Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Electronics Engineering and
Electronics & Telecommunication Engineering

Structure for Honors Degree – Artificial Intelligence and Machine Learning
w.e.f. 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET11	SY Sem II	Computational Statistics	3	1		4	30	70	25	125
HET12	TY Sem I	Artificial Intelligence	3		2	4	30	70	25	125
HET13	TY Sem II	Seminar			2*	1			25	25
HET14	TY Sem II	Machine Learning	3		2	4	30	70	25	125
HET15	B Tech Sem I	Mini Project			4*	2		50	50	100
HET16	B Tech Sem I	AI Applications	3		2	4	30	70	25	125
	Sub Total		**12**	**1**	**12**	**19**	**120**	**330**	**175**	**625**

* indicates contact hours

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Artificial Intelligence and Machine Learning

S.Y. BTech (Electronics Engineering)- Part-II

S.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-II

HET11: Computational Statistics

Teaching Scheme:
Lecture : 3Hrs/Week, 3 credits
Tutorial: 1Hr/Week, 1 credit

Examination Scheme:
ISE:30 Marks
ESE:70 Marks
ICA: 25 Marks

The goal of this course is to provide students an introduction to a variety of modern computational statistical techniques and the role of computation as a tool of discovery.

Course Prerequisite:

Student shall have knowledge of programming language python, also some background in probability and statistical inference.

Course Objectives:

1. To make students learn efficient numerical methods for solving problems in statistical analysis.
2. To make students use computational statistics in applications like statistical machine learning.
3. To describe the Dimensionality reduction method.
4. To introduce basics of Learning theory.

Course Outcomes:

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

1. Describe fundamental aspects of efficient numerical methods for statistical analysis
2. Explore modern computational statistical techniques
3. Describe the role of computation as a tool of discovery.
4. Apply statistical methods for Machine learning applications

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SECTION I

Unit 1: Probability Distributions (07)

Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Statistics and Independence, Gaussian distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform

Unit 2: Regression - linear and nonlinear (07)

Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection

Unity 3 : Matrix fundamentals (08)

Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces, Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation

SECTION II

Unit 4 : Dimensionality reduction (07)

Problem Setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective

Unit 5 : Basic learning theory (07)

- types, feasibility, training, testing, generalization, bias- variance, underfitting, overfitting etc

Unit 6: Introduction to Machine Learning (08)

Well posed learning problem, designing a learning system, perspectives and issues in machine learning, applications of machine learning, probability theory, model selection, the curse of dimensionality, decision theory, information theory

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Internal Continuous Assessment:

ICA consists of minimum 8 tutorials based upon above curriculum.

Text books:

1. Peter Givens, G. H. and Hoeting, J. A. (2005) Computational Statistics, 2nd Edition, Wiley-Interscience
2. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong .

Reference Books:

1. Liu, J. (2001). Monte Carlo Strategies in Scienti_c Computing, Springer-Verlag.
2. Lange, K. (2002). Numerical Analysis for Statisticians, Springer-Verlag, 2nd Edition.
3. Hastie, T., Tibshirani, R. and Friedman, J. (2009). The Elements of Statistical Learning, 2nd Edition, Springer.
4. Goodfellow, I., Bengio, Y. and Courville, A. (2016). Deep Learning, MIT Press.

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Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Artificial Intelligence and Machine Learning

T.Y. B.Tech (Electronics Engineering)- Part-I

T.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-I

HET12: Artificial Intelligence

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hr/week, 3 credits	ESE : 70 Marks
Practical: 2 hr/week, 1 credit	ISE : 30 Marks
	ICA : 25 Marks

Course Objectives:

1. To present to student general overview of AI with its future prospects
2. To make student understand various problem-solving methods through search techniques
3. To make student understand the various methods for knowledge representation and reasoning
4. To make student understand the various methods for decision making
5. To make student comprehend learning and knowledge acquisition concepts

Course Outcomes:

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

1. Formulate and solve sequence of actions for an agent as a search problem.
2. Infer from represented knowledge using logical and probabilistic reasoning methods
3. Solve agent decision problems using probability theory
4. Explain forms of learning and demonstrate their working.

Course Prerequisite:

Student shall have fundamental knowledge of algorithms

SECTION-I

Unit 1: Overview **(06)**

Foundations, scope, problems, and approaches of AI, intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents

Unit 2: Problem-Solving through Search **(07)**

Forward and backward, state-space, blind, heuristic, problem-reduction, A, A, AO, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications

Unit 3: Knowledge Representation and Reasoning (07)

Ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; first order logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications

SECTION II

Unit 4: Representing and Reasoning with Uncertain Knowledge (07)

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, and sample applications

Unit 5: Decision-Making (06)

Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications

Unit 6: Learning and Knowledge Acquisition (07)

A bird's eye view, scalability issues and the streaming scenario, a stroll through some application scenarios

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Internal Continuous Assessment (ICA)

ICA shall consist of minimum 08 experiments based on above Syllabus.

Text Books:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall
2. A First Course in Artificial Intelligence, Deepak Khemani, McGraw Hill Education (India)
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.

Reference Book:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw Hill

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Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Artificial Intelligence and Machine Learning

T.Y. B.Tech (Electronics Engineering)- Part-II

T.Y. B. Tech (Electronics & Telecommunication Engineering)- Part-II

HET13 – Seminar

Teaching Scheme:	**Examination Scheme:**
Practical : 2 hr/week, 1 credit	**ICA :** 25 Marks

Course Objectives:

1. To expose student to the latest trends in Artificial Intelligence
2. To develop communication Skill of the student
3. To make student able to write technical specifications, project document

Course Outcomes:

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

1. Identify a seminar topic after thorough literature survey
2. Prepare a seminar presentation to explore the latest trends in Artificial Intelligence.
3. Demonstrate communication Skills.
4. Inculcate presentation skills through reports and presentations while observing professional ethics

Course Prerequisite:

Student shall possess necessary technical report writing skills, presentation skills and shall have proficiency in software for word processing and presentation.

The objective of seminar is to enable the student to get exposed with technology, modern tools, techniques and various emerging applications of Artificial Intelligence. The students shall refer reference research papers from standard Journals from IEEE, Science Direct etc.

This is expected to provide a good initiation for the student(s) in R&D work which include:

1. Survey and study of published literature on the selected seminar topic.
2. Seminar over state-of-the-art technology to resolve problem undertaken.
3. Preparing a Written Report on the Study conducted for presentation to the Department.
4. Seminar, as oral Presentation before a departmental committee.

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T.Y. B.Tech (Electronics Engineering)- Part-II

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HET14 – Machine Learning

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hr/week, 3 credits	ESE : 70 Marks
Practical : 2 hr/week, 1 credit	ISE : 30 Marks
	ICA : 25 Marks

Course Objectives:

1. To make student learn necessity and different aspects of Machine Learning.
2. To make student understand Machine Learning Models.
3. To make student understand Classification and Regression.
4. To introduce to student real world applications of Machine Learning.

Course Outcomes:

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

1. Describe fundamental aspects of Machine Learning.
2. Distinguish between various characteristics of ML
3. Explore classification and regression algorithm
4. Design neural network for classification
5. Design and implement different Machine Learning models
6. Apply Machine learning techniques that enable to solve real world problems.

Course Prerequisite:

Student shall have knowledge of programming language like python / R, also fundamentals of probability and Statistics.

SECTION I

Unit 1: Introduction to Machine Learning (08)

Basics of Statistics, what is Machine learning? Examples of Machine Learning Problems, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, database and data processing for ML.

Unit 2: Theory of Machine Learning **(05)**

Definition of learning systems, Types: Supervised, Unsupervised, Semi Supervised, Reinforcement learning with examples. hypothesis space and inductive bias, evaluation, cross-validation, what is a feature? feature construction, feature extraction.

Unit 3: Supervised Learning **(08)**

Classification: Binary Classification- Assessing Classification performance.

Common classification algorithms: K Nearest Neighbor, Decision Tree, Random Forest model, Support vector machines. Probabilistic Models: Naïve Bayes Classifier.

Regression: Assessing performance of Regression- Error measures, Overfitting, underfitting, linear regression, logistic Regression. Multivariate Linear Regression.

SECTION II

Unit 4: Unsupervised Learning **(08)**

Unsupervised Vs supervised learning, Applications of unsupervised learning, Clustering, clustering as ML task, Different clustering techniques, partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN, Finding pattern using association rule, Association rule, apriori algorithm for association rule learning, Build the apriori principle rules.

Unit 5: Artificial Neural Networks **(08)**

Introduction, Exploring Artificial Neuron, Types of activation functions, Early implementations of ANN, Architectures of Neural Network, Learning process in ANN, Backpropagation, Deep learning

Unit 6: Applications of Machine Learning **(05)**

Email Spam and Malware Filtering, Image recognition, Speech Recognition, Traffic Prediction, Self-driving Cars, Virtual Personal Assistant, Medical Diagnosis.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practical based upon above curriculum.

Text books:

1. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rdEdition, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Prentice Hall of India,3rd Edition2014.
4. Dutt, Chandramouli, Das, “Machine Learning” Pearson publication, Eighth Impression,2022.

Reference Books:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar “Foundations of Machine Learning”, MIT Press,2012.

2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. Kevin P. Murphy “Machine Learning: A Probabilistic Perspective”, The MIT Press, 2012
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.
5. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRCPress,2014.
6. Charu C. Aggarwal, “DATA CLUSTERING Algorithms and Applications”, CRC Press,2014.
7. Machine Learning Mastery With Python 2016 by Jason Brownlee.

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HET15–Mini Project

Teaching Scheme:
Practical-4 Hours / week, 2 Credits

Examination Scheme
ESE- 50 Marks
ICA- 50 Marks

The mini project in Artificial Intelligence and Machine Learning is designed to provide students with practical experience in applying Artificial Intelligence and Machine Learning techniques and tools to solve real-world problems. Students will work in teams to select a project area, identify relevant data sources, and develop and implement model. The work will cover topics such as statistical analysis, Artificial Intelligence, and machine learning. Students will also develop communication and project management skills through regular presentations and team meetings.

Course Prerequisite:

The student shall have undergone a course on Computational Statistics, Artificial Intelligence, and Machine Learning. Also, students must be familiar with python programming and its libraries.

Course Objectives:

1. To enable students to gain hands-on experience in designing and implementing a solution using large data sets, also undergoing various steps.
2. To enhance students' skills in testing and debugging a project to ensure it meets the desired specifications.
3. To prepare students for future Artificial and Machine Learning based projects, where they will need to manage a large amount of data, communicate results effectively, and implement a project to meet specific goals.
4. To promote critical thinking, problem-solving, and creativity in the context of a practical in AI & ML related projects.

Course Outcomes:

After completing this course, a student shall be able to -

1. Define and analyze a real-world problem in Artificial Intelligence and Machine Learning.
2. Apply appropriate statistical and machine learning techniques to develop a model that solves the problem.
3. Evaluate the performance of the model and identify potential improvements.
4. Communicate the findings and results effectively through written reports and oral presentations.
5. Collaborate effectively with team members and manage project timelines and milestones.

