

**Dr. Babasaheb Ambedkar Technological University (Established a University of
Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)**

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CURRICULUM UNDER GRADUATE PROGRAMME FOR B. TECH

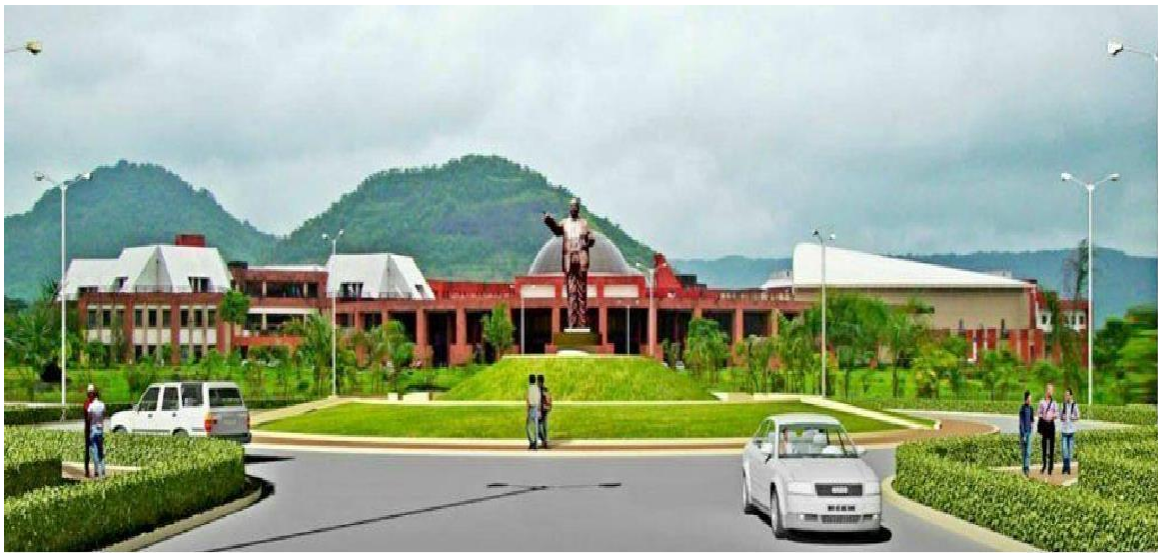
ARTIFICIAL INTELLIGENCE & DATA SCIENCE

WITH EFFECT FROM THE ACADEMIC YEAR

SY: 2021-2022

TY: 2022-2023

B. Tech: 2023-24



Course Structure for Third Year

B. Tech in Artificial Intelligence & Data Science

Semester V (Term 5)

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC5	BTAIC501	Computer Network and Cloud Computing	3	1	-	20	20	60	100	4
PCC6	BTAIC502	Machine Learning	3	-	-	20	20	60	100	3
HSSMC4	BTAIHM503	Humanities and Social Sciences including Management Elective Course (HSSMEC) – II								
	BTAIHM503A	1. Economics and Management	3	-	-	20	20	60	100	3
	BTAIHM503B	2. Business Communication								
	BTAIHM503C	3. Knowledge Reasoning and AI Ethics.								
PEC-2	BTAIPE504	Professional Elective Course (PEC) -II	3	1	-	20	20	60	100	4
	BTAIPE504A	1. Advanced Database System								
	BTAIPE504B	2. Soft Computing								
	BTAIPE504C	3. Sensors & Robotics Technology								
	BTAIPE504D	4. Advanced Java								
OEC-1	BTAIOE505	Open Elective Course (OEC) - I	3	1	-	20	20	60	100	4
	BTAIOE505A	1. Data Mining and Warehousing								
	BTAIOE505B	2. Digital Communication & Information Theory								
	BTAIOE505C	3. Software Engineering and Testing								
	BTAIOE505D	4. Virtual Reality								
LC3	BTAIL506	Machine Learning Lab and Competitive Programming Lab	-	-	4	60	-	40	100	2
PROJ	BTAIM507	Mini Project I	-	-	4	60	-	40	100	2
Internship	BTAIP408	Field Training / Internship / Industrial Training – II(Evaluation)	-	-	-	-	-	-	-	Audit
			15	3	8	220	100	380	700	22

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

Course Structure for Third Year
B. Tech in Artificial Intelligence & Data Science

Semester VI (Term 6)

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC7	BTAIC601	Deep Learning	3	1	-	20	20	60	100	4
PCC8	BTAIC602	Advanced Machine Learning	3	-	-	20	20	60	100	3
PEC-3	BTAIPE603	Professional Elective Course (PEC) -III	3	1	-	20	20	60	100	4
	BTAIPE603A	1. Geographical Information Systems								
	BTAIPE603B	2. Recommender System								
	BTAIPE603C	3. Industry 4.0 & Automation								
	BTAIPE603D	4. Web Development								
OEC-2	BTAIOE604	Open Elective Course (OEC) - I	3	1	-	20	20	60	100	4
	BTAIOE604A	1. Big Data Analytics								
	BTAIOE604B	2. Cryptography & Network Security								
	BTAIOE604C	3. Agile Methodology								
	BTAIOE604D	4. Augmented Reality								
HSSME C-5	BTAIHM605	Humanities and Social Sciences including Management Elective Course (HSSMEC) – II	3	-	-	20	20	60	100	3
	BTAIHM605A	1. Development Engineering								
	BTAIHM605B	2. Employability and Skills Development								
	BTAIHM605C	3. Consumer Behavior								
LC4	BTAIL606	Deep Learning Lab and Advanced Machine Learning Lab	-	-	4	60	-	40	100	2
PROJ	BTAIM607	Mini Project II	-	-	4	60	-	40	100	2
Internship	BTAIP608	Field Training / Internship / Industrial Training - III	-	-	-	-	-	-	-	Audit to be evaluated in VII semester
			15	3	8	220	100	380	700	22

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

Semester –VI
Deep Learning

BTAIC601	Deep learning	PCC7	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic Knowledge of Machine learning, Soft Computing, Data Structures, Python.

Course Objectives:

In this course, attendees will:

- Understand the context of neural networks and deep learning
- Have a working knowledge of neural networks and deep learning
- Explore the parameters for neural networks
- Use CNN and RNN for solving real world problem.

Course Outcomes:

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

CO1	Implement deep learning models in Python using the Keras/PyTorch library and train them with real-world datasets.
CO2	Design convolution networks for image classification.
CO3	Perform regularization, training optimization, and hyperparameter selection on deep models.
CO4	Design Recurrent Neural Networks for text and sequence classification.
CO5	Apply Generative Deep Learning for Generating images

Course Contents:

Unit 1: Introduction to Neural Network

[8 Hours]

Working Of Simple Artificial Neural Network, Multilayer Perceptron, Forward Propagation And Back Propagation Learning, Building Blocks of Deep Neural Networks, Optimization Techniques, Gradient Descent and its variants, Derivatives, Batch Optimization, Momentum Optimizer, RMSProp, Adam, Vectorization, Linear Regression and Logistic Regression with Deep Neural Network.

