`STATE BOARD OF TECHNICAL EDUCATION, BIHAR
Scheme of Teaching and Examination for
Vth SEMESTER DIPLOMA IN ELECTRONICS ENGINEERING
(Effective form Session 2020-2021 Batch)

THEORY

S.No	SUBJECTS	SUBJECT CODE	TEACHING SCHEME Periods per week	Hours of Exam	Teacher's Assessment (TA) Marks (A)	Class Test (CT) Marks (B)	End Semester Exam. (ESE) Marks (C)	Total Marks (A+B+C)	Pass Marks ESE	Pass Marks in the Subject	Credits
1.	Embedded Systems	2021501	04	03	10	20	70	100	28	40	03
2.	Mobile and Wireless Communication	2021502	03	03	10	20	70	100	28	40	03
3.	Industrial Automation	2021503	03	03	10	20	70	100	28	40	03
4.	Microwave & Radar	2021504	03	03	10	20	70	100	28	40	03
5.	Open Elective / COE	2021505	03	03	10	20	70	100	28	40	02

Renewable Energy Technologies (2021505A)	Artificial Intelligence (Basics) (2000505B)	
Internet of Things (Basics) (2000505C)	Drone Technology (Basics) (2000505D)	3D Printing & Design (Basics) (2000505E)
Industrial Automation (Basics) (2000505F)	Electric Vehicles (Basics) (2000505G)	Robotics (Basics) (2000505H)

	Total : 16			350	500			14

PRACTICAL

S.No	SUBJECTS	SUBJECT CODE	TEACHING SCHEME Periods per week	Hours of Exam	Practical (ESE) Internal (PA)	Practical (ESE) External (ESE)	Total Marks	Pass Marks in the Subject	Credits
6.	Embedded Systems Lab	2021506	02 50% Physical 50% Virtual	03	07	18	25	10	01
7.	Mobile and Wireless Communication Lab	2021507	02 50% Physica 50% Virtual	03	07	18	25	10	01
8.	Elective Lab / COE Lab		06 50% Physical 50% Virtual	03	15	35	50	20	03

Microwave & Radar Lab (2021508A)	Artificial Intelligence Lab (Basics) (2000508 B)	Internet of Things Lab (Basics) (2000508 C)	Drone Technology Lab (Basics) (2000508D)	3D Printing & Design Lab (Basics) 2000508E
Industrial Automation Lab (Basics) (2000508F)	Electric Vehicles Lab (Basics) (2000508G)	Robotics Lab (Basics) (2000508H)	

9	Industrial Automation Lab	2021509	02 50% Physical 50% Virtual	03	07	18	25	10	01
		Total: 12					125		06

TERM WORK

S.No	SUBJECTS	SUBJECT CODE	TEACHING SCHEME Periods per week	Marks of Internal (PA)	Marks of External (ESE)	Total Marks	Pass Marks in the Subject	Credits
10	Major Project Part-I & Cont. to VI Sem. Part-II	2021510	03	15	35	50	20	01
11.	Summer Internship-II (4 weeks) after IV Semester	2021511	-	07	18	25	10	02
12.	Course Under Moocs /Swayam/ /KYP (TW)/Others	2021512	02	15	35	50	20	01
	Total Periods per week of each duration One Hour = 33					**125 Total Marks:750**		**24**

EMBEDDED SYSTEMS
(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021501	Theory			No. of Period in One Session : 60			Credits
	No. of Periods Per Week			**Full Marks**	**:**	**100**	**03**
	L	**T**	**P/S**	**ESE**	**:**	**70**	
	04	-	-	TA	:	10	
	-	-	-	CT	:	20	

RATIONALE

In the rapidly growing digital world, role of embedded systems is increasingly vital in various domains such as industrial and home automation, entertainment systems, medical equipment's and many more. The core of all such system is powered by electronic hardware and associated software. It is therefore evident to impart the knowledge of the related technology and hands on skills to develop and maintain electronics hardware based embedded systems.

Course Objectives:

1. To have knowledge about the basic working of an Arduino system and its programming in Embedded C language.

2. To provide experience to integrate hardware and software for Arduino applications systems.

CONTENTS: THEORY

Chapter	Name of the Topic	Hours
Unit I	Embedded C basics operators for Arduino, familiarizing with the Arduino IDE, Sketch designing for Arduino, Communication interface using serial port, Basic understanding of the code with Boolean operations, pointer access operations, bitwise operations, compounded operations.	**18**
Unit II	Embedded C control structure blocks, Looping mechanism- for, do and while, the branching operations based on conditions expression.	**12**
Unit III	**Introduction to Arduino Mega** Arduino Mega specifications including power ratings, digital and analog peripherals, Difference between the C language and Embedded C language, Arduino Mega Ports, Pins, Digital and Analog Peripherals	**18**
Unit IV	**Communication with Arduino** Different communication modules available with their real-life application, Communication interface	**12**
	TOTAL	**60**

References:

S. No.	Title of Book	Author	Publication
1.	Arduino Projects For Dum- mies (For Dummies Series)	Kennedy George; Davis Bernard; Prasanna SRM	Wiley (5 July 2013) ISBN: 978-1118551479
2.	Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform	Massimo Banzi and Michael Shi-loh	Shroff/Maker Media; Third edition (27 December 2014) ISBN: 978-9351109075
3.	Embedded Systems	D.P. Nagpal	FPH

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.arduino.cc/reference/en/
2. https://learn.adafruit.com/category/learn-arduino

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned objective:

CO 1: Select the relevant microcontrollers for various industrial applications.

CO 2: Use 'Embedded C' programming language to maintain embedded systems.

CO 3: Interpret the communication standards of embedded systems.

CO 4: Develop basic applications using embedded systems.

CO 4: Interpret features of Real Time Operating System.

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MOBILE AND WIRELESS COMMUNICATION
(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021502	Theory			No. of Period in One Session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03	-	-	TA	:	10	
	-	-	-	CT	:	20	

RATIONALE

In this world of connectivity and collaborative work environment, it is necessary to connect to the network from anywhere, with anybody, at any time. Wireless communication provides connectivity with mobility, flexibility and convenience. Wireless devices are used across the various industries like Healthcare, Education, Automation, Renewable energy sector, Automobile etc. Effective use of Social networking has become possible due to high end wireless devices. This course will help the students to develop skills to handle wireless and mobile communication systems.

Course Objectives:

a. To introduce the concepts and techniques associated with Wireless Cellular Communication systems.
b. To familiarize with state of art standards used in wireless cellular systems.

