Dr. Babasaheb Ambedkar Technological University, Lonere

(Established as a University of Technology in the State of Maharashtra)

(Under Maharashtra Act No. XXIX of 2014)

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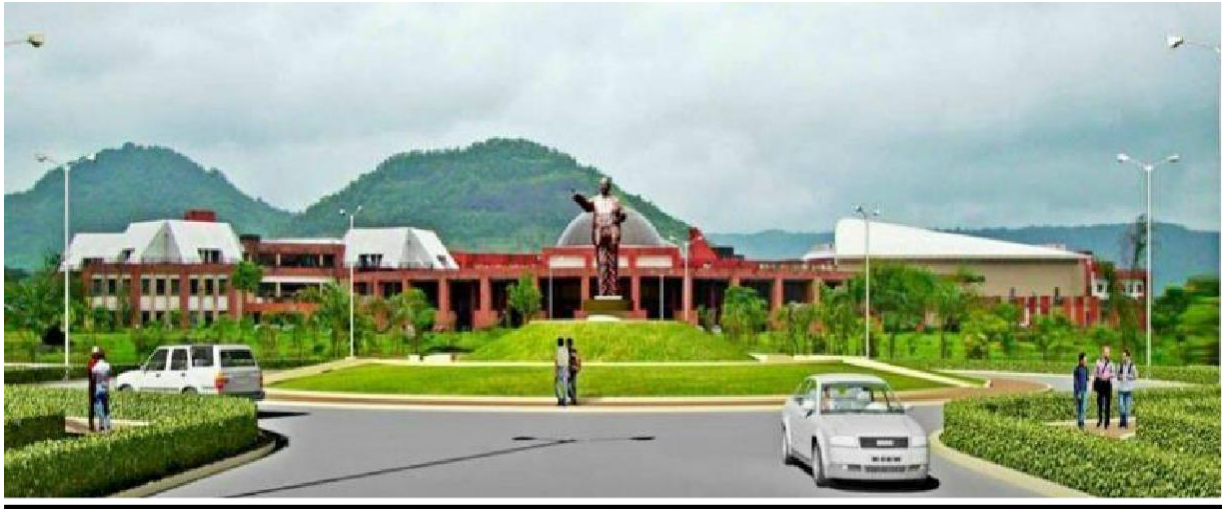
CURRICULUM FOR POST GRADUATE PROGRAMME

M. TECH

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

In line with New Education Policy 2020 guidelines

(Effective from Academic Year 2024-25)



Semester I

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC	MTAI101	Mathematics for AI	3	1	-	20	20	60	100	4
PCC	MTAI102	Advanced Machine Learning	3	1	-	20	20	60	100	4
PCC	MTAI103	Deep Learning	3	1	-	20	20	60	100	4
PEC	MTAI104	Program Elective - I 1. Quantum Computing 2. Industrial IoT 3. Cloud Computing	3	1	-	20	20	60	100	4
PEC	MTAI105	Program Elective -II 1.High Performance Computing 2.Cryptography and Network Security 3.Reinforcement Learning	3	1	-	20	20	60	100	4
Lab	MTAI106 L	Advanced Machine Learning and Deep learning Lab	-	-	4	60	-	40	100	2
CC	MTAI107	YOGA for Stress Management	-	-	2	-	-	-	-	Audit
			15	**5**	**6**	**160**	**100**	**340**	**600**	**22**

Semester II

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC	MTAI201	Full stack Development	3	1	-	20	20	60	100	4
PCC	MTAI202	Data Engineering	3	1	-	20	20	60	100	4
	MTAI203	Program Elective -III 1. DevOps 2. Natural Language Processing 3. Advanced Data Analytics	3	1	-	20	20	60	100	4
OE	MTAI204	Open Elective-I	3	-	-	20	20	60	100	3
PEC	MTAI205	Full stack Development Data Engineering Lab	-	-	2	60	-	40	100	1
PEC	MTAI206	Disaster Management	-	-	2	-	-	-	-	Audit
IKS	MTAI207	IKS Bucket#	3	-	-	20	20	60	100	3
ELC	MTAI208	Mini Project with seminar-I	-	-	4	60	-	40	100	2
			15	**3**	**8**	**220**	**100**	**380**	**700**	**21**

Semester III

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
OE	MTAI301	Open Elective II	3	-	-	20	20	60	100	3
MDM	MTAI302	Multidisciplinary Minor	3	-	-	20	20	60	100	3
ELC	MTAI303	Seminar II	-	-	4	60	-	40	100	2
ELC	MTAI304	Project I	-	-	4	60	-	40	100	10
			6	**-**	**8**	**160**	**40**	**200**	**400**	**18**

Semester IV

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC	MTAI401	Project Part II / OJT	-	-	24	100	-	100	200	12
			-	**-**	**24**	**100**	**-**	**100**	**200**	**12**

First Year (Semester –I)

Mathematics for AI

MTAI101	Mathematics for AI	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Undergraduate level mathematics

Course Contents:

Unit No 1:	**Linear Algebra and Calculus**	**[7 Hours]**
Vector Spaces and Operations, Scalars, Vectors, Matrices, Vector addition, scalar multiplication, Dot product, cross product, Matrix Operations, Matrix addition, multiplication, Transpose, inverse, and determinant, Special matrices (identity, diagonal), Eigenvalues and Eigenvectors, Applications in AI: PCA,SVD.Partial Differentiation, Chain rule, Gradients, Jacobian, Applications: Gradient descent optimization.		
Unit No 2:	**Probability Theory**	**[7 Hours]**
Basic Concepts, Random variables: discrete and continuous, Probability distributions: PMF, PDF, CDF, Expected value, variance, Common distributions: Binomial, Normal; Conditional Probability, Bayes' theorem, Independence, Applications in AI: Naïve Bayes classifier.		
Unit No 3:	**Descriptive Statistics**	**[6 Hours]**
Mean, Median, Variance, Standard Deviation, Quartiles, Percentiles, Interquartile Range, Skewness,Kurtosis, Histograms, Box Plots, Scatter Plots, Exploratory Data Analysis. Applications in AI: Customer Satisfaction Survey**,** Student Performance Analysis.		
Unit No 4:	**Inferential Statistics**	**[8 Hours]**
Introduction to Inferential Statistics, Probability Distributions (Discrete and Continuous), Central Limit Theorem, Sampling Distributions (Mean and Proportion), Estimation (Point and Interval), Hypothesis Testing (One-Sample, Two-Sample, Chi-Square), statistical significance and p-values, Chi-square test, Non-Parametric Methods (Mann-Whitney U test, Kruskal-Wallis test), Analysis of Variance (ANOVA).		
UNIT 5: Linear Regression Analysis		**[07 Hours]**
Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient.		

Reference Books

1.	Essential Maths For Data Science by Thomas Nield
2.	Practical Statistics for Data Scientist by Pere Bruce,Andrew Bruce and Petee Gedeck
3.	Mathematics for Machine Learning" by Marc Peter Deisenroth
4.	Introduction to Probability and Statistics for Engineers and Scientists" by Sheldon M. Ross
5.	Linear Algebra and Its Applications" by Gilbert Strang

First Year (Semester –I)

Advanced Machine Learning

MTAI102	Advanced Machine Learning	3L- 1T - 0P	4 Credits

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: Basics Machine Learning

Course Contents:

Unit No 1:	Foundations and Revision of Supervised Learning	[7 Hours]
Introduction to Supervised Learning : Definitions and Paradigms, Importance of Datasets inMachine Learning, Data Normalization Techniques, Hypothesis Evaluation Metrics Revision: Linear Regression, Logistic Regression, and Generalized Linear Models Bayes Decision Theory : Minimum Error Rate Classification, Normal Density and Discriminant Functions, Maximum Likelihood Estimation, Bayesian Parameter Estimation		
Unit No 2:	**Unsupervised Learning and Clustering**	**[9 Hours]**
Introduction to Unsupervised Learning : Overview and Importance, Clustering Techniques: K-means, Hierarchical, K Medoids, Silhouette Algorithm for Optimal K Selection Principal Component Analysis (PCA) : Fundamentals and Intuition, Dimensionality Reduction and Feature Selection, Applications: PCA on Images, Eigenfaces		
Unit No 3:	**Reinforcement Learning**	**[8 Hours]**
Reinforcement Learning Basics : Introduction and Applications, Exploration vs ExploitationDilemma, Markov Decision Processes (MDP), Q-learning and Policy Iteration : Q values and V values, Q-learning Algorithms, Policy Iteration Techniques		
Unit No 4:	**Time Series Analysis and Neural Networks**	**[9 Hours]**
Time Series Analysis : Importance and Components of Time Series DataTime Series Models: AR, MA, ARMA, ARIMA, Stationarity and Autocorrelation Function (ACF) & Partial Autocorrelation Function (PACF)		
Unit No 5:	**Advanced Techniques and Model Selection**	**[7 Hours]**
Kernel Methods and Boosting Techniques: Kernel Tricks and Support Vector Machines (SVM), Kernelized Support Vector Regression (K-SVR) and Kernel PCA, Boosting Algorithms: AdaBoost,Gradient Boosting **Model Selection and Evaluation** :Need and Importance of Model Selection, Cross-Validation Techniques, Evaluation Metrics for Model Selection		

Reference Books

1.	Shalev-Shwartz,S., Ben-David,S., (2014), Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press
2.	R. O. Duda, P. E. Hart, D. G. Stork (2000), Pattern Classification, Wiley-Blackwell, 2nd Edition.
3.	Mitchell Tom (1997). Machine Learning, Tata McGraw-Hill

First Year (Semester –I)

Deep Learning

MTAI103	Deep Learning	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic understanding of Machine Learning Concepts and Python programming.