Unit 2: Convolutional Neural Network

[7 Hours]

Introduction Convolutional Neural Network, Fully Connected Network vs Convolutional Neural Network , Building Blocks Of CNN: Filters, Convolution, Pooling, Activations Etc. Training Procedure of CNN, Feeding Images And Videos to CNN, Different CNN Architectures, Residual Networks, Skip Connections.

Unit 3: Transfer Learning and Effective training in Deep Net: [7 Hours]

Transfer Learning: Introduction To Transfer Learning, Need For Transfer Learning, Feature Extraction Using Transfer Learning, Fine Tuning.

Effective Training: Bias Variance Tradeoff, Dealing With Overfitting and Underfitting, Data Augmentation, Early Stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Regularization, Hyperparameter Tuning.

Unit 4: Deep learning for text and Sequences [7 Hours]

Introduction To Sequential/Temporal Data, Sequential Models, Introduction to Recurrent Neural Network ,Working of RNN, Representing Sequential Data using RNN, Working With Text Data, Text Generation With LSTM, LSTM And GRU, Transformer Network.

Unit 5: Generative Deep Learning [7 Hours]

Neural Style Transfer ,Variational Autoencoder, Generative Adversarial Network , Classical Supervised Tasks With Deep Learning, Image Denoising, Semantic Segmentation, Object Detection Etc.

Text Books

1. Francois Chollet, “Deep Learning with Python”, second edition.
2. Francois Chollet, “Deep Learning with Pytorch”, second edition

Reference Books

1. Michael Nielsen, [Neural Networks and Deep Learning](#), 2016
2. Deep Learning- Ian Goodfellow, Yoshua Benjio, Aaron Courville, The MIT Press
3. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

Semester –VI
Advanced Machine Learning

BTAIC602	Advanced Machine Learning	PCC8	3L- 0T - 0P	3 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Machine Learning Basics, Python Programming Language.

Course Objectives:

After completion of the course, students will learn:-

- To understand fundamental concepts of unsupervised learning and its various algorithms
- To understand Association Rules Mining and Recommendation Systems
- To apply ML algorithms on given data and interpret the results obtained
- To design appropriate ML solution to solve real world problems in AI domain

Course Outcomes:

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

CO1	Develop a good understanding of fundamental of unsupervised learning.
CO2	Formulation of Association Rules Mining and Recommendation Systems
CO3	Interpret a model using Reinforcement Learning.
CO4	Evaluate the time series data.
CO5	Design and Concrete implementations using boosting.

Course Contents:

Unit No 1: Unsupervised Learning

[7 Hours]

Unsupervised Learning - 1

Introduction to Unsupervised Learning, Introduction to Clustering, Using K-means for Flat Clustering, KMeans Algorithm, Using KMeans from Sklearn, Implementing Fit & Predict Functions, Implementing K-Means Class

Unsupervised Learning - 2

How to choose Optimal K, Silhouette algorithm to choose K, Introduction to K Medoids, K Medoids Algorithm, Introduction to Hierarchical Clustering, Top down/Divisive Approach, Bottom up/Divisive Approach

Principal Component Analysis PCA - 1

Intuition behind PCA, Applying PCA to 2D data, Applying PCA on 3D data, Math behind PCA, Finding Optimal Number of Features, Magic behind PCA, Dimensionality reduction

PCA - 2

PCA on Images, PCA on Olevitti Images, Reproducing Images, Eigenfaces, Classification of LFW Images

Unit No 2: Association Rules Mining and Recommendation Systems [7 Hours]

What are Association Rules, Association Rule Parameters, Calculating Association Rule Parameters, Recommendation Engines, Recommendation Engines working, Collaborative Filtering, Content Based Filtering.

Unit No 3: Reinforcement Learning

[8 Hours]

What is Reinforcement Learning, Why Reinforcement Learning, Elements of Reinforcement Learning, Exploration vs Exploitation dilemma, Epsilon Greedy Algorithm, Markov Decision Process (MDP), Q values and V values, Q – Learning, ϵ values.

Unit No 4: Time Series Analysis

[7 Hours]

Time Series Analysis, Importance of TSA, Components of TSA, White Noise, AR model, MA model, ARMA model, ARIMA model, Stationarity, ACF & PACF

Unit No 5: Model Selection and Boosting [7 Hours]

Model Selection, Need of Model Selection, Cross – Validation, Boosting, Boosting Algorithms, Types of Boosting Algorithms, Adaptive Boosting.

Text Books:

1. Ethem Alpaydm, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203-5078-6
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Mcgraw-Hill, ISBN No. 0-07-115467-1
3. Tom Mitchell, Machine Learning, Mcgraw-Hill, First Edition, ISBN No. 0-07-115467-1.
4. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622

Reference Books:

1. R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2/e, Wiley, 2001
2. Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning (From Theory to Algorithms), Cambridge University Press, First Edition, ISBN No. 978-1-107-51282-5.
3. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
4. A. Webb, Statistical Pattern Recognition, 3/e, Wiley, 2011.

Semester –VI
Geographic Information System

BTAIPE603A	Geographical Information System	PEC3	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Nil.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To understand the different components of GIS
2. To understand the different raster data file formats
3. To learn the Pre-processing of spatial datasets
4. To understand various GIS analysis

Course Outcomes:

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

CO1	Understand Geographic Information Systems
CO2	Analyze advantages and disadvantages associated with vector
CO3	Identify Spatial interpolation techniques.
CO4	Demonstrate GIS analysis-1.
CO5	Understand the applications Errors in GIS Key elements

Course Contents:

Unit 1: Introduction

[7 Hours]

What is Geographic Information Systems? Different components of GIS, Different types of vector data, Raster data models and their types TIN data model..

Unit 2: Non Special Data

[7 Hours]

Advantages and disadvantages associated with vector, raster and TIN Non-spatial data attributes and their type Raster data compression techniques Different raster data file formats spatial database systems and their types.

Unit 3: Pre-processing of spatial datasets

[8 Hours]

Pre-processing of spatial datasets Different map projections, Spatial interpolation techniques Different types of resolutions Digital Elevation Model (DEM).

Unit 4: Quality Assessment

[7 Hours]

Quality assessment of freely available DEMS GIS analysis-1

Unit 5: GIS Analysis

[7 Hours]

GIS analysis-2 and applications Errors in GIS Key elements of maps.

Note: Hands-on practice should cover under Tutorial slots.

Text Books

1. Ian Heywood, Sarah Cornelius and Steve Carver, An Introduction to Geographical Information Systems (4th Edition) 2012.

