YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
(An Autonomous Institution affiliated to R T M Nagpur University Nagpur)
Accredited by NAAC (1st Cycle) with 'A' Grade (Score 3.25 on 4 Point Scale)

Wanadongri, Hingna Road, Nagpur-441110

Department of Electronics & Communications Engineering (Honors in CVA)

B.E. Honors in Computer Vision and Automation SoE & Syllabus 2021-22

B.E Honors in Computer Vision and Automation

Information Brochure of Honor Program

1. Title of Program: **Computer Vision and Automation**

2. Type of Program : **Honor**

3. Department offering the program: **Electronics and Telecommunication Engineering**

4. Industry / Association / Collaboration**: Fireblaze Technologies Pvt. Ltd**.

5. Department/s eligible to opt for the program: **Only Department of Electronics and Telecommunication Engineering students are permitted to opt for this program.**

6. General information about courses in program: (250 words)

- The courses in the program include IoT, PLCs, Robotics, A.I., M.L., and Advanced Digital Communication which provides the vertical development of students and caters today's need of Industry.

- IoT, PLCs, Robotics helps students in Automation in Industries whereas the courses like A.I. and M.L. are the need of hour. Now a days AI and ML are extensively used in almost all applications like Health Sciences, **Cyber Security, Hiring Platforms and Systems,** making communication easy and seamless, **Accelerated Reading, Market Prediction, Accounting and Fintech , Building Smart Infrastructures and Solutions.** It helps in cyber security projects and are being used for building smart solutions.

- Advanced Digital Communication gives the detailed information about the core area of telecommunications.

7. Advance knowledge or research orientation of Program: (100 words) (for Honor)

- The Honors program covers most of the courses which are not covered in the UG courses, hence it provides the advanced knowledge in the area of telecommunication and it will help the student to undertake the projects in telecommunication with the help of the courses like IoT, AI and ML.

8. Employability potential of program: (100 words)
(for both Honor /Minor)

- Due to the great demand of AI ,ML and IoT in industries for carrying out various projects, the employability of students will be substantially increased due to this program.
- The knowledge of PLCs and IoT will be very much beneficial for the students as most of the industries use PLCs and IoT for automation.
- The students doing this program can be employed in all IT industries where most of the projects are in the area of AIML and IoT.
- PLC is a distinctive form of computer device designed for use in industrial control systems. It is required in various industries such as glass, paper ,cement etc. so, there is a great demand of engineers with the knowledge of PLCs.

9. Departmental Steering committee: For proper publicity / conduct of program

SN	Name of the Faculty Member	Post	Designation	e-mail ID	Contact Number
1.	Dr. M. S. Narlawar	HOD	Chairman	hod_et@ycce.edu	9763822298
2.	Dr. M. S. Dorle	Asst. Professor	In-charge	mdorle@gmail.com	9881711748
3.	Dr. P. W. Raut	Associate Professor	Member	pravinwraut@hotmail.com	9372153405
4.	Dr. D. B. Bhoyar	Asst. Professor	Member	dinesh.bhoyar23@gmail.com	9923448822

10. Program Coordinator:

SN	Name of the Faculty Member	Post	Designation	e-mail ID	Contact Number
	Dr. M. S. Dorle	Asst. Professor	In-charge	mdorle@gmail.com	9881711748

Scheme of Examinations

B.E Honors in Computer Vision and Automation

SN	Sem	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
					L	T	P	Hrs		MSEs*	TA**	ESE	
B.E Honors Computer Vision and Automation													
1	5	ETH131	Internet of Things	T	3	0	0	3	3	30	30	40	3
2	5	ETH132	Industrial Automation and Robotics	T	3	0	0	3	3	30	30	40	3
3	5	ETH133	Design Lab	P	0	0	2	2	1		60	40	3
4	6	ETH141	Machine learning	T	3	0	0	3	3	30	30	40	3
5	6	ETH142	Artificial Intelligence	T	3	0	0	3	3	30	30	40	3
6	6	ETH143	Simulation Lab	P	0	0	2	2	1		60	40	3
7	7	ETH151	Database Management Systems	T	3	0	0	3	3	30	30	40	3
8	7	ETH152	Database Management Systems Lab	P	0	0	2	2	1		60	40	3
			TOTAL		**15**	**0**	**6**	**21**	**18**				

MSEs* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 20 marks on lecture quizzes, 8 marks on assignments, 2 marks on class performance

TA = for Practical : MSPA will be 15 marks each**

V Semester
ETH131: Internet of Things

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. To understand the physical and Logical design of IoT. 2. To study the M2M and NETCONF. 3. To understand python programming. 4. To understand physical servers and cloud offerings.	1. Explore the physical and Logical design of IoT. 2. Explore the M2M and NETCONF. 3. Explore python programming. 4. Apply basic skills of IoT to solve real life problems.