CONTENTS: THEORY

Chapter	Name of the Topic	Hours
Unit I	**Overview of Cellular Systems** Evolution 2G/3G/4G/5G, cellular concept- Frequency reuse, Cochannel and Adjacent channel Interference	12
Unit II	**Wireless propagation** Link budget, Free-space path loss, Noise figure of receiver Multipath fading, Shadowing, Fading margin, Shadowing margin	13
Unit III	Antenna diversity, wireless channel capacity and MIMO	10
Unit IV	Overview of CDMA, OFDM and LTE	10
	TOTAL	45

References:

S. No.	Title of Book	Author	Publication
1.	Wireless Communications – Principles and Practice	T. S. Rappaport,	(2nd edition) Pearson ISBN 9788131731864
2.	Modern Wireless Communications	Haykin & Moher	Pearson 2011 (Indian Edition) ISBN: 978-8131704431
3.	Mobile and Wireless Communication	Rajesh Thakral	FPH

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned objective:

CO 1: Troubleshoot mobile handsets.

CO 2: Assess cellular systems capacity.

CO 3: Assess performance of standards of different cellular mobile systems.

CO 4: Select relevant wireless technology suitable for various applications.

CO 5: Test the performance of various wireless protocols.

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INDUSTRIAL AUTOMATION

(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021503	Theory			No. of Period in One Session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03	-	-	TA	:	10	
	-	-	-	CT	:	20	

RATIONALE:

In the present global scenario of manufacturing, industries are moving towards complete automation. Small and medium scale industries are in the phase of switching to PLC and SCADA technology for' the data acquisition and control. Therefore, it is necessary for Electronics/instrumentation engineers to have knowledge of both PLC and SCAUA technology. This course attempts to provide basic knowledge of these technologies to develop operational competency. Hence this course is foundation for the engineers who want to further specialize in the Industrial automation field.

Course Objectives:

The aim of this course is to help the student to attain the following industry identified objective through various teaching learning experiences:

   a. Maintain Industrial Automation systems.

CONTENTS: THEORY

Chapter	Name of the Topic	Hours
Unit I	Industrial automation overview and data acquisition Architecture of Industrial Automation Systems. Measurement Systems Characteristics Data Acquisition Systems	**11**
Unit II	Control Generation Introduction to Automatic Control P-I-D Control Feedforward Control Ratio Control The branching operations based on conditions expression	**14**
Unit III	Sequential control and PLC Introduction to Sequence Control, PLC, RLL PLC Hardware Environment	**10**
Unit IV	Industrial control application Hydraulic Control Systems Pneumatic Control Systems Energy Savings with Variable Speed Drives Introduction to CNC Machines	**10**
	TOTAL	**45**

References:

S. No.	Title of Book	Author	Publication
1.	Industrial Instrumentation, Control and Automation	S. Mukhopadhyay, S. Sen and A. K. Deb	Jaico Publishing House, 2013 ISBN: 978-8184954098
2.	Industrial Automation	Balakrishnan	FPH
3.	Industrial Automation	Rakesh Verma	FPH
4.	Electric Motor Drives, Modelling, Analysis and Control	R. Krishnan	Prentice Hall India, 2002 ISBN: 978-0130910141

Course Outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned objective:

    CO 1: Identify different components of an automation system.

    CO 2: Interface the given I/O crevice with appropriate PLC module.

    CO 3: Prepare a PLC ladder program for the given application.

    CO 4: Select the suitable motor drives for the specified application.

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MICROWAVE AND RADAR

(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021504	Theory			No. of Period in One Session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03	-	-	TA	:	10	
	-	-	-	CT	:	20	

RATIONALE:

Microwave communication is the back bone of terrestrial communication and also the sole of mobile communication. To provide communication at difficult geographical locations and for specific task microwave links and RADAR are the established telecommunication solution. This course has been designed to develop skills in the diploma engineers to maintain microwave and RADAR based telecommunication systems.

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

a. Maintain microwave and RADAR based communication systems.

CONTENTS: THEORY

Chapter	Name of the Topic	Hours
Unit I	Introduction to Microwaves History and applications of Microwaves Mathematical Model of Microwave Transmission Microwave transmission modes, waveguides and transmission lines, Impedance Matching Microwave Network Analysis	12
Unit II	Passive and Active Microwave Devices Directional Coupler, Power Divider, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Microwave Tubes.	06
Unit III	Microwave Design Principles- Microwave Filter Design, Microwave Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas	10
Unit IV	Microwave Measurements, Microwave Systems, Effect of Microwaves on human body.	5
Unit V	Doppler effect, CW Doppler RADAR: Block diagram, operation and application, FM CW RADAR: Block diagram. operation and application, MTI: Block diagram, operation concept of blind speed, application, Automatic target detection RADAR	12
	TOTAL	**45**

References:

S.No.	Title of Book	Author	Publication
1.	Microwave Engineering	D.M. Pozar	Wiley; Fourth edition (2013) ISBN 978-8126541904
2.	Foundation for Microwave Engineering	R.E. Collins	Wiley; Second edition (2007) ISBN: 978-8126515288
3.	Microwave & Radar	D.C. Sharma	FPH
4.	RADAR systems and radio aids to navigation	Sen, A.K. and Bhattaclsarya, A.B	Mercury Learning & Information. PVT.LTD. New Delhi, 20I7, ISBN: 978-1683921189

Course Outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO 1: Use specified waveguides in microwave communication system.

CO 2: Maintain passive microwave components and devices.

CO 3: Maintain active microwave components and devices.

CO 4: Interpret RADAR based systems for range detection.

CO 5: Maintain various types of RADAR system for the specified application.

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RENEWABLE ENERGY TECHNOLOGIES
(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021505A	Theory			No. of Period in One Session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	02
	L	T	P/S	ESE	:	70	
	03	-	-	TA	:	10	
	-	-	-	CT	:	20	

Course Learning Objectives:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

CONTENTS: THEORY

Chapter	Name of the Topic	Hours
Unit I	**Introduction** World Energy Use, Reserves of Energy Resources; Environmental Aspects of Energy utilization, Renewable Energy Scenario in India and around the World, Potentials, Achievements / Applications, Economics of renewable energy systems.	08
Unit II	**Solar energy:** Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.	12
Unit III	**Wind Energy:** Wind Data and Energy Estimation, Types of Wind Energy Systems, Performance, Site Selection, Details of Wind Turbine Generator, Safety and Environmental Aspects.	09
Unit IV	**Bio-Energy:** Biomass direct combustion, Biomass gasifiers; Biogas plants, Digesters, Ethanol production, Bio diesel, Cogeneration, Biomass Applications.	08
Unit V	**Other Renewable Energy Sources:** Tidal energy, Wave Energy, Open and Closed OTEC Cycles, Small Hydro-Geothermal Energy, Hydrogen and Storage, Fuel Cell Systems, Hybrid Systems.	08
	TOTAL	45

References:

S. No.	Books
1.	O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2.	Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006
3.	Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4.	Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5.	Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007
6.	Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7.	Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
8.	Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.
9.	Renewable Energy Technologies ,Harjeet Singh , FPH

Course outcomes:

At the end of the course, the student will be able to:

CO1:	Understand present and future energy scenario of the world.
CO2:	Understand various methods of solar energy harvesting.
CO3:	Identify various wind energy systems.
CO4:	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5:	Identify suitable energy sources for a location.

