NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute)

NIET
Greater Noida
Autonomous Institute
Estd.2001
Get Future Ready

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW

Evaluation Scheme & Syllabus

For

Bachelor of Technology
Computer Science and Engineering (Artificial Intelligence)
Fourth Year

(Effective from the Session: 2023-24)

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR (AN AUTONOMOUS INSTITUTE)

Bachelor of Technology
Computer Science and Engineering (Artificial Intelligence)
EVALUATION SCHEME
SEMESTER-VII

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
WEEKS COMPULSORY INDUCTION PROGRAM													
1	ACSML0702	Deep Learning	3	0	0	30	20	50		100		150	3
2		Departmental Elective-V	3	0	0	30	20	50		100		150	3
3		Open Elective-II	3	0	0	30	20	50		100		150	3
4		Open Elective-III	3	0	0	30	20	50		100		150	3
5	ACSML0752	Deep Learning Lab	0	0	2				25		25	50	1
6	ACSE0759	Internship Assessment-III	0	0	2				50			50	1
7		MOOCs (For B.Tech. Hons. Degree)											
		GRAND TOTAL										**700**	**14**

List of MOOCs (Coursera) Based Recommended Courses for Fourth Year (Semester-VII) B. Tech Students

S. No.	Subject Code	Course Name (Blockchain)	University / Industry Partner Name	No of HOURS	Credits
1.	AMC0157	Deep Neural Networks with PyTorch	IBM	30	2
2.	AMC0164	Introduction to Blockchain for Financial Services	INSEAD	29	2

OR

S. No.	Subject Code	Course Name (Java)	University / Industry Partner Name	No of HOURS	Credits
1	AMC0151	Blockchain, Cryptoassets, and Decentralized Finance	INSEAD	17	1
2	AMC0105	Developing Cloud Apps with Node.js and React	IBM	16	1

OR

S. No.	Subject Code	Course Name (Machine Learning)	University / Industry Partner Name	No of HOURS	Credits
1	AMC0167	Java Servlet Pages (JSPs)	LearnQuest	16	1
2	AMC0165	Introduction to Computer Vision and Image Processing	IBM	21	1.5

PLEASE NOTE:-

- **Internship (3-4 weeks) shall be conducted during summer break after semester-VI and will be assessed during Semester-VII**

Abbreviation Used: -

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

List of Departmental Electives

Departmental Electives	Subject Codes	Subject Name	Bucket Name	Branch	Semester
Elective-V	**ACSE0712**	**RPA Implementation**	**CRM-RPA**	**AI**	**7**
Elective-V	**ACSAI0712**	**Natural Language Processing**	**Data Analytics**	**AI**	**7**
Elective-V	**ACSE0713**	**Web Development using MERN Stack with DevOps**	**Full Stack Development**	**AI**	**7**
Elective-V	**ACSE0711**	**Game Programming**	**Mobility Management**	**AI**	**7**

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Bachelor of Technology
Computer Science and Engineering (Artificial Intelligence)
EVALUATION SCHEME
SEMESTER-VIII

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Open Elective-IV	2	0	0	30	20	50		100		150	2
2	ACSE0859/ ACSE0858	Capstone Project/Industrial Internship	0	0	20				200		300	500	10
3		MOOCs (For B.Tech. Hons. Degree)											
4		**TOTAL**										**650**	**12**

List of MOOCs (Coursera) Based Recommended Courses for Fourth Year (Semester-VIII) B. Tech Students

S.no	Subject Code	Course Name	University/Industry Partner Name	No. of Hours	Credit
1	AMC0180	Blockchain Transformations of Financial Services	INSEAD	15 hour	1
2	AMC0179	Blockchain in Financial Services: Strategic Action Plan	INSEAD	14 hours	1
3	AMC0184	Developing Applications with SQL, Databases, and Django	IBM	14	1
4	AMC0187	Getting started with Git & Github	IBM	8	0.5
5	AMC0181	Building Deep learning Models with TensorFlow	IBM	7	0.5
6	AMC0177	AI Capstone Project with Deep Learning	IBM	15 Hours	1
7	AMC0204	Programming Fundamentals Using Python Part-1	Infosys Springboard	43h 25m	3.5
8	AMC0219	Natural Language Processing with Real World Projects	Infosys Springboard	16 Hours	1
9	AMC0220	Natural Language Processing for Developers	Infosys Springboard	13 hours 37 Minutes	1
10	AMC0221	Deep Learning	Infosys Springboard	10 hours	1
11	AMC0214	The Complete React Developer Course	Infosys Springboard	39 h 55m	3
12	AMC0240	Machine Learning with Real World Projects	Infosys Springboard	30h 46m	2.5

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TE: Theory End Semester Exam., PE: Practical End Semester Exam.

