cryptography and Information Security", 3rd Edition, PHI,

Online Resources:

e-Books :

https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf.

MOOCs Courses link:

https://nptel.ac.in/courses/106/105/106105160/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23311	CO1	3	2	2	2	3	1						2
	CO2	2	2	3	3	3	2						2
	CO3	3	3	3	3	3	3						3
	CO4	2	3	3	3	3	1						2
	CO5	1	3	2	3	2	2						2
	CO6	3	3	2	3	3	2						3

Program Elective 2: Compiler Design

Course Code : IT23312	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
03	02	–	10	30	60	-	-	30

Prerequisite Course Mapping : Theory of Computation, Operating System

Course Objectives:

1. To Understand the language translation theories and compiler design stages
2. To Illustrate and Study various parser configurations
3. To Exemplify the use of syntax directed translation in intermediate code
4. To Understand Storage Management and Control Structure Environment.
5. To Learn to develop a Code generator
6. To Demonstrate the numerous machine independent optimization methods

Course Outcomes:

CO1: Design and **implement** a lexical analyzer using LEX tools
CO2: Design and **implement** a syntax analyzer using YACC tools
CO3: Understand syntax-directed translation and **Generate** intermediate codes
CO4: Understand run-time environment
CO5: Construct algorithms to produce computer code.
CO6: Analyze and **transform** programs to improve time and memory efficiency

UNIT No.	Content	Teaching Hours
I	**Introduction:** Introduction to compiler, translators, interpreter, Structure of Compiler **Lexical Analyzer:** Role of lexical analyzer, specification of tokens, recognition of tokens, regular expression, finite automata, regular expression to finite automata transition diagrams, tool for lexical analyzer LEX	7
II	**Syntax Analysis:** Introduction to parsing techniques, Context free Grammar, bottom-up parsing and top down parsing. top down parsing , recursive descent parsing, predictive parsing ,bottom up parsing : operator precedence parsing, LR parsers, construction of SLR, canonical LR and LALR parsing tables, construction of SLR parse tables for ambiguous grammar, the parser generator tools – YACC, error recovery in top down and bottom up parsing.	7
III	**Syntax-Directed Translation:** Syntax-Directed Definitions, Evaluation Orders for SDD's **Intermediate-Code Generation:** Variants of Syntax Trees, Three-Address Code,Types and Declarations, Type Checking, Control Flow, Intermediate Code for Procedures.	7
IV	**Run-Time Environments:** Storage Organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection .	6
V	**Code Generation:** Issues in the Design of a Code Generator ,The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.	6
VI	**Code Optimization:** The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant	6

	Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs.	

List of Practical Assignments:

1. Design and implement a lexical analyzer for given language using C and the lexical analyzer should ignore redundant spaces, tabs and newlines.
2. Implement Lexical Analyzer using Lex Tool.
3. Implement Calculator using LEX and YACC.
4. Write a program for construction of DFA for given Regular Expression.
5. Implement the front end of a compiler that generates the three address code for a simple language. (Group Project).
6. Implement Local and Global Code Optimizations such as Common Sub-expression Elimination, Copy Propagation, Dead-Code Elimination, Loop and Basic-Block Optimizations. (Group Project).

Text Books :

1. V. Aho, R. Sethi, J. D. Ullman, "Compilers: Principles, Techniques, and Tools", Pearson Edition, ISBN 81-7758-590-8.

Reference Books:

1. Dick Grune, Bal, Jacobs, Langendoen, " Modern Compiler Design", Wiley, ISBN 81-265-0418-8.
2. Anthony J. Dos Reis, "Compiler Construction Using Java, JavaCC and Yacc" Wiley, ISBN 978-0-470-94959-7.
3. K Muneeswaran, "Compiler Design", Oxford University press, ISBN 0-19-806664-3 3. J R Levin.
4. T Mason, D Brown, "Lex and Yacc", O'Reilly, 2000 ISBN 81-7366-061-X.

Online Resources:

1. NPTEL Compiler Design Course : https://archive.nptel.ac.in/courses/106/105/106105190/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23312	CO1	3	2	3	2	2				1	1		
	CO2	3	2	3	2	1				1	1		
	CO3	1	2	3	2	1				1	1		
	CO4	2	1	1	1	1				1	1		
	CO5	1	3	3	2	1				1	1	1	
	CO6	2	3	3	2	1				1	1	1	

Program Elective 2: Full Stack

Course Code : IT23313	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	–	30

Prerequisite Course Mapping:C++, Java.

Future Course Mapping: Computer Network, Distributed System.

Course Objectives:

1. To familiarize students with Web Programming basic concepts.
2. To learn and understand Web scripting languages.
3. To explore the Front end & Backend web programming skills.
4. To understand and learn Mobile web development.
5. To understand and learn Web application deployment.

Course Outcomes:

CO1: Understand & Develop Static and Dynamic website using technologies like HTML, CSS, Bootstrap.
CO2: Demonstrate the use of web scripting languages.
CO3: Understand the basics of Front End Technologies.
CO4: Develop web applications with Front End & Back End Technologies.
CO5: Develop a mobile website using JQuery Mobile.
CO6: Deploy web application on cloud using AWS.

