GovernmentPolytechnic,Mumbai

(AcademicallyAutonomousInstitute,GovernmentofMaharashtra)

NameoftheProgramme:Diploma inElectronicsEngineering

TeachingandExaminationScheme(P23) **With EffectFromAcademicYear:2023-24**

DurationofProgramme:6Semester **Duration:16WEEKS**

Semester:Fifth **Scheme: P23**

Sr No	CourseTitle		Course Type	CourseCode	Total IKS Hrs forSem.	LearningScheme					Credits	AssessmentScheme													
						ActualContactHrs./Week			Self-Learning (TermWork+Assignment)	NotionalLearningHrs/Week		Paperduration(hrs.)	Theory					BasedonLL&TL Practical					Based OnSelf Learning		TotalMarks
													FA-TH		SA-TH	Total		FA-PR		SA-PR			SLA		
						CL	TL	LL					TI	T2	Max	Max	Min	Max	Min	Max PR	Max OR	Min	Max	Min	
1	Entrepreneurship Development Programme (EDP)		AEC	EC 23503	4	3	2	-	1	6	3	2:30	20	20	60	100	40	-	-	-	-	-	50	-	150
2	VLSI		DSC	EC 23113		3	1	4	2	10	5	2:30	20	20	60	100	40	25	10	50@	-	20	25	-	200
3	Robotics		AEC	EC 23504		3	1	2	2	8	4	-	-	-	-	-	-	50	20	-	50@	20	25	-	125
4	Elective -2	Advanced Communication System	DSE	EC 23203		4	-	4	-	8	4	2:30	20	20	60	100	40	25	10	-	50#	20	-	-	175
		Advanced Embedded System	DSE	EC 23204																					
		Electric Vehicles	GE	EE 23204																					
5	Project and Seminar		INP	EC 23402	-	-	-	4	4	8	4	-			-	-		50	20	50#	-	20	50	-	150
Total					**4**	**13**	**4**	**14**	**9**	**40**	**20**					**300**		**150**		**100**	**100**		**150**		**800**

Abbreviations: CL-Classroom Learning, TL-Tutorial Learning, LL-Laboratory Learning, FA-Formative Assessment, SA-Summative Assessment, IKS-Indian Knowledge System, SLA-Self LearningAssessment**Legends :**@ InternalAssessment,#ExternalAssessment, *#On LineExamination,@$InternalOnline Examination

Note:1.FA-THrepresentsmarksoftwoclasstestsof20markseachconductedduringthesemester.

2. IfcandidateisnotsecuringminimumpassingmarksinFA-PRofanycoursethenthecandidateshallbedeclaredas"Detained"inthatsemester.

3. IfcandidateisnotsecuringminimumpassingmarksinSLAofanycoursethenthecandidateshallbedeclaredasfailandwillhavetorepeatandresubmitSLAwork.

4. NotionalLearninghoursforthesemesterare(CL+LL+TL+SL)hrs.*15Weeks

5. 1creditisequivalentto30Notionalhrs.

6. *SelflearninghoursshallnotbereflectedintheTimeTable.

CourseCategory: DisciplineSpecificCourseCore(DSC):2,DisciplineSpecificElective(DSE):0,ValueEducationCourse(VEC):1,Intern /Apprenti /Project /Community(INP)/Work Based Learning,SkillEnhancementCourse(SEC):2,GenericElective(GE):0

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CDC Co-ordinator
G.P. Mumbai

CDCCordinator, ElectronicsDepartment

HOD, ElectronicsDepartment

CDCIncharge, CDCCell

Principal, G.P.Mumbai

Programme: Diploma in Electronics Engineering (Sandwich pattern)													
Course Code: EC 23503	**Course Title: Entrepreneurship Development Programme**												
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Examination Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2:30 Hrs.)**	**FA-PR**	**SA**		**SLA**	**Total**
						T1	**T1**			**PR**	**OR**		
3	2	-	1	6	3	20	20	60	-	-	-	50	150

Total IKS Hrs. for course: 4
Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents the two class tests of 20 marks each conducted during the term.

I. Rationale:

Entrepreneurship and Startups are introduced in this curriculum to develop the entrepreneurial traits among the students before they enter into professional life. Exposing and interacting with entrepreneurship and startup eco-system, students will develop entrepreneurial mind set. The innovative thinking with risk-taking ability along with other traits will be inculcated in the students through micro-projects and training. This exposure will be instrumental in orienting the students in transforming them to become job generators after completion of Diploma in Engineering.

II. Industry / Employer Expected Outcome:

1. Develop project proposals for launching small scale enterprises and startup.
2. Prepare a 'Pitch- desk' for your startup.
3. Prepare a business plan for a. Market research b. Advertisement agency c. Placement Agency d.Repair and Maintenance agency e. Tour and Travel agency.
4. Prepare a 'Social entrepreneurship business plan, plan for CSR funding'.
5. Prepare a 'Women entrepreneurship business plan' Choose relevant government scheme for the product/service.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Identify one's entrepreneurial traits.
CO2	Use information collected from support agencies for establishing/setting up/founding startup.
CO3	Understand Business management process.
CO4	Characterize the Organizational Management along with Industrial safety.
CO5	Analyze and apply various Inventory management techniques.
CO6	Evaluate project performance using various tools and techniques.

IV Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	TLO1a. Compare advantages and disadvantages of Entrepreneurship TLO1b. Identify entrepreneurial traits through self-analysis TLO1c. Identify the Barriers to women entrepreneurs and promote women as an Entrepreneur TLO1d. Differentiate between entrepreneur and Manager	**Introduction to Entrepreneurship** 1.1. Definition of entrepreneurship, Entrepreneurship as a career: advantages, disadvantages , scope- local and global 1.2. Traits of successful entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking, learning from failure 1.3. Barriers to women entrepreneurs 1.4. Distinction of entrepreneur and Manager **Course Outcome: CO1** **Teaching Hours: 08 hrs**
2	TLO2a. Identify Small scale industries and its characteristics TLO2b. Understand key pillars to support startup. TLO2c. Understand the process to apply for DPIIT recognition TLO2d.Learn to identify various capital funding institutions and Plan a market study /survey for the specified enterprise. TLO2e. Justify USP of the given product/ service from marketing point of view.	**Startup Selection Process and support systems** 2.1.Small Enterprises: Definition, Characteristics & Types 2.2. Introduction: Startup India, Key Pillars of Support for Startup 2.3. DPIIT Recognition: DPIIT Recognition Guidelines, procedure and its benefits. 2.4. Support agencies for entrepreneurship: guidance, training, registration, technical consultation, technology transfer and quality control, marketing and capital generation:Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Industries Commission[KVIC], Small Industries Development Bank of India [SIDBI], Maharashtra Industrial