Project Guidelines:

- Students are expected to Identify and define a real-world problem in Artificial Intelligence and Machine Learning, with the help of an allocated guide/supervisor.
- Select appropriate data sources and collect relevant data. One can use online sources such Kaggle, UCI, NSE or offline sources such as Educational Institute, University, Business etc.
- Apply appropriate statistical and machine learning techniques to develop a model that solves the problem.
- Evaluate the performance of the model and identify potential improvements. Communicate the findings and results effectively through written reports and oral presentations.
- Students should collaborate effectively with team members and manage project timelines and milestones.

Project Area:

The project area can be chosen from various domains such as education, healthcare, finance, retail, social media, etc.

ICA Assessment Guidelines:

A group of 3 students shall be formed in the first week of semester and supervisor will be allocated. Students shall meet for minimum 4 hours in every week and carry out the steps given in the project guidelines.

ESE Assessment Guidelines:

Supervisors and a team of evaluators will assess the project work and give appropriate weightage for various stages of the project life cycle such as – Concept/Idea, Data Source and Collection, Visualization technique applied, Algorithm used for model building, Presentation skills and result reporting.

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HET16: AI Applications

Teaching Scheme:
Lecture : 3Hrs/Week, 3 credits
Practical: 2Hr/Week, 1 credit

Examination Scheme:
ISE:30 Marks
ESE:70 Marks
ICA: 25 Marks

This course is designed to provide students with an understanding of the applications of artificial intelligence (AI) in various industries. The course covers the fundamental concepts of AI, including machine learning, deep learning, natural language processing (NLP), computer vision, Expert systems, and reinforcement learning. The course also focuses on ethical considerations in AI applications.

Course Prerequisite:
Student shall have knowledge Artificial Intelligence and Machine Learning, programming language

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Course Objectives

1. To introduce students to the fundamental concepts and applications of AI
2. To enable students to apply AI techniques to real-world problems
3. To provide students with hands-on experience in developing AI applications
4. To discuss ethical considerations in AI applications

Course Outcomes:

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

1. Design and learn implementation of AI-based systems for solving real-world problems related to Expert Systems, computer vision.
2. Expose the field of natural language processing (NLP) applications such as sentiment analysis, chatbots, and speech recognition.
3. Explore computer vision techniques for image analysis, including object detection, segmentation and recognition.
4. Stay up-to-date with the latest trends and advances in AI applications by following relevant literature and attending professional conferences and events.

Section I

Unit 1: Overview of AI Applications [6 Hours]

Introduction, definitions of AI, Man Vs Computers, Simulation of Sophisticated and Intelligent Behavior, Branches of AI, Natural Language, Automated reasoning, Visual perception, intelligent agents, Major components of Intelligent system, Important definitions and Systems.

Unit 2: Computer Vision Representation [8 Hours]

Representation and Recognition, Object recognition, Pattern Recognition, Model based Object recognition, Relaxation Labelling Methods, Graph Searching.

Unit 3: Expert Systems [8 Hours]

Introduction to Expert system, Basic architecture of an Expert system, Types of Problems solved by expert systems, Features of an Expert System, Expert system architecture, Knowledge acquisition, Expert system tools, existing expert systems.

Section II

Unit 4: Natural Language Processing (NLP) [8Hours]

Language Models, Text Classification, Information Retrieval, Information Extraction, Phrase Structure Grammars, Syntactic Analysis (Parsing), Augmented Grammars and Semantic Interpretation, Machine Translation, Speech Recognition

Unit 5: Reinforcement Learning [6 Hours]

Reinforcement Learning Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, Applications of Reinforcement Learning

Unit 6: Robotics: [8 Hours]

Introduction , Robot Hardware ,Robotic Perception ,Planning to Move ,Planning Uncertain Movements ,Moving ,Robotic Software Architectures ,Application Domains.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practical based upon above curriculum covering various AI Applications and Tools.

Text books:

1. “A Classical Approach to Artificial Intelligence” by Munesh Chandra Trivedi, Second Edition, Khanna Publishing.
2. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig(*Third edition*) Pearson publication
3. "Artificial Intelligence Concepts and Applications by Lavika Goel, Wiley Publications.

Reference books:

1. Artificial Intelligence by Saroj Koushik, Cengage Learning Publication
2. The Essence of Artificial Intelligence by Alison Cousey, Pearson Publication
3. Introduction to Artificial Intelligence and Expert systems by Dan W. Patterson, Pearson Publication

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Structure for Honors Degree – Data Science
w.e.f. 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET21	SY Sem II	Database Management Systems	3	1		4	30	70	25	125
HET22	TY Sem I	Data Processing & Feature Engineering	3		2	4	30	70	25	125
HET23	TY Sem II	Seminar			2*	1			25	25
HET24	TY Sem II	Machine Learning	3		2	4	30	70	25	125
HET25	B Tech Sem I	Mini Project			4*	2		50	50	100
HET26	B Tech Sem I	Business Intelligence	3		2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

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Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Data Science

S.Y. B.Tech (Electronics Engineering)- Part-II

S.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-II

HET21: Database Management System

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Tutorial: 1Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

This course introduces a Data Base Management System, which is the system software for easy, efficient and reliable data processing and management. It covers ER Model, Relational Model, Structured Query Language, Relational Database Design and Concurrency Control techniques.

Course Objectives:

1. To understand the basics of database design, structure, implementation and applications.
2. To develop the logical design of the database using data modeling concepts such as entity relationship diagrams.
3. To understand and use Structured Query Language to query, update, and manage a database.
4. To apply normalization techniques to normalize the database.
5. To familiarize the students with the fundamentals of database transaction processing, learn techniques for concurrency control and recovery methods.

Course Outcomes:

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

1. Apply the basic concepts of database system to design relational model and schemas.
2. Design schema using E-R model and normalization.
3. Extract data using relational algebra and SQL.
4. Access data using Indexing and Hashing techniques.
5. Apply ACID properties for transaction processing.
6. Explain concurrency control and recovery methods.

SECTION– I

Unit 1: Introduction to DBMS **(03)**

Database- System Applications, Purpose of Database Systems, View of data, Database Languages, Database Architectures, Database users and administrators, history of databases system.

Unit 2: E-R model **(05)**

Overview of design process, E-R Model, Constraints, E-R diagrams, E-R design issues, Weak Entity Sets, Extended E-R features, Reduction to relational schema.

Unit 2: Relational Model **(05)**

Relational Model: Basic structure of relational databases, Database schema, keys, Schema diagrams, Relational Query languages, Relational algebra-Fundamental, Additional and Extended Relational Algebra Operations.

Unit 4: Introduction to SQL **(08)**

Overview, SQL data definition, SQL data types, Integrity constraints, Basic structure of SQL Queries, Types of SQL Commands: DDL, DML, DCL and TCL statements, Basic SQL clauses [select, from, where, group by, having, order by etc.].

SECTION-II

Unit 5: Intermediate SQL **(06)**

Additional basic operations, Set operations, NULL values, Aggregate functions, Nested sub queries, Modification of the databases. Join operations, Views, Integrity constraints, Authorization.

Unit 6: Normalization **(05)**

Features of good Relational Designs, Atomic Domains, First Normal Form, Keys and Functional dependencies, Second Normal Form, Boyce-Codd Normal Form, Third Normal Form, Functional dependency theory.

Unit 7: Indexing and Hashing **(05)**

Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access, Introduction to Indexing, Comparison of Indexing and Hashing, Index definition in SQL.

Unit 8: Transactions and Concurrency Control **(05)**

Transaction concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions. Concurrency Control - Lock based protocol: Locks, Granting of Locks, Two-Phase Locking Protocol. Time Stamp-based protocols, Deadlock handling.

Internal Continuous Assessment (ICA):
ICA shall consist of minimum 8 assignments/tutorials based on above syllabus.

Suggestive List of Assignments/tutorials:

- Write queries in SQL using DDL and DML commands.
- Write queries in SQL to demonstrate integrity constraints.
- Write nested sub queries in SQL using Joins and Set operations.
- Write queries in SQL to create Views and demonstrate Authorization.
- Identify set of functional dependencies, find canonical cover and closure of functional dependency.
- Convert the created database into 1NF, 2NF, 3NF and BCNF

Text books:

1. Database system concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan (McGraw Hill International Edition) sixth edition.
2. Database system concepts by Peter Rob, Carlos Coronel (Cengage Learning) ninth edition.

Reference Books:

1. Fundamentals of Database systems by Ramez El Masri, S. B. Navathe (Pearson Education)5thedition.
2. Database Management Systems by Ramkrishnan Gehreke (Tata McGraw Hill) third edition.
3. Principles of Database Systems by J. D. Ullman (Galgotia Publications)
4. Advanced Database Management System by Rini Chakrabarti, Shilbhadra Dasgupta (Dreamtech Press Publication).

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Honors in Data Science

T.Y. B.Tech (Electronics Engineering)- Part-I

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HET22 – Data Processing & Feature Engineering

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hr/week, 3 credits	ESE : 70 Marks
Practical : 2 hr/week, 1 credit	ISE : 30 Marks
	ICA : 25 Marks

Course Objectives:

1. To develop skills for analysis of data quality
2. To understand concept of dimensionality reduction and its benefits.
3. To know automated tools for feature engineering.

Course Outcomes:

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

1. Identify the data quality.
2. Select appropriate preprocessing technique for data.
3. Identify feature engineering requirements for machine learning.
4. Automate feature extraction.

Course Prerequisite:

Basics of statistics, Probability theory, data science and statistical programing Language.

SECTION I

Unit 1: Data Quality and Preprocessing (06)

Data Scale Types, Data Quality, converting to a Different Scale Type, Converting to a Different Scale, Data Transformation

Unit 2: Features (08)

Kinds of feature, Calculations on features, Categorical, ordinal and quantitative features, Structured features, Feature transformations, Thresholding and discretisation, Normalisation and calibration, Incomplete features, Feature construction and selection, Matrix transformations and decompositions.

Unit3: Dimensionality Reduction (07)

Introduction, Subset Selection, Principal Component Analysis, Feature Embedding, Factor Analysis, Singular Value Decomposition and Matrix Factorization, Multidimensional Scaling, Linear Discriminant Analysis, Canonical Correlation Analysis

SECTION II

Unit 4: Feature Engineering for Machine Learning (08)

Data Tasks, Models, Features, Model Evaluation, Scalars, Vectors, and Spaces, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Log Transform in Action, Power Transforms: Generalization of the Log Transform, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling)

Unit 5: Nonlinear Featurization via K-Means (06)

Model Stacking, k-Means Clustering, Clustering as Surface Tiling, k-Means Featurization for Classification, Alternative Dense Featurization

Unit 6: Automating the Fraternizer (07)

Image Feature Extraction and Deep Learning, Manual Feature Extraction: SIFT and HOG, Image Gradients, Gradient Orientation Histograms, SIFT Architecture, Learning Image Features with Deep Neural Networks, Fully Connected Layers, Convolutional Layers, Rectified Linear Unit (ReLU) Transformation, Response Normalization Layers, Pooling Layers, Structure of AlexNet

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Internal Continuous Assessment (ICA):

Minimum eight experiments based on above Syllabus.