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ARTIFICIAL INTELLIGENCE (BASICS)

	Theory			No of Period in one session : 45			Credits
Subject Code 2000505B	**No. of Periods Per Week**			**Full Marks**	**:**	**100**	
	L	**T**	**P/**	**ESE**	**:**	**70**	**02**
	03	**—**	**—**	**TA**	**:**	**10**	
				CT	**:**	**20**	

Rationale:

Artificial Intelligence , also known as data-driven science, is an interdisciplinary field of scientific methods, processes, and systems to extract <u>knowledge</u> or insights from <u>data</u> in various forms, structured or unstructured, similar to <u>data mining.</u>

What's the focus of this Curriculum?

Artificial Intelligence program is designed to impart an in-depth knowledge of the various libraries and packages required to perform data analysis, data visualization, web scraping, machine learning, Deep Learning using Python. The course is packed with real-life projects, assignments, demos, and case studies to give hands-on and experiments to the participants.

Course Objectives:

- This course gives an overview of the fundamentals of artificial intelligence.
- It contains a theory and practical component modern AI algorithms
- A practice component based on the real world problem to relate theoretical algorithms with experimental implementation.
- This course is divided into two parts viz.(Theory and Experiments)

Course Outcomes:

CO 1: Understand the objectives and functions of modern Artificial Intelligence.

CO 2: Develop AI based System Design & Development

CO 3: Categorize an AI problem based on its characteristics and its constraints.

CO 4: Develop AI Solutions & Applications

CO 5: Knowledge of machine learning algorithms and extracting knowledge models from data.

CO 6: Develop AI & Organizational Intelligence

CO 7: Analyze the complexity of a given problem and come with suitable optimizations

Contents: Theory			HRS
Unit -1	**Introduction to Data Science**		15
	1) Introduction to Data Science, ML, DL & AI - why is it so important? 2) Applications of Data science across industries 3) Business problems – Analytics scenarios 4) Python for Data Science 5) Data Scientist Toolbox, Tool of choice- Python: what & why? 6) Data Scientist - Tasks and Capabilities 7) Introduction to NumPy arrays, functions & properties 8) Introduction to pandas, Data frame functions and properties		
Unit -2	**Practice assignment – 2A Numerical Summary of Data**		18
	1) Summarizing numeric data and categorical data in pandas 2) Group wise summary of mixed data 3) Visual summary of different data combinations **Practice assignment – 2B** **Data Visualization using Python** 1)Need for visual summary 2)Introduction to Seaborn		
Unit -3	**Basics of Statistics**		12

	1) Introduction to Univariate Statistics, Shape
	 2) Central Tendency and variability
	       3) Outliers
	       4) Correlation
	 5) Introduction to Linear Algebra
	 6) Mathematics for Machine Learning
	 7) Vectors and Matrices
	 8) Matrices Operations
	 9) Applications to Data Problems		

		Total	45

BIBLIOGRAPHY:

1. http://Pandas.pydata.org/Pandas-docs/version/0.23/tutorials.html

2. https://docs.python.org/3/tutorial/datastructures.html

3. https://docs.scipy.org/doc/numpy/user/quickstart.html

4. https://wiki.python.org/moin/TimeComplexity

5. Python Data Science Handbook: Essential Tools for Working with Data by Jake VanderPlas

6.Artificial Intelligence And Deep Learning For Decision Makers: A Growth Hacker's Guide To Cutting Edge Technologies by Dr. Jagreet Kaur

7. Machine Learning using Python by Manaranjan Pradhan

INTERNET OF THINGS (IOT) (BASICS)

Subject Code 2000505 C	Theory			No of Period in one session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	02
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
				CT	:	20	

Rationale:

Course Objectives:

- Get Internet of Things (IoT) Fundamentals
- A background in electronic engineering or a related subject
- An understanding of basic networking
- Some software (coding) experience
- This course is divided into three parts viz.(Theory , Experiments and mini project component)

Course Outcomes:

CO 1: Explain the definition and usage of the term "Internet of Things" in different contexts

CO 2: Understand the key components that make up an IoT system

CO 3: Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack

CO 4: Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis

Contents: Theory		HRS
Unit -1	**Introduction to Internet of Things**	15
	1) Introduction to python and IOT Development Platforms	
	2) IOT Software and Cloud Services	
	Practice Assignment	
Unit -2	**Introduction to communication protocol and sensors**	15
	1) IOT Communication Protocols	
	2) Identification and Localization for IoT	
	3) Introduction to node MCU	
	4) Device integration with node MCU	
	5) Sensors and Actuators	
	Practice assignment	
Unit -3	**Introduction to APIs**	15
	1) APIs, and Client-Server Model for intranet and communication system	
	2) Identification and Localization for IoT	
	3) IOT based data-monitoring system	
	4) Database creation on cloud	
	Total	45

Text Books/References:

1. Amini, P. (2014). Sulley: Pure Python fully automated and unattended fuzzing frame- work.   https://github.com/OpenRCE/sulley

2.Internet of things (IoT) : technologies, applications, challenges and solutions by BK

3.. https://wiki.python.org/moin/TimeComplexity

4.. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos & Marilyn Wolf

5.Custom Raspberry Pi Interfaces: Design and build hardware interfaces for the Raspberry Pi by Warren Gay

DRONE TECHNOLOGY (BASICS)

Subject Code 2000505 D	Theor			No of Period in one session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	02
	L	T	P/	ESE	:	70	
	0	—	—	TA	:	10	
				CT	:	20	

Rationale:

In this Era of technology the demand for drones are increasing in the field of infrastructure, engineering, security, surveillance, environmental studies and monitoring. CoE-Drone initiative will address various aspects of the development and application of drone technology such as technological advancements, training, legal aspects, administrative management, and logistics. In this Center of Excellence we will collaborate with institutes and it is to provide a better environment for students and professionals.

Drone Technology has applications across technological advancements, training, legal aspects, administrative management, and logistics. This tutorial for beginners covers all the basics of Drone Technology (UAV).

Course Objectives:

- Gain knowledge about the flying techniques of drones.
- Use of drones for the safe and secured methodology of data gathering.
- Understand the rules and compliance for drone operations,
- To Understand the potential drone applications such as agriculture, survey, delivery system, safety, security and many other wider fields.

Course Outcomes:

CO 1: Safely operate a drone using an understanding of drone components, equipment, and technology.

CO 2: Integrate factors impacting drone flight such as environment, weather, and geography into planning and operations.

CO 3: Plan drone flights using an understanding of FAA and National Airspace System regulations and drone operation ethics.

CO 4: Use effective Crew Resource Management during field data collection.