		Development Corporation [MIDC] 2.5. Unique Selling Proposition [USP]: Identification, developing a marketing plan. **Course Outcome: CO2** **Teaching Hours: 12 hrs**
3	TLO3a. Describe the definition of Business and types of Business TLO3b. Describe the definition of Management and Levels of Business TLO3c. Understand the basic functions and principles of Management. TLO3d. Identify SWOT analysis through self analysis.	**Overview Of Business Management Process** 3.1 Definition of Business, 3.2 Types of Business- Service, Manufacturing & Trades 3.3 Management- Various Definitions 3.4. Levels of Management 3.5. Basic Functions of Management- Planning, Organizing, Staffing, Directing & Controlling 3.6. Fourteen Principles of Management 3.7 SWOT Analysis, Understanding Problems & their Nature, Complex Problem Solving. **Course Outcome: CO3** **Teaching Hours:10 hrs**
4	TLO4a. Describe the definition of Management and forms of ownership. TLO4b. Learn the functions of personnel management. TLO4c. Learn the functions of financial management. TLO4d. Understand the necessity of Industrial safety.	**Organizational Management and Industrial safety** 4.1. Organization- Definition 4.2 Forms of Ownership: Proprietorship, Partnership, Joint Stock Company, Co-Operative Society, Government Sector 4.3 Personnel Management- Definition & Functions. 4.4Financial Management: Objective, functions, 4.5. Capital generation: Types and Source of capital 4.6. Accidents: Definition and Causes of Accident 4.7 Safety Precautions at Industry **Course Outcome: CO4** **Teaching Hours : 10 hrs**
5	TLO5a. Understand the importance of Inventory management. TLO5b.Learn to prioritize inventory items based on their value to the business, enabling more efficient resource allocation and better inventory control. TLO5c. Learn to determine the optimal order quantity to minimize Inventory cost. TLO5d. Understand the process of aquaring good and services required for business.	**Materials Management** 5.1 Inventory Management: Definition of Inventory and inventory Control. Objectives of Inventory Control 5.2 ABC Analysis, Graphical Representation 5.3 Economic Order Quantity (E.O.Q.) 5.3.1 Graphical Representation 5.3.2 Calculation of E,O.Q. 5.4. Procurement: definition and types of Procurement **Course Outcome: CO5** **Teaching Hours : 10hrs**

6	TLO5a. Learn the Project management and its methodologies. TLO5b. Understand the Phases of the project management process. TLO5c. Identify risks that you may encounter for the given type of business/enterprise TLO5d. Learn the various methods for quality improvement in organization. .	**Project Management** 6.1. Project Management: Definition And Meaning of Project 6.2 Phases of the project management process: Project Initiation, Project Planning, Project Execution, Project Monitoring and Controlling, Project Closing. 6.3 Project management methodologies: Introduction to C.P.M & P.E.R.T, Preparation Of Network, Calculation of Project Duration And Floats 6.4 Concept oF Break Even Analysis 6.5 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, definition of startup cycle, ecosystem , angel investors, venture capitalist 6.5 Quality Improvement: Concept of KAIZEN, 5 "S",6 Sigma. 6.6 Advantages and Applications of KAIZEN, 5 "S",6 Sigma. **Course Outcome: CO6** **Teaching Hours : 10hrs**

V. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1: Collect information of need of entrepreneurship in India	Preparation of report on need of entrepreneurship in India	2	1
2	**LLO2.1 Identify different traits as an entrepreneur from various field** **LLO 2.2 Suggest different traits from identified problem**	Case study on 'Traits of Entrepreneur'	2	1
3	LLO 3.1 Explore probable risks for identified enterprise	Case study on 'Risks associated with enterprise	2	2
4	**LLO 4.1 Identify new product for development** **LLO 4.2 Prepare a newly developed product**	Preparation of report on 'Development of new Product	2	2
5	**LLO 5.1 Identify Process for development of product for new startup**	Preparation of Report on 'for new startup' and its complete registration process	2	2
6	**LLO 6.1 Develop questioner for**	Market survey for setting up new	2	2

	market survey	Start up		
7	**LLO 7.1 Interpret the use of Technology Life Cycle**	A Case study on ' Technology life cycle' of any successful entrepreneur.	2	
8	**LLO 8.1 Use information related to support of startups from Government and nongovernment agencies' LLO 8.2 Prepare report for setting up startup**	Preparation of report on 'Information for setting up new startup' with the support of any support system	2	2
9	**LLO 9 Calculate Brake even point of any enterprise**	Preparation of report on 'Brake even point calculation' of any enterprise	2	6
10	**LLO 10 Plan a USP of any enterprise.**	A case study based on 'Unique selling Proposition (USP) of any successful enterprise	2	2
11	**LLO 11 Use relevant related information and prepare a Business plan.**	Prepare a ' Women entrepreneurship business plan ' Choose relevant government scheme for the product/service	2	1
12	**LLO 12 Understand SWOT Analysis and Problem Solving**	A case study based on 'SWOT Analysis of any successful enterprise	2	3
13	**LLO13 Use the available information and prepare the report**	Prepare a report on Government e Marketplace (GeM) portal procurement	2	4
14	**LLO 14 Identify any quality improvement technique and prepare a report on related case study**	Prepare a report on Case Study: Applying the Quality Improvement Techniques of Manufacturing Industries	2	6
15	**LLO 15 Understand the necessity of Industrial safety.**	Prepare a chart for safety precautions to be taken in industry.	2	5

VI. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 10 Assignment)

1. Prepare a 'Pitch- desk' for your start up
2. **Prepare a business plan for a. Market research b. Advertisement agency c. Placement Agency d. Repair and Maintenance agency e. Tour and Travel agency**
3. **Prepare a 'Social entrepreneurship business plan, plan for CSR funding**
4. **Case study on 'Return on Investment (ROI)'of any successful startup**

5. **Write report on "Entrepreneurial Education: Exploring the evolution of corporations, differences between startups and large companies, and the importance of entrepreneurial education."**
6. **Prepare a report on "Market Analysis and Validation: Techniques for market opportunity analysis and validation using case studies."**
7. **Case study on "Customer Acquisition Strategies: Exploring strategies for customer acquisition: Get, Keep, Grow, and understanding web and physical customer acquisition methods."**
8. **Prepare a report on "Factory Act 1948 and its provisions."**
9. **Prepare a report on "Workmen Compensation Act and its provisions."**
10. **Prepare a report on various Taxation applicable in India.**

VII. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to entrepreneurship	2	4	2	8
2	Startup Selection Process and support systems	2	2	4	12
3	Overview Of Business Management Process	2	6	2	10
4	Organizational Management and Industrial Safety	2	6	2	10
5	Materials Management	2	4	4	10
6	Project Management	2	4	4	10
	Total	**14**	**32**	**14**	**60**

VIII. Assessment Methodologies/Tools

SLA assessment (Assessment for Learning)
Rubrics for continuous assessment based on process and product related performance indicators. (50 marks)

IX. Suggested COs - POs Matrix Form(Electronics Engineering)

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	-	-	1	-	3	-	-	-
CO2	3	2	1	-	2	1	3	-	-	-
CO3	3	1	2	-	2	1	3	-	-	-
CO4	3	2	1	-	2	1	3	-	-	-
CO5	3	3	3	1	2	2	3	-	-	-
CO6	3	3	3	1	3	3	3	-	-	-
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