Text books:

1. A General Introduction to Data Analytics, by Joao Moreira, Andre Carvalho, Tomas Horvath, Wiley Publication.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Prentice Hall of India, 3rd Edition2014.
4. Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists 1st Edition by Alice Zheng , Amanda Casari, O'REILLY publication

Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
2. Charu C.Aggarwal,“Data Classification Algorithms and Applications”, CRCPress,2014.
3. Charu C. Aggarwal, “DATA CLUSTERING Algorithms and Applications”, CRC Press,2014.
4. Machine Learning Mastery With Python 2016 by Jason Brownlee.

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T.Y. B.Tech (Electronics Engineering)- Part-II

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HET23 – Seminar

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hr/week, 1 credit	ICA : 25 Marks

Course Objectives:

1. To expose student to the latest trends in Data Science
2. To develop communication Skill of the student
3. To make student able to write technical specifications, project document

Course Outcomes:

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

1. Identify a seminar topic after thorough literature survey
2. Prepare a seminar presentation to explore the latest trends in Data Science.
3. Demonstrate communication Skills.
4. Inculcate presentation skills through reports and presentations while observing professional ethics

Course Prerequisite:

Student shall also possess necessary technical report writing skills, presentation skills and shall have proficiency in software for word processing and presentation

The objective of seminar is to enable the student to get exposed with technology, modern tools, techniques and various emerging applications of data science. The students shall refer reference research papers from standard Journals from IEEE, Science Direct etc.

This is expected to provide a good initiation for the student(s) in R&D work which include:

1. Survey and study of published literature on the selected seminar topic.
2. Seminar over state-of-the-art technology to resolve problem undertaken.
3. Preparing a Written Report on the Study conducted for presentation to the Department.
4. Seminar, as oral Presentation before a departmental committee.

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HET24 – Machine Learning

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hr/week, 3 credits	ESE : 70 Marks
Practical: 2 hr/week, 1 credit	ISE : 30 Marks
	ICA : 25 Marks

Course Objectives:

1. To make student learn necessity and different aspects of Machine Learning.
2. To make student understand Machine Learning Models.
3. To make student understand Classification and Regression.
4. To introduce to student real world applications of Machine Learning.

Course Outcomes:

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

1. Describe fundamental aspects of Machine Learning.
2. Distinguish between various characteristics of ML
3. Explore classification and regression algorithm
4. Design neural network for classification
5. Design and implement different Machine Learning models
6. Apply Machine learning techniques that enable to solve real world problems.

Course Prerequisite:

Student shall have knowledge of programming language like python / R, also fundamentals of probability and Statistics.

SECTION I

Unit 1: Introduction to Machine Learning **(08)**

Basics of Statistics, what is Machine learning? Examples of Machine Learning Problems, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, database and data processing for ML.

Unit 2: Theory of Machine Learning **(05)**

Definition of learning systems, Types: Supervised, Unsupervised, Semi Supervised, Reinforcement learning with examples. hypothesis space and inductive bias, evaluation, cross-validation, what is a feature? feature construction, feature extraction.

Unit 3: Supervised Learning **(08)**

Classification: Binary Classification- Assessing Classification performance.

Common classification algorithms: K Nearest Neighbor, Decision Tree, Random Forest model, Support vector machines. Probabilistic Models: Naïve Bayes Classifier.

Regression: Assessing performance of Regression- Error measures, Overfitting, underfitting, linear regression, logistic Regression. Multivariate Linear Regression.

SECTION II

Unit 4: Unsupervised Learning **(08)**

Unsupervised Vs supervised learning, Applications of unsupervised learning, Clustering, clustering as ML task, Different clustering techniques, partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN, Finding pattern using association rule, Association rule, apriori algorithm for association rule learning, Build the apriori principle rules.

Unit 5: Artificial Neural Networks **(08)**

Introduction, Exploring Artificial Neuron, Types of activation functions, Early implementations of ANN, Architectures of Neural Network, Learning process in ANN, Backpropagation, Deep learning

Unit 6: Applications of Machine Learning **(05)**

Email Spam and Malware Filtering, Image recognition, Speech Recognition, Traffic Prediction, Self-driving Cars, Virtual Personal Assistant, Medical Diagnosis.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practical based upon above curriculum.

Text books:

1. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rdEdition, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Prentice Hall of India,3rd Edition2014.
4. Dutt, Chandramouli, Das, “Machine Learning” Pearson publication, Eighth Impression,2022.

Reference Books:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar “Foundations of Machine Learning”, MIT Press,2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. Kevin P. Murphy “Machine Learning: A Probabilistic Perspective”, The MIT Press, 2012
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.
5. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRCPress,2014.
6. Charu C. Aggarwal, “DATA CLUSTERING Algorithms and Applications”, CRC Press,2014.
7. Machine Learning Mastery With Python 2016 by Jason Brownlee.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Data Science

Final Year B.Tech (Electronics Engineering)-Part-I

Final Year B.Tech (Electronics & Telecommunication Engineering)-Part-I

HET25–Mini Project

Teaching Scheme:
Practical-4 Hours / week, 2 Credits

Examination Scheme:
ESE- 50 Marks
ICA- 50 Marks

The mini project in data science is designed to provide students with practical experience in applying data science techniques and tools to solve real-world problems. Students will work in teams to select a project area, identify relevant data sources, and develop and implement a data analysis solution. The work will cover topics such as data preprocessing, data visualization, statistical analysis, and machine learning. Students will also develop communication and project management skills through regular presentations and team meetings.

Course Prerequisite:

The student shall have undergone a course on Database Management Systems, Data Analytics, and Machine Learning, Also, students must be familiar with python programming and its libraries related to Data Analysis.

Course Objectives:

1. To enable students to gain hands-on experience in designing and implementing a solution using large data sets, also undergoing various steps for data science.
2. To enhance students' skills in testing and debugging a project to ensure it meets the desired specifications.
3. To prepare students for future data analytics projects, where they will need to manage a large amount of data, communicate results effectively, and implement a project to meet specific goals.
4. To promote critical thinking, problem-solving, and creativity in the context of a practical business analytics project

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Course Outcomes:

After completing this course, a student shall be able to -

1. Define and analyze a real-world problem in data science.
2. Apply appropriate statistical and machine learning techniques to develop a model that solves the problem.
3. Evaluate the performance of the model and identify potential improvements.
4. Communicate the findings and results effectively through written reports and oral presentations.
5. Collaborate effectively with team members and manage project timelines and milestones.

Project Guidelines:

- Students are expected to Identify and define a real-world problem in data science, with the help of an allocated guide/supervisor.
- Select appropriate data sources and collect relevant data. One can use online sources such Kaggle, UCI, NSE or offline sources such as Educational Institute, University, Business etc.
- Students shall clean and preprocess the data using appropriate techniques in data analytics.
- Apply data visualization and exploratory data analysis techniques to gain insights into the data.
- Apply appropriate statistical and machine learning techniques to develop a model that solves the problem.
- Evaluate the performance of the model and identify potential improvements. Communicate the findings and results effectively through written reports and oral presentations.
- Students should collaborate effectively with team members and manage project timelines and milestones.

Project Area:

The project area can be chosen from various domains such as education, healthcare, finance, retail, social media, etc.

Data Sources:

Data can be collected from various sources such as publicly available datasets, data repositories, web scraping, etc.

ICA Assessment Guidelines:

A group of 3 students shall be formed in the first week of semester and supervisor will be allocated. Students shall meet for minimum 4 hours in every week and carry out the steps given in the project guidelines.

ESE Assessment Guidelines:

Supervisors and a team of evaluators will assess the project work and give appropriate weightage for various stages of the project life cycle such as – Concept/Idea, Data Source and Collection, Data Cleansing and preprocessing, Visualization technique applied, algorithm used for model building, presentation skills and result reporting.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Data Science

Final Year B.Tech. (Electronics Engineering)-Part I

Final Year B.Tech. (Electronics & Telecommunication Engineering)- Part-I

HET26: Business Intelligence

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Practical: 2 Hrs/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

Business Intelligence (BI) is the process of collecting, analyzing, and interpreting data to provide insights and decision support for organizations. This course will introduce students to the concepts, tools, and techniques used in BI, including data mining, analysis, and visualization, as well as BI applications. Students will also learn about the strategy and implementation of BI projects.

Course Prerequisite:

Student shall have knowledge of basic types of data, data preprocessing methods, data cleaning and features extractions techniques.

Course Objectives:

1. To explain the basic components that makes up a business intelligence environment.
2. To discuss the structure of the decision-making process
3. To describe the mathematical model for business intelligence analyses
4. To discuss different visualization tools and techniques for data representation and report preparation.
5. To illustrate various applications of Business Intelligence

Course Outcomes:

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

1. Describe the basic components of BI environment.
2. Apply data mining techniques for data analysis.
3. Use ETL and BI tools for the decision support system.
4. Represent data using different visualization tools and techniques
5. Explicate components of Business performance measurement systems.
6. Illustrate various applications of Business Intelligence.

SECTION – I

Unit 1: Introduction to Business Intelligence (08)

Effective and timely decisions, role of mathematical models, BI architectures, ethics on BI, Introduction to data warehouse, architecture, OLAP

Unit 2: **Decision Support System (07)**

Representation of decision making system, evolution of information system, definition and development of decision support system, mathematical models for decision making

Unit 3: Data Warehousing and Data Mining (07)

Definition and architecture of data warehouse, cubes and multidimensional analysis, definition and applications of data mining, data mining process, analysis methodologies.

SECTION – II

Unit 4: Business Reporting, Visual Analytics and Business Performance Management (08)

Business reporting definitions and concepts, data and information visualization, different types of charts and graphs, data visualization and visual analytics, performance dashboards, business performance management, performance measurement, balanced scorecards, six sigma as a performance measurement system.

Unit 5: BI applications: Marketing Models (07)

Relational marketing, Salesforce management, marketing models case studies, financial applications

Unit 6: BI applications: Logistic and Production Models (07)

Supply chain optimization, optimization models for logistics planning, revenue management system, Logistics business case studies.

Internal Continuous Assessment (ICA):

ICA shall consist of minimum of 6 practical tasks based on above syllabus and one project based assignment to perform analysis and generate reports using any tool for a given application.

Text Book:

1. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman, Elsevier
2. Business Intelligence Data mining and optimization for Decision making by Carlo Vercellis, ISBN:978-81-265-4188-1, Wiley Publication
3. Business Intelligence and Analytics: Systems for Decision Support by Efraim Turban, Ramesh Sharda, Dursun Delen by Pearson Education, Ltd.
4. Data Mining and Business Intelligence by S.K. Shinde and Uddagiri Chandrashekhar
5. Data Mining for Business Intelligence by Galit Shmueli, Nitin Patel, Peter Bruce, Wiley Publications.