CO 5: Program and fly a drone equipped with GPS to capture video and/or still photography.

CO 6: Use post-processing techniques to achieve project goals.

Contents: Theory		HRS
Unit -1	**Introduction to Drone Technology** 1) Introduction to Drones and UAV 2) Drone flights using an understanding of FAA 3) Introduction to Flight Dynamics 4) Various types of Drones and their respective Applications **Practice Assignment**	15
Unit -2	**Introduction to Drone component:** 1) Parts of Drones 2) Sensors 3) Motors 4) Application of DC motors in drones **Practice assignment**	15
Unit -3	**Introduction to Drone controller and motion** 1) Propulsion and Vertical Motion 2) Controller and Flying Instructions	15
	Total	45

Text Books/References:

1. DIY Drone and Quadcopter Projects: A Collection of Drone-Based Essays, Tutorials, and Projects by Make Magazine

2. Make: Getting Started with Drones: Build and Customize Your Own Quadcopter by Terry Kilby & Belinda Kilby

3. Agricultural Drones: A Peaceful Pursuit by K R Krishna

4. Building Multicopter Video Drones: Build and fly multicopter drones to gather breathtaking video footage by **Ty Audronis**

3D PRINTING & DESIGN (BASICS)

Subject Code 2000505 E	Theor			No of Period in one session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	02
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
				CT	:	20	

Rationale:

COURSE OBJECTIVES

The student will be able to

• Gain knowledge and skills related to 3D printing technologies.

• Learn the selection of material, equipment, and development of a product for the Industry 4.0 environment.

• Understand the various software tools, processes and techniques for digital manufacturing.

• Apply these techniques to various applications.

COURSE OUTCOMES

After completion of this course, the students will be able to:

CO 1: Develop CAD models for 3D printing.
CO 2: Import and Export CAD data in STL file format and able to generate GCODE of file.
CO 3: Select a specific material for the given application.
CO 4: Select a 3D printing process for an application.
CO 5: Produce a product using 3D Printing or Additive Manufacturing (AM).

Contents: Theory	HRS
Unit -1 INTRODUCTION CAD-CAM and its integration, Process chain for 3D Printing, Classification of 3D Printing Processes, Product design and prototyping, Advantages, Additive v/s Conventional Manufacturing processes, Applications, Reverse Engineering for 3D Printing.	12
Unit -2 DATA PREPARATION FOR 3D Printing STL interface Specification, STL data generation, STL data Manipulation, Advantages and limitations of STL file format, Open files, Repair of STL files, Alternative 3D Printing interfaces, Part orientation and support generation, Factors affecting part orientation, Various models for part orientation determination, The function of part supports, Support structure design, Automatic support structure generation. Model Slicing and Contour Data organization, Direct and adaptive slicing: Identification of peak features, Adaptive layer thickness determination, Tool path generation	18

Unit -3	Additive Manufacturing Techniques	15
	Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology, Direct Energy Deposition. Process, Process parameter, Process Selection for various applications, typical materials and applications. Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defense, Automotive, Construction, Food Processing, Machine Tools	

LIST OF SUGGESTED BOOKS

1.   Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct   Digital Manufacturing", Springer, 2010.

2.   Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.

3.   Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.

4.   CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.

5.   D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.

6.   L. Lu, J. Fuh and Y.S. Wong, "Laser-Induced Materials and Processes for Rapid Prototyping", Kulwer Academic Press, 2001.

7.   Zhiqiang Fan And Frank Liou, "Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy", InTech, 2012.

INDUSTRIAL AUTOMATION (BASICS)

Subject Code 2000505 F	Theory			No of Period in one session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	02
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
				CT	:	20	

Rationale:

Course Objectives:

- Understanding the fundamental terminologies used in the manufacturing industry, viz. lead time, cycle time, production rate, communication.
- Understanding of the discussions, subjects, and programming.
- This course is divided into two parts viz.(Theory & Experiments)

Course Outcomes:

CO 1: Understand the various Automation Strategies.

CO 2: Co-relate Industrial Manufacturing Processes and Applications

CO 3: Understanding to Reduces production time while maintaining excellent accuracy

CO 4: Understanding the basic operation of electrical and electronic devices.

CO 5: Learn software (coding)

Contents: Theory	HRS
Unit -1 **What is Industrial Automation** 1) Introduction to Industrial Automation and component 2) Applied Mathematics 3) Temperature Measurement 4) AC VS DC 5) Motors 6) Power Supply 7) Fuses 8) Circuit Breakers Relays	15

Unit -2	1) Three Phase Systems	15
	2) Automation Principles and Strategies	
	3) Introduction to Computer Integrated Manufacturing	
	4) Overloads and Overcurrents	
	5) MCCB	
	6) Motor Driving overview	
	Practice assignment	
Unit -3		15
	1) FW-BW Motor Driving Design	
	2) Simulating FW-BW	
	3) Star-Delta Motor Driving	
	4) Limit Switches	
	5) Role of Sensors in an Automation System	
	6) Level Sensors	
	7) Temperature Sensors	
	8) Flow Sensors	
	Pressure Sensors	

List of Suggested Books.

ELECTRIC VEHICLES (BASICS)

Subject Code 2000505 G	Theory			No of Period in one session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	02
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
				CT	:	20	

Rationale:

Based on above lab details and equipment specifications, students will be trained to meet the demand of EV industry. Theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student can demonstrates the following industry-oriented competencies.

Course outcomes:

1. Explain the fundamental concept of an Electric Vehicle.
2. Explain the application and functions of various Electronic Hardware in an EV.
3. Explain the role of a Motor & Transmission Control in an EV.
4. Interpret the salient features of Hybrid Electric Vehicles.
5. Interpret the Dynamics of hybrid and Electric Vehicles.
6. Maintain the DC-DC and DC-AC converters in EV applications.
7. Select the batteries for EV applications.

Contents: Theory	HRS
Unit -1 **Electrical Fundamentals** Fundamentals of Electrical engineering, Wiring, Power generation, distribution and transmission, Earthing and Insulation, RLC circuits, Transformers, AC/DC systems, DC/DC systems, Introduction to EV Powertrain, AC-DC Converters, DC-DC Converters, Auxiliary Battery Systems, Regenerative systems	10
Unit -2 **Introduction to Electric Vehicles** Introduction to Electric Vehicles, Electric Drives, Energy Storage, Energy management system, mobility and connectors	08
Unit -3 **Electric Motors** Introduction to electrical machines, DC Motor Dynamics and control, AC Motor Dynamics and Control, PWM and Inverter	08

Unit -4	**Battery and Energy Storage** Battery Fundamentals- characteristics, configuration and parameters, Battery pack and Battery management system, Battery testing, disposal and recycling	07
Unit -5	**Charging Stations** Introduction to Charging stations, On-board and off-board chargers, CHAdeMO charging system, CCS charging system, GB/T charging system, Indian Charging system, CAN communication and interaction with VCU	12
	Total	45