Reference Books

1. Chang Kang-tsung (Karl), Introduction to Geographic Information Systems, 2006
2. Tor Bernhardsen Geographic Information Systems: An Introduction, May 2002

Semester –VI
Recommended Systems

BTAIPE603B	Recommended Systems	PEC3	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic Knowledge of Machine learning, Python.

Course Objectives:

Upon completion of this course, the student should be able to:

1. Understand basics concepts of Recommended System.
2. Apply various types of recommendation system.
3. Evaluate recommendation system.

Course Outcomes:

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

CO1	Understand the need and challenges of Recommended Systems.
CO2	Apply Collaborative Filtering for recommendation.
CO3	Develop content based recommendation system.
CO4	Develop time location based recommendation system.
CO5	Evaluate recommended system using different metric.

Course Contents:

Unit 1: Introduction to Recommended Systems [7 Hours]

Introduction ,Goals of Recommender Systems ,Basic Models/types of Recommender Systems, Challenges in Recommender Systems, The Cold-Start Problem in Recommender Systems ,Attack-Resistant Recommender Systems, Privacy in Recommender Systems.

Case study: Basic recommendation system using weighted average and popularity score.

Unit 2: Collaborative Filtering

[7 Hours]

Types of Collaborative Filtering: Neighborhood/memory based vs Model based. Neighborhood based Collaborative Filtering: User based Collaborative Filtering, Item based Collaborative Filtering, cold-start problem.

Model based Collaborative Filtering: Naive Bayes Collaborative Filtering, Matrix Factorization, Singular Value Decomposition, Association rule mining.

Case study: Book Recommendation using Collaborative Filtering

Unit 3: Content-Based Recommender Systems

[8 Hours]

Introduction, Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents,

Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity measures, ,Similarity based retrieval, Classification algorithms.
Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders

Case Study: 1.Content Based Recommendation System

2. Movie recommendation system (using K nearest Neighbor K-nearest neighbor method, using Pearson Correlation etc).

Unit 4: Time- and Location-Sensitive Recommender Systems [7 Hours]

Introduction, Temporal Collaborative Filtering, Discrete Temporal Models, Location-Aware Recommender Systems, case study.

Unit 5: Evaluating Recommender Systems [7 Hours]

Introduction, Evaluation Paradigms, General Goals of Evaluation Design , Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures.

Note: Hands-on practice of Recommender System should cover under Tutorial slots. Text Books

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Aggarwal, C. C. “Recommender Systems: The Textbook”. Springer 2016. ISBN 978-3-319-29657-9

Reference Books

1. Deepak K. Agarwal, Bee-Chung Chen, ,Statistical Methods for Recommender Systems, Cambridge University Press(2016).

Semester –VI
Industry 4.0 and Automation

BTAIPE603C	Industry 4.0 and Automation	PEC3	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

1. Basics of Control Systems
2. Foundation of sensors and actuators
3. Fundamentals of Power Devices and Circuits

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Globalization and emerging issues of Industry 4.0
2. Internet of Things and Robotics as Pillars of Industry 4.0
3. Process control and Automation
4. Understand architecture of PLC, SCADA and DCS and their Importance in Industrial Automation

Course Outcomes:

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

CO1	Define essential elements of Industry 4.0
CO2	Describe architecture of Industrial IoT
CO3	Explain Recent Technological Components of Robots
CO4	Understand and Recognize Industrial needs of Automation
CO5	Identify and interpret the functionality of PLC, SCADA and DCS.

Course Contents:

Unit No 1: Introduction:

[8 Hours]

Introduction, core idea of Industry 4.0, Globalization and Emerging Issues, The Fourth Revolution, Smart and Connected Business Perspective, Smart Factories, Technology Roadmap of for Industry 4.0, A brief overview of pillars of Industry 4.0: Internet of Things, Cloud Computing, Cybersecurity, Big Data and Analytics, Additive Manufacturing, Virtual/Augmented Reality, and Robotics.

Unit No 2: Internet of Things in Industry 4.0

[7 Hours]

Introduction to Internet of things (IoT) and Industrial Internet of Things (IIoT), IIoT Business Model and Reference Architecture, IIOT Layers: Sensing, Processing, Communication, and Analytics. Software Defined Networks.

Unit No 3: Robotics in Industry 4.0**[7 Hours]**

Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly.

Unit No 4: Introduction to Automation**[7 Hours]**

Process control principles, Control System Evaluation, Analog control, Digital control, Architecture of Industrial Automation Systems(Automation Pyramid), Advantages and limitations of Automation, Concept and Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Concept of VFD, Energy conservation schemes through VFD.

Unit No 5: PLC, SCADA and DCS**[7 Hours]**

Introduction to Programmable Logic Controllers (PLC), Generalized Block Diagram, and Essential components of PLC, Typical Specifications of PLC. Concept of SCADA, Architecture of SCADA, Components of SCADA Systems, human-machine interface (HMI) Basic Concept of DCS, History and Hierarchy of DCS, Basic Components of DCS as Operator Station, Control Module, and I/O module , Types of DCS, Comparison of PLC, DCS and SCADA

Note: Consider practical approach of Robotics under Practical slots. Text Books

1. Alp Ustundag, Emre Cevikacan, Industry 4.0 : Managing the Digital Transformation, Springer
2. Curtis Johnson, “Process Control Instrumentation Technology”, 8th Edition, Pearson Education.
3. Madhuchhanda Mitra, Samarjit Sen Gupta, “Programmable Logic controllers and Industrial Automation”, Penram International Publishing India Pvt. Ltd

Reference Books

1. Kilian, “Modern control technology: components & systems”, Delmar 2nd edition.
2. R.G. Jamkar, “Industrial Automation Using PLC SCADA & DCS” Global Education Limited
3. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Pres

Semester –VI
Web Development

BTAIPE603D	Web Development	PEC3	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Fundamentals of web essentials and markup languages
2. Use of the Client-side technologies in web development
3. Use of the Server-side technologies in web development
4. Understand the web services and frameworks

Course Outcomes:

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

CO1	Implement and analyze behavior of web pages using HTML and CSS
CO2	Apply the client-side technologies for web development
CO3	Analyze the concepts of Servlet and JSP
CO4	Analyze the Web services and frameworks
CO5	Apply the server side technologies for web development

Course Contents:

Unit No 1: Introduction to Web Essentials

[7 Hours]

The internet, basic internet protocols, the world wide web, HTTP Request message, HTTP response message, web clients, web servers. **HTML:** Introduction, history and versions.

HTML Elements: heading, paragraphs, line break, colors and fonts, links, frames, list, tables, images and forms. Difference between HTML and HTML5. **CSS:** Introduction to style sheet, CSS features, CSS core syntax, Style sheets and HTML, Style rule cascading and inheritance, text properties. Bootstrap

Unit No 2: Client-Side Technologies: JavaScript and DOM

[7 Hours]

JavaScript: Introduction to JavaScript, JavaScript in perspective, basic syntax, variables and data types, statements, operators, literals, functions, objects, arrays, built in objects, JavaScript debuggers. DOM: Introduction to Document Object Model, DOM history and levels, intrinsic event handling, modifying element style, the document tree, DOM event handling, jQuery, Overview of Angular JS.