Unit No.	Syllabus	Hours
I	**INTRODUCTION TO WEB TECHNOLOGIES** **HTML:** Getting started with HTML, Why HTML, Tags and Elements, Attributes, Properties, Headings list, Links, Tables, Images, HTML Form, Media (Audio, Video), Semantic HTML5 Elements. **CSS:** Why CSS, Types of CSS, how to use CSS, Properties, Classes, Child-Class (Nested CSS), Colors, Text, Background, Border, Margin, Padding, Positioning (flex, grid, inline, block), Animation, Transition. **BOOTSTRAP:** Why Bootstrap, CSS over Bootstrap, how to Use Bootstrap, Bootstrap Grid System, Bootstrap Responsive, Bootstrap Classes, Bootstrap Components (i.e., Button, Table, List, etc.), Bootstrap as a Cross Platform. **W3C:** What is W3C, How W3C handles/Supports Web Technologies.	7
II	**WEB SCRIPTING LANGUAGES** **JavaScript:** Introduction to Scripting languages, Introduction to JavaScript (JS), JS Variables and Constants, JS Variable Scopes, JS Data Types, JS Functions, JS Array, JS Object, JS Events. **Advanced JavaScript:** JSON - JSON Create, Key-Value Pair, JSON Access, JSON Array, JS Arrow Functions, JS Callback Functions, JS Promises, JS Async-Await Functions, JS Error Handling. **AJAX:** Why AJAX, Call HTTP Methods Using AJAX, Data Sending, Data Receiving, AJAX Error Handling. **JQUERY :**Why JQuery, How to Use, DOM Manipulation with JQuery, Dynamic Content Change with JQuery, UI Design Using JQuery .	7

III	**FRONT END TECHNOLOGIES** **Front-End Frameworks:** What is a web framework? Why Web Framework? Web Framework Types. **MVC:** What is MVC, MVC Architecture, MVC in Practical, MVC in Web Frameworks. **TypeScript:** Introduction to TypeScript (TS), Variables and Constants, Modules in TS. **AngularVersion 10+:** Angular CLI, Angular Architecture, Angular Project Structure, Angular Lifecycle, Angular Modules, Angular Components, Angular Data Binding, Directives and Pipes, Angular Services and Dependency Injections (DI), Angular Routers, Angular Forms. **ReactJS:** Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook useContext() hook.	6
IV	**BACK END TECHNOLOGIES** **Node.JS:** Introduction to Node.JS, Environment Setup, Node.JS Events, Node.JS Functions, Node.JS Built- in Modules, File System, NPM, Install External Modules, Handling Data I/O in Node.JS, Create HTTP Server, Create Socket Server, Microservices- PM2. **ExpressJS:** Introduction to ExpressJS, Configure Routes, Template Engines, ExpressJS as Middleware, Serving Static Files, REST HTTP Method APIs, Applying Basic HTTP Authentication, Implement Session Authentication. **MongoDB:** NoSQL and MongoDB Basics, MongoDB-Node.JS Communication, CRUD Operations using Node.JS, Mongoose ODM for Middleware, Advanced MongoDB.	7
V	**MOBILE WEB DEVELOPMENT** **Mobile-First:** What is Mobile-First? What is Mobile Web? Understanding Mobile Devices and Desktop. **JQuery Mobile:** Introduction to the jQuery Mobile Framework, Set-up jQuery Mobile, Pages, Icons, Transitions, Layouts Widgets, Events, Forms, Themes, Formatting Lists, Header and Footer, CSS Classes, Data Attributes, Building a Simple Mobile Webpage.	6
VI	**WEB APPLICATION DEPLOYMENT** **Cloud:** AWS Cloud, AWS Elastic Compute, AWS Elastic Load Balancer and its types, AWS VPC and Component of VPC, AWS storage, Deploy Website or Web Application on AWS, Launch an Application with AWS Elastic Beanstalk.	6

List of Practical Assignments:

1. Create a responsive web page which shows the ecommerce/college/exam admin dashboard with sidebar and statistics in cards using HTML, CSS and Bootstrap.
2. Write a JavaScript Program to get the user registration data and push to array/local storage with AJAX POST method and data list in the new page.
3. Create a version control account on GitHub and use Git commands to create a repository and push your code to GitHub.
4. Create an Angular application which will do the following actions: Register User, Login User, Show User Data on Profile Component.
5. Create a Node.JS Application which serves a static website.
6. Create four API using Node.JS, ExpressJS and MongoDB for CRUD Operations on assignment no.4.
7. Create a simple Mobile Website using jQuery Mobile
8. Deploy/Host Your web application on AWS VPC or AWS Elastic Beanstalk.

Text Books :

1. Kogent Learning Solutions Inc, Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition, ISBN: 9788177228496.
2. Raymond Camden, Andy Matthews, JQuery Mobile Web Development Essentials, Packet Publishing, Second Edition, 9781782167891.

Reference Books:

1. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81- 265-1635-3.
2. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81-265- 1635-3.
3. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, BPB Publications,4th Edition, ISBN:978-8183330084.
4. Adam Bretz& Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256.
5. JavaScript: The Definitive Guide - Master The World's Most-Used Programming Language, Seventh Edition.
6. Programming Typescript: Making Your JavaScript Applications Scale, Boris Cherny.

Online Resources:

NPTEL Course :

1. https://archive.nptel.ac.in/courses/106/106/106106222/
2. https://archive.nptel.ac.in/courses/106/106/106106156/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23313	CO1	2	2	3	-	3	-	-	2	3	2	-	1
	CO2	2	3	3	-	3	-	-	2	3	2	-	1
	CO3	2	2	3	-	3	-	-	2	3	2	-	1
	CO4	3	3	3	-	3	-	-	2	3	2	-	1
	CO5	2	2	2	-	3	-	-	2	2	2	-	1
	CO6	3	2	3	-	3	-	-	2	2	2	-	1

Program Elective 2: Introduction to Artificial Intelligence

Course Code : IT23314	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
03	02	–	10	30	60	-	-	30

Prerequisite Course Mapping: Data Structures

Future Course Mapping: Deep Learning, Computer Vision.