Course Contents:

Unit No 1:	Fundamentals of Neural Network	[7 Hours]
Introduction to Neuron and Neural Networks, MP Neuron, Perceptron Learning, Error and Error Surfaces,Linear Classifiers, Activation Functions, Feedforward Neural Networks, Forward Propagation in Neural Networks, Working of Neural Networks, Use of Vectorization, Multilayer Perceptron (MLP), Understanding Learning Parameters of Neural Network, Understanding Training, Testing, and Validation Data, Loading and Feeding Datasets to the Neural Network.		
Unit No 2:	**Backpropagation and Optimization in Neural Network**	**[7 Hours]**
Objective/Loss Functions, Role of Optimizer, Computation Graph, Computing Gradients, BackpropagationLearning, Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Build a Neural Network with Two-Three Hidden Layers Using Forward Propagation and Backpropagation.		
Unit No 3:	**Performance Analysis and Effective Training in Neural Network**	**[7 Hours]**
Performance Metrics for Classification and Regression, Understanding Overfitting and Underfitting, Initialization Strategies for Neural Networks, Greedy Layerwise Pre-training, Better Activation Functions, Better Weight Initialization Methods, Batch Normalization, Challenges in Training Deep Neural Networks,Vanishing and Exploding Gradients, Regularization: Bias-Variance Tradeoff, L2 Regularization, Early Stopping, Dataset Augmentation, Understanding Hyperparameters, Tuning Hyperparameters.		
Unit No 4:	**Convolutional Neural Network (CNN)**	**[8 Hours]**
Dense Neural Network vs CNN, Convolutional Neural Network Building Blocks: Convolution, Pooling, Transpose Convolution, Dilated Convolution, Dense Layers, Padding, Backpropagation in CNN, Understanding Trainable Parameters of CNN, CNN for Image Classification, CNN for Segmentation, CNNfor Object Detection, Transfer Learning, Fine-Tuning Pre-trained CNN Models, Skip Connections, Why Skip Connections Works, Different Convolutional Neural Network Architectures: LeNet, AlexNet, ZF-Net,VGGNet, GoogLeNet, ResNet		
Unit No 5:	**Advanced Techniques in Unsupervised and Semi-Supervised Learning**	**[7 Hours]**
Autoencoders, Sparse Autoencoders, Regularization in Autoencoders, Denoising Autoencoders, StackedAutoencoders, Self-Organizing Map, Contrastive Learning, One-Shot Learning, Meta Learning, Siamese Networks, Graph Neural Networks		

Reference Books

1.	1.Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press
2.	2.Francois Challot, “Deep Learning with Python”, second edition.
3.	Michael Nielsen, Neural Networks and Deep Learning, 2016

First Year (Semester –I)

Quantum Computing

MTAI104A	Quantum Computing	3L- 1T - 0P	4 Credits

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: Linear Algebra, Calculus.

Course Contents:

Unit No 1:	Introduction and overview	[7 Hours]
Global perspectives, Quantum bits, Quantum computation, Quantum algorithms, Experimental quantum information processing, Quantum information		
Unit No 2:	**Qubits and Quantum States**	**[7 Hours]**
The Qubit, Vector Spaces, Linear Combinations of Vector, Uniqueness of a Spanning Set, Basis and Dimension, Inner Products, concepts of superposition and entanglement		
Unit No 3:	**Quantum Mechanics**	**[7 Hours]**
The State of a Quantum System, Time-Evolution of a Closed System, Composite Systems, Measurement, Mixed States and General Quantum Operations		
Unit No 4:	**Quantum Model of Computation**	**[8 Hours]**
The Quantum Circuit Model, Quantum Gates, Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations, Efficiency of Approximating Unitary Transformations, Implementing Measurements with Quantum Circuits		
Unit No 5:	**Introductory Quantum Algorithms**	**[7 Hours]**
Probabilistic Versus Quantum Algorithms, Phase Kick-Back, The Deutsch Algorithm, The Deutsch–Jozsa Algorithm, Simon's Algorithm		

Reference Books

1.	Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.
2.	Quantum Computation and Quantum Information, M. A. Nielsen &I.Chuang, Cambridge University Press (2013)
3.	David McMahon-Quantum Computing Explained-Wiley-Interscience , IEEE Computer Society (2008)

First Year (Semester –I)

INDUSTRIAL IOT

MTAI104B	Industrial IOT	3L- 1T - 0P	4 Credits

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:

Course Contents:

Unit No 1:	Introduction to Industrial IoT (IIoT) Systems	[5 Hours]
The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.		
Unit No 2:	**Implementation systems for IIoT**	**[10 Hours]**
Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitionson IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, Wi-Fi, and LoRa Protocols and IoT Hub systems.		
Unit No 3:	**IIoT Data Monitoring & Control**	**[10 Hours]**
IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for DataMonitoring, Data Analytics and Predictive Maintenance with IIoT technology.		
Unit No 4:	**Cyber Physical Systems:**	**[6 Hours]**
Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Realityand Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis		
Unit No 5:	**Industrial IoT- Applications**	**[5 Hours]**
Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (IncludingAR and VR safety applications), Facility Management. Case Study.		

Reference Books

1.	Industry 4.0: The Industrial Internet of Things Alasdair GilchristPublications: Apress
2.	The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
3.	Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.
4.	Dr. OvidiuVermesan, Dr. Peter Friess, "*Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems*", River Publishers

First Year (Semester –I)

CLOUD COMPUTING

MTAI104C	Cloud Computing	3L- 1T - 0P	4 Credits

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:

Course Contents:

Unit No 1:	Cloud Computing Overview	[10 Hours]
Origins of Cloud computing – Cloud components - Essential characteristics – On-demand selfservice,Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.		
Unit No 2:	**Cloud Insights**	**[8 Hours]**
Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.		
Unit No 3:	**Cloud Architecture- Layers and Models**	**[8 Hours]**
Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.		
Unit No 4:	**Introduction to VMWare Simulator**	**[7 Hours]**
Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtualmachines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.		
Unit No 5:	**Cloud Integration with AI and Data Science**	**[7 Hours]**
AI and Data Science Workflows in the Cloud, Machine Learning as a Service (MLaaS), Big Data Processing in the Cloud: Hadoop, Spark on Cloud, Data Pipelines and Workflow Orchestration, Deploying AI Models on Cloud Platforms		

Reference Books

1.	Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
2.	"Cloud Computing: Principles and Paradigms" by Rajkumar Buyya, James Broberg, and Andrzej M. Goscinski
3.	"Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis
4.	"AWS Certified Solutions Architect Official Study Guide: Associate Exam" by Joe Baron, Hisham Baz, Tim Bixler, et al.
5.	"Google Cloud Platform for Architects" by Vitthal Srinivasan, Karthik Sonti
6.	"Azure for Architects: Implementing Cloud Design, DevOps, IoT, and Serverless Solutions" by Ritesh Modi

First Year (Semester –I)

High Performance Computing

MTAI105A	High Performance Computing	3L- 1T - 0P	4 Credits

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: Basics of Computer Architecture and Organization

Course Contents:

Unit No 1:	Introduction	[7 Hours]
Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Architectures: N-wide superscalar architectures, Multi-core architecture.		
Unit No 2:	**Parallel Programming**	**[7 Hours]**
Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, A Brief History of GPUs.		
Unit No 3:	**Basic Communication**	**[7 Hours]**
Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Communication Operations.		
Unit No 4:	**Parallel Algorithms- Sorting and Graph**	**[8 Hours]**
Issues in Sorting on Parallel Computers, Parallelizing Quick sort, Bubble Sort and its Variants, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel Best- First Search.		
Unit No 5:	**CUDA Architecture**	**[7 Hours]**
CUDA Architecture, Applications of CUDA : Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C.		

Reference Books

1.	High Performance Computing by CRC PRESS. TAYLOR & FRANCIS
2.	CUDA by Example , by Jason sanders, Edward Kandrot
3.	Introduction to Parallel Computing, by Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar

First Year (Semester –I)

CRYPTOGRAPHY AND NETWORK SECURITY

MTAI105B	Cryptography And Network Security	3L- 1T - 0P	4 Credits

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: UG level course in Mathematics, Data Structures

Course Contents:

Unit No 1:	Cryptography Concepts and Techniques	[7 Hours]
Security Concepts: 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, substitutiontechniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.		
Unit No 2:	**Symmetric And Asymmetric key Ciphers**	**[7 Hours]**
Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipheroperation, Stream ciphers, RC4. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, ElGamal Cryptography, Diffie- Hellman Key Exchange, Elliptic Curve Cryptography		
Unit No 3:	**Key Management and Distribution**	**[7 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:	**Wireless Network Security**	**[7 Hours]**
Transport-level Security: Web security considerations, Secure Socket Layer and Transport LayerSecurity, 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:	**E-Mail Security & Firewall**	**[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. **Firewalls:** Firewall Design Principles, Types of Firewalls. Viruses and Intruders. **Case Studies on Cryptography and security:** Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.		

Reference Books

1.	Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition 2011.
2.	Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition 2010.
3.	Information Security, Principles, and Practice: Mark Stamp, Wiley India 2011.
4.	Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH 2016.
5.	Introduction to Network Security: Neal Krawetz, CENGAGE Learning 2007.
6.	Network Security and Cryptography: Bernard Menezes, CENGAGE Learning 2010.

First Year (Semester –I)

Reinforcement Learning

MTAI105C	Reinforcement Learning	3L- 1T - 0P	4 Credits

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: Machine Learning, AI Basic Concepts and Use cases

Course Contents:

Unit No 1:	Introduction to Reinforcement Learning	[8 Hours]
Definition and key components of RL, Markov decision processes (MDPs) and states, actions, rewards, transitions, Exploration-exploitation dilemma, Policy evaluation and control methods, Value functions and the Bellman equation		
Unit No 2:	**Reinforcement Learning Algorithms**	**[8 Hours]**
Monte Carlo methods (MC, TD, Q-learning), On-policy vs. off-policy methods, SARSA and its variants, Actor-critic methods (e.g., DDPG, SAC), Deep Q-learning (DQN) and related algorithms		
Unit No 3:	**Reinforcement Learning Techniques**	**[8 Hours]**
Multi-agent reinforcement learning (MARL), Hierarchical reinforcement learning, Policy search methods, Model-based reinforcement learning, Safety and ethical considerations in RL		
Unit No 4:	**Advanced Reinforcement Learning Techniques**	**[8 Hours]**
Multi-agent RL, hierarchical RL, continuous control, safety and ethical considerations in RL		
Unit No 5:	**Unit No 5:**	**[8 Hours]**
Real-world examples in robotics, game playing, control systems, resource management, etc. Case studies and open challenges in RL research		

Reference Books

1.	Richard S. Sutton and Andrew G. Barto; Reinforcement Learning: An Introduction; 2nd Edition, MIT Press, 2020.
2.	Dimitri P. Bertsekas; Reinforcement Learning and Optimal Control; 1st Edition, Athena Scientific, 2019.
3.	Csaba Szepesvári; Algorithms of Reinforcement Learning; Synthesis Lectures on Artificial Intelligence and Machine Learning, vol. 4, no. 1, 2010.