Unit No 3: Java Servlets and XML**[7 Hours]**

Servlet: Servlet architecture overview, A “Hello World” servlet, Servlet generating dynamic content, Servlet life cycle, parameter data, sessions, cookies, URL rewriting, other Servlet capabilities, data storage, Servlets concurrency, databases (MySQL) and Java Servlets. XML: XML documents and vocabularies, XML declaration, XML Namespaces, DOM based XML processing, transforming XML documents, DTD: Schema, elements, attributes. AJAX: Introduction, Working of AJAX.

Unit No 4: JSP and Web Services**[8 Hours]**

JSP: Introduction to Java Server Pages, JSP and Servlets, running JSP applications, Basic JSP, JavaBeans classes and JSP, Support for the Model-View-Controller paradigm, JSP related technologies. Web Services: Web Service concepts, writing a Java Web Service, Writing a Java web service client, Describing Web Services: WSDL, Communicating Object data: SOAP. Struts: Overview, architecture, configuration, actions, interceptors, result types, validations, localization, exception handling, annotations.

Unit No 5: Server Side Scripting Languages**[7 Hours]**

PHP: Introduction to PHP, uses of PHP, general syntactic characteristics, Primitives, operations and expressions, output, control statements, arrays, functions, pattern matching, form handling, files, cookies, session tracking, using MySQL with PHP, WAP and WML. Introduction to ASP.NET: Overview of the .NET Framework, Overview of C#, Introduction to ASP.NET, ASP.NET Controls, Web Services. Overview of Node JS.

Note: Hands-on practice of Web Development should cover under Tutorial slots.

Text Books

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035
2. Robert W Sebesta, "Programming the World Wide Web , 4th Edition, Pearson education, 2008
3. Marty Hall, Larry, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.

Reference Books

1. H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429.
2. Chris Bates, "Web Programming Building Internet Applications , 3rd Edition, Wiley India, 2006.
3. Xue Bai et al, "The web Warrior Guide to Web Programming , Thomson, 2003.

Semester –VI
Big Data Analytics

BTAIOE604A	Big Data Analytics	OEC2	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment

Course Objectives:

Upon completion of this course, the student should be able to

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System
6. Apply analytics on Structured, Unstructured Data.

Course Outcomes:

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

CO1	Identify Big Data and its Business Implications.
CO2	List the components of Hadoop and Hadoop Eco-System
CO3	Access and Process Data on Distributed File System
CO4	Develop Big Data Solutions using Hadoop Eco System
CO5	Use Big data Framework, security and governance.

Course Contents:

Unit No 1: Introduction to Big Data and Hadoop **[7 Hours]**

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analyzing Data with UNIX tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

Unit No 2: HDFS (Hadoop Distributed File System): **[7 Hours]**

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

Unit No 3: Map Reduce:

[7 Hours]

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features, Hadoop cluster.

Unit No 4: Hadoop Eco System:**[8 Hours]**

Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.

Big SQL : Introduction

*Unit No 5: Big Data Framework and security:**[7 Hours]*

Apache kafka: Feature, concept, architecture, components

Apache Spark: Feature, concept, architecture, components.

Kerberos authentication: Feature, concept, architecture, components

Note: Hands-on practice of to deploy Big Data systems should cover under Tutorial slots. Text Books

1. Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Reference Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
4. Anand Rajaraman and Jef rey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
6. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007
7. Pete Warden, “Big Data Glossary”, O’Reily, 2011.
8. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

Semester –VI
Cryptography & Network Security

BTAIOE604B	Cryptography & Network Security	OEC2	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. The objectives of information security
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability
3. Understand various cryptographic algorithms.
4. Understand the basic categories of threats to computers and networks
5. Describe public-key cryptosystem.
6. Describe the enhancements made to IPv4 by IPSec
7. Understand Intrusions and intrusion detection
8. Discuss the fundamental ideas of public-key cryptography.
9. Generate and distribute a PGP key pair and use the PGP package to send an encrypted email message.
10. Discuss Web security and Firewalls

Course Outcomes:

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

CO1	Understand basic cryptographic algorithms, message and web authentication and security issues.
CO2	Ability to identify information system requirements for both of them such as client and server.
CO3	Ability to understand the current legal issues towards information security.
CO4	Develop transport level security.
CO5	Apply knowledge for develop model.

Unit No 1: Security Concepts:

[7 Hours]

Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

Unit No 2: Symmetric key Ciphers:**[7 Hours]**

Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

Unit No 3: Cryptographic Hash Functions, key management and distribution: [8 Hours]

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric, Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

Unit No 4: Transport-level Security:**[7 Hours]**

Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH)

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.

Unit No 5: Case Study:**[7 Hours]**

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange

Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability

Note: Hands-on practice should cover under Practical slots.

Text Book:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

Reference Books:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

Semester –VI
Agile Methodology

BTAIOE604C	Agile Methodology	OEC2	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will learn:-

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of agile development and testing techniques.
- To understand the benefits and pitfalls of working in an agile team.
- To understand agile development and testing.

Course Outcomes:

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

CO1	Realize the importance of interacting with business stakeholders in determining the requirements for a software system
CO2	Perform iterative software development processes: how to plan them, how to execute them.
CO3	Point out the impact of social aspects on software development success.
CO4	Develop techniques and tools for improving team collaboration and software quality.
CO5	Perform Software process improvement as an ongoing task for development teams and show agile approaches can be scaled up to the enterprise level.

Course Contents:

Unit No 1: AGILE METHODOLOGY

[7 Hours]

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values.

Unit No 2: AGILE PROCESSES

[8 Hours]

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

Unit No 3: AGILITY AND KNOWLEDGE MANAGEMENT

[7 Hours]

Agile Information Systems – Agile Decision Making - Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

Unit No 4: AGILITY AND REQUIREMENTS ENGINEERING

[7 Hours]

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

Unit No 5: AGILITY AND QUALITY ASSURANCE

[7 Hours]

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

Text Books

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

Reference Books

1. Craig Larman, —Agile and Iterative Development: A Manager's Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

Semester –VI
Augmented Reality

BTAIOE604C	Augmented Reality	OEC2	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial : 1 hr./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

The objective of this course is to provide a foundation to the fast growing field of AR and make the students aware of the various AR devices

Course Outcomes:

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

CO1	Describe how AR systems work and list the applications of AR.
CO2	Understand and analyse the hardware requirement of AR.
CO3	Use computer vision concepts for AR and describe AR techniques.
CO4	Analyse and understand the working of various state of the art AR devices .
CO5	Acquire knowledge of mixed reality .