Course Objectives:

1. To understand Fundamental concepts of Artificial Intelligence
2. To study application of different search strategies for problem solving.
3. To study local search algorithms and constraint satisfaction problem
4. To understand Fundamentals of Game Theory.
5. To explore Various knowledge representations and reasoning schemes.
6. To understand uncertainty in AI and Bayesian Networks

Course Outcomes:

CO1: To **Study** the fundamental concepts of Artificial Intelligence
CO2: **Implement** smart system using different informed search / uninformed search or heuristic approaches
CO3: To **Understand** and formulate local search algorithms and Constraint satisfaction problems
CO4: **Application** of adversarial search techniques and **designing** of games.
CO5: To **Illustrate** knowledge reasoning and knowledge representation methods.
CO6: To **Analyze** Uncertainty in AI and **Study** Bayesian Networks

UNIT No.	Syllabus	Teaching Hours
I	**Introduction:** Introduction to Artificial Intelligence, Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risks and Benefits of AI, Intelligent Agents, Types of Agents, Agents and Environments, Good Behaviour: Concept of Rationality, Nature of Environments, Structure of Agents.	6
II	**Problem Solving:** Search Strategies: Problem spaces (states, goals and operators), problem solving by search, **Uninformed search**: breadth-first, depth-first, depth limited search, depth first with iterative deepening, uniform cost search **Heuristic Search Techniques:** Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best-first Search; Problem Reduction. Local Search algorithms.	7
III	**Local Search and Constraint Satisfaction** **Local Search:** Local Search Algorithms and Optimization Problems: Hill-climbing search, Simulated annealing, Local beam search, Genetic algorithms, Searching with Nondeterministic Actions: AND–OR search trees **Constraint Satisfaction Problems**: Defining Constraint Satisfaction Problems (CSP), Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs.	7
IV	**Adversarial Search and Games:** Game Theory, Optimal Decisions in Games,	7

	Heuristic Alpha–Beta Tree Search, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction Problems (CSP), Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs.	
V	**Knowledge Representation:** Logic, Propositional Logic, First Order Logic, Inference in First Order Logic: Unification, Forward Chaining, Backward Chaining, resolution, Introduction to NLP.	6
VI	**Uncertainty in AI and Bayesian Networks:** Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule And Its Use, Representing Knowledge In An Uncertain Domain, The Semantics of Bayesian Networks, Approximate Inference In Bayesian Networks	

List of Practical Assignments:

1. Implement A star (A*) Algorithm for any game search problem.
2. Implement n-queens problem using Hill-climbing / simulated annealing
3. Write a program for the Information Retrieval System using appropriate NLP tools (such as NLTK, Open NLP, …) a. Text tokenization b. Count word frequency c. Remove stop words d. POS tagging.
4. Implement Greedy search algorithm for any of the following application:
    a. Single-Source Shortest Path Problem
    b. Job Scheduling Problem
5. Write a program for the Tic-Tac-Toe game.
6. Develop an elementary Chabot for any suitable customer interaction application.(Group Project)

Text Books :

1. Stuart Russel, Peter Norvig, "AI – A Modern Approach", Third Edition, Pearson Education, 2009
2. Elaine Rich, Kevin Knight and Shivashankar B Nair", Artificial Intelligence ", Tata McGraw Hill Edition 3rd Edition, 2009

Reference Books:

1. Algorithmic Game theory Edited by N Nishan, T Roughgarden; Cambridge University Press
2. Allen B. Downey, "Think Stats", Second Edition, O'Reilly Media, ISBN: 978-1-491-90733-7
3. D Fudenberg & J Tirole "Game Theory", MIT Press
4. K. Boyer, L. Stark, H. Bunke, "Applications of AI, Machine Vision and Robotics", World Scientific PubCo, 1995

Online Resources:

1. https://nptel.ac.in/courses/106102220
2. http://onlinestatbook.com/Online_Statistics_Education.pdf
3. https://london.ac.uk/sites/default/files/study-guides/introduction-tonatural-language-processing.pdf
4. https://www.deeplearningbook.org/contents/TOC.html
5. https://cvlesalfabegues.com/search/natural-language-understanding-2nd--dition/ww.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epubpdf/

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23314	CO1	1	2	2	1			1	1		2		
	CO2	1	3	3	2	2	1		1	1	2		
	CO3	2	3	3	2	2	1		1	1	2		
	CO4	3	3	3	2	2	1		1	1	2		
	CO5	3	2	2	2	1	1	1			2		
	CO6	3	2	2	1						2		

Program Elective 3: Introduction to Internet of Things

Course Code : IT23315	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
03	02	-	10	30	60	-	30	-

Prerequisite Course Mapping:

1) Basics of Computer Network
2) Processor Architecture

Future Course Mapping:

Project

Course Objectives:

To provide an understanding of the foundational concepts, frameworks, and architecture of IoT, including its enabling technologies and deployment models.

1. To explore the role of sensors, actuators, and communication protocols in IoT, focusing on the integration of smart objects into IoT systems
2. To provide hands-on experience with IoT platforms like Arduino, NodeMCU, and Raspberry Pi, and enable students to program and interface sensors and actuators.
3. To understand and evaluate various communication protocols used in IoT, including both non-IP and IP-based protocols, and the challenges related to IoT deployment.
4. To explore the integration of cloud computing in IoT systems and address security concerns in IoT environments.
5. To examine and implement IoT applications across various domains such as smart homes, healthcare, agriculture, and industry, showcasing the versatility of IoT technologies.

Course Outcomes:

On completion of the course, students will be able to–

1. Apply IOT knowledge to explain IoT deployment levels.
2. Identify and describe the components of smart objects, including sensors, actuators, and communication protocols.
3. NodeMCU, and Raspberry Pi to control sensors and actuators for practical IoT applications
4. Explain and compare communication protocols in IoT systems (such as MQTT, IPv6, ZigBee
5. Understand and implement cloud-based IoT applications
6. Design and implement domain-specific IoT applications.