X. Suggested Learning Materials / Books

Sr. No	Author	Title	Publisher
1	Dr .O.P. Khanna	Industrial Engineering and Management.	Dhanpal Rai & Sons., New Delhi, ISBN: 9788189928353, 9788189928353
2	Dr. Nishith Dubey, Aditya Vyas , Annu Soman , Anupam Singh	Un- boxing Entrepreneurship your self help guide to setup a successful business	Indira Publishing House ISBN 2023,978-93-93577-70-2
3	Alpana Trehan	Entrepreneurship	N.K.Book Binder, ISBN: 978-93-5004-026-3
4	Khanka, S.S.	Entrepreneurship and Small Business Management	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6

XI. Learning Websites & Portals

Sr. No	Link / Portal	Description
1	https://www.startupindia.gov.in/content/sih/en/startup-scheme.html	Link for startup registration (DPIIT Recognition)
2	https://ndl.iitkgp.ac.in/ndl_he	Video lectures on all topics
3	https://onlinecourses.nptel.ac.in/noc25_mg71/preview	Video lectures on project management
4	http://niesbud.nic.in/Publication.html	The National Institute for Entrepreneurship and Small Business Development Publications
5	http://www.ediindia.org/institute.html	About - Entrepreneurship Development Institute of India (EDII)
6	http://www.nstedb.com/training/training.htm	NSTEDB - Training
7	http://www.mced.nic.in/allproduct.aspx	MCED Product and Plan Details

XII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.Yogesh Pingle	Director,YPP Technology	Industry Expert Institute Course Expert
2	Mrs. Nirmala Kamble	Lecturer in Electronics, Thakur Engg. college	Academic Expert
3	Mr. R.M. Ingle	SL. Grade Lecturer in Electronics	Institute Course Expert
4	Mrs. Vishakha K. Jadhav	Lecturer in Electronics	Institute Course Expert

Coordinator
Curriculum Development,
Department of Electronics Engineering

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CDC Co-ordinator
G. P. Mumbai

Head of Departments
Department of Electronics Engineering

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai

Programme : Diploma in Electronics Engineering (Sandwich pattern)													
Course Code: EC 23113					**Course Title: VLSI**								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						**Examination Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2Hrs.30 min.)**	**FA-PR**	**SA**		**SLA**	**Total**
										PR	**OR**		
3	1	4	2	10	5	20	20	60	25	50@	-	25	200

Total IKS Hrs. for course: 2hrs.

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA- TH represents the two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. Rationale:

The influence of integrated-circuit technology in the past few years on our society has been prevalent, in area ranging from consumer products to business management to manufacturing control. The driving force behind this pervasiveness is that the functional capability of modern integrated circuitry has increased in scope and complexity exponentially with time over the past 20 years. The designers of modern integrated circuitry have continually endeavored to provide more computational speed with less dissipated electrical power and less circuit board area, while maintaining a low failure rate and an aggressive cost. The complexity and speed is finding ready application for VLSI systems in digital processing. Although silicon MOS-based circuitry will meet most requirement in such systems. The student can acquire knowledge in the design skill of combinational and sequential circuit with the help of VHDL and NMOS and CMOS logic circuit processing operation; student can use this knowledge as technician, supervisor and programmer in different sections of industry.

II. Industry / Employer Expected Outcome

VLSI design has a significant impact on both employers and the industry, driving innovation and shaping technological advancements. The industry benefits from increased efficiency, cost-effectiveness, and performance improvements in digital electronics, leading to advancements in diverse sectors. For employers, VLSI design provides a pathway for creating innovative products, attracting skilled talent, and enhancing competitiveness in the global market.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	To learn basic CMOS Circuits and CMOS process technology.
CO2	Implement logical equations using NMOS and CMOS technology
CO3	Understand Hardware description language, its components and programming syntax.
CO4	Develop program to implement combinational logic circuit using VHDL.
CO5	Understand ASIC, FPGA and PLDs architecture.

IV.Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO1a.**Understand CMOS Technology **TLO1b.**Analyze IV Characteristic and Current equation **TLO1c.**Evaluate MOS transistor under static condition. **TLO1d.**Analyze Dynamic behavior **TLO1e.**Analyze Fabrication process of CMOS. **TLO1f.**Understand Layout Design Rules.	**Introduction to CMOS Technology** **1.1 MOS Transistor** 1.1.1 Construction of PMOS and NMOS 1.1.1 IV Characteristic 1.1.2 Current equation 1.1.3 MOS transistor under static condition 1.1.4 Dynamic behavior **1.2 CMOS Technology** 1.2.1 Introduction to CMOS 1.2.2 Fabrication process of CMOS 1.2.3 Technology scaling **1.3 Layout Design Rules** **1.4 Second order Effects** **Course Outcome: CO1 Teaching Hours: 12hrs** **Marks: 12(R-6, U-6, A--)**
	TLO2a. Understand static and dynamic behavior of CMOS inverter. TLO2b.Analyze Static and dynamic power	**Digital Circuit Design** 2.1 The static CMOS inverter 2.2 Dynamic behavior of CMOS 2.3 Fan-In and Fan -Out 2.4 Static and dynamic power consumption 2.5 Design of basic gates using PMOS, NMOS and CMOS

2	consumption derivation. TLO2c. Develop design of basic gates using PMOS, NMOS and CMOS logic TLO2d. Implement MOS logic to draw complex logic equation.	logic 2.6 Drawing complex logic equation using CMOS logic 2.7 Interconnect modelling (simple RLC) **Course Outcome: CO2** **Teaching Hours :12hrs** **Marks: 12(R-4, U-4, A-4)**
3	TLO3a. Understand HDL Frontend design flow. TLO3b. Understand Concurrent constructs. TLO3c. Write simple program to implement combinational and Sequential Circuits. TLO3d. Understand Test bench and its applications.	**VHDL Programming** 3.1 Introduction to HDL: History of VHDL, Pros and cons of VHDL 3.2 VHDL flow element (Entity, Architecture, Configuration, Package, Library only definitions) 3.3 Data types, Operators, Operations, Signal constant and variables (syntax and use) 3.4 HDL Front end design flow. 3.5 Concurrent constructs. 3.6 Simple VHDL program to implement combinational and Sequential Circuits such as MUX, DEMUX, ENCODER, DECODER, ALU, Flip Flop, Counter, shift register, MOORE, MEALY Machines. 3.7 Test bench and its applications. **Course Outcome: CO3** **Teaching Hours :12hrs** **Marks: 12(R-4, U-4, A-4)**
4	TLO4a. Understand Circuit Families TLO4b. Understand Ratioed circuit and Capcode voltage switch design. TLO4c. Understand Dynamic CMOS design. TLO4d. Understand Dynamic logic basic principles. TLO4e. Understand Speed and forward dissipation of dynamic logic. TLO4f. Understand Issues in dynamic design. TLO4g. Understand How to choose a logic style. TLO4h. Understand Tristate Invertor	**Combinational Logic Gates** 4.1 Static CMOS design 4.1.1 complementary CMOS 4.1.2 Ratioed circuit 4 1.3 Pass -Transistor circuit 4.2 **Dynamic CMOS design** 4.2.1 Dynamic logic basic principles 4.2.2 Speed and Power dissipation of dynamic logic 4.2.3 Issues in dynamic design 4.2.4 Cascading dynamic gates 4.3 How to choose a logic style 4.4 Transmission Gate 4.5 The Tristate Invertor **Course Outcome: CO4** **Teaching Hours: 12hrs** **Marks: 12(R-4, U-4, A-4)**