Course Contents:

Unit No 1: Introduction to Augmented Reality: [7 Hours]

What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality

Augmented Reality Concepts- Augmented Reality Working, Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

Unit No 2: Augmented Reality Hardware: [7 Hours]

Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception , Requirements and Characteristics, Spatial Display Model.

Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

Unit No 3: Computer Vision for Augmented Reality & A.R. Software: [7 Hours]

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking

Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

Unit No 4: AR Techniques- Marker based & Markerless tracking: [8 Hours]

Marker-based approach- Introduction to marker-based tracking, types of markers, marker camera pose and identification, visual tracking, mathematical representation of matrix multiplication

Marker types- Template markers, 2D barcode markers, imperceptible markers.

Marker-less approach- Localization based augmentation, real world examples

Tracking methods- Visual tracking, feature based tracking, hybrid tracking, and initialization and recovery.

Unit No 5: AR Devices & Components: [7 Hours]

AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene

AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems.

Note: Hands-on practice of Augmented Reality should cover under Tutorial slots.

Text Books

2. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
3. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494.

Reference Books

1. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
2. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
3. <https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf>
4. <https://docs.microsoft.com/en-us/windows/mixed-reality/>
5. <https://docs.microsoft.com/en-us/archive/msdn-magazine/2016/november/hololens-introduction-to-the-hololens>

Semester –VI
Development Engineering

BTAIHM605A	Development Engineering	HSSMEC5	3L- 0T - 0P	3 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will learn:-

Course Outcomes:

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

CO1	Improve the skills of development engineering
CO2	Get the knowledge of world poverty and development
CO3	Aware about social justice
CO4	Apply development strategies
CO5	Understand engineering for sustainable community development

Course Contents:

Unit No 1: Introduction

[7 Hours]

Introduction, Various Definitions of Development Engineering.

Unit No 2: World Poverty and Development

[8 Hours]

World Poverty and Development, Poverty in the India, Sustainable Development, Culture and Global Competence, The Engineer's Role.

Unit No 3: Social Justice

[7 Hours]

Social Justice, Social Justice and Engineering, Religious Perspectives, Secular Perspectives.

Unit No 4: Development Strategies

[7 Hours]

Development Strategies: Society, Technological Change, and Development, Development Economists' Perspectives, Global Health Perspective, International Education Perspective, Social Business Perspectives.

Unit No 5: Engineering for Sustainable Community Development

[7 Hours]

The Engineer as a Helper Participatory Community Development, Teamwork and Project Management, Community Assessment: Learning About a Community, Project Selection, Humanitarian Technology, Participatory Technology Development, Humanitarian STEM Education. ICT for Development, AI for Humanitarian purposes, Blockchain and Social Development.

Text Books

1. Kevin M. Passino, Humanitarian Engineering: Advancing Technology for Sustainable Development

Semester –VI
Employability and Skill Development

BTAIHM605B	Employability and Skill Development	HSSMEC5	3L- 0T - 0P	3 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will learn:-

Course Outcomes:

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

CO1	Improve the soft skills and communication.
CO2	Empower Arithmetic and Mathematical Reasoning and Analytical Reasoning and Quantitative Ability
CO3	Use of grammar.
CO4	Development in interview skills.
CO5	Develop problem solving techniques.

Course Contents:

Unit No 1: Soft Skills & Communication basics: [7 Hours]

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills, Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing.

Unit No 2: Arithmetic and Mathematical Reasoning and Analytical Reasoning and Quantitative Ability [8 Hours]

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, remainder theorem).

Matching, Selection, Arrangement, Verifications (Exercises on each of these types).

Verbal aptitude (Synonym, Antonym, Analogy).

Unit No 3: Grammar and Comprehension [7 Hours]

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

Unit No 4: Skills for interviews**[7 Hours]**

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.

Unit No 5: Problem Solving Techniques**[7 Hours]**

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

Text Books

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, -Soft Skills- An integrated approach to maximize personality, ISBN: 987-81-265-5639-7, First Edition 2016

Reference Books

1. Wiley Wren and Martin, "English grammar and Composition", S. Chand publications.
2. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.
3. Philip Carter, "The Complete Book of Intelligence Test", John Willey & Sons Ltd.
4. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page.
5. Eugene Ehrlich, Daniel Murphy, "Schaum;s Outline of English Grammar", McGraw Hills.
6. David F. Beer, David A. McMurrey, -A Guide to Writing as an Engineer, ISBN: 978- 1-118- 30027-5 4th Edition, 2014, Wiley.

Semester –VI
Consumer Behavior

BTAIHM605C	Consumer Behavior	HSSMEC5	3L- 0T - 0P	3 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will learn:-

Course Outcomes:

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

CO1	Study of Consumer Behavior
CO2	Get Market Segmentation and Positioning
CO3	Develop Models of Consumer Behavior
CO4	Analyze Psychological Influences on Consumer Decision Making
CO5	Study Diffusion of innovation Diffusion Process

Course Contents:

Unit No 1: Introduction to the Study of Consumer Behavior: [7 Hours]

Defining Consumer Behavior, Scope and Application of Consumer Behavior, Why Study Consumer Behavior, Evolution of Consumer Behavior as a Field Of Study and its relationship with Marketing: Behavioral Dimension, The Interdisciplinary Nature of Consumer Behavior. Market Research and Consumer Behavior, Relevance of Market Research with Consumer Behavior, Approaches to Consumer Behavior Research, Quantitative Research, Qualitative Research.

Unit No 2: Market Segmentation and Positioning [8 Hours]

Market Segmentation, Basis for Segmentation, Alternatives available for Segmentation, Positioning. The Consumer Decision Making Process: Buying Motives, Buying Roles, Consumer Decision Making Process, Levels of Consumer Decision Making, Perspectives to Consumer Decision Making, Consumer Decision Making Process.

Unit No 3: Models of Consumer Behavior [7 Hours]

The Economic model, Learning model, Psychoanalytic model, The sociological model. The Howard Sheth model of Buying Behaviour, The Nicosia model, The Engel - Kollat - Blackwell Model, Engel, Blackwell and Miniard (EBM) model.

Unit No 4: Psychological Influences on Consumer Decision Making [7 Hours]

Consumers Needs & Motivation, Emotions and Mood, Consumer Involvement, Consumer Learning, Personality, Self-concept and Self-image, Consumer Perception, Risk and Imagery. Consumer Attitude: Belief, Affect, Attitude and Intention, Attitude Formation and Attitude Change, Consumer Communication. Sociological Influences on Consumer Decision Making: Consumer groups, Consumer reference groups, Family and Life cycle, Social class and mobility, lifestyle analysis, Culture; Sub-Culture, Cross Culture, Interpersonal Communication and influence, Opinion Leadership.