UNIT No.	Syllabus	
I	**Introduction To Internet of Things** Definition and Characteristics of IoT , Working Definition, IoT Frameworks, Basic Nodal Capabilities, IoT Architecture, IoT Devices, Physical Design of IoT: IoT Protocols, Logical Design of IoT: Functional block, communication Model, Communication API's, IoT Enabling Technologies: WSN, cloud computing, Big data Analytics, communication Protocols, Embedded systems, IoT levels and Deployment templates: Level 1 to Level 5.	7
II	**Things in IoT** Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, LoRaWAN, Electronic Communication Protocols (Device Interfacing) Protocols: I2C, SPI, UART, USRT, CAN.	6
III	**IOT Platforms and its programming**	6

	Introduction to Arduino, NODEMCU and Raspberry Pi- Installation, Introduction to Python program with Raspberry Pi with focus on interfacing external gadgets (Bluetooth Speaker, Camera), controlling output, and reading input from pins. Introduction to Arduino Programming, Basics of NODEMCU interfacing with sensors, actuators and cloud, Integration of Sensors and Actuators with Arduino.	
IV	**Communication Protocols and IOT Challenges** Introduction to Non-IP Based Protocol (BlueTooth, ZigBee), IP Based Protocol (IPV4, IPV6, 6LoWPAN), Application Layer Protocols (MQTT, AMQP) Wireless medium access issues, MAC protocol, routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.	6
V	**Cloud Offerings and IOT Security** **Introduction to Cloud Storage models (SaaS, Paas, IaaS) and communication APIs Web server** – Web server for IoT, Cloud for IoT (ThingSpeak), Python web application framework, designing a RESTful web API. **IoT Security**: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modelling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non repudiation and availability, Security model for IoT.	7
VI	**IOT Applications** Home Automation - Smart Appliances, Intrusion Detection, Smoke/Gas Detector, Smart City –Smart Parking, Smart Road, Structural Health Monitoring, Surveillance applications, Health - Fitness and Health Monitoring, Wearable Electronics, Agriculture - Smart Irrigation, Greenhouse Control, Environment -Weather Monitoring, Noise Pollution Monitoring, Logistic - Root Generation and Scheduling, Shipment Monitoring, Retail Management - Inventory Management, Smart Payments, Industry Applications - Machine Diagnosis and Prognosis, Indoor Air Quality Monitoring.	7

List of Practical Assignments:

1. Create a simple traffic light system using 3 LEDs (Red, Yellow, Green) controlled by a timer
2. Use an ultrasonic sensor to measure the distance of an object and display the result on the serial monitor
3. Create a system that regulates the room temperature by turning on/off a fan or heater based on sensor input.
4. Use IR sensor to detect the obstacle and control the LED based on Input received (LED should be ON if obstacle found, display the status on serial monitor).
5. Use a gas sensor (MQ-2) to detect gas leaks and trigger an alarm.
6. Build an automated plant watering system using a soil moisture sensor, a relay, and a water pump.
7. Implement a door lock system using a servo motor and an RFID reader to unlock doors upon identification.
8. Use a PIR motion sensor to detect movement and trigger an alarm
9. Control an LED using a web interface hosted on the NodeMCU over Wi-Fi. This introduces basic web server functionality with NodeMCU
10. Use a DHT11 temperature sensor with NodeMCU to read temperature and humidity values and display them on a simple web page hosted on the NodeMCU.

Text Books :

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach" , 2014, Universities Press(India) Pvt Ltd., ISBN: 9788173719547
2. Matt Richardson & Shawn Wallac, "Getting Started with Raspberry Pi", 2014, O'Reilly (SPD), ISBN:9789350239759

3. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms and Use Cases", 2017, CRC Press, ISBN: 13:978-1-4987-6128-4.
4. Rushi Gajjar, "Raspberry Pi Sensors", 2015, Packt Publishing, ISBN : 978-1-78439-361-8
5. Robert H. Bishop, "The Mechatronics Handbook", 2002, CRC Press , ISBN: 0-8493-0066-5/02

Reference Books:

1. Peter Waher, "Learning Internet of Things", 2015, Packt Publishing, ISBN: 978-1-78355-353-2
2. Peter Friess, "Internet of Things – From Research and Innovation to Market Deployment", 2014, River Publishers, ISBN: 978-87-93102-94-1
3. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", 2010, Wiley Publication, ISBN: 978-0-470-99765-9
4. Simon Monk, "Raspberry Pi Cookbook, Software and Hardware Problems and solutions", 2019, O'Reilly, ISBN 9781492043225

Online Resources:

1. Introduction to Arduino and its Setup: https://www.arduino.cc/en/software
2. Introduction to Raspberry Pi and its OS (Raspbian Lit): https://www.raspberrypi.org/software/operating- systems/
3. Cloud for IoT– ThingSpeak: https://thingspeak.com/
4. Cloud for IoT - Ubidots: https://ubidots.com/stem/

Overall IoT Course Contents: https://onlinecourses.nptel.ac.in/noc21_cs17/preview

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23315	CO1	3	1	1		1			1	1			
	CO2			1	1	2			1	1			
	CO3	2	2	1	1	3			1	2			1
	CO4	2	2		2	2			1	1			1
	CO5	1	2	2	2	3			1	1			
	CO6	1	2	3	2	2			1	2			1

Program Elective 3: Cyber Security

Course Code : IT23316	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	30	-

Prerequisite Course Mapping: Basics of computer network and computer programming

Future Course Mapping: Quantum cryptography

Course Objectives:

1. To understand the basic approaches in cyber security and Information Security.
2. To analyze the cryptography and networking terms.
3. To understand about different types of hacking and cyber-crimes.
4. To apply and analyze the issues related to cyber forensics.
5. To learn cyber security implications.
6. To understand privacy issues.

Course Outcomes:

CO 1: Understand various basic approaches in cyber security and Information Security.
CO 2: Understand Cryptography and network basics.
CO 3: To analyze the types of hacking and cyber crimes.
CO 4: Understand cyber forensics.
CO 5: Learn security implications.
CO 6: Analyze privacy issues.