5	TLO5a. Understand ASIC, CPLD, FPGA. TLO5b. Understand CPLD-Internal block diagram with explanation TLO5c. Understand FPGA-Internal block diagram with explanation. TLO5d. Compare ASIC, FPGA and CPLD.	**ASICS AND PLPs** 5.1 ASIC Design flow. 5.2 PLDs- PLA, PAL 5.2.1 PROM,PLA,PAL 5.2.2 Implementation of combinational circuits using PLA and PAL. 5.3 CPLD-Functional block diagram. 5.4 FPGA-Functional block diagram 5.5 Comparison of ASIC, FPGA and CPLD. **Course Outcome: CO4** **Teaching Hours :12hrs** **Marks: 12(R-4, U-4, A-4)**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	No.of hrs.	Relevant COs
1	**LLO a.** Understand micro wind Tool **LLO b.** Use Micro wind tool to write program for logic gates.	Design and simulate CMOS Basic gates using micro wind Tool. Write VHDL Program for logic Gates	4	CO1
2	**LLO a.** Write program for half and full adder **LLO b.** Write and execute program, observe output	Write VHDL Program for Half and full-adder and subtractor and Synthesize using FPGA	4	CO3
3	**LLO a.** Write program for mux/demux. **LLO b.** execute program, observe output as per t.t.	Write VHDL Program 8:1 Multiplexer, 1:8 Demultiplexer and Synthesize using FPGA	4	CO3
4	**LLO a.** Write program for decoder. **LLO b.** execute program, observe output	Write VHDL Program 2:4 Decoder, 8:3 Encoder and Synthesize using FPGA	4	CO3
5	**LLO a.** Write program for f sync. counter **LLO b.** execute program, observe output	Write VHDL Program for Synchronous Counter and Synthesize using FPGA	4	CO3
6	**LLO a.** Write program for gray code. **LLO b.** execute code for same **LLO c.** Observe output as per t.t.	Write VHDL Program for Binary to Grey Code Converter and Synthesize using FPGA	4	CO3
7	**LLO a.** Write program for ADC/DAC interface **LLO b.** execute code for same	Write VHDL Program for Interfacing of ADC, DAC and Synthesize using FPGA	4	CO3

8	**LLO a.** Write program for 4-bit ALU. **LLO b.** execute code for same	Write VHDL Program for Implementing 4-bit ALU or sequence Generator and Synthesize using FPGA	4	CO3
9	**LLO a.** Write program for Scrolling of data on seven segments. **LLO b.** execute code for same	Write VHDL Program for Scrolling of data on seven segment display and Synthesize using FPGA	4	CO3
10	**LLO a.** Write program for LCD controller **LLO b.** execute code for same	Write VHDL Program for LCD controller and Synthesize using FPGA	4	CO3
11	**LLO a.** Write program for 8-bit ALU. **LLO b.** execute code for same	Microproject-8-BIT ALU Design	4	CO3
12	**LLO a.** Learn Write program for 8-bit ALU. **LLO b.** Test code of ALU.	Microproject-8-BIT ALU Design. Phase-III. Rapid Proto typing-Testing (Manual testing) and evaluation	4	CO5
13	**LLO a.** Learn Write program for 8-bit ALU **LLO b.** Test code of ALU.	Microproject-8-BIT ALU Design. Phase-IV. Implementation-Demonstration, deployment and Orientation	4	CO5
14	**LLO a.** Report writing ALU testing using test bench **LLO b.** Test code of ALU for various operation.	Report writing ALU testing using test bench. Test bench is prepared to test 8-bit ALU and verify the result using test vector for various arithmetic and logical operations	4	CO5
15	**LLO a.** Report writing ALU testing using test bench	Report writing ALU testing using test bench. Collect the data and prepared the report.	4	CO5

Note: 10 to 12 experiments should be performed in a term for completion of TW

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 10 Assignments)

1. Assignment based on CMOS Technology i.e Construction, Characteristic, I V Equation and dynamic behavior.
2. Fabrication process of CMOS, Technology scaling, Layout Design Rules.
3. Simple VHDL program to implement combinational MUX, DEMUX, ENCODER, DECODER, ALU.
4. Simple VHDL program to implement Sequential Circuits such as Flip Flop, Counter, shift register
5. Assignments based on Dynamic CMOS design.
6. Assignments based on ASIC Design flow.
7. Assignments based on CPLD-Internal block diagram with explanation.
8. Assignments based on FPGA-Internal block diagram with explanation.
9. Micro projects: 8 BIT ALU Design.

V. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to CMOS Technology	6	6	-	12
2	Digital Circuit Design	4	4	4	12
3	VHDL Programming	4	4	4	12
4	Combinational Logic Gates	4	4	4	12
5	ASICS AND PLP'S	4	4	4	12
Total					**60**

VI.Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (50 marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering and Practices for Society, Sustainability Environment	PO-6 Project Management	PO-7 Life Long Learning	SO-1	SO-2	SO-3
CO1	2	3	3	3	1	2	2	3	3	2
CO2	2	2	3	3	1	2	2	2	3	3
CO3	2	3	3	3	1	2	2	3	3	3
CO4	2	3	2	2	1	2	2	2	2	3
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

IX. Suggested Learning Materials / Books

Sr. No	Author	Title	Publisher
1	Jan M. Rabaey, A. Chandrakasan ,B. Nikolic,	Digital Integrated Circuits (2nd Edition)	Prentice Hall; 1st edition 978-0131786097, 0131786091
2	Neil H. E. Weste Kamran.	Principals of CMOS VLSI Design: A System Perspective	Pearson Education, 2015. 9789332542884
3	VISI Design and EDA Tools	VISI Design and EDA Tools	Scitech Publication India Ltd.2011 8183714528, 9788183714525
4	Douglas Perry	VHDL Programming by Example	Tata McGraw-Hill, 2002 8183714528, 9788183714525

X. Learning Websites & Portals

Sr. No	Link / Portal	Description
1	https://freevideolectures.com/subject/vlsi-and-asic-design/	Basics of VHDL
2	https://www.udemy.com/course/vhdl-programming-with-intel-quartus-prime-tool/	Basics of VHDL, All projects
3	https://www.intel.com/content/www/us/en/programmable/support/training/course/ohdl1110. html	All projects
4	https://www.youtube.com/watch?v=mwJ3uMWvJX0	All projects
5	https://www.youtube.com/watch?v=ht7nEjNydDU	All projects