UNIT-1:
Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels. **5 Hrs.**

UNIT-2:
Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style. **6Hrs**

UNIT-3:
M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG. **7Hrs**

UNIT-4:
Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions **6Hrs**

UNIT-5:
Python Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages, IoT Device-Raspberry Pi, Programming Raspberry pi with Python **6Hrs**

UNIT-6:
IoT physical servers and cloud offerings, Introduction to cloud storage models and communication APIs, Python web application frame work-Django, Amezon web service for IoT **7Hrs**

Text books:				
1	Internet of Things: A Hands-On Approach	1st edition 2015	by Arshdeep Bahga, Vijay Madisetti	Orient Blackswan Private Limited - New Delhi
Reference books:				
1	Designing the Internet of Things	1st edition	By Adrian McEwen	Wiley
2	Python for Everybody		Charles R. Severance	

V Semester
ETH132: Industrial Automation and Robotics

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn the basic Concept of Industrial Automation. 2. Understand functioning of automation components. 3. Learn the programming related to automation and robotics. 4. Understand the concept behind controlling systems.	1. Understand the Concept of Industrial Automation. 2. Identify the components required for automation systems. 3. Write the program for PLC and Robotics. 4. Design control system as per the application

UNIT I: Introduction: Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: modbus & profibus

(5 Hours)

UNIT II: Automation components: Sensors: temperature, pressure, force, displacement. Introduction to Actuators, process control valves. Introduction of DC and AC servo drives for motion control.

(6 Hours)

UNIT III : Programmable logic controllers: Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

(7 Hours)

UNIT IV : Introduction to robotics

Definition of a Robot - Basic Concepts - Robot configurations - Types of Robot drives - Basic robot motions - Point to point control - Continuous path control.

(6 Hours)

UNIT V: Components, Operations, Sensing and Machine Vision

Basic control system concepts - control system analysis - robot actuation and fed back, Manipulators - director and inverse kinematics, Coordinate transformation - Brief Robot dynamics. Types of Robot and effectors - Grippers - Tools as end effectors - Robot/End - effort interface.

Range sensing - Proximity sensing - Touch sensing - Force and Torque sensing.

(6 Hours)

UNIT VI: Robot Programming

Methods - languages - Capabilities and limitation - Artificial intelligence - Knowledge representation - Search techniques - A1 and Robotics.

(6 Hours)

Text books:

1.	Industrial Instrumentation and Control	Third Edition 2009	S.K. Singh	The McGraw Hill Companies
2.	Robotics Control, sensing, Vision and Intelligence	1987	K.S. Fu., R.C.Gonalez, C.S.G.Lee	McGraw Hill International Edition

Reference books:				
1.	Process Control Instrumentation Technology	2014 Eighth edition	C.D. Johnson	Prentice Hall of India.
2.	Programmable logic controller	Fourth edition 2006	W. Bolton	ELSEVIER
2.	Industrial control handbook	Third Edition 1998	E A Parr	Butterworth-Heinemann
	Industrial robotics, technology, Programming and Applications	1986	Mikell P. Groover, mitchell Weiss	McGraw Hill International Edition
	Robotic engineering - An Integrated Approach	1989	Richard D. Klafter, Thomas A. Chmielewski and Michael Negin	Prentice Hall Inc, Englewoods Cliffs, NJ, USA,

V Semester
ETH133: Design Lab

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn Python Programming 2. Understand the interfacing with the Raspberry pi 3. Learn the program for PLC and Robotics. 4. Understand characteristics of automation components	1. Explore Python Programming 2. Explore the interfacing with the Raspberry pi 3. Write the program for PLC and Robotics. 4. Explore characteristics of automation components

