SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

B. TECH.
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

IV YEAR
(VII & VIII Semester)

Effective for the students admitted in the year 2020-21 and onwards

Teaching & Examination Scheme
B.Tech.: Artificial Intelligence and Machine Learning
4th Year - VII Semester

THEORY												
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**					**Cr**
		Code	**Title**									
				L	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**		
1	PCC	7AM4-01	Internet of Things	3	0	0	3	30	120	150		**3**
2	OE		Open Elective – I	3	0	0	3	30	120	150		**3**
		Sub Total		**6**	**0**	**0**	**6**	**60**	**240**	**300**		**6**
PRACTICAL & SESSIONAL												
3	PCC	7AM4-21	Internet of Things Lab	0	0	4	2	60	40	100		**2**
4		7AM4-22	Cyber Security Lab	0	0	4	2	60	40	100		**2**
5	PSIT	7AM7-30	Industrial Training	1	0	0	-	75	50	125		**2.5**
6		7AM7-40	Seminar	2	0	0	-	60	40	100		**2**
7	SODECA	7AM8-00	Social Outreach, Discipline & Extra-Curricular Activities	-	-	-	-	0	25	25		**0.5**
		Sub- Total		**3**	**0**	**8**	**-**	**255**	**195**	**450**		**9**
		TOTAL OF VII SEMESTER		**9**	**0**	**8**	**-**	**315**	**435**	**750**		**15**

L: Lecture, T: Tutorial, P: Practical, Cr: Credits ETE: End Term Exam, IA: Internal Assessment

Teaching & Examination Scheme
B.Tech.: Artificial Intelligence and Machine Learning
4th Year - VIII Semester

SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs	IA	ETE	Total	
THEORY											
1	PCC/PEC	8AM4-01	Deep Learning	3	0	0	3	30	120	150	**3**
2	OE		Open Elective – II	3	0	0	3	30	120	150	**3**
		Sub Total		**6**	**0**	**0**	**6**	**60**	**240**	**300**	**6**
PRACTICAL & SESSIONAL											
3	PCC	8AM4-21	Deep Learning Lab	0	0	2	2	30	20	50	**1**
4		8AM4-22	Statistical Modeling and Forecasting Lab	0	0	2	2	30	20	50	**1**
5	PSIT	8AM7-0	Project	3	0	0	-	210	140	350	**7**
7	SODECA	8AM8-00	Social Outreach, Discipline & Extra-Curricular Activities	-	-	-	-	-	25	25	**0.5**
		Sub- Total		**3**	**0**	**4**	**-**	**270**	**205**	**475**	**9.5**
		TOTAL OF VIII SEMESTER		**9**	**0**	**4**	**-**	**330**	**445**	**775**	**15.5**

L: Lecture, T: Tutorial, P: Practical, Cr: Credits ETE: End Term Exam, IA: Internal Assessment

List of Open Electives for Artificial Intelligence and Machine Learning				
Subject Code	**Title**		**Subject Code**	**Title**
Open Elective - I			**Open Elective - II**	
7AG6-60.1	Human Engineering and Safety		8AG6-60.1	Energy Management
7AG6-60.2	Environmental Engineering and Disaster Management		8AG6-60.2	Waste and By-product Utilization
7AN6-60.1	Aircraft Avionic System		8AN6-60.1	Finite Element Methods
7AN6-60.2	Non-Destructive Testing		8AN6-60.2	Factor of Human Interactions
7CH6-60.1	Optimization Techniques		8CH6-60.1	Refinery Engineering Design
7CH6-60.2	Sustainable Engineering		8CH6-60.2	Fertilizer Technology
7CR6-60.1	Introduction to Ceramic Science & Technology		8CR6-60.1	Electrical and Electronic Ceramics
7CR6-60.2	Plant, Equipment and Furnace Design		8CR6-60.2	Biomaterials
7CE6-60.1	Environmental Impact Analysis		8CE6-60.1	Composite Materials
7CE6-60.2	Disaster Management		8CE6-60.2	Fire and Safety Engineering
7EE6-60.1	Electrical Machines and Drives		8EE6-60.1	Energy Audit and Demand side Management
7EE6-60.2	Power Generation Sources.		8EE6-60.2	Soft Computing
7EC6-60.1	Principle of Electronic communication		8EC6-60.1	Industrial and Biomedical applications of RF Energy
7EC6-60.2	Micro and Smart System Technology		8EC6-60.2	Robotics and control
7ME6-60.1	Finite Element Analysis		8ME6-60.1	Operations Research
7ME6-60.2	Quality Management		8ME6-60.2	Simulation Modeling and Analysis
7MI6-60.1	Rock Engineering		8MI6-60.1	Experimental Stress Analysis
7MI6-60.2	Mineral Processing		8MI6-60.2	Maintenance Management
7PE6-60.1	Pipeline Engineering		8PE6-60.1	Unconventional Hydrocarbon Resources
7PE6-60.2	Water Pollution control Engineering		8PE6-60.2	Energy Management & Policy
7TT6-60.1	Technical Textiles		8TT6-60.1	Material and Human Resource Management
7TT6-60.2	Garment Manufacturing Technology		8TT6-60.2	Disaster Management