List of Suggested Book :-

ROBOTICS (BASICS)

Subject Code 2000505 H	Theory			No of Period in one session : 45			Credits
	No. of Periods Per Week			Full Marks	:	100	02
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
				CT	:	20	

Rationale:

Course Objectives:

- Understanding of the basic concepts of design, Function and applications of Robots
- Application of sensors and drives in the Robots
- Learn the robot programming and robot kinematics
- Learn software (coding)
- This course is divided into two parts viz.(Theory and Experiments)

Course Outcomes:

- The students will be able to apply the basic engineering after this course
- Gain knowledge for the robotics design .
- Understand robot Functionality and key robot part.
- Will understand application of Robots

Contents: Theory		HRS
Unit -1	**What is Robotics** 1) Introduction to Robotics and history of Robot types and component 2) Robot Control :Basics of control: open loop- closed loop, Transfer functions, Control laws: P, PD, PID 3) Sensors in Robotics: Contact and Proximity, Position, Velocity, Force, Tactile Robot Simulation software	15
Unit -2	1) Control Hardware and Interfacing 2) Classification of robots 3) Forward and inverse kinematics, Jacobian, Singularity, and Statics 4) Axis and Angle Representations 5) Actuators in Robotics: Electric, Hydraulic and Pneumatic; Transmission: Gears Timing Belts and Bearings, Parameters for selection of actuators **Practice assignment**	18

Unit -3	1) Position and Orientation in Robot	12
	2) The Pose of a Rigid Body	
	Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation, DH parameters	
	Total	45

Text Book/References:

1. Introduction to Robotics : J. Craig , Pearson
2. Robotics Engineering : R. Klafter, PHI
3. Industrial Robotics : M. P. Groover, Ashish Dutta , McGraw Hill

EMBEDDED SYSTEMS LAB
(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021506	Practical			No of Period in one session:30			Credits
	No. of Periods Per Week			Full Marks	:	25	01
	L	T	P/S	Internal (PA)	:	07	
	-	-	02	External (ESE)	:	18	

Course content:

SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Hrs.
1.	Built-in LED state control by push button sketch implementation	02
2.	Built-in LED blinking sketch implementation	02
3.	Built-in LED blinking by toggling states based on binary operation	02
4.	Built-in LED state control by user interface through serial port	02
5.	User interface for Boolean operation and bit wise operation through serial port	02
6.	User interface for compounded operation through serial port	02
7.	Looping mechanism to check the state of pin and if change print its status on serial port	02
8.	Controlling multiple LEDs with a loop and an array	02
9.	Use a potentiometer to control the blinking of an LED	02
10.	Uses an analog output (PWM pin) to fade an LED.	02
11.	Servo Motor Control using PWM	02
12.	Temperature sensor interfacing and sending its reading over serial port	04
13.	I2C light sensor interfacing and sending its reading over serial port	04
	Total=	30

LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1.	Arduino Projects For Dummies (For Dummies Se-ries)	Kennedy George; Davis Bernard; Prasanna SRM	Wiley (5 July 2013) ISBN : 978-1118551479
2.	Make: Getting Started With Arduino - The Open Source Electronics Proto-typing Platform	Massimo Banzi and Michael Shiloh	Shroff/Maker Media; Third edition (27 December 2014) ISBN : 978-9351109075

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.arduino.cc/reference/en/
2. https://learn.adafruit.com/category/learn-arduino

MOBILE AND WIRELESS COMMUNICATION LAB
(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021507	Practical			No of Period in one session : 16			Credits
	No. of Periods Per Week			Full Marks	:	25	01
	L	T	P/S	Internal (PA)	:	07	
	-	-	02	External (ESE)	:	18	

Course Content:

SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S.No.	Practical Outcomes (PrOs)	Hrs.
1.	To understand the cellular frequency reuse concept to find the co-channel cells for a particular cell.	02
2.	To understand the path loss	02
3.	Understand the path loss with shadowing	02
4.	Understanding the Flat fading	02
5.	Understanding the Frequency selective fading	02
6.	Understanding the Multipath channel for the following objectives 1. No Fading 2. Flat Fading 3. Dispersive Fading	02
7.	To simulate a dipole antenna (λ, $\lambda/4$, $\wedge/2$, $3\lambda/2$) for a particular fre- quency using 4NEC2	02
8.	Perform following experiments using CDMA trainer kit 1. PSK modulation and demodulation experiment 2. Bit synchronization extraction experiment 3. Error correction encoding experiment	02
	Total=	16

REFERENCES/SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1	Wireless Communications – Principles and Practice	T. S. Rappaport,	(2nd edition) Pearson ISBN 9788131731864
2	Modern Wireless Communications	Haykin & Moher	Pearson 2011 (Indian Edition) ISBN : 978-8131704431

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MICROWAVE AND RADAR LAB

(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021508A	Practical			No of Period in one session:14			Credits
	No. of Periods Per Week			Full Marks	:	50	03
	L	T	P/S	Internal (PA)	:	15	
	-	-	06	External (ESE)	:	35	

Course Content:

PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Hrs
1.	To study wave guide components.	02
2.	To study the characteristics of Gunn oscillator Gun diode as modulated source.	02
3.	Introduction to Smith chart and its application for the unknown impedance measurement.	02
4.	Study the behavior of impedance matching for passive networks using Smith chart.	02
5.	To study loss and attenuation measurement of attenuator	02
6.	Construct a cavity resonator in waveguide and study its characteristics using the network analyzer and a frequency counter.	02
7.	To determine the frequency and wave length in are ctangular waveguide working in TE10 mode	02
	Total=	14

LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1	Microwave Engineering	D.M. Pozar	Wiley; Fourth edition (2013) ISBN 978-8126541904
2	Foundation for Microwave Engineering	R.E. Collins	Wiley; Second edition (2007) ISBN : 978-8126515288

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ARTIFICIAL INTELLIGENCE LAB (BASICS)

Subject Code 2000508 B	Practical			No of Period in one session:			Credits
	No. of Periods Per Week			Full Marks	:	50	
	L	T	P/S	Internal (PA)	:	15	03
	—	—	06	External (ESE)	:	35	

Rationale:

Objective:

	Contents: Practical	Hrs	
Unit -1	**Introduction to Python** 1) Installation of Python framework and packages: Anaconda and pip 2) Writing/Running python programs using Spyder, Command Prompt 3) Working with Jupyter Notebooks 4) Creating Python variables: Numeric, string and logical operations 5) Basic Data containers: Lists, Dictionaries, Tuples & sets **Practice Assignment-2 Operations & Functions in Python** 1)Writing for loops in Python 2) List & Dictionary Comprehension 3) While loops and conditional blocks 4) List/Dictionary comprehensions with loops		
Unit -2	1)Reading and writing external data 2)Manipulating Data Columns		
Unit -3	1) Introduction to Univariate Statistics, Shape 2) Central Tendency and variability 3) Outliers 4) Correlation 5) Z-score 6) Normalization		
	Total		