First Year (Semester –I)

Advanced Machine Learning and Deep learning Lab

MTAIL106	**Advanced Machine Learning and Deep learning Lab**	**0L- 0T - 4P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 4 hrs./week	Continuous Assessment : 60 Marks End Semester Exam: 40 Marks (Duration 03 hrs.)

Students need to perform five practicals from Advance machine leaning and five practical's form deep leaning lab

First Year (Semester –I)

YOGA for Stress Management

MTAI107	YOGA for Stress Management	**0L- 0T - 2P**	**AUDIT COURSE**

Course Contents:

Unit No 1:		**[8 Hours]**
Introduction to Yoga for Stress Management - 1 Introduction to Yoga for Stress Management - 2 Stress according to Western perspective Stress Eastern Perspective Developmental process: Western and Eastern Perspective Stress Hazards and Yoga		
Unit No 2:		**8 Hours]**
Meeting the challenges of Stress - 1 Meeting the challenges of Stress - 2 Introduction to Stress PhysiologyStress, Appetite and Dietary management- Modern and Yogic perspective Sleep and Stress: understanding the relationship for effective management of stress		
Unit No 3:		**8 Hours]**
Stress Assessment methods- a valuable tool toward stress management Role of Yoga in prevention and management of stress related disorders – a summary of research evidence Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 1 Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 2 Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 3		
Unit No 4:		**8 Hours]**
Concept of stress and its management - perspectives from Bhagavad Gita - Part 1 Concept of stress and its management - perspectives from Bhagavad Gita - Part 2 Concept of stress and its management - perspectives from Bhagavad Gita - Part 3		
Unit No 5:		**[8 Hours]**
Bio-Psycho-Socio-Spiritual model of stress management Yoga practices for Stress Management Breathing practices – 1 Hands in and out breathing, Hands stretch breathing, Ankle stretch breathing Breathing practices – 2Dog Breathing, Rabbit breathing, Tiger breathing, Sashankasana breathing Breathing practices – 3 Bhujangasana breathing, Ardha Shalabhasana breathing (alternate legs), Straight leg raising (alternate legs), Straight leg raising (both legs), Sethubandhasana lumbarstretch, Instant Relaxation Technique (IRT) Loosening Practices – 1 Shoulder Rotation, Side bending, standing twist, Hip rotation, Thigh strengthening Loosening practices – 2 Chakki chalan, Bhunamasana Chalana, Alternative toe touching Loosening practices – 3 Side leg raising, Pavana muktasana kriya: Wind releasing pose movements, Quick Relaxation Technique (QRT)		
Unit No 6:		**[8 Hours]**
Asana practices – 1 Tadasana, Ardhakati Chakrasana, Ardha Chakrasana, Trikonasana, Vrikshasana Asana practices – 2 Vakarasana, Janu Sirshasana, Ushtrasana, Sashankasana, Asana practices – 3 Ardhamatseyndrasana, Paschimottanasana, Poorvottanasana, Gomukhasana Asana practices – 4 Makarasana, Bhujangasana, Salambha Shalabahasana, Dhanurasana Asana practices – 5 Setubandhasana, Sarvangasana, Mastyasana, Deep Relaxation Technique (DRT) Soorya Namaskar Pranayama – 1 Kapalbhati kriya and Sectional Breathing Pranayama – 2 Nadishuddhi Pranayama Pranayama – 3 Bhramari, Sheetali, Sitkari and Ujjayi Om Meditation Cyclic Meditation Integrated Yoga Module I Integrated Yoga Module II Integrated Yoga Module III		

Reference Books

1. H R Nagendra and R Nagarathna. Yoga for Promotion of Positive Health. Swami VivekanandaYoga Prakashana. 2011.
2. Contrada, R., & Baum, A. (Eds.). The handbook of stress science: Biology, psychology, andhealth. Springer Publishing Company. 2010
3. Al'Absi, M. (Ed.). Stress and addiction: Biological and psychological mechanisms. Elsevier. 2011.
4. Van den Bergh, O. Principles, and practice of stress management. Guilford Publications. 2021.
5. Swami Muktibodhananda, Hatha Yoga Pradipika, Bihar Scool of Yoga, 1998
6. Swami Satyananda Saraswati, Four Chapters on Freedom, Bihar Scool of Yoga, 1975
7. Swami Tapasyananda, Srimad Bhagavat Gita, Sri Ramakrishna Math, 2012

First Year (Semester –II)

Fullstack Development

MTAI201	Full Stack Development	3L- 1T - 0P	4 Credits

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 programming knowledge, Understanding of HTML and CSS.

Course Contents:

Unit No 1:	Full Stack Development Basics	[7 Hours]
Introduction to full-stack development, Client-server architecture and HTTP protocol, Setting up development environment (IDEs, version control), Introduction to Git and GitHub for version Control, HTML, CSS, CSS3, JavaScript: Fundamentals of JS , Function, Working with Forms, Event handling. Document Object Model (DOM) and its structure, ES functions, BootStrap		
Unit No 2:	**Front-End Framework (React)**	**[7 Hours]**
Introduction to React, Overview of React, Virtual DOM, JSX syntax, Setting up a React development environment, React component, PROPS, State and Evenet Handling, Component lifecycle methods, Hooks useState and useEffect, Managing forms and user input, Custom hooks for reusable logic, Context API for global state management, Routing and Navigation		
Unit No 3:	**Backend Django Framework**	**[7 Hours]**
Overview of Django and its components, Installation of Python and Django, Creating a virtual environment, Setting up a Django project and app, Understanding project structure and basics of Django models, Views, Templates and Forms,		
Unit No 4:	**Authentication, Authorization, and Django REST Framework**	**[7 Hours]**
User authentication and registration, Customizing Django authentication system, User permissions and groups, Introduction to Django REST Framework (DRF), Building RESTful APIs with DRF, Overview of databases (SQL vs. NoSQL), Introduction to SQL databases (e.g., MySQL, PostgreSQL), Working with ORM (Object-Relational Mapping) libraries, Introduction to NoSQL databases (e.g., MongoDB), Integrating databases with back-end frameworks		
Unit No 5:	**Deployment, Testing**	**[7 Hours]**
Introduction to cloud platforms (e.g., AWS, Azure, Google Cloud), Version control and project management with Git, Authentication and Authorization, Deployment strategies for web applications, Deploying and testing of web applications.		

Reference Books

1. Head First HTML and CSS by Elisabeth Robson (beginner-friendly, visual learning)
2. Eloquent JavaScript by Marijn Haverbeke (in-depth JavaScript guide)
3. Learning PHP, MySQL & JavaScript by Robin Nixon (comprehensive introduction to all three technologies)
4. Pro Git by Scott Chacon (essential guide to version control for web development)
5. "Learning React: Modern Patterns for Developing React Apps" by Alex Banks and Eve Porcello
6. "React Up and Running: Building Web Applications" by Stoyan Stefanov
7. "Pro React" by Cassio de Sousa Antonio
8. "Django for Beginners" by William S. Vincent
9. "Two Scoops of Django: Best Practices for Django 3.x" by Daniel Roy Greenfeld and Audrey Roy Greenfeld
10. "Django 3 by Example" by Antonio Mele
11. "High-Performance Django" by Peter Baumgartner and Yann Malet
12. "Django Documentation" (Official Django Documentation)
13. "Django Unleashed" by Andrew Pinkham

First Year (Semester –II)

Data Engineering

MTAI202	Data Engineering	3L- 1T - 0P	4 Credits

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.)

Course Contents:

Unit No 1:	Introduction to Data Engineering	[7 Hours]
Contents- Introduction to Data Engineering, Role of a Data Engineer, Differences between Data Engineering, Data Science, and Data Analysis, Data Types and Formats (Structured, Semi-Structured, Unstructured), Data Lifecycle, Introduction to ETL (Extract, Transform, Load) Processes, Brief Introduction to Database Systems (Relational, NoSQL), Data Warehousing Concepts		
Unit No 2:	**Data Collection and Ingestion**	**[7 Hours]**
Contents- Data Source Identification, Data Ingestion Methods (Batch, Real-Time), ETL vs. ELT, Introduction to various ETL Tools (Apache Nifi, Talend, Informatica), Building ETL Pipelines, Introduction to Stream Processing, Tools and Frameworks (Brief Introduction to Apache Kafka, Apache Flink , Apache Storm), Data APIs and Web Scraping Techniques		
Unit No 3:	**Data Storage and Management**	**[7 Hours]**
Contents- Data Warehousing (Brief Introduction to Amazon Redshift, Google BigQuery, Snowflake), Data Lakes (Hadoop HDFS, AWS S3, Azure Data Lake), Data Modeling Concepts, Normalization and Denormalization, ER Diagrams, Introduction to Hadoop Ecosystem, Apache Spark for Data Processing		
Unit No 4:	**Data Processing and Transformation**	**[8 Hours]**
Contents- Data Cleaning Techniques, Data Transformation and Aggregation, Handling Missing and Inconsistent Data, Advanced SQL (Complex Queries, Joins, Window Functions, CTEs), Workflow Orchestration Tools (Brief Introduction to Apache Airflow), Scheduling and Monitoring Data Pipelines, Python for Data Engineering (Pandas), Writing Efficient and Scalable Data Transformation Scripts		
Unit No 5:	**Data Quality, Security, and Governance**	**[7 Hours]**
Contents- Data Quality Management (Validation, Error Handling, Data Profiling), Metadata Management, Data Lineage, Regulatory Compliance (GDPR, CCPA), Data Security (Encryption, Access Control, Authentication), Secure Data Transmission, Monitoring and Logging (Prometheus, Grafana, ELK Stack), Troubleshooting and Debugging Data Pipelines		

Reference Books

1.	“Data Engineering with python” by Paul Crickard
2.	Data Engineering Cookbook" by Andreas Kretz
3.	Building Data Streaming Applications with Apache Kafka" by Saurabh Gupta

First Year (Semester –II)

DevOps

MTAI203A	DevOps	3L- 1T - 0P	4 Credits

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: Software Engineering Basics

Course Contents:

Unit No 1:		**[7 Hours]**
Introduction: Devops, SDLC Models,Lean, Agile, Why Devops?, History Of Devops, Devops Stakeholders, Devops Goals, Devops Perspective, Devops And Agile, Devops Tools		
Unit No 2:		**[7 Hours]**
Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.		
Unit No 3:		**[7 Hours]**
Container: Objective and Concept, Container Vs Virtual Machine, Docker introduction and installation on Different OS (CentOS, Windows, etc.), Docker Commands toMaintain Container, Docker Compose, Docker: Registry, Hub, Communication/Networking within Single Docker Container, Communication/Networking acrossDocker Container, Building Docker Images		
Unit No 4:		**[7 Hours]**
CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment , Benefits of CI/CD,Metrics to track CICD practices		
Unit No 5:		**[7 Hours]**
Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment		

Reference Books

1.	Engineering DevOps by Marc Hornbeek
2.	Continuous Delivery with Docker and Jenkins By Rafał Leszko
3.	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , JezHumb,1st Edition, O'Reilly publications, 2016.