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.Anjum Mujawar	Selection grade Lecturer in Electronics	Vidyalankar Polytechnic, wadala, Mumbai
3	Dr. Sachin D,Pabale	HOD, Electronics Department	Government Polytechnic, Mumbai
4	Mrs. Archana D Kalyankar	Lecturer in Electronics	Government Polytechnic, Mumbai

Coordinator
Curriculum Development
Department of Electronics

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Head of Departments
Department of Electronics

CDC Co-ordinator
G. P. Mumbai

I/C, Curriculum Development Cell

Principal
Government Polytechnic, Mumbai

Programme: Diploma in Electronics Engineering (Sandwich pattern)													
Course Code: EC23504					**Course Title: Robotics**								
Compulsory / Optional: Compulsory													
Teaching Scheme and Credits						**Examination Scheme**							
						FA-TH		**SA-TH (2Hrs. 30 min.)**	**FA-PR**	**SA**		**SLA**	**Total**
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**T1**	**T2**			**PR**	**OR**		
3	1	2	2	8	4				50		50@	25	125

Total IKS Hrs. for course: -

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents a two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. Rationale:

Robots are widely used in the fields of manufacturing, medicine, search and rescue, service, and entertainment. So, it is very much important to teach robotics as the synergistic integration of mechanics, electronics, controls, and computer science. This subject is intended to make student aware with basics of robot sensors, controls and transformations along with essential kinematics and dynamics.

II. Industry / Employer Expected Outcome

Develop and implement creative solutions for real time problems that can enhance efficiency, safety and convenience across various domains.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Understand the importance of Robotics Systems.
CO2	Design the power source for Robotics Systems.
CO3	Install and maintain the sensors and Transducer of Robotics systems.
CO4	Select the Robotics Systems for given application.
CO5	Understand the concept of Industry 4.0.
CO6	Apply computer vision techniques to enable robots to perform autonomous tasks such as object recognition, localization, and automated inspection in industrial applications.

IV.Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	**TLO1a.** State importance of Robotics **TLO1b.** Explain Robotics System Architecture **TLO1c.** Describe the Block diagram of robot. **TLO1d.** Describe various generations of Robotics systems. **TLO1e.** Describe various terms related with Robotics systems. **TLO1f.** List Selection parameters of robot	**Unit-I** **Introduction to Robotics** 1.1 Definition and origin of robotics 1.2 Different types of robotics. 1.3 Block diagram of Robot. 1.4 Various Generations of Robot. 1.5 Definition related to Work Envelop, Degree of freedom, End Effector and Manipulator. 1.6 Selection of Robot parameter. Course Outcome: CO1 Teaching Hours: 8hrs Marks: 10(R- 4, U-4, A-2)
2	**TLO2a.** Define actuators **TLO2b.** Classify different types of actuators **TLO2c.** Determination of HP of motor and gearing ratio. **TLO2d.** Path determining in Robotics systems.	**Unit-II** **Robotics Power Sources** 2.1 Definition of actuators. Hydraulic, pneumatic and electric drives. 2.2 Determination of HP of motor and gearing ratio. 2.3 Variable speed arrangements. 2.4 Path determination. **Course Outcome**: CO2 Teaching Hours: 6hrs Marks: 10(R- 4, U-4, A-2)

3	**TLO3a.** List types and functions of gripper. **TLO3b.** Describe the function of vacuum and mechanical grippers. **TLO3c.** Design the different type of end effector. **TLO3d.** List the specifications of gripper.	**Unit-III** **Robot End Effector** 3.1 Types and function of gripper. 3.2 Study of magnetic vacuum and mechanical grippers. 3.3 Design and function of different type of end effector. 3.4 Considerations in gripper specification and design. Course Outcome: CO4 Teaching Hours: 7hrs Marks: 10(R- 4, U-4, A-2)
4	**TLO4a.** List the functions of different sensors. **TLO4b.** List the Selection Criterion for Sensors and Actuators. **TLO4c.** Describe the working and functions of different sensors. **TLO4d.** Describe the working and functions of different Robot actuators.	**Unit-IV** **Sensors and Robot Actuation Systems.** 4.1 Function and use of sensors and Actuators in robotics Basic. 4.2 Selection Criterion for Sensors and Actuators. 4.3 Sensors 4.3.1 Micro switches. 4.3.2 Strain gauges. 4.3.3 Capacitive, inductive and ultrasonic. 4.3.4 Laser sensors, sensor for welding. 4.4 Robot Actuation Systems 4.4.1 Electric, Hydraulic and Pneumatic. 4.4.2 Transmission: Gears, Timing Belts and Bearings **Course Outcome:** CO3 Teaching Hours: 8hrs Marks: 10(R- 4, U-4, A-2)
5	**TLO5a.** Describe the given Application of Robotics Systems. **TLO5b.** List Core idea and Origin concept of Industry 4.0.	**Unit-VI** **Robotics Applications and Industry 4.0** 5.1 Application of Robotics Systems. (Any 3) 5.5.1 Material handling. 5.5.2 Process operation and inspection. 5.5.3Machine loading and unloading. 5.5.4 Spot and arc welding. 5.5.5 Spray painting. 5.5.6 PCB Soldering. 5.5.7 Laser cutting etc. 5.2 Industry 4.0 5.2.1 Introduction to Industry 4.0. 5.2.2 Core idea and Origin concept of Industry 4.0. 5.2.3 Advances in Robotics in the Era of Industry 4.0. **Course Outcome:** CO5 Teaching Hours: 8hrs Marks: 10(R- 4, U-4, A-2)

6	TLO6a. Explain the role of computer vision in robotic systems. TLO6b. Identify and describe different types of cameras and depth sensors used in robotics. TLO6c. Apply image processing techniques for object recognition and localization. TLO6d. Integrate computer vision techniques to enable autonomous robots to perform tasks such as inspection and guidance. TLO6e. Assess the applications and limitations of computer vision in industrial automation.	**Unit-VI** **Computer Vision Applications in Robotics** 6.1 Introduction to computer vision. 6.2 Machine perception in robots. 6.3 Types of cameras and depth sensors. 6.4 Image processing techniques for object recognition and Localization. 6.5 Applications in automated inspection, autonomous robots, and robot-guided operations **Course Outcome:** CO6 Teaching Hours: 8hrs Marks: 10(R- 4, U-4, A-2)