Unit No 5: Diffusion of innovation Diffusion Process [7 Hours]

Adoption Process, Consumer Innovators, Multiplicative innovation adoption (MIA) model. Organizational Buying: Differences between Industrial Markets and Consumer Markets, Differences between Organizational and Consumer Buying, Buying Decisions in Organizational Buying Process, Types of Decision Making, Organization Buyer's Decision Making Process, and Factors influencing Organizational Buying Behaviour, Decision Makers in Organizational Buying, Webster and Wind model of Organizational buying behaviour, The Sheth model of Industrial buying, The Sheth model of Industrial buying Consumer Behavior Analysis and Marketing Strategy: Consumer Behavior and Product Strategy, Consumer Behavior and Pricing Strategy, Consumer Behavior and Distribution Channel Strategy, Consumer Behavior and Promotion Strategy.

Text Books

1. Consumer Behavior, Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

Reference Books

1. Consumer Behavior, Concepts and Applications, Loudon, D.L. and Bitta, A.J.D, TatacGrawHill.
2. Consumer Behavior and Marketing Startegy, Peter, J.P. and Olson, J.C., Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

Semester –VI
Deep Learning and Advanced Machine Learning Lab

BTAIL606	Deep Learning and Advanced Machine Learning Lab	LC4	0L-0T-4P	2 Credits
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Teaching Scheme	Examination Scheme
Practical: 04 hrs./week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks End Semester Examination: 40 Marks

Deep Learning Lab

Practical List

1. Loading dataset into keras/pytorch, creating training and testing splits.
2. Creating functions to compute various losses.
3. Feeding data to pretrained neural network and making predictions.
4. Implementing regression using deep neural network.
5. Classifying IMDB movie review dataset using deep neural network-binary classification problem.
6. Classifying Reuters dataset using deep neural network-multiclass classification problem.
7. Classifying MNIST Dataset using CNN.
8. Classifying data using pretrained models/transfer learning.
9. Training various popular neural networks (Resnet, VGGNet, InceptionV3 etc) on custom Dataset.
10. Temperature forecasting using RNN.
11. Implementation of GAN on any suitable dataset.

Advanced Machine Learning Lab

1. Implementing K-means Clustering.
2. Implementing Hierarchical Clustering.
3. Implementation of Apriori Algorithm.
4. Implementation of Market Basket Analysis.
5. Reinforcement Learning-
 - a. Calculating Reward
 - b. Discounted Reward
 - c. Calculating Optimal quantities
 - d. Implementing Q Learning
 - e. Setting up an Optimal Action
6. Time Series Analysis-
 - a. Checking Stationary
 - b. Converting a non-stationary data to stationary
 - c. Implementing Dickey Fuller Test
 - d. Plot ACF and PACF
 - e. Generating the ARIMA plot
 - f. TSA Forecasting
7. Boosting
 - a. Cross Validation
 - b. AdaBoost

Semester –VI
Mini Project -II

BTAIM607	MINI PROJECT-II	Project	0L-0T-4P	2 Credits
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Guidelines for Mini Project

The students shall study in group of two members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Artificial Intelligence, Data Science, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring the current technical journal or reference books, under the guidance of the teacher.

In this subject head, it is expected that the student should complete the following tasks.

1. Identify problem statement / idea which is solving one problem preferably local problem may bein their University / College / nearby vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement solution using latest technology
5. Write 20-25 pages report (use of latex is more suitable).
6. Present / demonstrate the solution in front of faculty member

The students shall prepare his report and execution of project for other students of his class in the presence of his guide and examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:

The Continues Assessment for this head will consists of the report written in a technical reporting manner and execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Semester –VI
Internship - III

BTAIP608	Field Training / Internship / Industrial Training	Internship	Audit
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Guidelines for Internships

Guidelines for Field Training / Internship / Industrial Training Industrial Training:

1. To apply for a suitable Industrial Training, submit an application form to respective Organization concerned one semester before the Industrial Training Programmed commences.
2. Student can also apply through online platforms such as Internshala for industrial training.
3. Submit one copy of the offer letter for the Industrial Training to the Head of the department or Faculty coordinator (Industrial Training).
4. To complete the Industrial Training process within the specified time based on the Industrial Training Programme schedule.
5. Assessment within the Industrial Training context aims to evaluate the student's work quality and appropriateness to the field of study with reference to the learning outcomes of the Industrial Training Programme.
6. Evaluation of the students' performance should be done in the next upcoming semester.
7. Those students who fails, they can also complete online certification courses which are available at free of cost on various MOOC platforms.

COURSE CURRICULUM MAPPING WITH MOOC PLATFORM NPTEL

Sr. No	Name of Subject as per Curriculum	Course Code	Semester	SWAYAM/ NPTEL Course And Web Link	Name of Institute offering course	Relevance %	Duration of Course
1	Computer Network and Cloud Computing	BTAIC501	V	Cloud computing https://onlinecourses.nptel.ac.in/noc22_cs87/preview Computer Networks and Internet Protocol https://onlinecourses.nptel.ac.in/noc22_cs19/preview	IIT Kharagpur	60 %	12 weeks
2	Machine Learning	BTAIC502	V	Introduction to machine learning https://onlinecourses.nptel.ac.in/noc22_cs97/preview	IIT Kharagpur	80 %	8 weeks
	Knowledge reasoning and AI ethics	BTAIHM503	V	Artificial intelligence: knowledge representation and reasoning https://nptel.ac.in/courses/106106140	IIT Madras	60 %	12 weeks
4	Virtual Reality	BTAIPE504A	V	Virtual reality engineering https://nptel.ac.in/courses/121106013	IIT Madras	70 %	12Weeks
5	Soft computing	BTAIPE504B	V	Introduction to soft computing https://onlinecourses.nptel.ac.in/noc22_cs54/preview	IIT Kharagpur	40 %	8 Weeks
6				Neural networks and applications https://archive.nptel.ac.in/courses/117/105/117105084/	IIT Kharagpur	40 %	37 lectures
7	Sensors and Robotics Technology	BTAIPE504C	V	Introduction to robotics https://onlinecourses.nptel.ac.in/noc22_de11/preview Introduction to robotics https://archive.nptel.ac.in/courses/107/106/107106090/	IIT Madras	70 %	12 weeks
8	Advanced Java	BTAIPE504D	V	Programming in Java https://onlinecourses.nptel.ac.in/noc22_cs47/preview	IIT Kharagpur	50 %	12 weeks
9	Data mining and warehousing	BTAIOE505A	V	Data mining https://onlinecourses.swayam2.ac.in/cec19_cs01/preview		60 %	12 weeks
10				Data mining https://onlinecourses.nptel.ac.in/noc21_cs06/preview	IIT Kharagpur	40 %	8 weeks
11	Digital communication and information theory	BTAIOE505B	V	An introduction to coding theory https://onlinecourses.nptel.ac.in/noc22_ee108/preview	IIT Kanpur	80 %	12 weeks
12				Principles of Digital communication https://nptel.ac.in/courses/108101113	IIT Bombay	90 %	12 weeks
13	Software engineering and testing	BTAIOE505C	V	Software engineering https://onlinecourses.nptel.ac.in/noc22_cs106/preview	IIT Kharagpur	60 %	12 weeks
14				Software testing https://onlinecourses.nptel.ac.in/noc19_cs71/preview	IIT Bangalore	60 %	12 weeks
15				Software testing https://onlinecourses.nptel.ac.in/noc20_cs19/preview	IIT Kharagpur	40 %	4 weeks
16	Deep learning	BTAIC601	VI	Deep learning https://onlinecourses.nptel.ac.in/noc20_cs62/preview	IIT Kharagpur	80 %	12 week
17				Deep learning https://onlinecourses.nptel.ac.in/noc22_cs124/preview	IIT Ropar	70 %	12 weeks
18	Advanced Machine Learning	BTAIC602	VI	Machine learning for engineering and science application https://onlinecourses.nptel.ac.in/noc19_cs82/preview	IIT Madras	50 %	12 Weeks
19	Augmented reality	BTAIPE603A	VI	-			
20	Recommender system	BTAIPE603B	VI	-			