Reference Books:

1. Data Warehousing in the Real World – Anahory& Murray, Pearson Edt.
2. Data Warehousing Fundamentals – Ponniah, Wiley Publication

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Electronics Engineering and
Electronics & Telecommunication Engineering

Structure for Honors Degree – Internet of Things(IoT)
w.e.f. 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET31	SY Sem II	Fundamentals of IoT	3	1		4	30	70	25	125
HET32	TY Sem I	Industrial IoT	3		2	4	30	70	25	125
HET33	TY Sem II	Seminar			2*	1			25	25
HET34	TY Sem II	IoT Cloud Platform	3		2	4	30	70	25	125
HET35	B Tech Sem I	Mini Project			4*	2		50	50	100
HET36	B Tech Sem I	Architecting IoT Solutions	3		2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Internet of Things(IoT)

S.Y. B.Tech (Electronics Engineering)- Part-II

S.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-II

HET31: Fundamentals of IoT

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Tutorial: 1Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

The Internet of Things (IoT) refers to the system in which different devices equipped with sensors and signal processing are connected through a network to communicate with each other and/or with central servers. This course provides a thorough introduction to the different components of an IoT System. The course also introduces different communication protocols. Introduction to Raspberry Pi and its architecture is also a part of this course.

Course Objectives:

1. To make student aware of different components of an IoT System
2. To introduce to student different sensors used in IoT.
3. To make student learn usage of different sensors in IoT.
4. To make student learn different communication technologies used in IoT.
5. To make student build simple IoT applications with Raspberry Pi.

Course Outcomes:

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

1. Define what Internet of Things is with suitable example.
2. Comprehend different components of an embedded System w.r.t. IoT.
3. Select appropriate sensor for a given IoT application with suitable justification.
4. Categorize different communication technologies used in IoT.
5. Construct a solution based on Raspberry Pi for the development of simple IoT application.

SECTION I

Unit 1 - Introduction to Internet of Things (06)

Introduction to IoT, different components of an IoT system: embedded system, communication systems, cloud, applications of IoT in various domains.

Unit 2 – Embedded Systems for IoT (07)

Introduction to embedded systems, different components of an embedded system, basics of Linux based embedded systems, various embedded platforms used in IoT, understanding the various IDEs used for embedded development.

Unit 3 – Sensors Fundamentals and Characteristics (08)

Sensors, Sensor Classification, Signals and Systems, Units of Measurements, Sensor Characteristics.

SECTION II

Unit 4 – Sensor Applications (07)

Occupancy and Motion Detectors, Position, Displacement, and Level, Velocity and Acceleration, Humidity and Moisture Sensors, Light Detectors, Temperature Sensors.

Unit 5 – Communication technologies for IoT (06)

Basics of the communication technologies (Bluetooth Low Energy (BLE), Wifi, RFID) their architecture, characteristics, limitation, power consumption parameters and applications.

Unit 6 – Development of IoT solution. (08)

Introduction to Raspberry Pi, Linux- Introduction, File System, Raspbian O.S.- Introduction, Installing Raspbian on Pi, First boot and Basic Configuration of Pi, Popular Linux Commands for shell access, remote access though Putty, features, Python programs for interfacing I/O devices like led's, switch's, LCD, etc with Raspberry Pi.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 tutorials based on above curriculum

Text Books

1. Internet of Things: Architecture and Design Principles by Raj Kamal, First edition, McGraw Hill Education
2. The Definitive Guide to the ARM Cortex-M3 by Joseph Yiu, Second Edition, Elsevier
3. Internet of Things for Architects by Perry Lea, Packt Publishing Limited
4. Analytics for the Internet of Things (IoT) by Andrew Minteer, First edition, Packt Publishing

5. Getting Started with Python for the Internet of Things by Dr. Steven Lawrence Fernandes, SaiYamanoor, and Tim Cox, First edition, Packt Publishing
6. Internet of Things Programming Projects: Build Modern IoT Solutions with the Raspberry Pi 3 and Python by Colin Dow, Packt Publishing Limited

Reference Books

1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos, Marilyn Wolf, 1st ed. 2018 edition, Springer
2. Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 by Peter Waher. First edition, Packt Publishing
3. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed by Perry Xiao, 1st edition, Wiley
4. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer

Recommended Online Free Courseware /Learning Resources

1. Udemy.com
2. Introduction to ARM mbed: playlist on Youtube
3. https://www.raspberrypi.org/teach/

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Internet of Things(IoT)

T.Y. B.Tech (Electronics Engineering)- Part-I

T.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-I

HET32: Industrial IoT

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Practical: 2Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

The Industrial Internet of Things (IoT) has transformed how businesses think about and interact with the world. Sensors can measure the performance of high- volume industrial manufacturing operations or the daily environmental health of a remote island. The IoT makes it possible to study the world at various levels of precision and enable data-driven decision making anywhere. Machine learning (ML) and Elastic cloud computing have accelerated our ability to understand and analyze the huge amount of data generated by the IoT. With edge computing, data analytics and ML models can process information locally at the source where the data is generated. This course introduces an approach to combine the technologies of edge computing and machine learning to deliver next-generation cyber-physical outcomes.

Course Objectives:

1. To make students aware of data driven architecture for edge devices.
2. To introduce students with machine learning at the edge.
3. To make students learn various edge topologies.
4. To make students learn the deployment of edge applications in real time.
5. To make students build edge applications on the cloud.

Course Outcomes:

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

1. Define data driven architecture with machine learning for the edge.
2. Define the anatomy of edge machine learning solutions.
3. Build an edge application w.r.t. best edge topology for a given application
4. Orchestrate deployment of streaming from the edge to a data lake on the cloud.
5. Design data flow patterns on the cloud.

SECTION I

Unit 1 - Introduction to the Data-Driven Edge with Machine Learning (06)
Living on the edge, Bringing ML to the edge, Tools to get the job done, Demand for smart home and industrial IoT, Setting the scene: A modern, smart home solution, Hands-on prerequisites.

Unit 2 – Foundations of Edge Workloads (07)
The anatomy of an edge ML solution, IoT Greengrass for the win, Checking compatibility with IoT Device Tester, Installing IoT Greengrass, Your first edge component.

Unit 3 – Building the Edge (08)
Exploring the topology of the edge, Reviewing common standards and protocols, Security at the edge, Connecting your first device – sensing at the edge, Connecting your second device – actuating at the edge.

SECTION II

Unit 4 – Extending the Cloud to the Edge (07)
Creating and deploying remotely, Storing logs in the cloud, Synchronizing the state between the edge and the cloud, Deploying your first ML model.

Unit 5 – Ingesting and Streaming Data from the Edge (07)
Defining data models for IoT workloads, Designing data patterns for the edge, Getting to know Stream Manager, Building your first data orchestration workflow on the edge, Streaming from the edge to a data lake on the cloud.

Unit 6 – Processing and Consuming Data on the Cloud (07)
Defining big data for IoT workloads, Introduction to Domain-Driven Design (DDD) concepts, Design data flow patterns on the cloud, Remembering data flow anti-patterns for edge workloads.

Internal Continuous Assessment (ICA):
ICA consists of a minimum of 8 practicals based on the above curriculum.

Text Books

1. Intelligent Workloads at the Edge: Deliver cyber-physical outcomes with data and machine learning using AWS IoT Greengrass by Indraneel Mitra, Ryan Burke, Packt Publishing Limited, First Published-2022.
2. Internet of Things for Architects by Perry Lea, Packt Publishing Limited
3. Internet of Things Programming Projects: Build Modern IoT Solutions with the Raspberry Pi 3 and Python by Colin Dow, Packt Publishing Limited

Reference Books

1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos, Marilyn Wolf, 1st ed. 2018 edition, Springer
2. Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 by Peter Waher. First edition, Packt Publishing

Recommended Online Free Courseware /Learning Resources

1. Udemy.com
2. https://docs.aws.amazon.com/iot/index.html

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Internet of Things(IoT)

T.Y. B.Tech (Electronics Engineering)- Part-II

T.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-II

HET33 – Seminar

Teaching Scheme:
Practical : 2 hr/week, 1 credit

Examination Scheme:
ICA : 25 Marks

Course Objectives:

1. To expose student to the latest trends in cloud computing
2. To develop communication skill of the student
3. To make student able to write technical specifications, project document
4. To make students follow professionalism throughout all the activities

Course Outcomes:

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

1. Identify a seminar topic after thorough literature survey
2. Prepare a seminar presentation to explore the latest trends in cloud computing.
3. Demonstrate communication skills.
4. Inculcate presentation skills through reports and presentations while observing professional ethics

Course Prerequisite:

Student shall also possess necessary technical report writing skills, presentation skills and shall have proficiency in software for word processing and presentation

The objective of the seminar is to enable the student to get exposed to technology, modern tools, techniques and various emerging applications of Artificial Intelligence. The students shall refer to reference research papers from standard Journals from IEEE , ScienceDirect etc.

This is expected to provide a good initiation for the student(s) in R&D work which include:

1. Survey and study of published literature on the selected seminar topic.
2. Seminar over state-of-the-art technology to resolve problems undertaken.
3. Preparing a Written Report on the Study conducted for presentation to the Department.
4. Seminar, as oral Presentation before a departmental committee.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Internet of Things (IoT)

T.Y. BTech (Electronics Engineering)- Part-II

T.Y. BTech (Electronics & Telecommunication Engineering)- Part-II

HET34: IoT Cloud Platforms

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Tutorial: 2Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

The Internet of Things (IoT) cloud platforms refers to the system in which different devices equipped with sensors and processing units are connected through a network to communicate with each other and/or with central servers. This course provides a thorough introduction to the fundamental components and effective designs to be considered for a cloud based scenario along with introduction to the design cloud services, database concepts, planning and design familiarity with architectural trade-off decisions, high availability versus cost and introduction to several AWS services.

Course Objectives:

1. To make student aware of cloud computing concepts.
2. To introduce students with different identity access policies on AWS.
3. To make students learn resource allocation schemes.
4. To make students learn different compute and load balancing concepts.
5. To make students use storage services for various applications.

Course Outcomes:

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

1. Define what is cloud computing.
2. Configure roles using AWS Identity and Access Management.
3. Configure resources with secured connectivity using AWS Virtual Private Cloud.
4. Architect the cloud infrastructure using Elastic compute cloud and Elastic Load Balancing.
5. Store and retrieve data using AWS S3.