INTERNET OF THINGS (IOT) LAB (BASICS)

Subject Code 2000508 C	Practical			No of Period in one session:			Credits
	No. of Periods Per Week			Full Marks	:	50	
	L	T	P/	Internal (PA)	:	15	03
	—	—	06	External (ESE)	:	35	

	Contents: **Practical**	**Hrs**
Unit -1	**Introduction to Python for IoT** 1) Python programing refreshers for IoT 2) Integration of python program with cloud services 3) Microsoft Azure, AWS and GCP **Practice Assignment**	
Unit -2	1)Python and Cloud for sensor integration 2) IoT Kit development with sensors and camera integration 3)Home Automation System **Practice assignment**	
Unit -3	1) Face Recognition Bot 2) Working with Raspberry pi development with sensor 3) Smart Garage Door **Practice assignment**	
	Total	

DRONE TECHNOLOGY LAB (BASICS)

Subject Code 2000508 D	Practical			No of Period in one session:			Credits
	No. of Periods Per Week			Full Marks	:	50	03
	L	T	P/S	Internal (PA)	:	15	
	—	—	06	External (ESE)	:	35	

	Contents: Practical	Hrs
Unit -1	**Introduction to Python for Drone** 1) Python programing refreshers for IoT, AI and Drone 2) Integration of devices with cloud services 3) Microsoft Azure, AWS **Practice Assignment**	
Unit -2	1)Understanding Electronic Components like IC, Resistors, Capacitors, Inductors 2) Fly with a Smartphone as a Controller 3) Design & Development of basic drone **Practice assignment**	
Unit -3	1. Understanding of various Drone Components such as Fan, Propeller, Electric-Motor, Camera System, GPS, etc. 2. Kits development for basics drone applications 3. Training on Drone simulator software viz. Air Sim **Practice assignment**	
	Total	

3D PRINTING & DESIGN LAB (BASICS)

Subject Code 2000508 E	Practical			No of Period in one session:			Credits
	No. of Periods Per Week			Full Marks	:	50	03
	L	T	P/S	Internal (PA)	:	15	
	—	—	06	External (ESE)	:	35	

List of Experiment

Contents: Practical	Hrs
1. To study the anatomy of FDM based 3D Printer Machine. 2. To model the single 3-D component using CAD software. 3. To model 3D multiple components joined together to form assembly. 4. To Practice on CAD Data Exchange in different file formats. 5. To study the various Pre-processing requirements on 3D printing. 6. To calibrate the 3D printer and making it ready for 3d print. 7. To Analyze and apply different process of algorithm for slicing/supports/layers/orientation etc. 8. To study the relationship between different process parameter of slicing tool and printing time. 9. To Scan the any 3D object using 3D scanner and prepare it for 3d printing. 10. To design and develop any machine components prototype into 3D printer Machine.	
Total	

INDUSTRIAL AUTOMATION LAB (BASICS)

Subject Code 2000508F	Practical			No of Period in one session:			Credits
	No. of Periods Per Week			Full Marks	:	50	03
	L	T	P/S	Internal (PA)	:	15	
	—	—	06	External (ESE)	:	35	

Rationale:

Objective:

	Contents: Practical	Hrs
Unit -1	1) Circuit Simulation Software Installation 2) Simulating a Relay Contactors, Simulating a Contactor **Practice Assignment**	
Unit -2	1. Direct Driving Design 2. Simulating Direct Drive 3. Pressure and Temperature Transmitters 4. Flow Measurement Practice assignment	
Unit -3	1. Simulation FW-BW 2. Simulation Star-Delta **Practice assignment**	
	Total	

ELECTRIC VEHICLES LAB (BASICS)

	Practical			No of Period in one session:			Credits
Subject Code 2000508 G	**No. of Periods Per Week**			**Full Marks**	**:**	**50**	**03**
	L	T	P/S	**Internal (PA)**	**:**	**15**	
	—	—	**06**	**External (ESE)**	**:**	**35**	

Lab: Electric Vehicle (21 Hrs Duration)

1. Evaluation of charging characteristics of battery using CC, CV and CP mode.

2. Evaluation of discharging characteristics of battery.

3. Evaluation of charging/discharging of battery while charging/discharging with different C-rate.

4. Evaluation of Battery Charging/Discharging characteristics at different ambient temperatures. (Using thermal chamber)

5. Fuel economy comparison with new set of batteries and aged batteries.

6. Demonstrate the effect on state of health after a no. Of charge/discharge cycle.

7. Evaluate the temperature cut-off point for BMS.

8. Testing batteries and comparing performance using different testing standards:

   a) GB/T-31484 or 31485

   b) IEC 62660-1: 2018 or IEC 62660-2 : 2018

9.Comparing performance of battery and finding gas gauge after charging battery

   a) 0%-100%

   b) 30%-100%

   c) 50%-100%

10.A) Evaluate specific power, specific energy, life span, performance and cost parameter of EV battery.

   B) Evaluate SoH of EV battery after a no. of charge/discharge cycles.

   C) Selecting suitable battery for EV based on the above findings

ROBOTICS LAB (BASICS)

Subject Code 2000508 H	Practical			No of Period in one session:			Credits
	No. of Periods Per Week			Full Marks	:	50	
	L	T	P/S	Internal (PA)	:	15	03
	—	—	06	External (ESE)	:	35	

	Contents: Practical	Hrs
Unit -1	1) Study components of an industrial robot 2) Robot simulator for Robotics 3) Integration of assorted sensors (IR, Potentiometer, strain gages etc.) **Practice Assignment**	
Unit -2	1. Forward kinematics and validation using a software (Free software tool). 2. War Field Spying Robot using Night Vision Wireless Camera 3. Obstacle Avoiding Robot Practice assignment	
Unit -3	1. Inverse kinematics of an industrial robot and validation using any open source software. 2. Smart Cleaning Robot 3. Microcontroller lab (open source) **Practice assignment**	
	Total	

INDUSTRIAL AUTOMATION LAB

(ELECTRONICS ENGINEERING GROUP)

	Practical			No of Period in one session:15			Credits
Subject Code 2021509	**No. of Periods Per Week**			**Full Marks**	**:**	**25**	**01**
	L	**T**	**P/S**	**Internal (PA)**	**:**	**07**	
	-	-	02	**External (ESE)**	**:**	**18**	

Course Content:

SUGGESTED PRACTICALS/ EXERCISES

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Hrs.
1.	Develop a data acquisition system using arduino	~~02~~
2.	Temperature control system using PID	~~02~~
3.	Level control system based on error feedback	~~02~~
4.	PLC programming using Relay ladder Logic for AND, OR, XOR and NOR gate	~~02~~
5.	PLC, RLL programming using CASCADE method	~~02~~
6.	PLC timer, counter, registers and analog input/output functions	~~02~~
7.	Variable Speed drive of an induction motor	~~02~~
8.	PLC/ microcontroller-based computer numerical control machine job completion	~~02~~
	Total=	**16**

LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Industrial Instrumentation, Con- trol and Automation	S. Mukhopadhyay, S. Sen and A. K. Deb	Jaico Publishing House, 2013 ISBN : 978-8184954098
2	Electric Motor Drives, Modelling, Analysis and Control	R. Krishnan	Prentice Hall India, 2002 ISBN : 978-0130910141

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MAJOR PROJECT PART-I & CONT. TO VI SEM. PART-II

(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021510	Term Work						Credits
	No. of Periods Per Week			Full Marks	:	50	01
	L	T	P/S	Internal (PA)	:	15	
	-	-	03	External (ESE)	:	35	

RATIONALE:

It is required to develop this skill in the students so that they continue to acquire on their own new knowledge and skills from different on the job experiences' during their career in industry. An educational 'project' just does that and may be defined as 'a purposeful student activity, planned, designed and perform by a student or group of students to solved complete the identified problem task, which require students to integrate the various skills acquired over a period to accomplish higher level cognitive and affective domains outcomes and sometimes the psychomotor domain outcomes as well'. Projects mainly serve this purpose of developing learning-to-learn skills with an aim to develop the following attributes in the students:

a) Initiative, confidence and ability to tackle new problems
b) Spirit of enquiry
c) Creativity and innovativeness
d) Planning and decision-making skills
e) Ability to work in a team and to lead a team
f) Ability of self-directed learning which is required for lifelong learning
g) Persistence (habit of not giving up quickly and trying different solutions in case of momentary failures, till success is achieved Resourcefulness
i) Habit of keeping proper records of events and to present a formal comprehensive report of their work.

COMPETENCY:

The course should be taught and implemented with the aim to develop the required course outcomes (COs) so that students will acquire following competency needed by the industry:

a) Plan innovative/creative solutions independently and/or collaboratively to integrate various competencies acquired during the semesters to solve/complete the identified problems/task/shortcomings faced by industry/user related to the concerned occupation.

COURSE OUTCOMES (COs)

The following could be some of the major course outcomes depending upon the nature of the projects undertaken. However, in case of some projects few of the following course outcomes may not be applicable.

CO 1 : Write the problem/task specification in existing systems related to the occupation.
CO 2 : Select, collect and use required information/knowledge to solve the problem/complete the task.
CO 3 : Logically choose relevant possible solution(s).
CO 4 : Consider the ethical issues related to the project (if there are any).
CO 5 : Assess the impact of the project on society (if there is any).
CO 6 : Prepare project proposal with action plan and time duration scientifically before beginning of project.

CO 7 : Communicate effectively and confidently as a member and leader of team.

Capstone Project Planning:

Students are supposed to find out a suitable project and prepare a detailed plan in fifth semester so that it can be executed smoothly in sixth semester. The main characteristic of any project whether small or b1g is that it requires simultaneous application of various types of skills in the different domains of learning. Moreover, project normally do not have a predefined single solution, in other words for the same problem different students may come up with different but acceptable solutions. Further, in the process of arriving at a particular solution, the student must be required to make a number of decisions after scrutiny of the information s/he has accumulated from experiments, analysis, survey and other sources. The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. A detailed project report is to be prepared as project progresses, which has to be submitted after the project is over. For self-assessment and reflection students have to also prepare a portfolio of learning. During the guidance and supervision of the project work, teachers should ensure that students acquire following learning outcomes (depending upon the nature of the project work some of these learning outcomes may not be applicable:

a) Show the attitude of enquiry.
b) Identify the problems in the area related to their programme.
c) Identify the information suggesting the cause of the problem and possible solutions.
d) Assess the feasibility of different solutions and the financial implications.
e) Collect relevant data from different sources
   (books/1nternet/market/suppliers/experts etc.through surveys/interviews).
f) Prepare required drawings and detailed plan for execution of the work.
g) Work persistently and participate effectively in group work to achieve the targets.
h) Work independently for the individual responsibility undertaken.
i) Ask for help from others including guide, when required.
j) Prepare portfolio to reflect (chintan-manan) on experiences during project work.
k) Prepare seminar presentations to present findings/features of the project.
l) Confidently answer the questions asked about the project.
m) Acknowledge the help rendered by others in success of the project.

Scopes of Projects:

Scope of the project work should be decided based on following criteria:
a) **Relation to diploma programme curriculum:** When students intend to select topics for the project work they need to choose a project which relates well to their curriculum (It may be beyond curriculum, but it should relate to it) and requires implementation of theories already learnt and skills already possessed by them from the previous semesters.
b) **Abilities possessed by the group of students:** Projects should be chosen so that it can be completed mainly using students' problem-solving capabilities and depth of learning. It is natural that highly motivated students or high achievers may come out with projects which are more complex and challenging. Teachers should guide students to choose challenging projects according to the students' ability.
c) **Resources Available:** Students and Guides should keep in mind the availability of resources while deciding the topic and the scope of the project. Some of the important resources which need consideration are:
   i. Time available
   i1. Raw Material/Components required

   iii. Manufacturing/Fabrication equipment and tools required
   iv. Testing/Measuring equipment and instruments requi1'ed
   v. Access to Journals (Library/Digital)
   vi. Expertise for theoretical guidance (available in polytechnic, nearby

vii. Expertise and technology required for fabrication (if required)
viii. Software required.

GUIDELINES FOR UNDERTAKING A PROJECT:

The selection of the Capstone Project title must have emphasis to the Elective courses/ Elective Group taken for the study and exam for 5"' and 6"' semester. The students will then work on the identified problem/task through a rigorous process of understanding and analyzing the problem, conducting a literature search, deriving, discussing (monitored by the guide every fortnight) and designing the Semester V 'Project Proposal' with the following sub- titles:

- Rationale (one page)
- Introduction
- Literature Survey
- Problem Definition
- Proposed Methodology of solving Identified problem
- In-case some prototype has to be fabricated then its tentative design and procedure for making it should be part of the proposal.
- Resources and consumables required.
- Action Plan (sequential list of activities with probable dates of completion

As soon as the 'Project Proposal' is approved by the teacher, the student will begin to maintain a dated 'Project Logbook for the whole semester. This is a sort of a 'weekly diary' indicating all the activities conducted by the student every week in the semester to complete the project. This 'project logbook' should be got signed by the teacher at regular intervals for progressive assessment to match the project proposal. If this is maintained sincerely and truthfully by the student, it will be very helpful in compiling the 'Project Report' at the end of the semester by him/her.