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AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Coursera certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 HOURS =0.5 Credit
2. For 13 to18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Coursera registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

i. If he / she secures 7.50 as above CGPA.
ii. Passed each subject of that degree program in the single attempt without any grace.
iii. Successful completion of MOOCs based 20 credits.

B. TECH FOURTH YEAR

Course code	ACSML0702	L T P	Credits
Course title	DEEP LEARNING	3 0 0	3

Course objective: To be able to learn unsupervised techniques and provide continuous improvement in accuracy and outcomes of various datasets with more reliable and concise analysis results.

Pre-requisites: Python, Basic Modeling Concepts.

Course Contents / Syllabus

UNIT-I	INTRODUCTION	8 HOURS

Model Improvement and Performance: Curse of Dimensionality, Bias, and Variance Trade-off, Overfitting and underfitting, Regression - MAE, MSE, RMSE, R Squared, Adjusted R Squared, p-Value, Classification - Precision, Recall, F1, Other topics, K-Fold Cross-validation, RoC curve, Hyper-Parameter Tuning Introduction – Grid search, random search, Introduction to Deep Learning.

Artificial Neural Network: Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: Single layer and Multilayer feed-forward networks, recurrent networks. Various learning techniques; Perception and Convergence rule, Hebb Learning. Perceptron's, Multilayer perceptron, Gradient descent, and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm.

UNIT-II	CONVOLUTION NEURAL NETWORK	8 HOURS

What is computer vision? Why Convolutions (CNN)? Introduction to CNN, Training a simple convolutional neural net, Exploring the design space for convolutional nets, Pooling layer motivation in CNN, Designing a convolutional layered application, Understanding and visualizing a CNN, Transfer learning and fine-tuning CNN, Image classification, Text classification, Image classification and hyper-parameter tuning, Emerging NN architectures.

UNIT-III	DETECTION & RECOGNITION	8 HOURS

Padding & Edge Detection, Strided Convolutions, Networks in Networks and 1x1 Convolutions, Inception Network Motivation, Object Detection, and YOLO Algorithm.

UNIT-IV	RECURRENT NEURAL NETWORKS	8 HOURS

Why use sequence models? Recurrent Neural Network Model, Notation, Back-propagation through time (BTT), Different types of RNNs, Language model and sequence generation, Sampling novel sequences, Vanishing gradients with RNNs, Gated Recurrent Unit (GRU), Long Short-Term Memory (LSTM), Bidirectional RNN, Deep RNNs

UNIT-V	AUTOENCODERS IN DEEP LEARNING	8 HOURS

Auto-encoders and unsupervised learning, Stacked auto-encoders and semi-supervised learning, Regularization - Dropout and Batch normalization.

Course outcome: After completion of this course students will be able to

CO 1	Analyze the ANN model and understand the ways of accuracy measurement.	K4

CO 2	Develop a convolutional neural network for multi-class classification in images.	K6
CO 3	Apply a Deep Learning algorithm to detect and recognize an object.	K3
CO 4	Apply RNNs to Time Series Forecasting, NLP, Text and Image Classification.	K3
CO 5	Apply Lower-dimensional representation over higher-dimensional data for dimensionality reduction and capture the important features of an object.	K3

Textbooks:

1. Zurada and Jacek M, "Introduction to Artificial Neural Systems", West Publishing Company, 1992, ISBN: 9780534954604
2. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
3. Simon Haykin, "Neural Networks and Learning Machines" Third Edition
4. Deep Learning", I Goodfellow, Y Bengio and A Courville, 1st Edition 2016
5. Introduction to Machine Learning with Python ", by Andreas C. Müller, Sarah Guido
6. R2. Deep Learning with Python by François Chollet 1st Edition

Reference Books:

1. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola "Dive into Deep Learning", Release 0.17.4
2. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Arti□Russell, S. and Norvig, N. Arti Intelligence. 2003.