4th Year - VII Semester
B. Tech. (Artificial Intelligence and Machine Learning)

7AM4-01: Internet of Things

Credit: 3 **Max Marks: 150 (IA :30, ETE:120)**

3L+ 0T+ 0P **End Term Exams: 3 hr**

SN	Contents	Hours
1	**Introduction:** Objective, scope and Outcome of the course.	01
2	**Introduction to IoT:** Definition and characteristics of IoT, Design of IOT: Physical design of IOT, Logical Design of IOT- Functional Blocks, communication models, communication APIs, IOT enabling Technologies- Wireless Sensor Networks, Cloud computing, big data analytics, embedded systems. IOT Levels and deployment templates.	07
3	**IoT Hardware and Software:** Sensor and actuator, Humidity sensors, Ultrasonic sensor, Temperature Sensor, Arduino, Raspberry Pi, LiteOS, RIoTOS, Contiki OS, Tiny OS.	08
4	**Architecture and Reference Model:** Introduction, Reference Model and architecture, Representational State Transfer (REST) architectural style, Uniform Resource Identifiers (URIs). Challenges in IoT- Design challenges, Development challenges, Security challenges, Other challenges.	08
5	**IOT and M2M:** M2M, Difference and similarities between IOT and M2M, Software defined networks, network function virtualization, difference between SDN and NFV for IoT.	08
6	**Case study of IoT Applications:** Domain specific IOTs- Home automation, Cities, environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyles.	08
	Total	40

TEXTBOOKS:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
3. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill HigherEducation

4. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.

4th Year - VII Semester
B. Tech. (Artificial Intelligence and Machine Learning)

7AM4-21: Internet of Things Lab

Credit: 2 **Max Marks: 100 (IA :60, ETE:40)**

0L+ 0T+ 4P **End Term Exams: 2 hr**

SN	List of Experiments
1	Start Raspberry Pi and try various Linix commands in command terminal window: *ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.*
2	Run some python programs on Pi like: a) Read your name and print Hello message with name b) Read two numbers and print their sum, difference, product and division. c) Word and character count of a given string. d) Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input.
3	Run some python programs on Pi like: a) Print a name 'n' times, where name and n are read from standard input, using for and while loops. b) Handle Divided by Zero Exception. c) Print current time for 10 times with an interval of 10 seconds. d) Read a file line by line and print the word count of each line.
4	a) Light an LED through Python program b) Get input from two switches and switch on corresponding LEDs c) Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
5	a) Flash an LED based on cron output (acts as an alarm) b) Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load. c) Get the status of a bulb at a remote place (on the LAN) through web.
6	The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

4th Year - VII Semester
B. Tech. (Artificial Intelligence and Machine Learning)

7AM4-22: Cyber Security Lab

Credit: 2 **Max Marks: 100 (IA :60, ETE:40)**
0L+ 0T+ 4P **End Term Exams: 2 hr**

SN	List of Experiments
1	Implement the following Substitution & Transposition Techniques concepts: a) Caesar Cipher b) Rail fence row & Column Transformation
2	Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
3	Implement the following Attack: a) Dictionary Attack b) Brute Force Attack
4	Installation of Wire shark, tcpdump, etc and observe data transferred in client server communication using UDP/TCP and identify the UDP/TCP datagram.
5	Installation of root kits and study about the variety of options.
6	Perform an Experiment to Sniff Traffic using ARP Poisoning.
7	Demonstrate intrusion detection system using any tool (snort or any other s/w).
8	Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures.
	PROJECT: In a small area location such as a house, office or in a classroom, there is a small network called a Local Area Network (LAN). The project aims to transfer a file peer-to-peer from one computer to another computer in the same LAN. It provides the necessary authentication for file transferring in the network transmission. By implementing the Server-Client technology, use a File Transfer Protocol mechanism and through socket programming, the end user is able to send and receive the encrypted and decrypted file in the LAN. An additional aim of the project is to transfer a file between computers securely in LANs. Elements of

	security are needed in the project because securing the files is an important task, which ensures files are not captured or altered by anyone on the same network. Whenever you transmit files over a network, there is a good chance your data will be encrypted by encryption technique. Any algorithm like AES is used to encrypt the file that needs to transfer to another computer. The encrypted file is then sent to a receiver computer and will need to be decrypted before the user can open the file.