SECTION I

Unit 1 - Introduction to Cloud Computing and AWS (07)

History of the cloud, Basic AWS concepts, Benefits of using AWS over traditional data center, Accessing AWS services, AWS overview, What are SaaS, PaaS, and IaaS?, Understanding virtualization, Elasticity versus scalability, Comparing AWS cloud and on-premises data centers, Total Cost of Ownership (TCO) versus Return on Investment (ROI), Creating a new AWS account, Deleting an AWS account, AWS free tier, Root user versus non-root user, AWS dashboard, Core AWS services, Shared security responsibility model, AWS soft limits, Disaster recovery with AWS.

Unit 2 – Identity and Access Management (07)

Understanding AWS root user, Elements of IAM, Introduction to AWS CLI, Group, IAM role, Policy, STS, IAM best practices.

Unit 3 – Virtual Private Cloud (07)

AWS VPC, Subnet, IP addressing, Creating a VPC, Security, VPC networking components, NAT, VPC peering, VPC endpoint, ClassicLink, VPC best practices.

SECTION II

Unit 4 – Elastic compute cloud (07)

Introduction to EC2, Pricing for EC2, EC2 instance lifecycle, AMI, Introducing EBS, EC2 best practices.

Unit 5 – Elastic Load Balancing (07)

Introduction to Elastic Load balancer, ELB best practices, How Amazon CloudWatch works, Elements of Amazon CloudWatch, CloudWatch dashboards, Monitoring types – basic and detailed, CloudWatch best practices.

Unit 6 – Simple Storage Service, Glacier, and CloudFront (07)

Amazon S3, Creating a bucket, Transfer Acceleration, Requester Pay model, Understanding objects, Versioning, Object tagging, S3 storage classes, Comparison of S3 storage classes and Glacier, Lifecycle management, Hosting static website on S3.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practicals based on above curriculum

Text Books

1. AWS Certified Developer Associate Guide, by Vipul Tankariya and Bhavin Parmar Packt Publishing Ltd.
2. Amazon Web Services in Action Paperback by Andreas Wittig and Michael Wittig, Manning Publisher.

Reference Books

1. AWS Cookbook: Recipes for Success on AWS (Grayscale Indian Edition) by John Culkin (Author), Mike Zazon (Author), Oreilly Publishers.

2. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos, Marilyn Wolf, 1st ed. 2018 edition, Springer

Recommended Online Free Courseware /Learning Resources

1. Udemy.com
2. https://docs.aws.amazon.com/

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Internet of Things

Final Year B.Tech (Electronics Engineering)-Part-I

Final Year B.Tech (Electronics & Telecommunication Engineering)-Part-I

HET35–Mini Project

Teaching Scheme:
Practical-4 Hours / week, 2 Credits

Examination Scheme
ESE- 50 Marks
ICA- 50 Marks

The mini project in Internet of Things is designed to provide students with practical experience in applying Internet of Things based techniques and tools to solve real-world problems. Students will work in teams to select a project area, identify relevant sources, and develop and implement model. Students will also develop communication and project management skills through regular presentations and team meetings.

Course Prerequisite:

The student shall have undergone a course on Fundamentals of IoT, Industrial IoT, and IoT cloud platform. Also, students must be familiar with appropriate Hardware platforms and programming languages.

Course Objectives:

1. To enable students to gain hands-on experience in designing and implementing a solution undergoing through various steps.
2. To enhance students' skills in testing and debugging a project to ensure it meets the desired specifications.
3. To prepare students for future IoT based projects, where they will need to communicate results effectively, and implement a project to meet specific goals.
4. To promote critical thinking, problem-solving, and creativity in the context of a practical in IoT related projects.

Course Outcomes:

After completing this course, a student shall be able to -

1. Define and analyze a real-world problem in the field of Internet of Things.
2. Apply appropriate techniques to develop a model that solves the problem.
3. Evaluate the performance of the model and identify potential improvements.
4. Communicate the findings and results effectively through written reports and oral presentations.
5. Collaborate effectively with team members and manage project timelines and milestones.

Project Guidelines:

- Identify a problem or challenge: Look for a problem or challenge that can be addressed using IoT technology. It could be something as simple as automating your home or tracking your daily activity, or something more complex like monitoring the environment or optimizing industrial processes.
- Choose your hardware and software: Once you have identified the problem, choose the appropriate hardware and software to solve it. There are many IoT development boards, sensors, and cloud platforms available, so choose the ones that best fit your needs and budget.
- Plan and design: Plan and design your project by creating a schematic diagram, a flowchart, or a storyboard. This will help you visualize how your IoT system will work and identify any potential issues before you start building.
- Build your prototype: Build a prototype of your IoT system using the hardware and software you have chosen. Make sure to test each component individually before assembling the whole system.
- Program your device: Program your IoT device using a programming language that is compatible with your hardware and software. Make sure to test your code thoroughly before deploying it to your device.
- Integrate your IoT system: Integrate your IoT system by connecting your device to the cloud platform of your choice. This will allow you to monitor and control your device remotely, as well as collect and analyze data.
- Test and debug: Test your IoT system thoroughly and debug any issues that you encounter. Make sure that your system is reliable, scalable, and secure.
- Document and present: Document your project by creating a detailed report or presentation that explains the problem you addressed, the hardware and software you used, your design and implementation, and your results. Be sure to include any challenges you faced and how you overcame them.

Project Area:

The project area can be chosen from various domains such as education, healthcare, finance, retail, social media, etc.

ICA Assessment Guidelines:

A group of 3 students shall be formed in the first week of semester and supervisor will be allocated. Students shall meet for minimum 4 hours in every week and carry out the steps given in the project guidelines.

ESE Assessment Guidelines:

Supervisors and a team of evaluators will assess the project work and give appropriate weightage for various stages of the project life cycle such as – Concept/Idea, Data Source and Collection, Visualization technique applied, model building, Presentation skills and result reporting.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

Honors in Internet of Things(IoT)

Final year B.Tech (Electronics Engineering)- Part-I

Final Year B.Tech (Electronics & Telecommunication Engineering)- Part-I

HET-36 Architecting IoT Solutions

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 70 Marks
Practical : 2 hrs/week, 1 credit	ISE : 30 Marks
	ICA : 25 Marks

This course introduces AWS well architected tool and makes an AWS-based infrastructure more efficient to increase performance and reduce costs. This further discusses the use of Well-Architected Framework to improve architectures with AWS solutions. Gain hands-on experience using computer, networking, storage and database AWS services covering IaaS and PaaS.

Course Prerequisite:

Students must have completed the Industrial IoT course.

Course Objectives:

1. To introduce students to AWS Well-Architected Framework
2. To introduce students to the important parameters of AWS Well-Architected Framework to perform reliably, securely and efficiently.
3. To introduce students with various security aspects of the framework.
4. To introduce students to various workload architectures paradigms.
5. To make students aware of various performance metric to achieve tradeoff between compute and memory reliant operations.

Course Outcomes:

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

1. Experiment various paradigms offered by AWS Well-Architected Framework
2. Demonstrate the use of AWS Well-Architected Framework to review cloud operations
3. Monitor the potential risk for a given architecture
4. Measure the cloud architectures for multiple workloads for a given application
5. Assess the performance metric for a given use case

SECTION - I

Unit 1 – Introduction to Framework **[4 Hrs.]**

Introduction, Definitions, On Architecture, General Design Principles

Unit 2 - The Five Pillars of the Framework **[10 Hrs.]**

Design Principles, Definition, Best Practices, Resources of: Operational Excellence, Security, Reliability, Performance Efficiency, Cost Optimization,

Unit 3 – Operations **[8 Hrs.]**

Operational Excellence, Organization, Prepare, Operate, Evolve

SECTION - II

Unit 4 – Security **[6 Hrs.]**

Identity and Access Management, Detection, Infrastructure Protection, Data Protection, Incident Response

Unit 5 - Reliability **[6 Hrs.]**

Foundations, Workload Architecture, Change Management, AWS Well-Architected Framework for Failure Management.

Unit 6 – Performance **[10 Hrs.]**

Performance Efficiency, Selection, Review, Monitoring, Trade Offs, Cost Optimization, Practice Cloud Financial Management, Expenditure and usage awareness, Cost-effective resources, Manage demand and supply resources, Optimize over time

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Internal Continuous Assessment (ICA):

ICA shall consist of a minimum of eight experiments/assignments based on the above syllabus.

Text Book:

1. AWS for Solutions Architects: Design your cloud infrastructure by implementing DevOps, containers, and Amazon Web Services, 2021, by Alberto Artasanchez, Packs Publishers 1st edition

Reference Book:

1. AWS for System Administrators: Build, automate, and manage your infrastructure on the most popular cloud platform – AWS by Prashant Lakhera, Packt Publishing 1st edition

Additional Resources:

AWS Well-Architected Framework Documentation

https://docs.aws.amazon.com/wellarchitected/latest/framework/welcome.html

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Electronics & Telecommunication Engineering

Structure for Honors Degree – Railway Engineering
w.e.f. 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET41	SY Sem II	Railway Engineering: A Beginner's Perspective	3	1		4	30	70	25	125
HET42	TY Sem I	Data Communication and Signaling in Railway	3		2	4	30	70	25	125
HET43	TY Sem II	Seminar			2*	1			25	25
HET44	TY Sem II	Applications of IT and Control Engineering in Railway	3		2	4	30	70	25	125
HET45	B Tech Sem I	Mini Project			4*	2		50	50	100
HET46	B Tech Sem I	Advanced Communication and Modern Signaling in Railway	3		2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Railway Engineering

S.Y. BTech (Electronics & Telecommunication Engineering)- Part-II

HET41: Railway Engineering: A Beginner's Perspective

Teaching Scheme:
Lecture : 3Hrs/Week, 3 credits
Tutorial: 1Hr/Week, 1 credit

Examination Scheme:
ISE:30 Marks
ESE:70 Marks
ICA: 25 Marks

Railway engineering is a multi-faceted engineering discipline dealing with the design, construction and operation of all types of rail transport systems. It encompasses a wide range of engineering disciplines, including civil engineering, computer engineering, electrical engineering, mechanical engineering, industrial engineering and production engineering. In this course, there is study of Railway signaling with Electronics part. This course is help for new beginners to understand the operation of railway signaling.

Course prerequisite: Prerequisite for this course is Basic electronics and Basic Electrical Engineering.

Course Objectives:

1. To make student aware of Indian Railways System
2. To summarize Railway Transportation and Its Development
3. To understand role of Electrical, Electronics, Computer, Civil, and Mechanical Engineers in Railways
4. To discuss recent trends in Indian Railways
5. To discriminate the Indian Railways as an International Perspective

Course Outcomes:

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

1. Define the Indian Railways System
2. Summarize Railway Transportation and Its Development
3. Understand the role of Electrical, Electronics, Computer, Civil and Mechanical Engineers in Railways
4. Discuss the recent trends in Indian Railways
5. Discriminate the Indian Railways as an International Perspective

SECTION I

Unit 1-Indian Railways - A Perspective : (05)

General Features of Indian Railways, Important Statistics of Indian Railways, Organization of Indian Railways, Indian Railway Finances and their Control, Commission of Railway Safety, Recruitment Boards of Indian Railways Different Corporations in Indian Railways, Indian Railway Information Systems, Growth of Indian Railways.