First Year (Semester –II)

Natural Language Processing

MTAI203B	Natural Language Processing	3L- 1T - 0P	4 Credits

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: Basics of Artificial Intelligence.

Course Contents:

Unit No 1:	**Fundamental of NLP**	**[7 Hours]**
Introduction, Regular Expressions, Text Normalization, Edit Distance, N-gram Language Models		
Unit No 2:	**Sequence Labeling for Parts of Speech and Named Entities**	**[7 Hours]**
Part-of-Speech Tagging, Named Entities and Named Entity Tagging, HMM Part-of-Speech Tagging, Conditional Random Fields (CRFs), Evaluation of Named Entity Recognition		
Unit No 3:	**Neural Networks and Neural Language Models**	**[7 Hours]**
Units, The XOR problem, Feedforward networks for NLP: Classification, Training Neural Nets, Feedforward Neural Language Modeling, Training the neural language mode		
Unit No 4:	**RNNs, LSTM, Transformers and Large Language Models**	**[8 Hours]**
Recurrent Neural Networks, RNNs as Language Models, RNNs for other NLP tasks, The LSTM, The Transformer: A Self-Attention Network, Multihead Attention, Transformer Blocks		
Unit No 5:	**Applications**	**[8 Hours]**
Question Answering and Information Retrieval, Machine Translation ,Biomedical Text Mining ,Emerging Applications of Natural Language Generation in Information Visualization, Education, and Health Care		

Reference Books

1.	Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009.
2.	Nitin Indurkhya and Fred J Damerau, "Handbook of natural language processing," Chapman and Hall/CRC, 2010.
3.	Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit" by Steven Bird, Ewan Klein, and Edward Loper.

First Year (Semester –II)

Advanced Data Analytics

MTAI203C	**Advanced Data Analytics**	**3L- 1T - 0P**	**4 Credits**

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: Mathematics for AI & Statistics

Course Contents:

Unit No 1:	**Foundations of Data Analytics**	**[8 Hours]**
The statistical Methods, Misuse, Misinterpretation and bias, Sampling and sampling size, Data preparationand cleaning, Missing data and data errors, Exploratory Data Analysis, Statistical error, Statistical Modeling, Computational Statistics, Inference, Bias, Cofounding, Hypothesis testing, Types of error, Statistical significance, Confidence Interval, Power and robustness, Degrees of freedom, Non parametric analysis.		
Unit No2:	**Data transformation and standardization**	**[8 Hours]**
Box-Cox and power transforms, Freeman-Tukey (square root and arcsine) transforms, Log and Exponential transforms, Logit transforms, Normal transform.		
Unit No 3:	**Randomness and Randomization**	**[8 Hours]**
Random numbers , Random permutations , Resampling , Runs test , Random walks , Markov processes , Monte Carlo methods		
Unit No 4:	**Classical Tests and Contingency Tables**	**[8 Hours]**
Goodness of fit tests: Anderson-Darling, Chi-square test, Kolmogorov-Smirnov, Ryan-Joiner, Shapiro-Wilk,Jarque-Bera, Lilliefors; Z- test: test of single mean, standard deviation known, Test of the difference between two means, standarddeviation known, test for proportions, P; T-tests: test of single mean, standard deviation not known, Test of the difference between two means,standard deviation not known, test of regression coefficients		
Unit No5:	**Analysis of Variance and Covariance**	**[8 Hours]**
ANOVA: Single factor or one way ANOVA, Two factor or two-way and higher-way ANOVA, MANOVA, ANCOVA; Non Parametric ANOVA: Kruskal Wallis ANOVA, Friedam ANOVA test, Mood's median		

Reference Books

1.	"Data Mining: Concepts and Techniques" by Jiawei Han and Micheline Kamber
2.	"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
3.	"High-Performance Spark: Best Practices for Scaling and Optimizing Apache Spark" by Holden Karau and Rachel Warren
4	"Ensemble Learning: A Concise Introduction" by Thomas G. Dietterich

First Year (Semester –II)

New Labour Codes of India

MTAI204A	**New Labour Codes of India**	**3L- 0T - 0P**	**3 Credits**

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:

Course Contents:

Unit No 1:	**History of Labour Laws**	**[8 Hours]**
Introduction**,** Government Policies, History of Labour Laws in the Country, History: Previous Social Legislations in India, National Labour Commission Reports		
Unit No 2:	**Trade Unions**	**8 Hours]**
Evolution of Trade Unions in India, Constitutional Freedom to Form Association and Unions, International Labour Organization on Trade Unions, Trade Union – Definition, Registration, Cancellation, Management of Funds, Trade Union – Recognition, Immunities.		
Unit No 3:	**Strikes & Layoffs**	**8 Hours]**
Industrial Dispute – Introduction, Definitions, Resolution of Industrial Disputes, Concept of Workmen, Contract of service, Contract for service, Strike, Lock-out, Retrenchment, Closure of Undertakings, Industrial Employment (Standing Orders), Disciplinary Action and Procedures**.**		
Unit No 4:	**Payment of Wages**	**8 Hours]**
The Code on Wages 2019 – An Introduction, Minimum Wages, Floor Wages, Central and State Advisory Board, Payment of Wages, Deductions & Recovery, Fines, Equal Remuneration, Bonus, Minimum Wage Fixing Convention, 1970, Protection of Wages Convention, 1949, Equal RemunerationConvention, 1951: International Instruments on Equality of Pay, Protection of Workers‘ Claims (Employer‘s Insolvency) Convention, 1992, Discrimination (Employment and Occupation) Convention,1992		
Unit No 5:	**Social security & Insurance**	**[8 Hours]**
Employees State Insurance, Different Benefits under the ESI Scheme, Employee‘s Provident Fund, Gratuity, Maternity Benefit, Social Security in case of Building and other Construction Workers, Social Security for Unorganized sector and Platform workers, Bonded Labour System Abolition and Regulation, Child Labour Prohibition, Plantation Labour.		
Unit No 6:	**Factories & various types of workers**	**[8 Hours]**
The Meaning of Factory, Manufacturing Process, Approval and Licensing of Factories, Role of Inspector-cum-facilitator and Other Authorities, Social Security Fund, Offences and Penalties, Contract Labour and Proposed ILO Convention, Inter-State Migrant Workers**,** Mines Workers, Beedi and Cigar Workers (Kerala & West Bengal Legislations), Audio- Visual workers, Cine-workers and Dockworkers, The Effective Abolition of Child Labour (ILO: C029, C105, C138 & C182), The GovernanceConvention of ILO Labour Standards.		

Reference Books

1. Labour Law (Taxman)
2. E-book of the Ministry of Labour and Employment - https://labour.gov.in/e-book-1
3. Reading material prepared by the Course Co-ordinator.
4. Avtar Singh and Harpreet Kaur, Introduction to Labour and Industrial Laws, 2nd ed.,Lexis Nexis Butterworths Wadhwa.

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
New Labour Codesof India	Prof. KD Raju	IIT Kharagpur	https://onlinecourses.nptel.ac.in /noc23_lw05/preview

First Year (Semester –II)

Urban Utilities Planning : Water Supply, Sanitation and Drainage

MTAI204B	**Urban Utilities Planning : Water Supply, Sanitation and Drainage**	**3L- 0T - 0P**	**3 Credits**

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:

Course Contents:

Unit No 1:	**Urban Utilities**	**[8 Hours]**
Urban utilities planning: Introduction, Urban Water Supply, Collection of water.		
Unit No 2:	**Water Storage & Distribution**	**8 Hours]**
Pumping and storage, Water supply Distribution system and Plans, Water Quality, testing, treatment, and cost.		
Unit No 3:	**Sanitation**	**8 Hours]**
Sanitation and Drainage Fundamentals, Water carriage system, Sewer design,		
Unit No 4:	**Sewage treatment**	**8 Hours]**
Sewer appurtenances and master plans, Sewage treatment, drainage, and recharge		

Reference Books

1. Water Supply Engineering, S. K. Garg (18th ed.), Khanna Publishers.
2. Water Supply and Sanitary Engineering, G. S. Birdie & J. S. Birdie (8th ed.), Dhanpat Rai Publishing Company, New Delhi.
3. Stormwater drainage manual Planning, Design and Management, Drainage services department, Government of the Hong Kong Special Administrative Region.

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
Urban Utilities Planning: Water Supply, Sanitation and Drainage	Prof. Debapratim Pandit	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc23_ar08/preview

First Year (Semester –II)

Environment and Development

MTAI204C	Environment and Development	3L- 0T - 0P	3 Credits

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:

Course Contents:

Unit No 1:	Environmental movement	[8 Hours]
Introduction: Development, economic growth and sustainable development, Basic ecosystem ecology, Environmentalism, Environmental Movement, Environmentalism in the global south,		
Unit No 2:	**Social ecology**	**8 Hours]**
Approaches to environment: Ecofeminism, Feminist political ecology, Marxism and ecology, Debates on environmental ethics: Deep ecology, Gandhi and ecology, social ecology.		
Unit No 3:	**Impact of Religion on environment**	**8 Hours]**
Religion, environment, and conservation: Religion, environment and historical roots of ecological crisis, Biodiversity conservation ethics in Buddhism and Hinduism, Christian religion in the age of ecological crisis		
Unit No 4:	**Natural Resources & development**	**8 Hours]**
Natural resource management, Common property vs. private property, Livelihoods, forests, and conservation, Displacement, dispossession, and development: Conservation-induced displacement, Environment impact assessment and national rehabilitation & resettlement policy, Dispossession, and land acquisition.		
Unit No 5:	**Gender & Development, Climate change**	**[8 Hours]**
Development theory and gendered approach to development, Gender, environment & sustainable development. Environment and climate change: Climate change interventions and policy framework, Eastern Himalayas, and climate change.		
Unit No 6:	**Belief and local knowledge of environment**	**[8 Hours]**
Belief and knowledge systems, biodiversity conservation and sustainability: Ecological knowledge, biodiversity conservation and sustainability, Traditional religion and conservation of nature in Northeast India: Case study Local knowledge in the environment-development discourse: Indigenous knowledge, environment anddevelopment, Relevance of indigenous knowledge: case study		