NPTEL/ Youtube/ Faculty Video Link:

Unit 1	(371) Lec-1 Introduction to Artificial Neural Networks - YouTube (3) Deep Learning(CS7015): Lec 8.1 Bias and Variance - YouTube (3) Mod-10 Lec-39 Assessing Learnt classifiers; Cross Validation; - YouTube (3) Lec-1 Introduction to Artificial Neural Networks - YouTube (3) Lec-2 Artificial Neuron Model and Linear Regression - YouTube (3) Evaluation and Cross-Validation - YouTube
Unit 2	(3) Lecture 1 | Introduction to Convolutional Neural Networks for Visual Recognition - YouTube (3) Lecture 2 | Image Classification - YouTube (3) Lecture 3 | Loss Functions and Optimization - YouTube (3) Hyperparameter optimization - YouTube (3) Deep Learning(CS7015): Lec 11.3 Convolutional Neural Networks - YouTube
Unit 3	(3) C4W3L09 YOLO Algorithm - YouTube (3) Edge Detection - YouTube (3) Neural Networks - Networks in Networks and 1x1 Convolutions - YouTube
Unit 4	(3) Backpropagation in CNNs - YouTube (3) Deep RNNs and Bi- RNNs - YouTube (3) Deep Learning(CS7015): Lec 13.4 The problem of Exploding and Vanishing Gradients - YouTube (3) Deep Learning(CS7015): Lec 14.2 Long Short Term Memory(LSTM) and Gated Recurrent Units(GRUs) - YouTube
Unit 5	(3) Deep Learning(CS7015): Lec 7.1 Introduction to Autoncoders - YouTube (3) Deep Learning(CS7015): Lec 9.5 Batch Normalization - YouTube (3) Deep Learning(CS7015): Lec 7.3 Regularization in autoencoders (Motivation) - YouTube

B. TECH FOURTH YEAR			
Course code	**ACSML0752**	**L T P**	**Credit**
Course title	**DEEP LEARNING LAB**	**0 0 2**	**1**
Suggested list of Experiments			
Sr. No.	**Name of Experiment**		**CO**
1	Write a program Print Dimensions of dataset		CO1
2.	Write a program to Calculate of Accuracy Values.		CO1
3.	Write a program to Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.		CO1
4.	Write a program to Compose Matrix Shape and Tensor Shape.		CO2
5.	Write a program to showing Accessing and Manipulation of tensors.		CO2
6.	Write a program to understand the mechanism of practically training a binary classifier.		CO2
7.	Implement with a program showing Access and manipulation of tensors.		CO2
8.	Write a program to show Regression Data Sampling.		CO2
9.	Write a program to Combat Overfitting.		CO1
10.	Write a program Print Dimensions of dataset.		CO2
11.	Write a program to Calculate of Accuracy Values.		CO2
12.	Write a program to Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.		CO1
13.	Write a program to build a simple autoencoder based on a fully-connected layer in Keras.		CO3
14.	Implement Long Short-Term Memory Networks using sample data.		CO1
15.	Write a program showing Automatic Image Captioning with Keras ---Facial Recognition.		CO3
Lab Course Outcome: After completion of this course students will be able to			
CO1	Develop python programs to work on Data sets and Implement Artificial Neural Network Techniques.		K6
CO2	Explore different types of tensors and perform exploratory data analysis on different data sets.		K4
CO3	Apply Automatic Image Captioning with Keras ---Facial Recognition.		K3

B. TECH FOURTH YEAR

Course code	ACSE0712	L T P	Credits
Course title	RPA IMPLEMENTATION	3 0 0	3

Course objective: This course is designed to give a thorough understanding and practical skills in developing and deploying software robots for Robotic Process Automation (RPA).

Pre-requisites: Basic Knowledge of C Programming

Course Contents / Syllabus

UNIT-I	DATA MANIPULATION	8 HOURS

Introduction to Data Manipulation, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data Recording and Advanced UI Interaction; Recording Introduction, Basic and Desktop Recording, Web Recording, Input/output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques.