UNIT No.	Syllabus	Hours
I	**Introduction to Cyber Security,Information Security Basics** Confidentiality, Integrity & Availability (CIA),The challenges of Security, Threats, Attacks , Operational Model of Security,Cryptography,Symmetric and Asymmetric Cryptography,Brute-Force Attack. **Cyber Security Basics**: Introduction to Cyber Security, Need, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber-warfare, Cyber Terrorism.	8
II	**Network Fundamentals, Cryptography Basics** LAN, MAN, WAN, Wi-Fi, Network Protocols (TCP/IP, DNS, HTTP), Network Devices (Routers, Switches, Firewalls),**Cryptography Basics**: Encryption, Decryption, Types of Encryption (Symmetric Cipher-DES, Asymmetric Cipher-RSA,Diffie Hellman, Cryptographic Hash functions and MessageAuthentication codes)	6
III	**Cyber Crimes and Hacking** Cyber stalking, forgery, software piracy, cyber terrorism, phishing,computer hacking,creating and distributing viruses over the internet, spamming, cross site scripting,cybersquatting, logic bombs, web jacking, internet time thefts, DoS attack, Man in the middle attack,salami attack, data diddling, email spoofing.Types of Hacking	7
IV	**Cyber Forensics** Cyber forensics,cyber forensics investigation process, digital evidence,challenges in cyber forensics, Web Attack Forensics, Intrusion forensics, database forensics, preventive forensics, Anti forensics practices, Anti-forensics detection techniques, Network forensics analysis tools; Email Forensics: e-mail Protocols, email crimes, email forensics, Bitcoin Forensics:crypto currency, crimes related to bitcoin.	6
V	**Cyber Security- Organizational Implications:** Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security	6

	and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.	
VI	**Privacy Issues:** Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. MiniCases: The Indian Case of Online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.	6

List of Practical Assignments:

1. Perform port scanning with nmap
2. Install Wireshark for monitoring Network Communication with sniffers.
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures.
4. Use Open SSL command to generate min 10 passwords of length 12 characters.
5. Perform email analysis using the Autopsy tool.

Text Books :

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B.B. Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.
3. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auerback Publications, 2013.
4. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.
3. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.
4. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H. Malin, E. Casey and J. M. Aquilina, Syngress, 2012.
5. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes, Syngress, 2007.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://www.netacad.com/courses/introduction-to-cybersecurity?courseLang=en-US

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23316	CO1	2	0	0	0	0	1	0	0	1	0	1	1
	CO2	2	0	1	0	2	1	0	3	1	1	2	1
	CO3	2	3	2	2	3	2	1	1	1	1	2	1
	CO4	3	0	2	0	2	1	0	1	1	1	0	1
	CO5	3	0	0	0	2	1	0	1	1	1	0	1
	CO6	2	3	1	2	3	0	2	1	1	0	2	1

Program Elective 3: Deep Neural Network

Course Code : IT23317	Course Credits: 04	Course type: PEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
3	2	-	10	30	60	-	30	-

Prerequisite Course Mapping: Python Programming, Machine Learning

Future Course Mapping: Reinforcement Learning

Course Objectives:

1. To introduce the theoretical foundations, algorithms, methodologies, and application of neural networks and deep learning.
2. To study and apply Convolution Neural Network for real life applications.
3. To understand the Recurrent and Recursive nets in Deep Learning.
4. Study of unsupervised deep learning algorithms like autoencoder.
5. To study and apply pretrained Deep learning models and study of transfer learning.
6. To understand basics of Reinforcement Learning.

Course Outcomes:

CO1: To **Understand** the theoretical foundations, algorithms, and methodologies of Deep Learning
CO2: To **Apply** the concepts of Convolution Neural Networks and **use** of popular CNN architectures.
CO3: To **Compare** Feed Forward Neural Network and Recurrent Neural Network and **develop the** application of RNN and LSTM.
CO4: To **Elaborate and design** unsupervised deep learning algorithms like Autoencoders.
CO5: To **Explore** Representation Learning and Transfer Learning techniques using variants of CNN architecture.
CO6: To **Understand** Reinforcement Learning

UNIT No.	Syllabus	
I	**Introduction to Neural Networks** :The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks , Training Neural Networks :Backpropagation and Forward propagation Activation Functions :Linear ,Sigmoid, Tannh, Hard Tanh, Softmax, RELU, LRELU, ERELU, Loss Functions :Loss Function Notation , Loss Functions for Regression , Loss Functions for Classification, Loss Functions for Reconstruction, Hyperparameters : Layer size, Learning Rate, Regularization(dropout, drop connect, L1, L2), Momentum, Sparsity, Implementing Gradient Descent, vanishing and Exploding gradient.	7
II	**Convolutional Neural Network:** Introduction to CNN, Convolution Operation, Parameter Sharing, Equivalent Representation, Pooling, Variants of the Basic Convolution Function, The basic Architecture of CNN, Popular CNN Architecture – AlexNet.	7
III	**Recurrent Neural Networks:** Recurrent Neural Networks: Types of Recurrent Neural Networks, Feed-Forward Neural Networks vs Recurrent Neural Networks, Long Short-Term Memory Networks (LSTM), Encoder Decoder architectures, Recursive Neural Networks	7
IV	**Autoencoders:** Undercomplete Autoencoders, Regularized Autoencoders-Sparse Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders.	6
V	**Representation Learning:** Greedy Layerwise Pre-training, Transfer Learning and Domain Adaption, Distributed Representation, Variants of CNN: DenseNet.	6
VI	**Reinforcement Learning:** Introduction of deep reinforcement learning, Markov Decision	6

	Process, basic framework of reinforcement learning, challenges of reinforcement learning, Dynamic programming algorithms for reinforcement learning, Q Learning and Deep Q-Networks, Deep Q recurrent networks, Simple reinforcement learning for Tic-Tac-Toe.	