Expt. No.	Name of Experiment
1	Experiment based on loops and functions in python.
2	To Interface LED with Raspberry pi.
3	To Interface DHT11 sensor with Raspberry pi.
4	Experiment based on File handling using Python.
5	To monitor temperature and humidity data remotely using things speak platform.
6	Experiment based on Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system.
7	Experiment based on Robot programming.
8	Measurement of Temperature using RTD.
9	Measurement of Strain using Strain Gauge or load cell
10	Study the characteristics of LVDT
11	Performed logical operation using Ladder Diagram.
12	Study of PLC Programmer
13	**Mini-project**

VI Semester
ETH141: Machine learning

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the concepts of machine learning and regression models 2. Understand the concept of classification for model evaluation. 3. Learn Supervised and unsupervised learning algorithms. 4. Learn the concept of artificial neural network and deep networks	1. Apply and analyze models using regression 2. Apply supervised and unsupervised learning for problem solving 3. Apply neural network algorithms for classification 4. Evaluate deep neural network with parameters computational complexity

Prerequisites: Basic probability and statistics, linear algebra and calculus and some background in programming

UNIT I : Regression

Supervised and Unsupervised learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling **06Hrs**

UNIT II : Classification

Logistic Regression, Hypothesis Representation, Decision Boundary, Cost Function and Gradient Descent, Multiclass Classification, Regularization, Model Evaluation
06Hrs

UNIT III : Supervised Learning

KNN, SVM, Decision Tree, Naïve Bayes Classifier, Random Forest **06Hrs**

UNIT IV : Unsupervised learning

K-means Clustering, Hierarchical Clustering, DBSCAN Clustering, Recommendation System, Anomaly Detection **06Hrs**

UNIT V: Artificial Neural Network

Introduction to Neural Network, Activation Functions, Perceptron Rule, Backpropogation **06Hrs**

UNIT VI: Deep Learning

Introduction to Deep Learning, Building Blocks of CNN, Computational Complexity, CNN Architectures
06Hrs

Text books:				
1	Understanding Machine Learning. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html	2017	Shai Shalev-Shwartz and Shai Ben-David.	Cambridge University Press.
2	The Elements of Statistical Learning. https://web.stanford.edu/~hastie/ElemStatLearn/	2009	Trevor Hastie, Robert Tibshirani and Jerome Friedman.	Second Edition
3.	Pattern Recognition and Machine Learning. https://www.microsoft.com/en-us/research/people/cmbishop/downloads/	2006	Christopher Bishop.	Springer
Reference books:				
1	Foundations of Data Science.	January 2017	Avrim Blum, John Hopcroft and Ravindran Kannan.	
2	Deep Learning, Part II, http://www.deeplearningbook.org/	2016	Goodfellow, I., Bengio, Y., Courville, A.	MIT Press
3	Machine Learning: A Probabilistic Perspective	2012	Kevin P. Murphy	MIT Press
4.	MACHINE LEARNING An Algorithmic Perspective	Second Edition	Stephen Marsland	Chapman & Hall/CRC

VI Semester
ETH142 : Artificial Intelligence

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn the fundamentals of Artificial Intelligence, Autonomous Agents. 2. Learn the problem solving techniques. 3. Understand the Knowledge and Reasoning based methods 4. Study the machine learning and Natural Language Processing.	1. Apply basic of Artificial Intelligence programming techniques 2. Solve the problems using different search techniques. 3. Describe the Knowledge and Reasoning based methods 4. Describe the concept of Machine Learning and Natural Language Processing

UNIT 1: Introduction to AI and intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents, Artificial Intelligence programming techniques (5 Hours)
UNIT 2: Problem Solving: Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods. Game Playing: minimax, alpha-beta pruning. (6 Hours)
UNIT 3: Knowledge and Reasoning: Building a Knowledge Base: Propositional logic, first order Logic, situation calculus. Theorem Proving in First Order Logic. Planning, partial order planning. (6 Hours)
UNIT 4: Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks. (7 Hours)
UNIT 5: Machine Learning: Overview of different forms of learning, Learning Decision Trees, Neural Networks (6 Hours)
UNIT 6: Introduction to Natural Language Processing, Deep Learning for Natural Language Processing, Computer Vision (6 Hours)