4th Year - VIII Semester
B. Tech. (Artificial Intelligence and Machine Learning)

8AM4-01: Deep Learning

Credit: 3 **Max Marks: 150 (IA :30, ETE:120)**
3L+ 0T+ 0P **End Term Exams: 3 hr**

S. No	Content	Hour
1	**Introduction:** Objective, scope and outcome of the course.	**1**
2	**Neural Networks** - Binary Classification, Logistic Regression, Gradient Descent, Derivatives, Computation graph, Vectorization, Vectorizing logistic regression – Shallow neural networks: Activation functions, non-linear activation functions, Backpropagation, Data classification with a hidden layer	**7**
3	**Deep Neural Networks:** Deep L-layer neural network, Forward and Backward propagation, Deep representations, Parameters vs Hyperparameters, Building a Deep Neural Network (Application).	**8**
4	**Supervised Learning with Neural Networks** – Practical aspects of Deep Learning: Train/Dev / Test sets, Bias/variance, Overfitting and regularization, Linear models and optimization, Vanishing/exploding gradients, Gradient checking – Logistic Regression, Convolution Neural Networks, RNN and Backpropagation – Convolutions and Pooling.	**8**
5	**Optimization algorithms:** Mini-batch gradient descent, exponentially weighted averages, RMS prop, Learning rate decay, the problem of local optima, Batch norm – Parameter tuning process.	**8**
6	**Neural Network Architectures** – Recurrent Neural Networks, Adversarial NN, Spectral CNN, Self-Organizing Maps, Restricted Boltzmann Machines, Long Short-Term Memory Networks (LSTM) and Deep Reinforcement Learning – Tensor Flow, Keras or MatConvNet for implementation.	**8**
	Total	**40**

TEXTBOOKS:

1. Deep Learning, Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press, 2017
2. James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012.

3. Goodfellow, Ian, et al. "Generative Adversarial Networks." arXiv preprint arXiv:1406.2661 (2014).
4. François Chollet "Deep Learning with Python," First Edition, Manning Publication,2018
5. Neural Networks and Deep Learning, Michael Nielsen, Determination Press

4th Year - VIII Semester
B. Tech. (Artificial Intelligence and Machine Learning)

8AM4-21: Deep Learning Lab

Credit: 1 **Max Marks: 50 (IA :30, ETE:20)**
0L+ 0T+ 2P **End Term Exams: 2hr**

S. No.	List of Experiments
1	Basic implementation of a MLP in numpy and Tensor Flow
2	Basic implementation of a deep Learning models in PyTorch and Tensor Flow. Tune its performance by adding additional layers provided by the library.
3	Implement custom operations in PyTorch by using deep learning via gradient descent; recursive chain rule (backpropagation); bias-variance tradeoff, regularization; output units: linear, softmax; hidden units: tanh, RELU.
4	Implement a simple CNN starting from filtering, Convolution and pooling operations and arithmetic of these with Visualization in PyTorch and Tensorflow.
5	ConvNet Architectures: Implement a famous convNet architectures - AlexNet, ZFNet, VGG, C3D, GoogLeNet, ResNet, MobileNet-v1.
6	Familiar with vanilla RNNs and LSTMs on a simple toy problem.
7	Vision and Language: Implement a different tasks involving Vision and Language e.g., Image and video captioning along with the use of attention.
8	Implement Deep Generative Models Variational Auto Encoders (VAE) and Generative Adversarial Networks (GAN) in PyTorch
9	Implementation advance topics: Vision Transformer, Neural Architecture Search, Propose and demonstrate a novel deep learning application project

4th Year - VIII Semester
B. Tech. (Artificial Intelligence and Machine Learning)

8AM4-22: Statistical Modeling and Forecasting Lab

Credit: 1 **Max Marks: 50 (IA :30, ETE:20)**

0L+ 0T+ 2P **End Term Exams: 2 hr**

For Following experimentation following time series data may be used:

1.Download Monthly, Seasonal and Annual Min, Max and avg Temp Series from 1901 to 2017 from https://data.gov.in/catalog/all-india-seasonal-and-annual-minmax-temperature-series.

2.Stock market dataset https://www.kaggle.com/datasets/borismarjanovic/price-volume-data-for-all-us-stocks-etfs

3. Any Kaggle time series dataset https://www.kaggle.com

Exp. No.	List of Experiments
1	Cleaning, Preprocessing and Handling Time Series Data • Time Series Data Cleaning • Loading and Handling Times series data • Preprocessing Techniques
2	How to Checking Stationarity of a Time Series and making Time Series data Stationary Estimating & Eliminating Trend. • Aggregation • Smoothing • Polynomial Fitting Eliminating Trend and Seasonality • Differencing • Decomposition
3	Time Series analysis a) Moving Average time analysis data. b) Smoothing the Time analysis Data. c) Check out the Time series Linear and non-linear trends.
4	Time Series Modelling and Forecasting • Moving average • Exponential smoothing • ARIMA

	• Seasonal autoregressive integrated moving average model (SARIMA)
5	Dependence Techniques • Multivariate Analysis of Variance and Covariance • Canonical Correlation Analysis • Structural Equation Modeling Inter-Dependence Techniques • Factor Analysis • Cluster Analysis