PROJECT REPORT

At the end of fifth Semester, the student will prepare a Semester V 'Project Report' with the following sub-titles:

- Certificate (in the Format given in this document as annexure A)
- Acknowledgements
- Abstract (in one paragraph not more than 150 words)
- Content Page
- Chapter-1 Introduction and background of the Industry or User based Problem
- Chapter -2 Literature Survey for Problem Identification and Specification,
- Chapter-3 Proposed Detailed Methodology of solving the identified problem with action plan
- References and Bibliography

Note: The report should contain relevant diagrams and figures, charts.

PROGRESSIVE ASSESSMENT (PA) GUIDELINES

15 Marks are allocated for the formal progressive assessment. However, following points need consideration during the three times of formal progressive assessment of the students at the end of 4th, 12th and 14th week.

a) Fortnightly monitoring by the mentoring teachers is necessary and marks given progressively (even the gradual chapter preparation) so that that students will not copy earlier reports or get things done or reports from the market. The students should not be awarded marks if they have not done on their own.

b) For progressive assessment at the end of 14''' week, students should be asked to give the power point presentation before group of teachers and junior students (so that junior students may also get awareness about the capstone project work they have to carry out in future).

c) Although marks for portfolio preparation is to be given at the end of 14''' week, students should be asked to bring their partly prepared portfolio (relevant sections prepared) also during their assessment at the end of 4"t week and 12''' week.

d) Marks for portfolio preparation should be based only on proper preparation of portfolio by writing answers to most of the prompts (self-questions to students) in the portfolio. These marks should not be based on the mistakes indicated by students in their working (while answering the prompts) and corrective actions taken by them.

e) The students would be awarded marks for their efforts (In some cases it may happen that due to some reasons such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks it they have done enough efforts.)

f) Originality of the report (written in own words) would be given more importance rather than use of glossy paper or multi-color printing.

END-SEMESTER-EXAMINATION (ESE) ASSESSENT GUIDELINES

The remaining 25 marks are for the end-semester-examination (ESE). And marks would be given according to following criteria. Moreover, the suggested evaluation scheme can be changed slightly by the external faculty according to nature of problem / project following University guidelines.

a) For each project, the one or two students from the concerned group of students should be asked to present the power point presentation before the external and internal (for about 10 minutes) and then external should ask the questions from each member of the group separately

to ascertain the contribution made by each student.

b) The students would be awarded marks for their efforts (In some cases it may happen that due to some reason such as unavailability of some material or component or some other resources, students may not be able to complete the project, but they have tried their best, in such cases students would be given appropriate marks commensurate with their efforts.)

c) The students would not be awarded marks if they have completed the project by getting done the work from market or some professionals (taking help and guidance is different as compared to getting the work or maximum part of the work completed from others on payment basis).

d) Originality of the report (written in own words, even if there are grammatical and spelling mistakes) would be given more importance rather than quality of printing and use of glossy paper (and preparing report by copy pasting from other reports).

Note: It is very common that people are not able to complete the project in time despite best of their effort '. (Please recall that how many times people are able to complete in time, personal project such as building own house or professional projects such as Developing the lab in the institute). So if students have put in enough genuine efforts but could not complete the project in time then we should consider it sympathetically and they should be given marks based on their efforts and they should get more marks as compared to student's who have got their projects completed by taking major help from others/markets.

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SUMMER INTERNSHIP-II (4 WEEKS) AFTER IV SEMESTER
(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021511	Term Work			No of Period in one session:30			Credits
	No. of Periods Per Week			**Full Marks**	:	25	
	L	**T**	**P/S**	**Internal (PA)**	:	07	02
	-	-	4 weeks	**External (ESE)**	:	18	

CONTENTS: TERM WORK

Course Objective:

ln plant training is a learning opportunity for students. Students should therefore receive feedback on their performance so that they can grow professionally. Over all professional development of diploma Electronics engineers is the need of the day for enabling them to sustain in competitive global environment.

COURSE OUTCOME:

CO 1 : Exposure to the organizational environment and recognize the requirement of the organization and cope with the organizational scenario.

CO 2 : Identify career paths taking into account their individual strengths and aptitude and prepare a report about the work experience in organization.

CO 3 : Communicate effectively through technical presentation.

CO 4 : Enhancing the employability skills and staft-up skills to increase his/her ability to engage in life- long learning.

CO 5 : Develop individual confidence to handle various engineering assignments and expose themselves to acquire life skills to meet societal challenges.

Summer Internship-II

Introduction:

- Summer Internship means a course of training in any organization or establishment undergone by the student of final year diploma in Electronics Engineering in pursuance of memorandum of understanding between organization and department of the concerned institute or department can make necessary arrangements in the local vicinity industries to get on job learning exposure to the students in industries.

- Organization means any organization or business in which any trade, occupation or subject field in concerned engineering or technology.

The Industries where Internship can be undergone:

- The supervisory faculty / Head of section / students may identify Electronics or communication- based service / industrial organization preferably in the local vicinity with prior approval on the principal of concerned institution. Structured training to be detailed by the concerned supervisory faculty and a detailed report of the Internship undergone shall be submitted by the student for evaluation.

- The students may be allowed to undergo Internship in any Government/Private organizations dealing Electronics/Communication based job or services.

Obligation 0f students:

- Students must be punctual and exhibit good conduct during the training period.

- Students shall maintain log of activities and submit report on schedule of work entrusted during Internship.

- Students are required undergo Internship in stipulated time frame.

- Students are obligated to get familiar with the process and activities during in-plant training.
- Students may be encouraged to develop a solution to the tasks/problems related to the
- Electronic components testing/ servicing to acquire knowledge and to reciprocate to the industrial needs.

Monitoring of Internship:

- The Head of section shall prepare batches of students and allocate a supervisory faculty to each batch. Supervisory faculty shall assist students in identifying industrial organization and monitor the activities of the students during the schedule of training.
- The concerned supervisory faculty in consultation with respective industrial organization shall review the progress of students undergoing Internship in a time frame. The head of section must take complete responsibilities in organizing Internship.
- Student undergoing Internship in the respective branch of Engineering in any establishment shall be treated as a trainee. The provision of any law with respect to labor will not apply to such a trainee
- It shall not be obligatory on the part of the Employer/Organization to offer any stipend and other welfare amenities available, if any, to the students undergoing in-plant training. However, if the organization desirous to do so, at will be a privilege for the students.

Internal Examination: Scheme of evaluation

Sl. No	Particulars	Marks
1	Visiting organization	5
2	Submission of report	5
3	Viva	5
Total		15

Course Under Moocs /Swyam/ Others (TW)

(ELECTRONICS ENGINEERING GROUP)

Subject Code 2021512	Term Work			No of Period in one session:30			Credits
	No. of Periods Per Week			Full Marks	:	50	
	L	T	P/S	Internal (PA)	:	15	01
	-	-	02	External (ESE)	:	35	