UNIT-II	SELECTORS	8 HOURS

Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image-based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices using tab for Images Starting Apps.

UNIT-III	DATA TABLES AND AUTOMATION	8 HOURS

Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table Basics Data Manipulation in Excel, Extracting Data from PDF, extracting a single piece of data, Anchors, Using anchors in PDF.

Email Automation: Email Automation, Incoming Email automation, Sending Email automation.

UNIT-IV	DEBUGGING AND EXCEPTION HANDLING	8 HOURS

Debugging Tools, Strategies for solving issues, Catching errors.

Orchestrator: Tenants, Authentication, Users, Roles, Robots, Environments, Queues & Transactions, Schedules.

UNIT-V	ROBOTIC FRAMEWORK	8 HOURS

Re-Framework template, Re-Framework template works, Use Re-Framework to automate your own processes. .NET Classes and Objects.

Course outcome: After completion of this course students will be able to:

CO 1	Apply basic concepts and methods from design engineering to explore creative solutions of real-world problems.	K3
CO 2	Learn Robotic Process Automation, and massive career opportunity in this field.	K2
CO 3	Implement the knowledge of RPA tools, functions in various industries and perform, control various tasks using RPA bots.	K3
CO4	Gain expertise in Desktop, Web & Citrix Automation and use RE-Framework to build a structured business automation process.	K2
CO 5	Develop a real-world workflow automation project and will be able to debug a workflow.	K6

Textbooks:
1) Vaibhav Jain, “Crisper Learning: For UiPath”, Latest Edition, Independently Published, 2018.
2) Alok Mani Tripathi, “Learning Robotics Process Automation”, Latest Edition, Packt Publishing ltd, Birmingham. March 2018
Reference Books/E-Books:
1) Kelly Wibbenmeyer, “The Simple Implementation Guide to Robotic Process Automation (RPA)”, Latest Edition, iUniverse Press.
2) https://www.uipath.com/hubfs/ebook-its-time-to-automate.pdf
Links:
https://www.youtube.com/watch?v=6QoCG6YIPVo&list=PL41Y-9S9wmyJarNN2KnB4XudpT1yE1kVd
https://www.youtube.com/watch?v=YOHFgrOvPTM&list=PL41Y-9S9wmyLvF6Ou0oPhg6MrFWSw7sn4
https://www.youtube.com/watch?v=QMBuyLMjOhM&list=PL41Y-9S9wmyIYX6kciM8DboVYymsv2y6K
https://www.youtube.com/watch?v=KE9raKNTkfI&list=PL41Y-9S9wmyLeXL1DY9j-XepNb_vg9N8t
https://www.youtube.com/watch?v=2rjr8QhD9oc&list=PL41Y-9S9wmyJi2zmWY77yPZrdVI7ab3Ja

B. TECH FOURTH YEAR

Course code	ACSAI0712	L T P	Credits
Course title	NATURAL LANGUAGE PROCESSING	3 0 0	3

Course objective: The course aims to provide an understanding of the foundational concepts and techniques in NLP. The focus is on providing application-based knowledge.

Pre-requisites: Programming Skills, Data Structures, Algorithms, Probability and Statistics, Machine Learning.

Course Contents / Syllabus

UNIT-I	OVERVIEW OF NATURAL LANGUAGE PROCESSING	8 HOURS

Definition, Applications and emerging trends in NLP, Challenges. Ambiguity.

NLP tasks using NLTK: Tokenization, stemming, lemmatization, stop-word removal, POS tagging, Parsing, Named Entity Recognition, coreference resolution.

UNIT-II	REGULAR EXPRESSIONS	8 HOURS

Data Preprocessing: Using Python - Convert to lower case, handle email-id, HTML tags, URLs, emojis, repeat characters, normalization of data (contractions, standardize) etc.

Vocabulary, corpora, and linguistic resources, Linguistic foundations: Morphology, syntax, semantics and pragmatics, Language models: Unigram, Bigram, N-grams.

UNIT-III	TEXT ANALYSIS AND SIMILARITY	8 HOURS

Text Vectorization: Bag-of-Words model and vector space models, Term Presence, Term Frequency, TF-IDF

Textual Similarity: Cosine similarity, Word Mover's distance, Word embeddings: Word2Vec, GloVe.