21	Industry 4.0 & automation	BTAIPE603 C	VI	Introduction to industry 4.0 and industrial internet of things https://onlinecourses.nptel.ac.in/noc22_cs95/preview	IIT Kharagpur	50%	12 weeks
22	Web Development	BTAIPE603 D	VI	Modern application development https://nptel.ac.in/courses/106106156	IIT Madras	40%	8 weeks
23	Big Data Analytics	BTAIOE604 A	VI	-			
24	Cryptography and network security	BTAIOE604 B	VI	Cryptography and network security https://onlinecourses.nptel.ac.in/noc22_cs90/preview	IIT Kharagpur	60%	12 weeks
25	Agile Methodology	BTAIOE604 C	VI	-			
26	Development Engineering	BTAIHM605 A	VI	Developing soft skill and personality https://archive.nptel.ac.in/courses/109/104/109104107/ Educational leadership https://archive.nptel.ac.in/courses/109/105/109105122/	IIT Kharagpur & Kanpur	40%	8 weeks
27	Employability and Skills Development	BTAIHM605 B	VI	Soft skills https://onlinecourses.nptel.ac.in/noc21_hs76/preview	IIT Roorkee	70%	12 weeks
28	Consumer Behavior	BTAIHM605 C	VI	Introduction to consumer behavior https://nptel.ac.in/courses/110105029	IIT Kharagpur	50%	8 weeks
29	Economics and management	BTAIHM605 D	VI	Economics / Management / Entrepreneurship https://nptel.ac.in/courses/110105067	IIT Kharagpur	60%	12 weeks

COURSE CURRICULUM MAPPING WITH MOOC PLATFORM COURSERA

Sr. No	Name of Subject as per Curriculum	Course Code	Semester	Coursera Course And Web Link	Name of Institute offering course	Relevance %	Duration of Course
1	Computer Network and Cloud Computing	BTAIC501	V	The Bits and Bytes of Computer Networking https://www.coursera.org/learn/computer-networking	Google Career Certificate	80%	6 Weeks
2				Introduction to Cloud Computing https://www.coursera.org/learn/introduction-to-cloud	IBM Cloud	75%	5 Weeks
3	Machine Learning	BTAIC502	V	Machine Learning for All https://www.coursera.org/learn/uol-machine-learning-for-all	University of London	90%	4 Weeks
4	Knowledge reasoning and AI ethics	BTAIHM503	V	Artificial Intelligence Ethics in Action https://www.coursera.org/learn/ai-ethics-analysis	LearnQuest	75%	3 Weeks
5	Virtual Reality	BTAIPE504A	V	Intro to AR/VR/MR/XR: Technologies, Applications & Issues https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality-technologies-applications-issues	University of Michigan	78%	4 Weeks
6	Soft computing	BTAIPE504B	V	Neural Networks and Deep Learning https://www.coursera.org/learn/neural-networks-deep-learning	DeepLearning.AI	65%	4 Weeks
7	Sensors and Robotics Technology	BTAIPE504C	V	AI For Everyone https://www.coursera.org/learn/ai-for-everyone	DeepLearning.AI	65%	4 Weeks

8	Advanced Java	BTAIPE 504D	V	Object Oriented Programming in Java https://www.coursera.org/learn/object-oriented-java	UC San Diego	75%	6 Weeks
9	Data mining and warehousing	BTAIOE 505A	V	Data Mining Pipeline https://www.coursera.org/learn/data-mining-pipeline	University of Colorado Boulder	85%	4 Weeks
10				Fundamentals of Data Warehousing https://www.coursera.org/learn/fundamentals-of-data-warehousing	LearnQuest	80%	3 Weeks
11	Digital communication and information theory	BTAIOE 505B	V	Fundamentals of Network Communication https://www.coursera.org/learn/fundamentals-network-communications	University of Colorado	76%	5 Weeks
12				Cryptography and Information Theory https://www.coursera.org/learn/crypto-info-theory	University of Colorado	80%	4 Weeks
13	Software engineering and testing	BTAIOE 505C	V	Software Engineering: Implementation and Testing https://www.coursera.org/learn/software-engineering-implementation-and-testing	The Hong Kong University of Science and Technology	90%	7 Weeks
14	Deep learning	BTAIC6 01	VI	Neural Networks and Deep Learning https://www.coursera.org/learn/neural-networks-deep-learning	DeepLearning.AI	80%	4 Weeks
15	Advanced Machine Learning	BTAIC6 02	VI	Advanced Machine Learning and Signal Processing https://www.coursera.org/learn/advanced-machine-learning-signal-processing	IBM Skills Network	80%	4 Weeks
16	Augmented reality	BTAIPE 603A	VI	Introduction to Augmented Reality and ARCore https://www.coursera.org/learn/ar	Daydream	85%	4 Weeks
17	Recommender system	BTAIPE603 B	VI	Basic Recommender Systems https://www.coursera.org/learn/basic-recommender-systems	EIT Digital	70%	4 Weeks
18	Industry 4.0 & automation	BTAIPE 603C	VI	Industrial Internet of Things (IIoT) https://www.coursera.org/learn/industrial-internet-of-things	University of Michigan	80%	4 Weeks
19	Web Development	BTAIPE 603D	VI	Web Application Development: Basic Concepts https://www.coursera.org/learn/web-app	University of New Mexico	80%	5 Weeks
20	Big Data Analytics	BTAIOE 604A	VI	Fundamentals of Software Architecture for Big Data https://www.coursera.org/learn/software-architecture-for-big-data-fundamentals	University of Colorado Boulder	75%	4 Weeks
21	Cryptography and network security	BTAIOE 604B	VI	Cryptography and Hashing Overview https://www.coursera.org/learn/crypto-hashing	University of California, Irvine	75%	4 Weeks
22	Agile Methodology	BTAIOE 604C	VI	Combining Scrum with Other Agile Methodologies https://www.coursera.org/learn/combining-scrum-with-other-methodologies	LearnQuest	85%	2 Weeks
23	Humanities and Social Sciences including Management Elective Course	BTAIH M605	VI	People and Soft Skills Assessment https://www.coursera.org/learn/people-soft-skills-assessment	IBM	65%	1 Week