Unit 2- Railway Transportation and Its Development : (07)

Terminology- Locomotive, Engine, Bogie, Coach, Freight train, Wheel Arrangement (WA), Driving Cab, Pantograph, Gauge, Transmission, Traction Motors, Coupler, Crossing, Diamond crossing, Junction, Terminal, Fishplate, Permanent way, Rolling stock

Evolution of Different Facets of the Railways

a. Rails Types of rail section: D.H. Rails, B.H. Rails and F.F. Rails, Standard rail sections, Comparison of rail types, Track structure and different gauges.

b. Sleepers , comparison of different types of sleepers and components of track

c. Bridges evolution of iron to steel, arch ,rcc, psc, steel

d. Mode of traction steam, diesel, electric

e. Locomotives evolution of locomotives of each type Various propulsion systems

f. Bogies and coaches

Unit 3- Role of Electrical, Electronics & Computer Engineering in Railways (09)

Introduction to Electrical Engines, Working of Locomotives, Overhead (OHE) Equipment's in Railways, Braking Systems in Railways, Power Supply System & Technology in Railways, Introduction to the Electronic System in Indian Railway, Electrical Switches and Relays used in Indian Railway, Display Control and Mechanism in Railway, Electronics Communication System in Railways, Safety Measures in Indian Railways, Software's in Indian Railways

SECTION II

Unit 4- Role of Civil and Mechanical Engineering in Railways (08)

Fundamentals of Geology, Tracking System, Layers of material on Tracks, Overview of Civil Engineering in Railway Systems, Introduction to Ballast, Rails, Sleepers, Points of Crossings, and Points of Switches, Maintenance of Railway Tracks.

Mechanical System used in Railway Engine & Bogies. Construction of Bogies, Material Used for Railing system, Mechanisms in Railway Locomotive, Study of Railway Engines, Maintenance of Railway Tracks

Unit 5- Recent Trends in Indian Railways (08)

Introduction, Modernization of traction, Speed trends, modernization of track, Trends in track vehicles, container transport service, Automation in operation, High powered locomotives, Miscellaneous development. Introduction to the Clean Energy in Indian Railways, Overview of Faster Trains in India, Overview of Bullet Trains and Metro, Concept of Anubhuti Coaches in Indian Railways, and Introduction to the Bio Toilets in Indian Railway.

Unit 6- Review of Railways - An International Perspective (05)

Overview of International Railways, Development of Railway Systems, Recent Trends in International Railways, and Overview of Maglev Technology.

Internal Continuous Assessment (ICA):

1. Case Study: Case Studies on Recent Trends in Railways (15 hrs)
2. Industrial Visits on Railway Workshops/Institutes/Industries (15 hrs)

References:

1. Satish Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press, 2007.
2. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia
3. M.A. Chowdhary and A. Sadek, Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003
4. S.C. Rangawala, Principles of Railway Engineering, Charotar Publication, 2015.
2. V. D. Kodgire, Sushil Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House
3. Handbook of Railway Vehicle Dynamics, Taylor & Francis Group
4. J. S. Mundrey, Railway Track Engineering, McGraw Hill Publication, 2009
5. R.. B. Gupte, Text Book Of Engineering Geology, Pune Vidyarthi Griha Prakashan
6. G. Shanmugam and M. S. Palanichamy, Basic Civil and Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi, 1996.
7. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.
8. Robert Sneddon, Material Technology, Heinemann Library, 2002 12. James A. Jacobs & Thomas Kilduff, Engineering Materials Technology: Structures, Processing, Properties, and Selection, Pearson; 5th edition, 2004
9. David A. Dornfeld, Green Manufacturing: Fundamentals and Applications, Springer; 2012 edition
10. Nand K. Jha, Green Design and Manufacturing for Sustainability, CRC Press; first edition, 2015
11. John B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Education; 1st edition, 2017
12. V. Ganeshan, Internal Combustion Engine, McGraw Hill Education; 4th edition, 2017
13. S.C. Saxena, S.P. Arora, A Text Book Of Railway Engineering, Dhanpat Rai Publications (p) Ltd.-new Delhi, 2010.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Railway Engineering

T.Y. BTech (Electronics & Telecommunication Engineering)- Part-I

HET42: Data Communication and Signaling in Railway

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week , 3 credits	ISE:30 Marks
Practical: 2Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

Course Objectives:

1. To make students aware of Data communication
2. To summarize Railway Transportation and Its Internet Facility
3. To understand the role of Electrical, Electronics in Railways
4. To discuss recent trends in signaling in Indian Railways
5. To discriminate against the Indian Railways from an International Perspective

Course Outcomes:

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

1. Define the Data communication
2. Summarize Railway Transportation and Its Internet Facility
3. Understand the role of Electrical, Electronics in Railways
4. Discuss the recent trends in signaling in Indian Railways
5. Discriminate the Indian Railways as an International Perspective

SECTION I

Unit 1 - Data Communication **(07)**

Introduction of data communication Fundamentals such as data, signals, etc., types of Transmission Medias, Types of Network cables: Twisted Pair cable, Coaxial Cable, Fiber Optic Cable,

Unit 2 - Internet **(07)**

IP Addressing: Physical, Logical Internet & Intranet, Components of the Internet, World Wide Web, E-Mail, Telnet, FTP, Understanding the World Wide Web, Hypertext: The Motion of the Web, Retrieving Documents on the Web: The URL, Real-Time Communication.

Unit 3 - Basics of Electrical and Electronics **(07)**

Passive Components, Basics of AC and Electrical Cables, Cells & Batteries, Transformers, AC & DC measurements, Soldering & De-soldering and switches, Rectifiers, IC Regulators, Different Batteries, 110 DC Voltage, Electromagnetic theory, Electric Discharge Different types of fuzes

SECTION II

Unit 4 - Basic Signaling in Railway **(07)**

Introduction to Signal, Objects of Signals, Types of Signals, Classification of Signals according to functions, Classification of Signals according to Location, Special Signals. Principles of Signaling, Concepts of points. Location of point and range of operation. Signaling Plan- Control Table, Characteristics OF Electro-Magnetic Relay, Classification Of Signaling Relay

Unit 5 - Computer Network **(06)**

Introduction to Computer Network, Networking Devices, Client-Server Communication, Installation & Configuration of DHCP, DNS, FTP, TELNET, Introduction to Network security & GPS

Unit 6 - Railnet (Railway Intranet) (08)

An Installation, Equipment used in Railnet, Installation of the equipment, Connectivity Diagram, IP Planning, E-Mail addressing, Software based on Railnet, Failure & Troubleshooting

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Internal Continuous Assessment (ICA):

1. ICA shall consist of minimum six to eight assignments based on entire curriculum
2. Industrial Training/Internship

References:

1. Computer Networks (Principles, Technologies and Protocols for network design) - Natalia Olifer, Victor Olifer (Wiley Publications)
2. Internetworking with TCP/IP Vol III. Client-Server Programming & Applications: Douglas E. Comer
3. Data Communication and Networking: Behrouz A. Forouzan
4. Satish Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press, 2007.
5. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia
6. S.C. Rangawala, Principles of Railway Engineering, Charotar Publication, 2015.
7. TCP/IP Protocol Suite: Behrouz A. Forouzan (Fourth Edition)
8. Internetworking with TCP/IP Vol III. Client-Server Programming & Applications: Douglas E. Comer
9. Engineering Circuit Analysis. Hayt W. H. & Kemmerly J. E. McGraw-Hill. 1993.
10. Circuits, Devices & Systems. Smith R. J. & Dorf R.C., John Wiley & Sons.1992.

11. Electronic Devices & Circuit Theory. Boylestad R. L. & Nashelsky L. 6th Ed. Prentice Hall India. 2001.
12. Principles of Communications: Systems, Modulation & Noise. Ziemer R. E. & Tranter W. H. 5th Ed. John Wiley & Sons. 2001.
13. Communication Systems. Haykin Simon. 4th Ed. John Wiley & Sons. 2001.
14. Digital & Analog Communication Systems. Shanmugam K. Sam. John Wiley & Sons. 1979.
15. Signals and Systems A.V. Oppenheim and A. S. Wilsky, 2nd edition [Pearson Education]
16. Signals and Systems Simon Haykin and Barry Van Veen, 2nd edition [Wiley and Sons]
17. Signals and Systems, I. Ravi Kumar, PHI

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Railway Engineering

T.Y. BTech (Electronics & Telecommunication Engineering)- Part-II

HET43: Seminar

Teaching Scheme:
Practical: 2Hr/Week, 1 credit

Examination Scheme:
ICA: 25 Marks

A student shall submit the seminar report and prepare a presentation for it.
The topic for the seminar Work may be Electronics and telecommunication Engineering, Railway Signaling, Modern communication technologies used in railway, Interlocking and inter-disciplinary areas related to Railway Engineering.

Guidelines for Project contents:

a) Seminar Report: The seminar report should be 25 to 50 pages (More pages can be used if needed). The entire Report has to be segmented chapter-wise as per the requirement.

1. Introduction (History, Importance of topic, Area, Problem identification, Objective of the seminar)
2. Literature Review
3. Design/ Experimentation/ Model/Actual work carried out for the same.
4. Observation/ Analysis/ Findings/Results

b) Presentation: The group has to prepare a PowerPoint presentation on the seminar report and present it in front of the faculty of the department. One copy of the report should be submitted to Institute/ Department, and one copy should remain with each student of the project group

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Electronics & Telecommunication Engineering

Honors in Railway Engineering

T.Y. BTech (Electronics & Telecommunication Engineering)- Part-II

HET44: Applications of IT and Control Engineering in Railway

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week , 3 credits	ISE:30 Marks
Practical: 2Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

Course Objectives:

1. To make students aware of FOIS system
2. To understand PRS System
3. To understand the control engineering in Railways
4. To discuss recent trends in microprocessor and micro controller in Indian Railways
5. To discriminate against the Indian Railways from an International Perspective

Course Outcomes:

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

1. Understand and analyze the FOIS system.
2. Understand and analyze the PRS system
3. Understand the control engineering in Railway.
4. Discuss the recent trends of microprocessor and micro controller in Indian Railways

SECTION I

Unit 1- Freight Operations Information Systems (FOIS) (07)

Introduction, Mission Statement of FOIS, Composition of FOIS system, FOIS Design Architecture, Existing FOIS Network, FOIS network topology, Introduction of IOT in Indian Railways

Unit 2 - Passenger Reservation System (PRS) (07)

PRS: Introduction, Main Frame Servers of PRS, Salient Features of PRS, Typical arrangement of PRS Terminals, Unreserved Ticketing System (UTS): Introduction, UTS Network, Basic requirements of UTS Network, Network Management System.

Unit 3 - Control Engineering **(07)**

System, Control system, Types of control systems, concept of feedback, Liquid level control system, Automobile driving system, Servomechanism for steering of antenna, Robotic control system. The transfer function of a closed-loop system, Data Loggers and Event Loggers, SCADA.