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1.1 - Survey of different Robotics Systems available in Market.	Collect the information and specifications of different robots and their allied systems.	2	CO1
2	LLO2.1 - Comparative study of drive technologies	Verify and compare the various drives used in different types of robots	2	CO1
3	LLO3.1 - Calculation of work envelope of any two types of robots	Calculate and record the work envelope of any two types of robots available in the laboratory	2	CO2
4	LLO4.1 - Design of gripper for pick and place, welding operation theoretically	Consider any application and theoretically design a gripper with its drawing and specifications	2	CO4
5	LLO5.1 - Demonstration of forward and reverse transformation for 2 degrees of freedom arm rotation.	Use and understand the robotic arm rotation in forward and reverse rotations. Draw the sketches and record the specifications	2	CO4
6	LLO6.1 - Identify different types of proximity and position	Identify and understand the performance of proximity and	2	CO3

	sensors	position sensors used in robotic systems		
7	LLO7.1 - Survey of different type of robot sensors available in market.	Collect the data and specifications of different robotic system sensors available in market	2	CO3
8	LLO8.1 - Identify different types of actuators.	Identify and collect the specifications of different actuators used in robotic system	2	CO4
9	LLO9.1 - Identify different types of Motion, Velocity and Acceleration sensors.	Identify and understand the performance of motion, velocity and acceleration sensors used in robotic systems	2	CO4
10	LLO10.1 - Use robot trainer to perform different tasks.	Use robotic trainer available in your laboratory	2	CO5
11	LLO11.1 - Simulate the working of pick and place robot.	Understand the simulator used to simulate pick and place robot.	2	CO5
12	LLO12.1-Visit to the industry, which is using more than two robot. Report on visit containing cell layout, design and control.	Visit a robotic based industry. Prepare a detailed report with necessary drawings along with essential specifications of robots.	2	CO5
			24	

Note: 10 to 12 experiments should be performed in a term for completion of TW

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 10 Assignments)

1. 10 Assignment covering all 6 unit.
2. Micro project Group of two students should prepare Robot application circuit. Based on practical list.
3. Case study based on Robotic Application.

VI. Specification Table:

Unit No.	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Robotics	04	04	02	10
2	Robotics Power Sources	04	04	02	10
3	Robot End Effector	04	04	02	10
4	Sensors and Robot Actuation Systems.	04	04	02	10
5	Robotics Applications and Industry 4.0	04	04	02	10
6	Computer Vision Applications in Robotics	04	04	02	10
Total		**24**	**24**	**12**	**60**

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)
Rubrics for continuous assessment based on process and product related performance indicators (50marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Practical performance (50 marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	3	3	2	2	3	2	2	3
CO2	3	2	2	2	2	2	3	2	2	3
CO3	3	2	1	1	2	2	3	2	2	2
CO4	3	3	2	1	2	1	3	2	2	2
CO5	3	3	2	1	2	1	3	1	1	1
CO6	3	2	3	2	1	1	2	3	2	1

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year of publication	ISBN
1	Industrial Robotics	M.P. Groover, Mitchell Weiss, MC Graw Hill International Edition	978-1259006210
2	Mechatronics	M. D. Singh and J. G. Joshi, PHI Learning Private Limited, New Delhi	9788120329867
3	Robotics Principals & Practices	Dr. K.C. Jain, Dr. L.N. Aggarwal, Khanna Publications, New Delhi.	978-8174091574
4	Robotics for Engineers	Koren Yoram, McGraw-Hill Education, New Delhi, 1st Edition	978-0070353992
5	Robotics	Fu K. S., Gonzalez R C., Lee C S G, McGraw - Hill Education, New Delhi Pvt. Ltd	NA

X. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Dr Jayant Joshi	Lecturer in Electronics	Government Polytechnic, Nashik
2	Mr Anjum Mujawar	Lecturer in Electronics	Vidyalankar Polytechnic, Mumbai
3	Mr V.Y. Patil	Lecturer in Electronics	Government Polytechnic, Mumbai

Coordinator
Curriculum Development,
Department of Electronics Engineering

Head of Departments
Department of Electronics Engineering

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CDC Co-ordinator
G. P. Mumbai

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai

Programme : Diploma in Electronics Engineering (Sandwich pattern)													
Course Code: EC23203					Course Title: Advance communication system								
Compulsory / Optional: Optional													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2Hrs .30 min.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
4	-	4	-	8	4	20	20	60	25		50#	-	175

Total IKS Hrs. for course: 2hrs.

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents the two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. 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 plays vital role in our daily life. Now a days modern high capacity telecommunication networks based on mobile communication and optical communication becomes integral part of industry, society and other organizations. This course has been designed to develop skills in the diploma engineers to maintain advance communication system.

II. Industry / Employer Expected Outcome

The study of Advance communication system will equip students with specific skills and knowledge that are highly valued by employers and essential for various industries. It will help students to maintain Wireless and optical communication systems.

III. Course Outcomes:

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Illustrate working principle of Satellite communication.
CO2	Assess cellular systems capacity
CO3	Assess performance of standards of different cellular systems
CO4	Classify different types of Optical Fibers, its structure and components.
CO5	Explain multiplexing techniques in fiber optics.

IV. Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's) aligned to CO's	Topics / Sub-topics
1	**TLO1a.** Describe with sketches the working principle of satellite. **TLO1b.** Describe with sketches the given terms related to satellite **TLO1c.** Explain the parameters with respect to the given type of the satellite orbit **TLO1d.** Explain various types of the satellite subsystems.	**Satellite Communication System** 1.1 Introduction to satellite communication system: Importance of satellite communication system, Uplink & downlink frequencies, Satellite frequency bands, Applications of Satellite Communication 1.2 Basic terminology used in satellite communication: Latitude, Longitude, Look angle, Elevation angle, Azimuth angle, Altitude, Footprint, Station keeping 1.3 Block diagram and function of satellite earth station, transponder. 1.4 Communication Satellite orbit and types: LEO, MEO, GEO 1.5 Subsystems of satellite: Block diagram and working Principle of Power subsystem, LNA, Attitude control subsystem, Thermal control subsystem, Repeaters, Telemetry tracking and command subsystem, Main and auxiliary propulsion subsystem, Antenna subsystem **Course Outcome: CO1** **Teaching Hours:13hrs** **Marks:14 (R-4, U-6, A-4)**
2	**TLO 2a.** Explain the given terms with respect to Cellular systems. **TLO 2b.** Describe the Basic Cellular systems. **TLO 2c.** Explain with relevant sketch the working principle of the different sections of mobile handset unit	**Cellular system architecture** 2.1 Cellular fundamentals: cell, cell structure, cluster, reuse factor, minimum reuse distance. 2.2 Basic cellular system: mobile station, base station, traffic channel (Forward and Reverse) , control channel (Forward and Reverse), frequency reuse, channel assignment strategies. 2.3 Mobile Phone Unit: Block diagram, working, features of transmitter, receiver section, Frequency Synthesizer, Control unit, Logic Unit of Mobile phone, sensors, speakers, camera, touch screen, motion sensors and other common sensors.