Textbooks / References:

1. Arnold, David, and Guha, Ramchandra, (eds.), 1997. Nature, Culture and Imperialism, New Delhi: Oxford University Press.
2. Baviskar, Amita. 1997. In the Belly of the River: Tribal Conflicts over Development in the Narmada Valley, OUP, Delhi.
3. Barnhill, David Landis & Roger S. Gottlieb. (eds.) 2001. Deep Ecology and World Religions: New Essays on Sacred Grounds. State Univ. of New York Press, Albany.
4. Bicker, Alan, Paul Sillitoe and Johan Pottier. 2004. Development and Local Knowledge: New

Approaches to Issues in Natural Resources Management, Conservation and Agriculture. Routledge, London & New York.
5. Esteva, G. 1997. _Development‘ in W. Sachs, ed., The Development Dictionary, Orient Longman, pp. 8-34.
6. Gadgil, Madhav and Guha, Ramchandra. 1995. Ecology and Equity: The use and Abuse of Nature in Contemporary India, New Delhi: Oxford University.
7. Gottlieb, Roger S. 2004. This Sacred Earth: Religion, Nature, Environment. Routledge, New York, and London.
8. Merchant, Carolyn. 1994. Ecology: Key Concepts in Critical Theory, Humanities Press, New Jersey.
9. Ramakrishnan, P.S. 1992. Shifting Agriculture and Sustainable Development: An Interdisciplinary Study from North-Eastern India, Man and the Biosphere Series, Volume 10, UNESCO.

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
Environment and Development	Prof. Ngamjahao Kipgen	IIT Guwahati	https://onlinecourses.nptel.ac.in/noc21_hs83/preview

First Year (Semester –II)

Entrepreneurship

MTAI204D	Entrepreneurship	3L- 0T - 0P	3 Credits

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:

Course Contents:

Unit No 1:		**[8 Hours]**
Entrepreneurial Journey, Entrepreneurial Discovery, Ideation and Prototyping,		
Unit No 2:		**8 Hours**
Testing, Validation and Commercialisation, Disruption as a Success Driver		
Unit No 3:		**8 Hours**
Technological Innovation and Entrepreneurship – 1, Technological Innovation and Entrepreneurship –2, Raising Financial Resources.		
Unit No 4:		**8 Hours**
Education and Entrepreneurship, Beyond Founders and Founder-Families, India as a Start-up Nation		
Unit No 5:		**8 Hours**
National Entrepreneurial Culture, Entrepreneurial Thermodynamics,		
Unit No 6:		**8 Hours**
Entrepreneurship and Employment, Start-up Case Studie		

Textbooks / References:

1. Zero to One: Notes on Startups, or How the Build the Future by Peter Thiel.
2. The Lean Startup: How Today‘s Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries.
3. India as Global Start-up Hub: Mission with Passion by C B Rao.
4. Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future by Ashlee Vance.
5. Steve Jobs by Walter Isaacson.
6. Innovation and Entrepreneurship: Practice and Principles by Peter F Drucker.
7. The Innovator‘s Solution: Creating and Sustaining Successful Growth by Clayton M Christensen.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Entrepreneurship	Prof. C Bhaktavatsala Rao	IIT Madras	https://onlinecourses.nptel.ac.in/noc20_mg35/preview

First Year (Semester –II)

Research Methodology

MTAI204E	Research Methodology	3L- 0T - 0P	3 Credits

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:

Course Contents:

Unit No 1:		**[8 Hours]**
Philosophy of Science (subjective versus objective, materialism versus idealism, causality, etc.)Logical Reasoning (inductive logic, deductive logix, syllogistic logic)		
Unit No 2:		**8 Hours]**
History of development of science and the influence of philosophy, What Scientists Actually Do		
Unit No 3:		**8 Hours]**
Forming a Hypothesis, Techniques of Scientific Measurement		
Unit No 4:		**8 Hours]**
Testing of hypothesis, Methods of Theoretical Research		
Unit No 5:		**[8 Hours]**
The Art of Scientific Communication, Presentation in Seminars and Conferences, SponsoredResearch, Ethical Conduct in Science		

Textbooks / References:

1. Soumitro Banerjee, Research Methodology for Natural Sciences, IISc Press, 2022.

First Year (Semester –II)

Full Stack Development and Data Engineering Lab

MTAIL205	**Full Stack Development and Data Engineering Lab**	**0L- 0T - 2P**	**1 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 2 hrs./week	Continuous Assessment : 60 Marks End Semester Exam: 40 Marks (Duration 03 hrs.)

Any six Experiments should be performed from full stack development and four experiment from data engineering

First Year (Semester –II)

Disaster Management

MTAI206	**Disaster Management**	**0L- 0T - 2P**	**AUDIT COURSE**

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Disaster Management: Disaster and Disaster Management – Concepts, Issues Concerned with Disaster Management. Disaster Management: Phases of Disaster Management, Phases of Disaster Management Types of Disasters: Bhopal Disaster: A Case Study, Types of Disasters-An Introduction, Natural Disaster, Man-made Disaster		
Unit No 2:		**8 Hours]**
Types of Disasters: Slow onset Disasters & Rapid onset Disasters, Simple and Complex, Tsunami: A Case Study Disasters, Tsunami: A Case Study, Cyclone Phallin 2013: A Case Study		
Unit No 3:		**8 Hours]**
Disaster Management in India -An Over View: Evolution of Disaster Management in India, Disaster and Disaster Management in India, National institute of Disaster Management, National Disaster Management Act 2005.		
Unit No 4:		**8 Hours]**
Disaster Management in India -An Over View: The National Policy o Disaster Management, 2009. Refugee Problem: National Plan on Disaster Management 2016, Refugee Problems, Impact of Disaster on the lives of Refugees. Refugee Problem: Problems of Women and Children during disasters, Principles of Psychosocial Care, Issues and Recovery during Emergency. Refugee Problem: Relationship between Disasters, Development and Vulnerabilities, Relationship between Disasters, Development and Vulnerabilities.		
Unit No 5:		**[8 Hours]**
Refugee Problem: Equity Issues in Disaster. Refugee Problem: Issues of Rehabilitation and Resettlement among the Disaster Survivors, Stakeholders in Disaster Relief Management - An Introduction. Stakeholders in Disaster Relief Management: Central Government. Stakeholders in Disaster Relief Management: State Government, District Administration. Armed Forces.		
Unit No 6:		**[8 Hours]**
Stakeholders in Disaster Relief Management: Para-Military Forces, Fire Services. Disaster Risk Reduction: Disaster Risk Reduction Strategies, Risk Reduction Preparedness Plans. Disaster Risk Reduction: Action Plans and Procedures, Early Warning Systems, Components of Disaster Relief, Factors contributing to Vulnerability. Disaster Risk Reduction: Disaster Risk Reduction - Master Planning for the Future, Capacity Building Rehabilitation measures and long-term reconstruction, Understanding Kerala Disaster 2018.		

Textbooks / References:

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi

3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopaedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopaedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur.
8. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10. Disaster Management Act 2005, Publisher by Govt. of India
11. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
12. NIDM Publications
13. High Power Committee Report, 2001, J.C. Pant
14. Disaster Mitigation in Asia & Pacific, Asian Development Bank
15. National Disaster Management Policy, 2009, GoI
16. Disaster Preparedness Kit, American Red Cross

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Disaster Management	Naveen Kumar Nanjundan	University Of Hyderabad	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

First Year (Semester –II)

Indian Knowledge System (IKS): Concepts and Applications in Engineering

MTAI207A	**Indian Knowledge System (IKS): Concepts and Applications in Engineering**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:	**Indian Knowledge System – An Introduction & Vedic Corpus**	**[8 Hours]**
What is IKS? Why do we need IKS? Organization of IKS, Historicity of IKS, Some salient aspects of IKS,Introduction to Vedas, A synopsis of the four Vedas, Sub- classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotiṣa, Vedic Life: A Distinctive Features.		
Unit No 2:	**Number system & Mathematics**	**8 Hours]**
Number systems in India - Historical evidence, Salient aspects of Indian Mathematics, Bhūta-Saṃkhyā system, Kaṭapayādi system, Measurements for time, distance, and weight, Piṅgala and the Binary system.Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contributions, Algebra, Geometry, Trigonometry, Binary mathematics, and combinatorial problems in Chandaḥ Śāstra, Magic squares in India		
Unit No 3:	**Engineering Technology: Metal & Other applications**	**8 Hours]**
Wootz Steel: The rise and fall of a great Indian technology, The Indian S & T heritage, Mining and ore extraction, Metals and metalworking technology, Iron and steel in India, lost wax casting of idols and artefacts, Apparatuses used for extraction of metallic components. Irrigation systems and practices in South India, literary sources for science and technology, Physical structures in India, irrigation and water management, dyes and painting technology, the art of making perfumes, Surgical techniques, shipbuilding, sixty-four art forms (64 Kalās) status of Indigenous S & T.		
Unit No 4:	**Town Planning and Architecture:**	**8 Hours]**
Perspective of Arthaśāstra on town planning, Vāstu-śāstra – The science of architecture eight limbs of Vāstu, town planning, temples in India: Marvelous stone architecture for eternity, temple architecture in India, Iconography.		
Unit No 5:	**Knowledge Framework and classifications:**	**[8 Hours]**
Indian scheme of knowledge, The knowledge triangle, Prameya – A vaiśeṣikan approach to physical reality, Dravyas – the constituents of the physical reality, Attributes – the properties of substances and Action – the driver of conjunction and disjunction, Sāmānya, viśēṣa, samavāya, Pramāṇa – the means of valid knowledge, Saṃśaya – ambiguities in existing knowledge, Framework for establishing valid knowledge, Deductive or inductive logic framework, Potential fallacies in the reasoning process, Siddhānta: established tenets in a field of study.		

Unit No 6:	**Linguistics**	**[8 Hours]**
Introduction to Linguistics, Aṣṭādhyāyī, Phonetics, word generation, computational aspects, Mnemonics, Recursive operations, Rule based operations, Sentence formation verbs and prefixes, role of Sanskrit in natural language processing.		

Textbooks / References:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), ―Introduction to Indian Knowledge System: Concepts and Applications‖, PHI Learning Private Ltd. Delhi.