Text books:				
1	Artificial Intelligence: A Modern Approach		Stuart Russell and Peter Norvig	Prentice-Hall
2	Artificial Intelligence: A New Synthesis		Nils J. Nilsson	Morgan-Kaufmann
Reference books:				
1	Dr. Dheeraj Mehrotra		Basics of Artificial Intelligence & Machine Learnig ,	Kindle Edition

VI Semester
ETH143 : Simulation Lab

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the concepts of regression models 2. Learn neural network classification for machine learning 3. Understanding clustering techniques and their utilization in machine learning 4. Solve the problems using search techniques and NLP	1. Implement and apply regression models 2. Apply neural network algorithms for classification 3. Apply clustering techniques and their utilization 4. Apply search techniques and NLP in problem solving

Expt. No.	Name of Experiment
1.	Experiment based on linear regression
2.	Experiment based on Logistic regression
3.	Implementation of AND/OR/NOT Gate using Single Layer Perceptron: http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/exp1/index.php
4.	Experiment based on gradient Descent
5.	Implementation of XOR Gate Using Multi-Layer Perceptron/ Error Back Propagation http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/exp2/index.php
6.	Case study explaining function of Optical Character Recognition http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/exp11/index.php
7.	Classify your uploaded image Python using TensorFlow 2 with Keras support https://www.kdnuggets.com/2020/05/interactive-machine-learning-experiments.html
8.	Experiment based on Clustering and dimension reduction
9.	Experiment based on Search Methods
10.	Experiment based on Deep Learning for Natural Language Processing
11.	Case study

VII Semester
ETH151: Database Management Systems

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) Learn different database system concepts 2) Learn the designing of Entity Relationship diagram. 3) Know relational data model, relational algebra & SQL Queries. 4) Understand relational database design. 5) Know about data integrity issues.	1) Analyze & compare different levels of abstraction & data independence. 2) Design Entity Relationship Diagram for any scenario. 3) Solve queries based on relational algebra & SQL. 4) Identify functional dependencies & normalise the database and apply ACID properties. 5) Analyse transaction management, various concurrency control protocols and crash recovery methods.

UNIT I [05 Hrs]
Introduction to Database Management System: General File System and Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.

UNIT II [06 Hrs]
Entity-Relationship Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme.

UNIT III [06 Hrs]
SQL: Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested subqueries, views, modification of database, transaction, Joins.
Advanced SQL: SQL data types & schemas, Integrity Constraints, Domain Constraints, Assertions, triggers, Advanced SQL Features.

UNIT IV [07 Hrs]
Relational Data Model: Structure of Relational Databases
Relational Algebra: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations, extended relational algebra operations, modification of the databases.

UNIT V [06 Hrs]
Relational Database Design: Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies, Alternative Approaches to Database design.

Transaction Management: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability.

UNIT VI [06 Hrs]
Concurrency Control: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques, Multiple Granularity, Multi version Timestamp Protocol, Transaction isolation levels, Read consistency.
Crash Recovery: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints, Shadow Paging.

TEXT BOOKS:

1. "Database System Concepts" Korth, Silberschatz: McGraw-Hill publication.
2. "Fundamentals of Database Systems ", Elmasri, Navathe & Gupta, Pearson Education.

REFERENCE BOOKS

1. Database System Concepts by Henry Korth and Others
2. Database Systems by Connolly, 3rd edition, Pearson Education.
3. Database Systems by S. K. Singh, Pearson Education.
4. Principles of Database Systems – Ullman, Golgotia Publications 1998

VII Semester
ETH152: Database Management Systems

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) Learn Baseband representation, reception and probability of error 2) Understand the transmission errors in digital communication systems 3) Understand the concept of spread spectrum modulation, its types and applications. 4) Understand the practical applications of Multichannel and multicarrier communication systems	1) Distinguish various digital modulation techniques. 2) Analyze the probability of errors in digital communication systems. 3) Apply spread spectrum modulation for various applications of communication systems. 4) Distinguish Multichannel and multicarrier communication systems

Expt. No.	Name of Experiment
1	Designing of an ER Diagram.
2	Designing of Database Schema based on ER diagram.
3	Installation & Study of My-SQL
4	Implementation of different DDL commands.
5	Implementation of Constraints: Referential Constraints, Domain Constraints
6	Implementation of different DML Commands
7	Study and Implement Inner join.
8	Study and Implement Outer Join.
9	Case Study