List of Practical Assignments:

1. Implementing Feedforward neural networks with Keras and Tensor Flow a. Import the necessary packages b. Load the training and testing data (MNIST/CIFAR10) c. Define the network architecture using Keras d. Train the model using SGD e. Evaluate the network f. Plot the training loss and accuracy
2. Build the Image classification model by dividing the model into following 4 stages:
    1. Loading and pre-processing the image data
    2. Defining the model's architecture
    3. Training the model
    4. Estimating the model's performance
0. Use Autoencoder to implement anomaly detection. Build the model by using:
    1. Import required libraries
    2. Upload / access the dataset
    3. Encoder converts it into latent representation
    4. Decoder networks convert it back to the original input
    5. Compile the models with Optimizer, Loss, and Evaluation Metrics
0. Implement the Continuous Bag of Words (CBOW) Model. Stages can be:
    1. Data preparation
    2. Generate training data
    3. Train model
    4. Output
0. Object detection using Transfer Learning of CNN architectures
    1. Load in a pre-trained CNN model trained on a large dataset
    2. Freeze parameters (weights) in model's lower convolutional layers
    3. Add custom classifier with several layers of trainable parameters to model
    4. Train classifier layers on training data available for task
    5. Fine-tune hyper parameters and unfreeze more layers as needed
0. Mini Project:
    1. Human Face Recognition
    2. Gender and Age Detection: predict if a person is a male or female and also their age
    3. Colorizing Old B&W Images: color old black and white images to colorful images
    4. Use the Google stock prices dataset and design a time series analysis and prediction system using RNN

Text Books :

1. Goodfellow, I., Bengio, Y.,,Courville, A, "Deep Learning", MIT Press, 2016.
2. Josh Patterson & Adam Gibson, "Deep Learning"
3. Charu Agarwal, "Neural Networks and deep learning", A textbook
4. Nikhil Buduma, "Fundamentals of Deep Learning", SPD
5. Francois chollet, "Deep Learning with Python"

Reference Books:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction"
2. Seth Weidman, "Deep Learning from Scratch: Building with Python from First Principles",O'Reily
3. Francois Duval, "Deep Learning for Beginners, Practical Guide with Python and Tensorflow"

Online Resources:

http://csis.pace.edu/ctappert/cs855-18fall/DeepLearningPractitionersApproach.pdf
https://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-1col-dkrieselcom.pdf
https://www.my-mooc.com/en/categorie/deep-learning
https://nptel.ac.in/courses/106106184

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23317	CO1	3	3	2	2	3	1			1	2	1	
	CO2	3	2	2	2	2	1			1	2	1	1
	CO3	2	2	2	1	3	1			1	2	1	1
	CO4	2	2	2	1	2	1			1	2	1	
	CO5	2	2	2	1	2	1			1	2	1	1
	CO6	2	1	1	1	0	1			0	2	1	

Environmental Studies

Course Code : HS23311	Course Credits: 02	Course type: HSSM

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
2	-	-	10	-	60	-	-	-

Course Objectives:

1. Understand the fundamental concepts of environmental science and its relevance to engineering.
2. Analyze the environmental impact of various engineering industries.
3. Learn about sustainable engineering practices, pollution control, and waste management.
4. Study environmental laws in India and global initiatives for environmental conservation.
5. Explore corrective measures and preventive technologies for mitigating environmental damage.

Course Outcomes:

CO 1: Gain an understanding of environmental issues related to engineering industries.
CO 2: Analyze the impact of engineering industries on the environment
CO 3: Learn sustainable engineering solutions for mitigating environmental damage.
CO 4: Be aware of Indian and global initiatives for environmental protection
CO 5: Develop a sense of responsibility towards environmental conservation in their professional field.

UNIT No.	Syllabus	Teaching Hours
I	**Introduction to Environmental Studies** Importance of Environmental Studies, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere, Ecosystems and Biodiversity: Types, Importance, and Conservation, Sustainable Development Goals (SDGs) and Role of Engineers in Sustainability, Renewable and Non-Renewable Resources, Water Resources: Overuse, Pollution, and Engineering Solutions, Energy Resources: Fossil Fuels, Nuclear Power, and Renewable Energy Alternatives, Land Resources: Soil Degradation, Deforestation, and Urbanization	6
II	**Impact of Engineering Industries on Environment** Manufacturing & Automobile Industry: Air pollution, Carbon emissions, Waste disposal, Chemical & Pharmaceutical Industry: Water and soil contamination, Hazardous waste, Construction & Infrastructure: Land degradation, Dust pollution, Waste generation, Electronics & IT Industry: E-waste, Energy consumption, Semiconductor waste, Power Generation (Thermal, Hydropower, Nuclear): Pollution, Waste heat, Radiation hazards, Causes and Effects of Climate Change, Global Warming and Greenhouse Effect.	7
III	**Engineering Solutions for Environmental Mitigation and Sustainable Practices** Carbon Capture and Storage (CCS), Green Chemistry & Eco-friendly Materials, Sustainable Design & Life Cycle Assessment (LCA), Energy-efficient Technologies & Smart Grids, Case Studies on Successful Pollution Reduction. Waste Management Strategies: Solid Waste and Biomedical Waste Management, E-Waste: Sources, Impact, and Recycling, Hazardous Waste Handling and Treatment, Circular Economy and Zero-Waste Technologies. Sustainable Engineering Practices: Renewable Energy Technologies (Solar, Wind, Biomass, Hydropower) Green Buildings and Sustainable Architecture, Electric Vehicles and Smart Transportation Systems, Sustainable Agriculture and Water Conservation Technologies	7
IV	**Environmental Initiatives in India and Worldwide** National Initiatives: Swachh Bharat Abhiyan, Namami Gange, National Green Tribunal (NGT), Corporate Social Responsibility (CSR) & Environmental Compliance, Environmental Activism and the Role of NGOs, Environmental Laws and Policies in	6

	India, The Environmental Protection Act, 1986, Role of Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCB), International Environmental Agreements (Kyoto Protocol, Paris Agreement, COP Summits), Global Initiatives: UNEP, IPCC, World Bank Environmental Policies	

List of Activities for reference:

Unit 1: Introduction to Environmental Studies

1. **Ecosystem Study Report** – Visit a local park, water body, or forested area and document its ecosystem components (flora, fauna, food chains).
2. **Sustainability Case Study** – Choose one of the *Sustainable Development Goals (SDGs)* and prepare a report on its implementation in India.
3. **Renewable vs. Non-Renewable Resources** – Prepare a comparative chart listing sources, usage, and sustainability factors.
4. **Water Conservation Survey** – Conduct a survey in your neighborhood or campus to assess water consumption and suggest conservation strategies.