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
Indian Knowledge System (IKS): Concepts and Applications in Engineering	Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan	(IIMB), Chanakya, University, Bangalore	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

First Year (Semester –II)

Indian Knowledge System (IKS): Humanities and Social Sciences

MTAI207B	**Indian Knowledge System (IKS): Humanities and Social Sciences**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:	**Indian Knowledge System – An Introduction & Vedic Corpus**	**[8 Hours]**
What is IKS? Why do we need IKS? Organization of IKS, Historicity of IKS, Some salient aspects of IKS,Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotiṣa, Vedic Life: A Distinctive Features.		
Unit No 2:	**Philosophical Systems**	**8 Hours]**
An introduction to philosophical systems, development of philosophy unique features of philosophy, Sāṅkhya approach of philosophy, Introduction to Yoga, tenet of Nyāya philosophy principles of Vaiśeṣika, doctrine of Pūrva-Mīmāṃsā Darśana, thesis of Vedānta and synopsis of Advaita philosophy of Viśiṣṭādvaita.		
Unit No 3:	**Wisdom through ages**	**8 Hours]**
Gateways of ancestral wisdoms, introduction to Purāṇa, the Purāṇic repository, Issues of interest in Purāṇas, Introduction to Itihāsas, Key messages in Itihāsas, Wisdom through Nīti- śāstras, Wisdom through Subhāṣita.		
Unit No 4:	**Health Wellness and Psychology:**	**8 Hours]**
Introduction to health, Āyurveda: approach to health, Sapta-dhātavaḥ: seven-tissues, role of agni in health, tri-doṣas, Āyurveda: definition of health, Psychological aspects of health, disease management elements, Dinacaryā: daily regimen for health & wellness, Importance of sleep, Food intake methods and drugs, Approach to lead a healthy life, Indian approach to psychology, the tri guṇa system & holistic picture of the individual, the Nature of Consciousness, consciousness studies and issues		
Unit No 5:	**Linguistics:**	**[8 Hours]**
Introduction to Linguistics, Aṣṭādhyāyī, phonetics, word generation, computational aspects, mnemonics, recursive operations, rule-based operations, sentence formation, verbs and prefixes, role of Sanskrit in natural language processing.		
Unit No 6:	**Governance and Public Administration:**	**[8 Hours]**
Introduction to raja dharma, Arthaśāstra: a historical perspective, Elements of a kauṭilyan state, The king & the amātya, Janapada & durga, treasury and the state economy (Kośa), danda, Mitra, the administrative setup, relevance of Arthaśāstra, public administration in Epics.		

Textbooks / References:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), ―Introduction to Indian Knowledge System: Concepts and Applications‖, PHI Learning Private Ltd. Delhi.
2. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
3. Sampad and Vijay (2011). ―The Wonder that is Sanskrit‖, Sri Aurobindo Society, Puducherry.
4. Acarya, P.K. (1996). Indian Architecture, Munshiram Manoharlal Publishers, New Delhi.
5. Kapoor Kapil, Singh Avadhesh (2021). ―Indian Knowledge Systems Vol – I & II‖, Indian Institute of Advanced Study, Shimla, H.P.
6. Dasgupta,S. (1975). A History of Indian Philosophy- Volume 1, Motilal Banarsidass, New Delhi.
7. PLofker, K. (1963). Mathematics in India, Princeton University Press, New Jeresy, USA"

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
Indian Knowledge System(IKS): Humanities and Social Sciences	Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan	Indian Institute of Management Bangalore (IIMB), Chanakya University, Bangalore	https://onlinecourses.swayam2.ac.in/imb23_mg55/preview

SEMESTER II

Mini Project and Seminar-I

MTAI208	**Mini Project and Seminar-I**	**0L- 0T - 4P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 4 hrs./week	Continuous Assessment : 40 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

The mini project shall be based on the recent trends in the industry, research and open problems from the industry and society. This may include mathematical analysis, modelling, simulation, and hardware implementation of the problem identified. The mini project shall be of the student‘s choice and approved by the guide. The student has to submit the report of the work carried out in the prescribed format signed by the guide and head of the department/institute.

SEMESTER III

Student Psychology

MTAI301A	Student Psychology	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Teaching Learning Process		
Unit No 2:		**8 Hours]**
Student Characteristics, Types and Problems		
Unit No 3:		**8 Hours]**
Psychological Tests and Inventories, Student Motivation		
Unit No 4:		**8 Hours]**
Physical and Cognitive Development		
Unit No 5:		**[8 Hours]**
Emotional and Social Development		
Unit No 6:		**[8 Hours]**
Neuro-Linguistic Programming, Counselling Skills, and Summary		

Textbooks / References:

1. Sharma, R.A. (2007). Training Technology. Meerut: Surya Publications.
2. Sharma, R.A. (2007). Psychology of Teaching-Learning Process. Meerut: Surya Publications.
3. B.Mukhopadhyay(1997). Motivation in Educational Management. New Delhi: Sterling Publishers.
4. Barki & Mukhopadhyay. (1995). Guidance and Counselling. New Delhi: Sterling Publishers.
5. Agochya, D. (2010). Life competencies for adolescents. New Delhi: Sage Publications.
6. Davies, I.K. (1971). Management of Learning. Berkshire: McGraw Hill.
7. Dusay. (1980). Egograms. New York: harper & Row.
8. Goleman, D. (1996). Emotional Intelligence. New York: Bantom Books.
9. Anastasi. (2016). Psychological Testing. New Delhi: Pearson Education. Psychological Tests.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Student Psychology	Dr. S. Renukadevi	NITTTR, Chennai	https://onlinecourses.swayam2.ac.in/ntr19_ed23/preview

SEMESTER III

Business To Business Marketing (B2B)

MTAI301B	**Business To Business Marketing (B2B)**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Introduction to B2B Marketing: Business marketing, Classifying goods for the business market, Business market customers, Market structure, Environment and Characteristics of Business Marketing, Strategic role of marketing, Commercial enterprises, Commercial and institutional customers, B2B vs B2C Marketing. Organizational Buying and Buyer Behaviour: Organizational buyers‘ decision process - A Stepwise Model and A Process Flow Model, Organizational and business markets - Government as a customer - Commercial enterprises - Commercial and institutional customers, Value analysis, Buygrid framework, Strategic procurement.		
Unit No 2:		**8 Hours]**
B2B Marketing Strategy: Strategy making and strategy management process, Industrial product strategy– Managing Products for Business Markets-Managing Services for Business Markets- Managing Business Market Channels the Growth-Share Matrix, Multifactor Portfolio Matrix, The Balanced Scorecard. B2B Marketing STP: Market Segmentation, bases for segmenting business markets, basic framework of segmentation, choosing target segments and positioning.		
Unit No 3:		**8 Hours]**
Business Marketing Communications- B2B Advertising, Digital marketing, - Trade shows, exhibitions, business meets - Managing the sales force - Deployment analysis, Direct marketing Demand forecasting: industrial market, Forecasting- meaning, importance and relevance, issues elated to forecasting, forecasting measurement models, sales force forecasting, estimating segment demand, Collaborative approach to estimate demand, qualitative and quantitative forecasting methods.		
Unit No 4:		**8 Hours]**
Product management: (existing and new) in industrial market, role of product in the industrial market, new product development, industrial product life cycle, product evaluation matrix, techniques for identifying new products QFD, perceptual mapping, reverse engineering, fish bone diagram, role of service and maintenance in industrial markets, customer experience life cycle, service quality. Pricing: Pricing strategies; the pricing policy; Price on the Internet; Financial marketing, competitive bidding, commercial terms and conditions, role of leasing.		
Unit No 5:		**[8 Hours]**
Buyer seller relationship, types of relationships, transactional and collaborative relationships, influencing industrial customers, role of service in industrial markets. CRM. B2B marketing research, challenges in B2B research, developing a marketing information system, role of qualitative research techniques in B2B research.		
Unit No 6:		**[8 Hours]**

Business marketing channels and participants - Channel design and management decisions - B2B logistics management, types of industrial middlemen and intermediaries, marketing logistics and physical distribution. Strategic decision making in industrial markets, strategic planning at corporate levels, allocation of resources, portfolio analysis, developing SBU'S objectives and goals, implementing and controlling marketing plan. Marketing through electronic commerce.

Textbooks / References:

1. Business Market Management Understanding, Creating and Delivering Value by James C. Anderson, Das Narayandas, James A. Narus and D.V.R. Seshadri Pearson, 2010 3rd edition
2. Business Marketing Management b2b By Hutt and Speh South-Western CENGAGE Learning www.cengagebrain.com 2013
3. B2B Brand Management by Kotler and Pfoertsch Springer www.springer.com 2006
4. Business Marketing: Text and Cases by Krishna K Havaldar, McGrawhill Publications, 2014 4th edition.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Business To Business Marketing (B2B)	Prof. J. K. Nayak	IIT Roorkee	Business To Business Marketing (B2B) – Course (nptel.ac.in)