SECTION II

Unit 4 - Microcontrollers and Microprocessors in Railways **(07)**

Sensors, DSLR (digital single-lens reflex), Android Based Controller, Micro-controller, PIC Controller DATALOGGER, ACD, Train Protection & Warning System, Auxiliary Warning System, Application of Microprocessors and Micro-controllers.

Unit 5 - Telecommunications in Railway **(07)**

Provisions of the Control Communication, 4 Wire/2 Wire Train Traffic Control Communication Equipment, V F Repeaters, Interruptions and Routine Tests on Control Circuits, Telephones Used In Control Working.

Unit 6 - Communication in Railway **(07)**

Radio Propagation, Public Address System, Multiplexing (Analog &Digital), Passenger Information System, Train Information System, Train Traffic Control Data Communications and Networking, Mobile Communications (VHF, SM-R, DECT, TETRA.), TCMS(Metro)

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum six to eight assignments based on the entire curriculum

References:

1. http://railwaytrainngsandt.blogspot.com/p/week.html.
2. https://iriset.indianrailways.gov.in
3. Mobile Communications – Jochen Schiller (PEARSON) (Chapters: 1, 2, 3, 5,6)
4. Qiao Jian-hua; Li Lin-sheng; Zhang Jing-gang; “Design of Rail Surface Crack-detecting System Based on Linear CCD Sensor”, IEEE Int. Conf. on Networking, Sensing and Control, 2008
5. K. Vijayakumar, S.R. Wylie, J. D. Cullen, C.C. Wright, A.I. AIShamma’a, “Non invasive rail track detection system using Microwave sensor”, Journal of App. Phy., 2009
6. White Paper- Safety on Indian Railways, April 2003, Govt. of India, Ministry of Railways.
7. Indian Railways - Safety Performance of relevant years, published by Safety Directorate of Ministry of Railways, Govt. of India
8. Development of Railway Signal & Telecom Systems on IR M C Yadav WM/Signal/SWS Sabarmati/Western Railway
9. Indian Railways Telecommunication Manual
10. Train Collision Avoidance System (TCAS). Government of India

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Railway Engineering

Final Year B.Tech (Electronics & Telecommunication Engineering)- Part-I

HET45-Mini Project

Teaching Scheme	**Examination Scheme**
Practical: 4 Hours/week, 2Credit	**ICA: 50 Marks**
	POE: 50 Marks

Course Objectives:

The primary objective of this course is to design and develop a state of the art project in the trendingareas of Railway Engineering focusing on Electronics, communication, signal processing, Networking etc.

Course Outcomes:

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

1. Apply the knowledge of electronics and communication engineering to the solution of railway engineering problems/project.
2. Apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to design electronics circuits using relevant software and hardware for signal processing, Microprocessor / Microcontroller, and communication based application.

Guidelines:

Group Size: The student will carry the project work individually or by a group of students. Optimum group size is 3 students. However, if project complexity demands a maximum group size of 4 students, the committeeshould be convinced about such complexity and scope of the work.

Selection and approval of topic should be related to real life application in the field of Railway Signaling and Telecommunication

OR

Investigation of the latest development in a specific field of Electronics or Communication or Signal Processing

OR

The investigation of practical problem in manufacture and / or testing of electronics or communication equipment

OR

The Microprocessor / Microcontroller based applications project is preferable.

OR

Software development project related to Communication, Instrumentation, and Signal Processingwith the justification for techniques used / implemented is accepted.

OR

Interdisciplinary projects should be encouraged.

Note: The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by internal and external guides. Project report must be submitted in the prescribed format only. No variation in the format will be accepted. One guide will be assigned at the most 3 project groups.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Railway Engineering

Final Year B.Tech (Electronics & Telecommunication Engineering)- Part-I

HET46: Advanced Communication and Modern Signaling in Railway

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs. /Week, 3 Credit	**ESE:** 70 Mark
Practical: 2 hr. /Week, 1 Credit	**ISE:** 30 Mark
	ICA: 25 Mark

Course Objectives:-

1. Apply the knowledge of modern signaling in railway.
2. To make Students understand the advance communication systems in railways.
3. To make students understand basics of NT domains.
4. Impart basic knowledge of modern railway communication components and their functions.

Course Outcomes:-

At the end of this course, Students will be able to

1. Students can understand modern signaling in railway.
2. Students can understand the advance communication systems in railways
3. Students can understand the basics of NT domains.
4. Students can understand modern railway communication components and their functions.

Unit 1: Modern Signaling in Railways: [9 hrs]

Modernization of Railway Signaling & Telecom by providing ETCS L-2 and LTE based Communication network, Intermediate Block Signaling using MSDAC, Avoid Slowing down of Train While Approaching the Station: Introduction of the Fifth Aspect of Signal

Unit 2: Networking with Windows 98 and Window NT: [9hrs]

Introduction, NT Server Installation, NT Domains, Managing User Accounts, Directory Shares, TCP/IP on WinNT

Unit 3: Advance Communication in railway: [9 hrs]

Future Railway Mobile Communications System, LTE for Railways (LTE-R), Broadband Interneton running trains through two-way satellite communication, VoIP based Train Control communication System (TCCS), and Open Source VoIP based solution for augmenting the Capacityof ISDN Exchange in Railway.

Unit 4: Advance Communication in railway: [9 hrs]

IP based Video Surveillance System (VSS) on Indian Railways, Networked PA System in Railways, IoT (Internet of Things) in Railways, UHF Digital (License free band radio) Handheld Trans-receivers, NextGen ATP for Automatic Train Operations.

Unit 5: Modern Signalling in Railways: **[9 hrs]**

Technologies and processes to meet the challenges of signaling system maintenance, Fail-Safety Requirement for Railway Signalling Equipment, Safety and Reliability in Software based Embedded Systems for Railway Signalling Applications, Safety Slogans for Signal Department.

Internal Continuous Assessment (ICA):

ICA shall consist of minimum six to eight assignments based on entire curriculum

References:

1. http://railwaytrainngsandt.blogspot.com/p/week.html.
2. https://iriset.indianrailways.gov.in
3. White Paper- Safety on Indian Railways, April 2003, Govt. of India, Ministry ofRailways.
4. Indian Railways Corporate Safety Plan (2003-13), August 2003, Govt. ofIndia, Ministry ofRailways.
5. Indian Railways - Safety Performance of relevant years, published by SafetyDirectorate of Ministry of Railways, Govt. of India.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Computer Science & Engineering, Information Technology, Electronics & Telecommunication Engineering

Structure for Honors Degree – Cyber Security
w.e.f. 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET51	SY Sem II	Cryptography	3	1		4	30	70	25	125
HET52	TY Sem I	Network Security and Secure Coding	3		2	4	30	70	25	125
HET53	TY Sem II	Seminar			2*	1			25	25
HET54	TY Sem II	Cyber Forensic	3		2	4	30	70	25	125
HET55	B Tech Sem I	Mini Project			4*	2		50	50	100
HET56	B Tech Sem I	Information Security and Audit	3		2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Cyber Security

S.Y. BTech (Electronics & Telecommunication Engineering)- Part-II

HET51 : Cryptography

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week, 3 credits	ESE: 70 Marks
Tutorial: 1 Hour/Week, 1 credit	ISE: 30 marks
	ICA: 25 Marks

This course provides an introduction to modern cryptography and communication security. It focuses on how cryptographic algorithms and protocols work and how to use them. The course covers the concepts of block ciphers and message authentication codes, public key encryption, digital signatures, and key establishment, as well as common examples and uses of such schemes, including the AES, RSA, and the Digital Signature Algorithm. Basic cryptanalytic techniques and examples of practical security solutions are explored to understand how to design and evaluate modern security solutions.

Course Objective:

This course aims to give students:

1. an overview of basic cryptographic concepts and methods
2. a good knowledge of some commonly used cryptographic primitives and protocols
3. a sound understanding of theory and implementation, as well as limitations and vulnerabilities
4. an appreciation of the engineering difficulties involved in employing cryptographic tools to build secure systems

Course Outcome:

At the end of course, students will be able to

1. Apply the most common type of cryptographic algorithm ·
2. Understand the Public-Key Infrastructure ·
3. Analyze different security protocols for protecting data on networks
4. Be able to compose, build and analyze simple cryptographic solutions
5. Perform simple vulnerability assessments.

SECTION – I

Unit 1 : Overview **(07)**

Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A model for Network Security

Unit 2 : Classical Encryption Techniques **(05)**

Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography

Unit 3 : Block Cipher and Data Encryption Standard **(08)**

Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles

AES: Finite field arithmetic, AES structure, AES transformation function, AES key expansion, An AES example

SECTION – II

Unit 4 : Public Key Cryptography and RSA **(07)**

Principles of Public-Key Cryptosystem: Public Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements of Public-Key Cryptosystems

RSA Algorithm: Description of Algorithm, Computational aspects, The Security of RSA

Diffie Hellman Key Exchange: The Algorithm, Key Exchange Protocols, Man-in-middle Attack

Unit 5 : Cryptographic Hash Functions and Message Authentication Codes **(08)**

Cryptographic Hash Functions: Applications, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA)

Message Authentication Codes: Requirements for Message Authentication Codes, Security of MACs, MACs based on Hash Functions (HMAC),Digital Signatures

Unit 6 : User Authentication **(07)**

Remote user authentication principles, Remote user authentication using symmetric encryption, Kerberos, Remote user authentication using asymmetric encryption, Federated Identity management, Personal identity Verification

Internal Continuous Assessment (ICA) :

Student should implement the following:

1. Implementation of Substitution Cipher
2. Implementation of Poly alphabetic Cipher (Vigenere Cipher and Vernam Cipher)
3. Implementation of Transposition Cipher
4. Implementation of Play fair Cipher
5. Implementation of Secure file transfer in Client/Server environment (use any one of above method for encryption and decryption).
6. Write a program to simulate RSA algorithm.
7. Implement Cryptographic Hash function
8. Simulate Kerberos authentication system

Text Book:

1. Williams Stallings–Cryptography and Network security principles and practices. Pearson Education (LPE) 6th Edition (Covers all above Units)

Reference Books:

1. Menezes, A.J., P.C. Van Oorschot, and S. A. Vanstone, "Handbook of Applied Cryptography"
2. Schneir, Bruce, "Applied Cryptography: Protocols and Algorithms"
3. Nina Godbole --Information systems security-Security management, metrics, frameworks and best practices (WILEY)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Cyber Security

T.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-I

HET52 : Network Security and Secure Coding

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week, 3 credits	ESE: 70 Marks
Practical : 2 Hours/Week, 1 credit	ISE: 30 marks
	ICA: 25 Marks

Course Objectives:

1. To acquire knowledge about security attacks, services and mechanisms.
2. To implement Internetwork security models with standards and vulnerabilities
3. To learn the Conventional Encryption Principles and Public key cryptography principles
4. To study attacks in simple networks

Course Outcomes:

After the completion of this course the student should be able to

1. Gain a complete knowledge on types of security attacks, services and mechanisms.
2. Understand the implementation of Internetwork security model and its standards and vulnerabilities.
3. Demonstrate the Conventional Encryption Principles and the Public key cryptography principles
4. Identify the vulnerable points for attacks in simple networks.