	(HSSMEC) – II						
24	Development Engineering	BTAIH M605A	VI	Developing a Systems Mindset https://www.coursera.org/learn/systems-mindset	University of Colorado Boulder	60%	3 Weeks
25	Employability and Skills Development	BTAIH M605B	VI	Learning How to Learn: Powerful mental tools to help you master tough subjects https://www.coursera.org/learn/learning-how-to-learn	Deep Teaching Solutions	65%	4 Weeks
26	Consumer Behavior	BTAIH M605C	VI	Market Research and Consumer Behavior https://www.coursera.org/learn/market-research	IE Business School	70%	4 Weeks
27	Economics and management	BTAIH M605D	VI	The Strategist's Challenge https://www.coursera.org/learn/strategists-challenge	University of Virginia Darden School Foundation	75%	4 Weeks

COURSE CURRICULUM MAPPING WITH MOOC PLATFORM Edx

Sr. No	Name of Subject as per Curriculum	Course Code	Se me ster	Edx Course And Web Link	Name of Institute offering course	Relev ance %	Durati on of Cours e
1	Computer Network and Cloud Computing	BTAIC5 01	V	Cloud computing https://onlinecourses.nptel.ac.in/noc22_cs87/preview 11 Computer Networks and Internet Protocol https://onlinecourses.nptel.ac.in/noc22_cs19/preview	IIT Kharagpur	40%	12 weeks
2	Machine Learning Knowledge reasoning and AI ethics	BTAIC5 02 BTAIH M503	V	Introduction to machine learning https://onlinecourses.nptel.ac.in/noc22_cs97/preview	IIT Kharagpur	80%	8 weeks
			V	Artificial intelligence: knowledge representation and reasoning https://nptel.ac.in/courses/106106140	IIT Madras	60%	12 weeks
3	Virtual Reality Soft computing	BTAIPE 504A BTAIPE 504B	V	Virtual reality engineering https://nptel.ac.in/courses/121106013	IIT Madras	70%	12Weeks 8 Weeks
			V	Introduction to soft computing https://onlinecourses.nptel.ac.in/noc22_cs54/preview	IIT Kharagpur	40%	
4	Data Analysis	BTAI4 01	IV	Neural networks and applications https://archive.nptel.ac.in/courses/117/105/117105084/	IIT Kharagpur	40%	37 lectures
5	Sensors and Robotics Technology	BTAIPE 504C	V	Introduction to robotics https://onlinecourses.nptel.ac.in/noc22_de11/preview Introduction to robotics https://archive.nptel.ac.in/courses/107/106/107106090/	IIT Madras	70%	12 weeks
6	Advanced Java	BTAIPE 504D	V	Programming in Java https://onlinecourses.nptel.ac.in/noc22_cs47/preview	IIT Kharagpur	50%	12 weeks
7	Data mining and warehousing	BTAIOE 505A	V	Data mining https://onlinecourses.swayam2.ac.in/c ec19_cs01/preview		60%	12 weeks
8	Internet of Things & Embedded System Digital communication and information theory	BTSE4 05B BTAIOE 505B	IV	Data mining https://onlinecourses.nptel.ac.in/noc21_cs06/preview	IIT Kharagpur	40%	8 weeks
			V	An introduction to coding theory https://onlinecourses.nptel.ac.in/noc22_ee108/preview	IIT Kanpur	80%	12 weeks

9	Programming in JAVA	BTSE405D	IV	Principles of Digital communication https://nptel.ac.in/courses/108101113	IIT Bombay	90%	12 weeks
	Software engineering and testing	BTAIOE505C	V	Software engineering https://onlinecourses.nptel.ac.in/noc22_cs106/preview	IIT Kharagpur	60%	12 weeks
	Programming in JAVA	BTSE405D	IV	Software testing https://onlinecourses.nptel.ac.in/noc19_cs71/preview	IIT Bangalore	60%	12 weeks
10	Computer Network and Cloud Computing	BTAIC501	V	Software testing https://onlinecourses.nptel.ac.in/noc20_cs19/preview	IIT Kharagpur	40%	4 weeks
11	Deep learning	BTAIC601	VI	Deep learning https://onlinecourses.nptel.ac.in/noc20_cs62/preview	IIT Kharagpur	80%	12 week
12	Knowledge reasoning and AI ethics	BTAIHM503	V	Deep learning https://onlinecourses.nptel.ac.in/noc22_cs124/preview	IIT Ropar	70%	12 weeks
13	Advanced Machine Learning	BTAIC602	VI	Machine learning for engineering and science application https://onlinecourses.nptel.ac.in/noc19_cs82/preview	IIT Madras	50%	12 Weeks
14	Augmented reality Recommender system	BTAIPE603A	VI	-			
		BTAIPE603B	VI	-			
15	Industry 4.0 & automation	BTAIPE603C	VI	Introduction to industry 4.0 and industrial internet of things https://onlinecourses.nptel.ac.in/noc22_cs95/preview	IIT Kharagpur	50%	12 weeks
16	Web Development	BTAIPE603D	VI	Modern application development https://nptel.ac.in/courses/106106156	IIT Madras	40%	8 weeks
17	Cryptography and network security	BTAIOE604A	VI	-			
		BTAIOE604B	VI	Cryptography and network security https://onlinecourses.nptel.ac.in/noc22_cs90/preview	IIT Kharagpur	60%	12 weeks
18	Agile Methodology Humanities and Social Sciences including Management Elective Course (HSSMEC) – II	BTAIOE604C	VI	-			
		BTAIHM605	VI	Developing soft skill and personality https://archive.nptel.ac.in/courses/109/104/109104107/ Educational leadership https://archive.nptel.ac.in/courses/109/105/109105122/	IIT Kharagpur & Kanpur	40%	8 weeks
17	Development Engineering Employability and Skills Development Consumer Behavior	BTAIHM605A		-			
		BTAIHM605B	VI	Soft skills https://onlinecourses.nptel.ac.in/noc21_hs76/preview	IIT Roorkee	70%	12 weeks
		BTAIHM605C	VI	Introduction to consumer behavior https://nptel.ac.in/courses/110105029	IIT Kharagpur	50%	8 weeks
18	Economics and management	BTAIHM605D	VI	Economics / Management / Entrepreneurship https://nptel.ac.in/courses/110105067	IIT Kharagpur	60%	12 weeks