UNIT-IV	TEXT CLASSIFICATION & NLP APPLICATIONS	8 HOURS

Text classification: Implement of applications of NLP using text classification- Sentiment Analysis, Topic modelling, Spam detection.

High Level NLP applications: Machine translation: Rule-based and statistical approaches, Text summarization Dialog systems, conversational agents and chatbots.

UNIT-V	ADVANCED NLP TECHNIQUES	8 HOURS

Sequential data, Introduction to sequence models - RNN and LSTM, Attention Mechanism, Transformer, Transformer-based models: BERT, GPT, T5, Introduction to Hugging Face Transformers, Case studies.

Course outcome: After completion of this course students will be able to:

CO 1	Appreciate the emerging trends and challenges in NLP and perform the basic NLP tasks using some NLP library.	K2
CO 2	Apply regular expressions for data cleaning and understand the fundamental concepts and theories underlying NLP.	K3
CO 3	Extract features and find similarity in text data.	K3

CO4	Implement NLP techniques to design real-world NLP applications	K6
CO 5	Apply advanced techniques like sequential modelling and attention mechanism to develop NLP applications	K6

Textbooks:

1)Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Second Edition, Pearson Education, 2009 ISBN 0131873210.
2)James Allen, Natural Language Understanding, 2nd edition, 1995 Pearson Education ISBN 13: 9780805303346.
3)Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, NLP: A Paninian Perspective,1st edition1995, Prentice ISSBN 9788120309210

Reference Books:

1)Christopher D.Manning and Hinrich Schutze,, "Foundations of Statistical Natural Language Processing" , MIT Press, 1999 Second Edition, ISBN No. 0-262-13360-l.
2)T. Winograd, Language as a Cognitive Process, 1st edition, 1983 Addison- Wesley ISBN 020108-571-2
3)L.M. Ivansca, S. C. Shapiro, Natural Language Processing and Knowledge Representation, 2nd edition, 2000 AAAI Press ISBN-13: 978-0262590211

Links:

1) https://realpython.com/nltk-nlp-python/
2) https://www.coursera.org/lecture/python-text-mining/basic-nlp-tasks-with-nltk-KD8uN
3) https://www.coursera.org/lecture/nlp-sequence-models/learning-word-embeddings-APM5s
4) https://www.coursera.org/projects/regular-expressions-in-python
5) https://www.coursera.org/learn/python-text-mining/lecture/sVe8B/regular-expressions

B.TECH FOURTHYEAR		
Subject Code: ACSE0713		**L T P 3 0 0**
Subject Name:Web Development using MERN Stack with DevOps		**Credits 3**
Course Objective: This course focuses on how to design and build static as well as dynamic web pages and interactive web applications. Students can understand how to put them together to create a MERN stack application.		
Pre- requisites: Student should have the knowledge of HTML, CSS and ES6		
Course Contents/Syllabus		
Unit-1	**Introduction to React JS:** Overview of frameworks, NPM commands, React App, Project Directory Structure, React Component Basic, Understanding JSX, Props and State, Stateless and Stateful Components, Component life cycle, Hooks, react-router vs react-router-dom,	**8 Hours**
Unit-2	**Connecting React with mongodB:** Google Material UI, AppBar, Material UI's Toolbar, NavBar, Material UI Buttons, SQL and Complex Transactions, Dynamic Schema, create Index (), get Indexes () & drop Index (), Replication, Statement-based vs. Binary Replication, Auto-Sharding and Integrated Caching, Load balancing, Aggregation, scalability.	**8 Hours**
Unit-3	**Node js & Express Framework:** Introduction, Environment Setup, serving static resources, template engine with vash and jade, Connecting Node.js to Database, Mongoose Module, Creating Rest APIs, Express Framework, MVC Pattern, Routing, Cookies and Sessions, HTTP Interaction, User Authentication	**8 Hours**
Unit-4	**Evolution of DevOps:** DevOps Principles, DevOps Lifecycle, DevOps Tools, and Benefits of DevOps, SDLC (Software Development Life Cycle) models, Lean, ITIL and Agile Methodology, Agile vs DevOps, Process flow of Scrum Methodologies, Project planning, scrum testing, sprint Planning and Release management, Continuous Integration and Delivery pipeline.	**8 Hours**
Unit-5	**CI/CD concepts (GitHub, Jenkins, Sonar):** GitHub, Introduction to Git, Version control system, Jenkins Introduction, Creating Job in Jenkins, adding plugin in Jenkins, Creating Job with Maven & Git, Integration of Sonar, Dockers, Containers Image: Run, pull, push containers, Container lifecycle, Introduction to Kubernetes.	**8 Hours**
Course Outcomes –		
CO1	Apply the knowledge of ES6 that are vital to implement react application over the web.	K3
CO2	Implement and understand the impact of web designing by database connectivity with Mongodb .	K3
CO3	Explain, analyze and apply the role of server-side scripting language like Nodejs and Express js framework	K4
CO4	Identify the benefits of DevOps over other software development processes to Gain insights into the DevOps environment.	K2
CO5	Demonstrate popular open-source tools with features and associated terminology used to perform Continuous Integration and Continuous Delivery.	K3
Textbooks:		
1. Kirupa Chinnathambi, “Learning React”, 2nd Edition 2016, Addison Wesley Publication.		