		Course Outcome: CO2 **Teaching Hours:11 hrs** **Marks:10 (R-4, U-4, A-2)**
3	**TLO3.a** Explain the effect of the given interference on cellular system performance **TLO3.b** Select the relevant method to improve coverage and system capacity of the given cellular system with justification. **TLO3.c** Describe GSM system with relevant sketch. **TLO3.d** Describe 5G network architecture.	**Mobile Communication System** 3.1 Interference: Co-Channel interference, Adjacent Channel Interference. 3.2 Improving Coverage and capacity in cellular systems: Cell splitting, Sectoring, Microcell Zone concept. Repeaters for range extension 3.3 Global System for Mobile Communication (GSM): 3.3.1 GSM system Architecture 3.3.2 Features and services 3.3.3 GSM channel types 3.3.4 GSM call routing, Mobile terminated call & mobile originated call sequence, stages of call processing in GSM. 3.4 Handoff Strategies: Concept of Handoff, Types of Handoff: Hard and soft Handoff 3.5 Limitation of 4G. 3.6 Introduction to 5G: 5G network architecture, 5G enable Technologies. **Course Outcome: CO3** **Teaching Hours: 14 hrs** **Marks:14 (R- 4, U-6, A-4)**
	TLO4.a Describe construction and features of optical fiber. **TLO4.b** Explain the block diagram of fiber optic communication. **TLO4.c** Explain the given terms related to optical theory. **TLO4.d** Calculate the acceptance angle, critical angle and numerical aperture of the given optical fiber cable.	**Theory of Optics and Fundamentals of Optical Fiber** 4.1 Optical spectrum: Band name and its range 4.2 Fiber optics communication 4.2.1 Introduction 4.2.2 Advantages and disadvantages 4.2.3 Applications 4.3 Block diagram and working of Fiber Optic communication system. 4.4 Definition and concept of reflection, refraction, dispersion, diffraction, absorption and scattering with the help of light theory. 4.5 Ray theory transmission: Total internal reflection, Definition of critical angle, Acceptance angle, Numerical Aperture. **Course Outcome: CO4** **Teaching Hours:11hrs** **Marks:12 (R- 4, U-6, A-2)**
	TLO5.a Explain the Concept of WDM. **TLO5.b** Explain the Operation of OTDR **TLO5.c** Explain the Block diagram of link Power Budget **TLO5.d** Explain Attenuation measurement using OTDR	**Multiplexing in Fiber Optic Communication** 5.1 Wavelength Division Multiplexing. 5.1.1 Definition and Necessity of WDM. 5.1.2 Advantages of WDM. 5.2 Block diagram and operational principles of WDM. 5.3 DWDM deployment of multiple wavelengths: Block diagram and working principle. 5.4 Link Power Budget: Block diagram of optical power loss model, explanation and formulas used. 5.5 Introduction to FTTH and (GPON) Gigabit passive optical network

		5.6 Attenuation measurements: OTDR Block diagram and working principle. **Course Outcome: CO5** **Teaching Hours :11hrs** **Marks:10 (R- 4, U- 4, A-2)**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr. No.	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	No. of hrs.	Relevant COs
1	LLO1 Use given microwave test bench setup for writing specifications of Microwave Test Bench and five major Microwave components.	Transmit and receive PC data through Satellite link.	4	CO1
2	LLO1 Use given microwave test bench setup for measuring characteristics of Reflex Klystron.	Transmit and receive Audio and Video signals through satellite link.	2	CO1
3	LLO1 Use given microwave test bench setup for measuring characteristics of microwave E-plane tee	Conversion of uplink and down link frequencies in digital Satellite communication systems	2	CO1
4	LLO1 Use given microwave test bench setup for measuring characteristics of microwave H-plane tee	Test the performance of audio satellite link for the specified Uplink and downlink frequency	2	CO1
5	LLO1 Identify different sections and components of mobile phone such as ringer section, dialer section, receiver section and transmitter section, camera, microphone, speaker, Dash light.	Identify different sections and component of mobile unit (Ringer section, dialer section, receiver section, transmitter section etc.)	4	CO2
6	LLO1 Demonstrate handoff, frequency response, cell splitting using Mobile trainer kit	Demonstration of handoff, frequency response, cell splitting.	2	CO3
7	LLO1 Test user Interface section (Keyboard Buzzer, Vibrator, LED, Mic and Speaker) of Mobile phone unit.	Testing of different sections of mobile phone unit	2	CO2
8	LLO1 Troubleshoot of different sections of mobile phone unit on Mobile trainer kit	Troubleshoot of different sections of mobile phone unit	2	CO2
9	LLO1 Identify Dual sim interface section, Touch screen display section, battery charging circuit, power management unit of 4G or 5G smartphone and test	Identification of different parts of smartphones using 4G or 5G experimental	4	CO3

	working.	setup		
10	LLO1 Install and authenticate eSIM (virtual SIM) on mobile handset.	Installation of eSim on mobile handset	2	CO3
11	LLO1 Using appropriate mobile app locate and find Internet signal strength of mobile tower.	Location of nearby tower and find internet connection strength	2	CO3
12	LLO1 Test the hard reset function, hotspot and other networking functions of the given smart phone.	Make Hotspot connection on Wi-fi on any 2 devices	2	CO3
13	LLO1 Build a Personal Area Network of mobile devices using Bluetooth.	Establish Personal Area Network of at least two devices	2	CO3
14	LLO1 Set Up of Fiber optic Analog link on fiber optic trainer kit	Setting Up of Fiber optic Analog link.	4	CO4
15	LLO1 Set Up of Fiber optic Digital link	Setting Up of Fiber optic Digital link.	4	CO4
16	LLO1 Measure Numerical aperture of optical fiber	Measurement of NA of optical fiber.	4	CO4
17	LLO1 Measure the length of fiber spool using OTDR	Measure the length of fiber spool using OTDR.	4	CO5
18	LLO1 Calculate the splice loss and measure the length of fiber by using two fiber spool and OTDR	Calculate the splice loss and measure the length of fiber by using two fiber spool and OTDR	4	CO5
19	LLO1 Observe loss in LC/PC adapter and measure the length of fiber using spool and OTDR.	Observe loss in LC/PC adapter and measure the length of fiber using spool and OTDR.	4	CO5
20	LLO1 Observe attenuation and measure the length of fiber using spool and OTDR.	Observe attenuation and measure the length of fiber using spool and OTDR.	4	CO5
21	LLO1 Construct Mini project using different components of wireless communication or optical fiber communication	Mini project on components of wireless communication or optical fiber communication	4	CO 1,2,3, 4,5

Note: 15 experiments should be performed in a term for completion of TW

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): (Minimum 10 Assignments) –NA

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Satellite Communication System	4	6	4	14
2	Cellular system architecture	4	4	2	10
3	Mobile Communication System	4	6	4	14
4	Theory of Optics and Fundamentals of Optical Fiber	4	6	2	12
5	Multiplexing in Fiber Optic Communication	4	4	2	10
Total		20	26	14	60

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

Rubrics for continuous assessment based on process and product related performance Indicators (25 marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Performance (50 marks)

VIII. Suggested COs - POs Matrix Form

CO	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO- 1	PSO- 2	PSO- 3
CO1	2	1	1	2	3	3	3	3	1	2
CO2	1	2	2	2	3	3	3	2	3	2
CO3	2	1	2	3	3	2	3	2	2	2
CO4	3	2	2	2	3	3	3	3	2	2
CO5	2	2	2	3	2	3	3	3	3	3
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