SEMESTER III

Organizational Behaviour

MTAI301C	**Organizational Behaviour**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Introduction – a) defining organization, behavior and organizational behavior, b) assumptions of OB, c) principles of OB, d) levels of OB, e) scope of OB, f) OB and Human Resource Management, g) Applications of OB, h) Historical developments of OB, i) emerging concerns Perception and Learning – a) understanding perception, b) Basic elements of perception, c) Principles of perceptual selection, d) Perceptual grouping, e) Social Perception, f) Self- perception and identity, g) attribution of causality, h) Perceptual biases in social perception, i) Implications for human resource management, j) defining learning, k) classical and operant conditioning l) learning in organizations.		
Unit No 2:		**8 Hours]**
Personality – a) Defining Personality, b) History of the concept, c) Key assumptions, d) biological and social determinants, e) Theories – Intrapsychic theory, social learning theory, self-theory, Trait, and type theories f) Related concepts (locus of control, dogmatism, authoritarianism, Machiavellianism), g) measuring personality. Attitudes – a) Definition, b) Key elements of attitudes, c) Attitudes and related concepts (Values, opinion, belief, and ideology), e) Characteristics of attitudes, f) Attitude formation, g) Attitude measurement, h) Changing attitudes, i) Attitudes at workplace (job satisfaction, work attitude and organizational commitment), j) Prejudice and discrimination at workspace.		
Unit No 3:		**8 Hours]**
Emotions in workplace - a) Definition, b) Types of emotions, c) Related concepts (mood, temperament), d) Stress in workplace, e) General Adaptation Syndrome, f) Managing Stress, g) Psychosomatic disorders and stress h) emotional labor and emotional contagion. Motivation – a) Definition, b) Process of motivation, c) Types of motives, d) Motivators at workplace, e) Motivation theories (Process and Content theories).		
Unit No 4:		**8 Hours]**
Interpersonal Dynamics – a) Definition, b) Psychological Contract, c) Trust and trust building, d) Prosocial behaviour, e) Cooperation Vs Competition f) Conflict management, g) Levels and types of conflict at workplace, h) Conflict management Styles, i) Managing Negotiations Power and Leadership - a) Defining Power, b) Sources of Power, c) Organizational politics, d) Leadership e) Managers Vs Leaders, f) Trait and Type approach to leadership g) Leadership style, h) Leadership Grid, i) Contingency Theories j) Contemporary issues		
Unit No 5:		**[8 Hours]**
Team Dynamics – a) Groups and Teams, b) Types of Teams, c) Stages in group development, d)problems in team work (Free riding, social loafing, group think), e) Cross-cultural virtual teams.Organizational culture – a) Defining culture, b) levels of culture, c) cultural dimensions, d) high and low context cultures, e) Strong and weak organizational cultures, f) Expressions of organizational culture, g) Impact of culture on individuals, h) Organizational cultural		

change		
Unit No 6:		**[8 Hours]**
Organization Change – a) Change in Organizations, b) Nature of the chance process, c) Types of chance, d) Impact of change, e) Managing resistance to change, f) Organizational Development interventions Organizational Structure and Design – a) Basic dimensions of structure, b) Departmentalization, c) Organizational life cycle, d) Organizations as socio-technical systems, e) Organizational design and its impact on employees, f) Organizational boundary spanning.		

Textbooks / References:

1. Behaviour in Organizations by Jerald Greenberg and Robert A. Baron, PHI learning private Ltd, New Delhi (Ninth Edition).
2. Understanding Organizational Behaviour by Udai Pareek, Oxford University Press (Third Edition).
3. ORGB by Nelson, Quick and Khandelwal, Cengage Learning New Delhi (second edition).

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Organizational Behaviour	Prof. M. P. Ganesh	IIT Hyderabad	Organizational Behaviour – Course (nptel.ac.in)

SEMESTER III

Principles of Economics

MTAI301D	Principles of Economics	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Principles of Economics, Thinking like an Economist; Interdependence and the gains fromTrade.		
Unit No 2:		**8 Hours]**
Market forces of supply and Elasticity, Application of elasticity; supply, demand, and governmentpolicies		
Unit No 3:		**8 Hours]**
Consumer and producer surplus; cost of taxation and international trade, Externalities, and costof production		
Unit No 4:		**8 Hours]**
Competitive market and monopoly market, Game theory and oligopoly, measures nationalincome, measuring cost of living		
Unit No 5:		**[8 Hours]**
Production and growth; Saving, Investment and the financial system, the monetary system,Money growth and inflation		

Textbooks / References:

1. N.Gregory Mankiw, Principles of Economics.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Principles Of Economics	Prof. Sabuj Kumar Mandal	IIT Madras	Principles Of Economics – Course (nptel.ac.in)

SEMESTER III

Intellectual Property & Rights

MTAI301E	**Intellectual Property & Rights**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Introduction to IPR: Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights, Introduction to TRIPS and WTO, Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade; Secret and trade dress, Design, Layout Design, Geographical Indication, Plant. Varieties and Traditional Knowledge.		
Unit No 2:		**8 Hours]**
Patent Rights and Copy Rights— Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence,Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.		
Unit No 3:		**8 Hours]**
Copy Right—Origin, Definition &Types of Copy Right, Registration procedure, Assignment & licence, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special referenceto software.		
Unit No 4:		**8 Hours]**
Trade Marks: Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties. Domain Names on cyber space.		
Unit No 5:		**[8 Hours]**
Trade Marks: Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties. Domain Names on cyber space.		
Unit No 6:		**[8 Hours]**
Basic Tenents Of Information Technology Act-2000, IT Act - Introduction, E-Commerce and legal provisions, E- Governance and legal provisions, Digital signature and Electronic Signature. Cybercrimes.		

Textbooks / References:

1. Intellectual Property Rights and the Law, Gogia Law Agency, by Dr. G.B. Reddy
2. Law relating to Intellectual Property, Universal Law Publishing Co, by Dr.B.L.Wadehra
3. IPR by P. Narayanan
4. Law of Intellectual Property, Asian Law House, Dr.S.R. Myneni.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Intellectual Property & Rights	Prof. Feroz Ali	IIT Madras	https://onlinecourses.nptel.ac.in/noc23_hs55/preview

SEMESTER III

Introduction to Public Administration

MTAI301F	**Introduction to Public Administration**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Public Administration: Meaning Nature, Scope and Significance of Public, Administration. Difference between Public and Private Administration, Administration as an Art or Science, New Public Administration, New Public Management, E-Governance: Concept, Rationale and significance.		
Unit No 2:		**8 Hours]**
Theories of Organization – Classical, Neo classical and Modern theory, Approaches to the study ofPublic Administration: Structural – functional, systems, approach, Behavioral approach, Public Choice approach, Bureaucracy: Meaning types and Weberian model of Bureaucracy.		
Unit No 3:		**8 Hours]**
Organization: formal and informal organizations, Principles of organization – Hierarchy, Span of control, unity of command and Coordination.		
Unit No 4:		**8 Hours]**
Concepts of Public Administration: Power, Authority, and responsibility, Decision Making: Meaning, Classification and Essentials of decision making, Process of decision making, techniquesof decision making, approaches to decision making.		
Unit No 5:		**[8 Hours]**
Good Governance: Concept, characteristics, elements. Issues and Challenges, Leadership: Development of leadership, Qualities of leadership, Accountability and control –Executive, Legislative, Judicial. Citizen and Administration: Issues and problems, Methods to promote good relationship.		

Textbooks / References:

1. Felix, A. Nigro and C. Nigro Modern Public Administration (New York: Lloyd Harper and Row, Latest edition)
2. John Pfiffiner and Frank Sherwood Administrative Organization (New Delhi: Prentice Hall, Latest ed.).
3. Peter F. Drucker Management: Tasks, Responsibilities, Practices (Bombay: AlliedPublishers, latest ed.).
4. H. Koontz and Cyril O'Donnell Principles of Management, (Tokyo: McGraw

Hill,latest ed).
5. Amitai Etzioni Modern Organizations (New Delhi: Prentice Hall, latest ed.).
6. Robert T. Golembiewsky Public Administration as a Developing Discipline (NewYork: Marcel, latest ed.).
7. Mohit Bhattacharya Public Administration (Calcutta: World Press, latest ed).
8. Mamta Mokta, S.S.Chauhan, S.K. Mahajan and Simmi Agnihotri Challenges inGovernance(ed) Anamica Publishers,New Delhi 2011
9. C.P. Bhambri Public Administration (Theory and Practice (Meerut: EducationalPublishers, latest ed.).
10. Bertram Gross The Managing of Organisations (London: Free Press, latest ed.).
11. W.M. Newman, C. Summer and E.Warren Management Concepts, behaviour &practice, edu. Publishers Meerut.
12. P. Herseay and K.H. Blanchard Management of Organisational Behaviour (NewDelhi:latest ed.).
13. Nicholas Henry Public Administration and Public Affairs, (New Jersey: Prentice Hall,latest ed.).
14. Herbert G. Hicks and Ray C. Gutlet Organisations: Theory and Behaviour (NewYork: McGraw Hill, latest ed.).
15. Ramesh, K. Arora (ed.) Perspective in Administrative Theory (New Delhi: Associated, latest ed.).
16. S.L. Kaushik and Pardeep Sahni (eds.) Public Administration in India: EmergingTrends (Allahabad: Kitab Mehal, latest ed.).
17. J.S. Vickers and George K. YarrowPrivatization: An Economic Analysis (Cambridge:MIT Press, latest ed.).
18. David Osborne and T. Gaebler Re-inventing Government: How the EntrepreneurialSpirit is Transforming the Public Sector (New York: Addison Wesley, latest ed.).

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Introduction to Public Administration	By Prof. Y. Pardhasaradhi	Osmania University Hyderabad.	https://onlinecourses.swayam2.ac.in/cec21_hs06/preview

SEMESTER III

Design of Mechatronic Systems

MTAI302**A**	**Design of Mechatronic Systems**	**3L- 0T – 0P**	**3 Credits**

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:

Course Contents:

Unit No 1:		**[8 Hours]**
Introduction: Elements of mechatronics system: Sensor, actuator, plant, and controller. Applications of mechatronics system. Systems like CDROM, scanner opened to see whats there inside and why? Integrated mechanical-electronics design philosophy. Examples of real-life systems. Smart sensor concept and utility of compliant mechanisms in mechatronics		
Unit No 2:		**8 Hours]**
Microprocessor building blocks, combinational and sequential logic elements, memory, timing, and instruction execution fundamentals with example of primitive microprocessor. Microcontrollers for mechatronics: Philosophy of programming interfaces, setting sampling time, and getting started with TIVA programming. Programming different interfaces PWM, QEI etc. Mathematical modeling of mechatronic systems,		
Unit No 3:		**8 Hours]**
Modeling friction, DC motor, Lagrange formulation for system dynamics. Dynamics of 2R manipulator, Simulation using Matlab, Selection of sensors and actuators.		
Unit No 4:		**8 Hours]**
Concept of feedback and closed loop control, mathematical representations of systems and control design in linear domain. Basics of Lyapunov theory for nonlinear control, notions ofstability, Lyapunov theorems and their application		
Unit No 5:		**[8 Hours]**
Trajectory tracking control development based on Lyapunov theory, Basics of sampling of asignal, and signal processing.		
Unit No 6:		**[8 Hours]**
Digital systems and filters for practical mechatronic system implementation. Research example/ case studies of development of novel mechatronics system: 3D micro-printer, Hele Shaw system for microfabrication.		

Textbooks / References:

1. Devdas Shetty, Richard A. Kolk, ―Mechatronics System Design,‖ PWS Publishingcompany.
2. Boukas K, Al-Sunni, Fouad M ―Mechatronic,Systems Analysis, Design andImplementation,‖ Springer,
3. Sabri Cetinkunt, ―Mechatronics with Experiments,‖ 2nd Edition, Wiley.
4. Janschek, Klaus, ―Mechatronic Systems Design,‖ Springer.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Design Of Mechatronic Systems	Prof. Prasanna Gandhi	IIT Bombay	Design Of Mechatronic Systems – Course (nptel.ac.in)

SEMESTER III

Ethical Hacking

MTAI302**B**	**Ethical Hacking**	**3L- 0T - 0P**	**3 Credits**

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.)