2. Mohan Mehul, “Advanced Web Development with React”, 2nd Edition 2020, BPB Publications.
3. Dhruti Shah, “Comprehensive guide to learn Node.js”, 1st Edition, 2018 BPB Publications.
4. Jennifer Davis, Ryn Daniels, “Effective DevOps: Building, Collaboration, Affinity, and Tooling at Scale”,1st Edition, 2016, O'Reilly Media Publication.
5. John Edward Cooper Berg, “DevOps. Building CI/CD Pipelines with Jenkins, Docker Container, AWS (Amazon Web Services) ECS, JDK 11, Git and Maven 3, Sonar, Nexus”, Kindle Edition,2019, O'Reilly Media Edition.

Reference Books:

1. Anthony Accomazzo, Ari Lerner, and Nate Murray, “Fullstack React: The Complete Guide to ReactJS and Friends”, 4th edition, 2020 International Publishing.
2. David Cho, “Full-Stack React, Type Script, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL”, 2nd edition, 2017 Packt Publishing Limited.
3. Richard Haltman & Shubham Vernekar, “Complete node.js: The fast guide: Learn complete backend development with node.js”5th edition, 2017 SMV publication.
4. Glenn Geenen, Sandro Pasquali, Kevin Faaborg, “Mastering Node.js: Build robust and scalable real-time server-side web applications efficiently” 2nd edition Packt,2017 Publishing Limited.
5. Greg Lim,” Beginning Node.js, Express & MongoDB Development, kindle edition,2019 international publishing.
6. Daniel Perkins, “ReactJS Master React.js with simple steps, guide and instructions” 3rd edition, 2015 SMV publication.
7. Peter Membrey, David Hows, Eelco Plugge, “MongoDB Basics”, 2nd edition ,2018 International Publication.

Links: NPTEL/You Tube/Web Link:

https://youtu.be/QFaFIcGhPoM?list=PLC3y8-rFHvwgg3vaYJgHGnModB54rxOk3
https://youtu.be/pKd0Rpw7O48
https://youtu.be/TlB_eWDSMt4
https://youtu.be/QFaFIcGhPoM

https://youtu.be/Kvb0cHWFkdc
https://youtu.be/pQcV5CMara8
https://youtu.be/c3Hz1qUUIyQ
https://youtu.be/Mfp94RjugWQ
https://youtu.be/SyEQLbbSTWg

https://youtu.be/BLl32FvcdVM
https://youtu.be/fCACk9ziarQ
https://youtu.be/YSyFSnisip0
https://youtu.be/7H_QH9nipNs
https://youtu.be/AX1AP83CuK4

https://youtu.be/2N-59wUIPVI
https://youtu.be/hQcFE0RD0cQ
https://youtu.be/UV16BbPcMQk
https://youtu.be/fqMOX6JJhGo

https://youtu.be/m0a2CzgLNsc
https://youtu.be/1ji_9scA2C4
https://youtu.be/tuIZok81iLk
https://youtu.be/IluhOk86prA
https://youtu.be/13FpCxCClLY