SECTION-I

Unit 1: Security Attacks **(08)**

Interruption, Interception, Modification and Fabrication, Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Unit 2 : Conventional Encryption Principles (07)

Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC.

Unit 3 : Public key cryptography principles (07)

Public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

SECTION-II

Unit 4 : Email privacy (08)

Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Unit 5 : Basic Concepts of SNMP (07)

Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats. Firewall Design principles, Trusted Systems. Intrusion Detection Systems.

Unit 6 : Secure Coding (07)

Memory safety and vulnerabilities: attacks and defenses, Memory safety and vulnerabilities: attacks and defenses, Fuzzing, Symbolic execution and static analysis, Secure Architecture Concepts and Principles

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Internal Continuous Assessment (ICA) :

Minimum 8-10 assignments based on above topics.

Text Books:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech

Reference Books:

1. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.
2. Network Security - Private Communication in a Public World by Charlien Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
3. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
4. Principles of Information Security, Whitman, Cengage Learn

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Cyber Security

T.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-II

HET53 – Seminar

Teaching Scheme:	**Examination Scheme:**
Practical : 2 hr/week, 1 credit	ICA : 25 Marks

Course Objectives:

4. To expose student to the latest trends in cyber security
5. To develop communication Skill of the student
6. To make student able to write technical specifications, project document

Course Outcomes:

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

5. Identify a seminar topic after thorough literature survey
6. Prepare a seminar presentation to explore the latest trends in cyber security.
7. Demonstrate communication Skills.
8. Inculcate presentation skills through reports and presentations while observing professional ethics

Course Prerequisite:

Student shall possess necessary technical report writing skills, presentation skills and shall have proficiency in software for word processing and presentation.

The objective of seminar is to enable the student to get exposed with technology, modern tools, techniques and various emerging applications of cyber security. The students shall refer reference research papers from standard Journals from IEEE, Science Direct etc.

This is expected to provide a good initiation for the student(s) in R&D work which include:

1. Survey and study of published literature on the selected seminar topic.
2. Seminar over state-of-the-art technology to resolve problem undertaken.
3. Preparing a Written Report on the Study conducted for presentation to the Department.
4. Seminar, as oral Presentation before a departmental committee.

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Electronics & Telecommunication Engineering

Honors in Cyber Security

T.Y. B.Tech (Electronics & Telecommunication Engineering)- Part-II

HET54 : Cyber Forensic

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week, 3 credits	ESE: 70 Marks
Practical : 2 Hours/Week, 1 credit	ISE: 30 marks
	ICA: 25 Marks

Course Objectives:

1. To learn computer forensics
2. To become familiar with forensics tools
3. To learn cybercrime legal investigations

Course Outcomes:

On completion of course student will able to:

1. Classify the cybercrime based on their type
2. Explore Cybercrime/Cyber Forensic concepts along with multiple tools.
3. Use Cyber forensic in cybercrime legal investigation

SECTION - I

Unit-1 Introduction to Cyber Security **(7)**

Introduction, Definition and Origins of the Word, Cybercrime and Information Security, Who are Cyber Criminals, Classification of Cybercrimes, How Criminal plan the Attack, Cyberstalking.

Unit-2 Tools and Method used in cybercrime **(7)**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and spywares, Virus and warms, Trojan Horses and Backdoors, DoS and DDoS Attacks, SQL Injection, Buffer Overflow .

Unit-3 Cyber Crime : The Legal Perspectives (6)

Introduction, Cybercrime and Legal Landscape around the World, Why do we need cyber law: the Indian Context, The Indian IT Act, Digital Signature and Indian IT Act, Amendment to the Indian IT Act.

SECTION– II

Unit - 4 Understanding Computer Forensics (7)

Introduction, Background of Cyber Forensics , Digital Forensics Science, Need for Computer Forensics , Cyber forensics and Digital Evidence, Digital Forensics Life Cycle, Chain of Custody Concept, Challenges in Computer Forensics,

Unit- 5 Network Forensics (8)

Network Basics for Digital Investigators: Introduction, Network basics for digital investigators: History, Technical overview, Network Technologies, Connecting networks using Internet Protocols.

Applying Forensic Science to Networks: Preparation & Authorization, Identification, Documentation Collection Preservation, Filtering Data reduction, Class / Individual characteristics, evaluation of source, evidence recovery, investigation reconstruction, reporting results.

Unit - 6 Forensics of Hand-Held Devices (6)

Introduction, Understanding Cell Phone Working Characteristics, Hand-Held Devices and Digital Forensics, Toolkits for Hand-Held Device Forensics, Techno-Legal Challenges with Evidence from Hand-Held Devices.

Internal Continuous Assessment (ICA):

Minimum 8 to 10 Experiments/Assignments based on above topic

Textbooks

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunita Belapure
2. Digital Evidence & Computer Crime – Forensic science, Computers & The Internet', Eoghan Casey, 3rd edition
3. 'Computer Forensics Computer Crime scene investigation', 2nd edition, Johm R. Vacca

Reference Books

1. 'Computer Forensics Investigating Network Intrusions & Cybercrime', EC–Council press, Cengage Learning
2. Guide to Computer Forensics & Investigations, 4th edition, Bill Nelson, Amelia Phillips & Christopher Steuart, Cengage Learning
3. 'Guide to Integrating Forensic Techniques into Incident Response', NIST, Karen Kent, Suzanne Chevalier Tim Grance, Hung Dang

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Cyber Security

Final Year B.Tech (Electronics & Telecommunication Engineering)-Part-I

HET55–Mini Project

Teaching Scheme:
Practical-4 Hours / week, 2 Credits

Examination Scheme
ESE- 50 Marks
ICA- 50 Marks

The mini project in Cyber Security is designed to provide students with practical experience in applying Cyber Security based techniques and tools to solve real-world problems. Students will work in teams to select a project area, identify relevant data sources, and develop and implement model. The work will cover topics such as Cryptography, Network Security, Cyber Forensic, Information Security and Audit. Students will also develop communication and project management skills through regular presentations and team meetings.

Course Prerequisite:

The student shall have undergone a course on Cryptography, Network Security, and Cyber Forensic. Also, students must be familiar with programming and its libraries.

Course Objectives:

1. To enable students to gain hands-on experience in designing and implementing a solution using various steps.
2. To enhance students' skills in testing and debugging a project to ensure it meets the desired specifications.
3. To prepare students for future Cyber Security based projects, where they will need to manage a large amount of data, communicate results effectively, and implement a project to meet specific goals.
4. To promote critical thinking, problem-solving, and creativity in the context of a practical in cyber security related projects.

Course Outcomes:

After completing this course, a student shall be able to -

1. Define and analyze a real-world problem in cyber security.
2. Apply appropriate learning techniques to develop a model that solves the problem.
3. Evaluate the performance of the model and identify potential improvements.
4. Communicate the findings and results effectively through written reports and oral presentations.
5. Collaborate effectively with team members and manage project timelines and milestones.

Project Guidelines:

- Students are expected to Identify and define a real-world problem in cyber security, with the help of an allocated guide/supervisor.
- Select appropriate data sources and collect relevant data. One can use online sources.
- Apply appropriate learning techniques to develop a model that solves the problem.
- Evaluate the performance of the model and identify potential improvements. Communicate the findings and results effectively through written reports and oral presentations.
- Students should collaborate effectively with team members and manage project timelines and milestones.

Project Area:

The project area can be chosen from various domains such as education, healthcare, finance, retail, social media, etc.

ICA Assessment Guidelines:

A group of 3 students shall be formed in the first week of semester and supervisor will be allocated. Students shall meet for minimum 4 hours in every week and carry out the steps given in the project guidelines.

ESE Assessment Guidelines:

Supervisors and a team of evaluators will assess the project work and give appropriate weightage for various stages of the project life cycle such as – Concept/Idea, Data Source and Collection, Visualization technique applied, model building, Presentation skills and result reporting.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Cyber Security

Final Year B.Tech (Electronics & Telecommunication Engineering)- Part-I

HET56 : Information Security And Audit

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week, 3 credits	ESE: 70 Marks
Practical : 2 Hours/Week, 1 credit	ISE: 30 marks
	ICA: 25 Marks

Course Objectives:

1. To make students familiar with Information security and Audit
2. To expose students to the latest trends of computer attack and defense
3. To discuss about advanced techniques in security

Course Outcomes:

On completion of course student will able to:

1. Understand importance of Information Security and Audit
2. Explore about latest trends of Computer attack and defense
3. Familiarize about advanced techniques in security

SECTION - I

Unit-1 Introduction to Information Security (7)

History and evaluation of Information security CIA triangle, Components of IS, Control in IT environment, Information security Management system, components of ISMS and conceptual framework, Steps for developing ISMS.

Unit-2 Information Security Policy and Standards (8)

Security principles, Types of Information security policies-Administrative and Technical, A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model, Security policy standards and practices - BS7799, ISO/IEC 17799, ISO 27001. Auditing tools such as ISO 27001 ISMS TOOL KIT, NGS AUDITOR.

Unit-3 Domains of IT Security (7)

User/accepted usage/ access, data access, physical access, Internet access, e-mail, digital signature, outsourcing, software development and acquisition, hardware acquisition. Network and telecom, BCP and DRP, security organization structure. Domains related security based case studies.

SECTION– II

Unit - 4 IT Governance **(7)**

What is IT Governance, good governance, objectives and dimensions, foundation, structure, processes. IT governance framework- COBIT, ITIL, ISO 17799, IT governance maturity model.

Unit- 5 Auditing for Security-I **(7)**

Introduction, Basic Terms Related to Audits**,** need for security audits in organization, organizational roles and responsibilities for security audit, Auditors responsibility in security audits, Types of security audits.

Unit - 6 Auditing for Security-II **(8)**

Approaches to Audits, Technology based audits vulnerability scanning and penetration testing, Resistance to security audits, Phase in security audit, Security audit engagement costs and other aspects, Budgeting for security audits, Selecting external security consultants, Key success factors for security audits.

Internal Continuous Assessment (ICA):

Minimum 8 to 10 Experiments based on above topic

Textbooks

1. Information Systems Security by Nina Godbole, Wiley 2008.
2. Network Security Essentials (Application and Standards) by William Stallings Peasrson Education, 2008

Reference Books

1. Information Security by Mark Stamp, Wiley-India, 2006.
2. Fundamentals of Computer Security, Springer.
3. Computer Security Basics by Rick Lehtinen and G. T. Gangemi Sr., SPD O'RELLY 2006.
4. Principles of Information Security, Whitman, Thomson.