Unit 2: Impact of Engineering Industries on Environment

1. **Industrial Impact Assessment** – Select an engineering industry (automobile, chemical, IT, etc.) and analyze its environmental impact.
2. **Carbon Footprint Calculation** – Calculate the carbon footprint of your daily activities (electricity, transportation, food, etc.) and suggest ways to reduce it.
3. **Climate Change Awareness Video** – Create a short video (2–3 min) explaining global warming and its impact.
4. **Case Study on Pollution Control Failures** – Research a real-world incident of industrial pollution (e.g., Bhopal Gas Tragedy, Minamata Disease) and analyze the causes and consequences.

Unit 3: Engineering Solutions for Environmental Mitigation and Sustainable Practices

1. **Waste Management Audit** – Conduct a waste audit in your college or home, classify the waste generated, and propose a waste management plan.
2. **E-Waste Collection Drive** – Organize a drive to collect and safely dispose of e-waste in your locality. Submit a report on the amount collected and its disposal method.
3. **Renewable Energy Model** – Create a working or conceptual model of a solar panel, wind turbine, or biomass plant.
4. **Green Building Analysis** – Identify a green building in your city (or college) and analyze its energy-efficient features.

Unit 4: Environmental Initiatives in India and Worldwide

1. **Report on National Environmental Policies** – Summarize key environmental laws in India and their effectiveness.
2. **International Climate Agreements Presentation** – Prepare a presentation on major agreements like the Paris Agreement, Kyoto Protocol, and their impact on India.
3. **NGO/CSR Initiative Study** – Research an NGO or corporate social responsibility (CSR) initiative focused on environmental protection and prepare a report.
4. **Swachh Bharat Implementation Review** – Visit a local area, document cleanliness conditions, and suggest improvements under *Swachh Bharat Abhiyan*.

Evaluation Criteria (10 Marks Total)

- Depth of Research & Analysis (3 Marks)
- Presentation & Clarity (3 Marks)
- Creativity & Practical Application (2 Marks)
- Timely Submission (2 Mark)

Text Books :

1. **Benny Joseph,** *Environmental Studies*, McGraw Hill Education, 3rd Edition, 2021.
2. **Anubha Kaushik & C.P. Kaushik,** *Environmental Studies*, New Age International Publishers, 5th Edition, 2022.

Reference Books:

1. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 3rd Edition, 2021.
2. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Press, 3rd Edition, 2021.
3. Suresh K. Dhameja, Environmental Science and Engineering, S.K. Kataria & Sons, 2nd Edition, 2020.

Additional Reports & Resources:

- Government of India - Ministry of Environment, Forest & Climate Change (MoEFCC) Reports (Website)
- United Nations Environment Programme (UNEP) Reports (Website)
- IPCC Climate Change Reports (Website)
- Central Pollution Control Board (CPCB) Reports (Website)

Prof. R.K. Shastri	Dr. C. B. Nayak	Prof. S.M. Bhosle	Prof. S.B. Lande
BOS Chairman – HSSM	Dean Autonomy	Dean Academics	Principal

Principal
Vidya Prathishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune
Id No. PU/PN/Engg/152/2006
PUNE (MS.)

Advanced Java Programming

Course Code : IT23318	Course Credits: 02	Course type: VSEC

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
1	2	-	10	-	-	30	-	30

Prerequisite Course Mapping:
1.Programming in JAVA.

Future Course Mapping:
2. Windows Application, Database Application, and Client Server Application Development

Course Objectives:
1.To learn the development of GUI applications using Applets and AWT.
2.To learn the relevant AWT/ swing components and understand the event handling by developing application GUI.
3.To learn accessing database through Java programs, using Java Database Connectivity (JDBC)
4.To learn invoking the remote methods in an application using Remote Method Invocation (RMI).
5.To understand the development of client /server communication programs using Java Networking classes and socket programming.
6.To understand the development of client/Server communication applications using Servlet and JSP.

Course Outcomes:
CO 1: Understand the development of GUI applications using Applets and AWT.
CO 2: Develop the GUI and windows applications using AWT/ Swing and Event Handling.
CO 3: Develop the java programs for accessing database using Java Database Connectivity (JDBC).
CO 4: Understand how to invoke the remote methods in an application using Remote Method Invocation (RMI).
CO 5: Design and develop the client /server communication programs using Java Networking classes and socket programming.
CO 6: Develop the client/Server communication applications using Servlet and JSP.

UNIT No.	Syllabus	Teaching Hours
I	**INTRODUCTION TO APPLET** Applet Basics – Introduction, limitations of AWT, Applet architecture – HTML APPLET tag – Passing parameter to Appletget, DocumentBase() and getCodeBase() , Japplet	3
II	**AWT/SWING AND EVENT HANDLING** Event Handling: Events, Event sources, Event classes, Event Listeners, handling mouse and keyboard events, Adapter classes, inner classes. AWT class hierarchy, user interface components- labels, button, text components, checkbox,etc. Lists panels – scroll pane, dialogs, menu bar, graphics. Layout manager	4
III	**GUI PROGRAMMING AND JDBC** Designing GUI in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Concept of JDBC, JDBC Driver Types & Architecture, JDBC Packages, A Brief Overview of the JDBC process and connection classes, Database Connection and SQL.	3
IV	**REMOTE METHOD INVOCATION(RMI)** Remote Method Invocation: Architecture, RMI registry, the RMI Programming Model; Interfaces and Implementations; Writing distributed application with RMI, Simple Client/Server Application using RMI.	3
V	**SOCKET PROGRAMMING** The java.net package, Connection oriented transmission – Stream Socket Class, creating a Socket to a remote host on a port (creating TCP client and server), Simple Socket Program Example. Connectionless transmission using UDP: Datagrams, DatagramSocket, DatagramPacket, A Datagram client-server communication example.	3

Democracy, Election, and Governance

Course Code : HS23312	Course Credits: AU	Course type: AUDIT

Teaching Scheme			Evaluation Scheme					
TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR
1	-	-	-	-	-	-	-	-

Course Objectives:

The primary objectives of this course are to:

1. Analyze the structure and role of democratic institutions
2. Understand the electoral process and the role of the Election Commission of India,
3. Study the framework of governance in India, covering the executive, legislative, and judicial branches at both central and state levels.