Course Contents:

Unit No 1:		**[8 Hours]**
Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocolstack.IP addressing and routing. TCP and UDP. IP subnets. Routing protocols. IP version 6.		
Unit No 2:		**8 Hours]**
Installation of attacker and victim system. Information gathering using advanced googlesearch, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool**.**		
Unit No 3:		**8 Hours]**
Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARPspoofing and MAC attack.		
Unit No 4:		**8 Hours]**
Introduction to cryptography, private-key encryption, public-key encryption. Cryptographic hash functions, digital signature and certificate, applications. Steganography, biometric authentication, network-based attacks, DNS, and Email security.		
Unit No 5:		**[8 Hours]**
Packet sniffing using Wireshark and Burpsuite, password attack using burp suite. Social engineering attacks and Denial of service attacks. Elements of hardware security: side-channel attacks, physical inclinable functions, hardware trojans.		
Unit No 6:		**[8 Hours]**
Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc. Attack on web servers: password attack, SQL injection, cross site scripting.		

Textbooks / References:

1. Data and Computer Communications -- W. Stallings.
2. Data Communication and Networking -- B. A. Forouzan
3. TCP/IP Protocol Suite -- B. A. Forouzan
4. UNIX Network Programming -- W. R. Stallings
5. Introduction to Computer Networks and Cybersecurity -- C-H. Wu and J. D. IrwinCryptography and Network Security: Principles and Practice -- W. Stalling

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
Ethical Hacking	Prof. Indranil Sengupta	IIT Kharagpur	Ethical Hacking – Course (nptel.ac.in)

SEMESTER III

Sustainable Power Generation Systems

MTAI302**C**	**Sustainable Power Generation Systems**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week	Continuous Assessment : 20 MarksMid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Contents:

Unit No 1:		**[8 Hours]**
Introduction to power generation: Global and Indian scenario, an overview of current technologies available for powergeneration, Concept of the renewable energy- based power plant Solar Thermal Power Generation: Fundamentals of Solar thermal energy conversion, solar thermal based power plantdesign and analysis (flat plate and concentrator), ORC, RC, and Stirling engine.		
Unit No 2:		**8 Hours]**
Solar Photovoltaic Power Generation: Fundamentals of Solar photovoltaic energy conversion, Solar PV power plant design,Performance analysis of standalone and grid connected PV systems. Wind Power Generation: Introduction to wind turbine, classification and analysis of different components, Theory,design, and analysis of wind turbines (horizontal axis and vertical axis) and wind farms.		
Unit No 3:		**8 Hours]**
Hydro Power Generation: Introduction to hydro power plant, overview of micro, mini and small hydro power plants,hydraulic turbines, Selection and design criteria of pumps and turbines, Brief theory, design, and analysis of hydro power plants Biomass Power Generation: Fundamentals of bioenergy production technologies through different routes, design, andanalysis of biochemical and thermochemical reactors for clean power generation and value- added products, IGCC.		
Unit No 4:		**8 Hours]**
Hydrogen energy and fuel cells Importance, various routes of hydrogen generation, basic principle, and design of different types of fuel cells and their applications, prospects, IGFC: Geothermal EnergyFundamentals, classification, theory, design, and analysis of geothermal power plant		

Unit No 5:		**[8 Hours]**
Ocean Thermal Energy Fundamentals, classification, theory, design, and analysis of ocean thermal power plantWeek 10: Module-10: Wave and Tidal Energy Fundamentals, classification, theory, design, and analysis of wave and tidal power plant		
Unit No 6:		**[8 Hours]**
Energy Storage Different modes of energy storage; design and analysis of different technologies for thermal, mechanical, and electro-chemical energy storage systemsEnergy Economics Cost analysis, interest, accounting rate of return, Payback, Discounted cash flow, Net present value, internal rateof return, Inflation, and life cycle analysis of energy systems.		

Textbooks / References:

1. J. Twidell, T. Weir, Renewable Energy Resources, Taylor and Francis, 4thEdition, 2021.
2. G. Boyle (Editor), Renewable Energy: Power for a SustainableFuture, Oxford University press, 3rd Edition, 2012.
3. G. N. Tiwari, Solar Energy, Fundamentals, Design, Modeling andApplications, Narosa, 2002.
4. J. A. Duffie and W. A. Beckman, Solar Engineering of ThermalProcesses, John Wiley, 4th Edition, 2013.
5. R. Gasch, J. Twele, Wind Power Plants: Fundamentals, Design,Construction and Operation, Springer, 2nd Edition, 2012.
6. P. Breeze, Hydropower, Elsevier, 1st Edition, 2018.
7. S. C. Bhattacharyya, Energy Economics Concepts, Issues, Markets andGovernance, springer, 2nd Edition, 2019.
8. S.p Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata Mc-Graw Hill Education Private Limited, 3rdEdition, 2010.

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
Sustainable Power Generation Systems	Dr. Pankaj Kalita	IIT Guwahati	Sustainable Power Generation Systems – Course (nptel.ac.in)

SEMESTER III

Components and Applications of Internet of Things

MTAI302**D**	**Components and Applications of Internet of Things**	**3L- 0T - 0P**	**3 Credits**

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:

Course Contents:

Unit No 1:	**Basics of IoT**	**[8 Hours]**

Introduction to Internet of things, Various sensors, and sensing techniques. Technological trends in IoT. impact of IoT on society. Review of various IoT application domain including agriculture, healthcare, manufacturing, device management, and vehicle to vehicle communicationand wearable computing devices.

Unit No 2:	**Microcontroller and Interfacing Techniques for IoT Devices**	**8 Hours]**

Introduction to IoT and architecture layers, IoT smart devices, Typical embedded computing systems, Introduction to ARM architecture and programming method, Embedded system development: a case study, Introduction to interfacing techniques.

Unit No 3:	**IoT Protocols & Security**	**8 Hours]**

Networking and basic networking hardware. Networking protocols, Interaction between software and hardware in an IoT device. IoT components and technologies to secure systems and devices. Various security issues related to the IoT and security architectures. Hardware security threats and security vulnerabilities; protecting physical hardware

Unit No 4:	**Location Tracking**	**8 Hours]**

Introduction to device localization and tracking; different types of localization techniques: time-of-arrival (TOA) based, time-difference-of-arrival (TDOA) based, angle-of-arrival (AOA) based, received signal strength (RSS) based, Radio-Frequency Identification (RFID) based and fingerprinting based; Monte-Carlo tracking; Kalman filter based tracking; Cramer- Rao lower bound (CRLB) for device location estimator; Device diversity/heterogeneity issue in IoT networks.

Unit No 5:	**Deep learning for IoT**	**[8 Hours]**

Deep learning for IoT

This topic will focus how to build good model from the past data to predict correctly when the system is provided with a data-point. In this course mostly, supervised learning will be considered. Basics of neural network, activation functions, back-propagation, etc. will be covered. At the end some of the challenges in the context of IoT will be mentioned.

Unit No 6:	**IoT Applications**	**[8 Hours]**

IoT Applications

Smart grid: Introduction to smart grid, Integration of IoT into smart grid, Standardization activitiesfor IoT aided smart grid, Applications of IoT aided smart grid, Architectures for IoT sided smart grid, Prototypes, Applications of big data and cloud computing, Open Issues, and challenges.

IoT-based Smart Home and Nano-grid Monitoring System

Sensor-Controller Coordination of a DC Microgrid in IoT Platform, Cyber physical system, dc microgrid, dc–dc power converter, distributed energy generator, sensor control and controller design. Low-Cost DC Nano-grid with Smart Remote Monitoring Unit, DC-DC converter modelling, closed loop control, placement of IoT devices, sensors, micro grid, solar energy, low- cost communication system design.
Introduction, objective, components of home monitoring system, control, and management, Zigbee,Wireless Sensor Network (WSN), Internet of Things (IoT).

Internet of Robotic Things (IoRT):

Introduction to stationary and mobile robots; Brief introduction to localization, mapping, planning,and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IoT in robotics; Architectures for IoRT; Examples and case studies; Open issues and challenges.

Textbooks / References:

It will be provided in each of the lecture sessions.
(Refer **NPTEL** platform)

NPTEL platform:

NPTEL Course	**Name of Instructor**	**Host Institute**	**Link**
Components And Applications of Internet of Things	Dr. Sanjoy Kumar Parida	Indian Institute of Technology Patna	https://onlinecourses.swayam2.ac.in/arp20_ap03/preview

SEMESTER III

Seminar-II

MTAI303	**Seminar-II**	**0L- 0T - 4P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 4 hrs./week	Continuous Assessment : 60 Marks End Semester Exam: 40 Marks (Duration 03 hrs.)

The seminar shall be on the state of the art in the area of the advanced communication of student‘s choice approved by an authority. The student shall submit the duly certified seminar report in standard format, for satisfactory completion of the work duly signed by the concerned guide and head of the Department/Institute.

SEMESTER III

Project-I

MTAI304	**Project-I**	**0L- 0T - 4P**	**10 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 4 hrs./week	Continuous Assessment : 60 Marks End Semester Exam: 40 Marks (Duration 03 hrs.)

Project-I is an integral part of the final project work. In this, the student shall complete the partial work of the project which will consist of problem statement, literature review,project overview, scheme of implementation that may include mathematical model/SRS/UML/ERD/block diagram/ PERT chart, and layout and design of the proposed system/work. As a part of the progress report of project-I work; the candidate shall deliver a presentation on progress of the work on the selected dissertation topic.
It is desired to publish the paper on the state of the art on the chosen topic in international conference/ journal.
The student shall submit the duly certified progress report of project -I in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.

SEMESTER IV

Project-II

MTAI401	**Project-II**	**0L- 0T - 24P**	**12 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 24 hrs./week	End Semester Exam: 100 Marks

In Project - II, the student shall complete the remaining part of the project which will consist of the simulation/ analysis/ synthesis/ implementation / fabrication of the proposed project work, work station, conducting experiments and taking results, analysis and validation of results and drawing conclusions.

It is mandatory to publish the paper on the state of the art on the chosen topic in international conference/ journal.

The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.