Course Outcomes: On completion of the course, students will be able to–

CO1: Explain the evolution and significance of democracy in India, its core principles, and its role in nation-building.

CO2: Describe the composition, powers, and functions of the Election Commission of India, and understand the electoral process.

CO3: Interprete the governance structures at the Union and State levels, covering executive, legislative, and judicial functions.

UNIT No.	Syllabus	Teaching Hours
I	**Democracy in India:** Evolution of Democracy, Dimensions of Democracy: Social, Economic and Political, Decentralisation: Grassroots Level Democracy, Challenges before Democracy: women and marginalized sections of the society	4
II	**Election:** Election Commission of India-composition, powers and functions, and electoral process. Types of emergency grounds, procedure, duration, and effects. Amendment of the constitution- meaning, procedure, and limitations.	3
III	**Governance:** Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions. State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayatraj system Challenges of caste, gender, class, democracy and ethnicity	6

Evaluation and Assessment

Since this is an **audit course**, evaluation will be based on active participation, understanding of concepts, and analytical skills:

1. **Assignments & Reports** – Writing assignments on topics like electoral reforms, democratic challenges, or constitutional amendments.
2. **Quizzes/MCQs** – Multiple-choice or short-answer questions covering key topics like the Election Commission, parliamentary proceedings, and governance.
3. **Group Discussions/Presentations**– Debates on issues like democracy and social justice, governance challenges, and the effectiveness of grassroots-level democracy.

VI	**WEB APPLICATIONS USING SERVELET AND JSP** Servlet overview – the Java web server ,Life Cycle of a Servlet, first servlet example.	2

List of Practical Assignments(Implement any six assignment)

1. Write a program to demonstrate status of key on an Applet window such as KeyPressed, KeyReleased, KeyUp, KeyDown.
2. Write a program to create a frame using AWT. Implement mouseClicked, mouseEntered() and mouseExited() events. Frame should become visible when the mouse enters it.
3. Develop a GUI which accepts the information regarding the marks for all the subjects of a student in the examination. Display the result for a student in a separate window.
4. Write a program to insert and retrieve the data from the database using JDBC.
5. Develop an RMI application which accepts a string or a number and checks that string or number is palindrome or not.
6. Write a program to demonstrate the use of InetAddress class and its factory methods.
7. Write Servlet (procedure for client side or procedure for server side) to display the username and password accepted from the client.
8. Create login form and perform state management using Cookies, HttpSession and URL Rewriting.
9. Create a simple calculator application using servlet.
10. Create a registration servlet in Java using JDBC. Accept the details such as Username, Password, Email, and Country from the user using HTML Form and store the registration details in the database.

Text Books :

1. Herbert Schildt, "Java: The complete reference", Tata McGraw Hill, 7th Edition
2. Jim Keogh, "Complete Reference J2EE" , Enterprise.
3. E. Balaguruswamy, "Programming with JAVA: A Primer" McGraw Hill Education, India, 5th Edition.

Reference Books:

1. "Java 6 Programming", Black Book, Dreamtech
2. "Java Server Programming, Java EE6 (J2EE 1.6)", Black Book, Dreamtech
3. M.T. Savaliya,"Advanced Java Technology", Dreamtech

Online Resources:

1. JAVA Business Application (swayam course)
   https://onlinecourses.swayam2.ac.in/aic20_sp14/course

2. COURCERA
   https://www.coursera.org/learn/advanced-java/supplement/Nphnb

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT23318	CO1	2	3	2									
	CO2	2	2	2		2							
	CO3			3			3						
	CO4				2		3						
	CO5	2		2			2						
	CO6			2			2	2					

Text Books :

1. Banerjee-Dube, I. (2014). A history of modern India. Cambridge University Press.
2. Bhargava, R. (2008). Political theory: An introduction. Pearson Education India.
3. Bhargava, R., Vanaik, A. (2010) Understanding Contemporary India: Critical Perspective. New Delhi: Orient Blackswan.
4. Chandhoke. N., Proyadardhi.P, (ed) (2009), 'Contemporary India: Economy, Society, Politics', Pearson India Education Services Pvt. Ltd, ISBN 978-81- 317-1929-9.
5. Chandra, B. (1999). Essays on contemporary India. Har-Anand Publications.
6. Chaterjee, P. (1997). State and Politics in India.
7. Dasgupta. S., (ed) (2011), 'Political Sociology', Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education in south Asia. ISBN: 978-317-6027- 7.
8. Deshpande, S. (2003). Contemporary India: A Sociological View, New Delhi:Viking Publication.
9. Guha, R. (2007). India After Gandhi: The History of the World's Largest. Democracy, HarperCollins Publishers, New York.
10. Guha, R. (2013). Gandhi before India. Penguin UK.
11. Jayal. N.G. (2001). Democracy in India.New Delhi: Oxford University Press.
12. Kohli, A. (1990). Democracy and discontent: India's growing crisis of governability. Cambridge University Press.
13. Kohli, A., Breman, J., & Hawthorn, G. P. (Eds.). (2001). The success of India's democracy (Vol. 6). Cambridge University Press.
14. Kothari, R. (1989). State against democracy: In search of humane governance. Apex Pr.
15. Kothari, R. (1970). Politics in India. New Delhi: Orient Blackswan.
16. Kothari, R. (1995). Caste in Indian politics. Orient Blackswan.
17. Sarkar, S. (2001). Indian democracy: the historical inheritance. the Success of India's Democracy, 23-46.

Prof. R.K. Shastri
BOS Chairman – HSSM

Prof. S.A. Takale
HoD – IT

Dr. C.B. Nayak
Dean Autonomy

Prof. S.M. Bhosle
Dean Academics

Prof. S.B. Lande
Principal

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune
Id No. / PU / PN / Engg / 152 / 2006
PUNE (MS)