IX. Suggested Learning Materials / Books

Sr. No	Title	Author	Publisher
1.	William C.Y. Lee	William C.Y. Lee	McGraw Hill Education; 2nd edition (1 July 2017); McGraw Hill Education (India) Pvt. ISBN : 978-0070635999
2.	Wireless Communications principles & practice	Theodore S. Rappaport	Pearson Education India; 2nd edition (1 January 2010), ISBN : 978-8131731864
3.	Optical Fiber Communication	Gerd Keiser, Tata McGraw Hill	978125906876
4.	Optical Network	Kumar Shiv Rajan, Morgan Kaufmann	978-0-12-374092-2
5.	Electronic Communication Systems	Kennedy, Davis , Mc-Graw Hill	978-0071077828
6.	Satellite Communication	Roddy Dennis, Tata Mc-Graw Hill, 2017	978-0070077850

X. Learning Websites & Portals

Sr. No.	Link / Portal	Description
1	https://www.ericsson.com/en/reports-and-papers/white-papers/advanced-antenna-systems-for-5g-networks	5G-networks
2	www.isro.gov.in	Satellite Communication
3	https://www.vssut.ac.in/lecture_notes/lecture1428730613.pdf	Free PDF notes

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No.	Name	Designation	Institute/Organization
1	Ms. S. N. Isal	Director	Techmahoday company
2	Mrs. A.M. Ghadge	Lecturer in Electronics	G.P. Thane
3	Ms. S. H. Sisodiya	Lecturer in Electronics	G. P. Mumbai
4	Ms. T. K. Balsaraf	Lecturer in Electronics	G. P. Mumbai

Coordinator
Curriculum Development,
Department of Electronics Engineering

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Head of Departments
Department of Electronics Engineering

CDC Co-ordinator
G. P. Mumbai

I/C, Curriculum Development Cell

Principal
Government Polytechnic, Mumbai

Programme : Diploma in Electronics Engineering (Sandwich pattern)													
Course Code: EC23204				Course Title: Advance Embedded system									
Compulsory / Optional: Optional													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2Hrs .30 min.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
4	-	4	-	8	4	20	20	60	25		50#	-	175

Total IKS Hrs. for course: -

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents the two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. Rationale:

This course will provide an opportunity to the students to become familiar with ARM microprocessor architecture, instruction set and programming The ARM7 architecture, although older than more modern ARM cores such as the Cortex-M or Cortex-A series, remains an attractive choice for many embedded systems due to its unique advantages such as power efficiency, mature and reliable technology, cost effectiveness and simplified design.

II. Industry / Employer Expected Outcome

Develop and implement creative solutions for real time problems that can enhance efficiency, safety and convenience across various domains.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Familiarize with ARM architecture and differentiate between RISC and CISC architectures
CO2	Understand the features, block and pin diagrams, and architectural overview of the LPC2148 microcontroller.
CO3	Understand and configure the system control features of the LPC2148 microcontroller.
CO4	Configure the memory map, pin connect block, and GPIO features of the LPC2148 microcontroller.
CO5	Enabling them to interface and control various peripheral.

III. Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1	TLO1a. Describe the architecture And evolution of ARM processors. TLO1b. Distinguish between different ARM processor families and their application areas. TLO1c. Understand and apply ARM processors in real-world scenarios. TLO1d. Utilize tools like compilers, emulators, and debuggers for ARM development. TLO1e. Understand the key Differences between RISC and CISC architectures	**Unit-I** **INTRODUCTION TO ARM PROCESSOR** 1.1. Introduction to ARM Processor 1.2.ARM processor family 1.3. Application of ARM Processor 1.4. Compiler, Emulation and Debugging 1.5. Difference between RISC & CISC **Course Outcome: CO1 Teaching Hours: 10hrs** **Marks: 12(R- 4, U-4, A-4)**
2	TLO2a. Describe the key features of the LPC2148 micro-controller. TLO2b.Interpret the block diagram of the LPC2148 and explain the functionality of various components. TLO2c.Analyze and understand the pin diagram of the LPC2148, recognizing the purpose and use of	**Unit-II** **LPC2148 MICROCONTROLLER PIN DETAILS, MEMORY** 2.1 Features of LPC2148 2.2 Block diagram of LPC2148 2.3 Pin diagram of LPC2148 2.4 Architectural overview 2.5 On-chip flash program memory 2.6 On-chip static RAM

	each pin. **TLO2d.** Explain the architectural design of the LPC2148, including the ARM7TDMI-S core.	**Course Outcome:** CO2 Teaching Hours: 10hrs Marks: 12(R- 4, U-6, A-2)
3	**TLO3a.** Understand the purpose and function of a crystal oscillator. **TLO3b.** Understand and explain the operation of PLL, reset, and wake-up timers. **TLO3c.** Identify the role of the brownout detector in protecting the micro-controller from low voltage conditions. **TLO3d.** Configure and utilize external interrupt inputs for responding to external events and enabling real-time operations. **TLO3e.** Understand and work with memory mapping control to manage system memory efficiently and protect critical data.	**Unit-III** **SYSTEM CONTROL** 3.1. Crystal Oscillator 3.2. PLL, Reset and Wake-up Timer 3.3. Brownout detector. 3.4. External Interrupt input 3.5. Memory Mapping Control 3.6. Power Control 3.7. VLSI Peripheral Bus (VPB) **Course Outcome:** CO3 Teaching Hours:12hrs Marks: 12(R- 4, U-4, A-4)
4	**TLO4a.** Explain the function of the Pin Connect Block (PCB) and configure micro-controller pins for different peripheral functions. **TLO4b.** Understand and use General Purpose I/O (GPIO) pins for interfacing with external components like LEDs, switches, and peripherals.	**Unit-IV** **MEMORY MAP, PIN CONNECT BLOCK, GPIO** 4.1. Pin Connect Block 4.2. General Purpose Parallel I/O: Features 4.2.1 8 Bit LED's and switches. 4.2.2 Relay and Buzzer. 4.2.3 Seven Segment Led. 4.2.4 Keypad. 4.2.5 LCD. **Course Outcome:** CO4 Teaching Hours: 12hrs Marks: 12(R- 4, U-4, A-4)

5	TLO5a. Understand and configure peripheral modules such as general-purpose timers, ADCs, DACs, UARTs, I2C, SPI, and RTC for a variety of embedded system applications. TLO5b. Design and develop embedded systems using UART, SPI, I2C, and real-time clocks, enabling efficient communication, time-based operations, and reliable data storage/retrieval.	**Unit-V** **LPC 2148 PERIPHERAL** 5.1. General purpose timer/ External event counters: Features Interfacing Timer and Counter Operation, 5.2. 10-bit ADC: Features • Interfacing Temperature Sensor LM35 5.3. 10-bit DAC: Features • Interfacing DAC 5.4. UARTs: Features, Serial Communication 5.5. Interrupt Controller, Interrupt Sources, External Interrupt 5.6. I2C – bus serial I/O Controller: Interfacing with AT24C1024 5.7. SPI- Serial I/O Controller: Features 5.7.1 Interfacing with 25LC040 5.8. Real Time Clock: Features 5.9. MEMORY CARD INTERFACING -LPC 2148 Interfacing with SD Memory card **Course Outcome:** CO5 Teaching Hours:16hrs Marks: 12(R- 4, U-4, A-4)

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1.1- Learners will be able to perform arithmetic operations using ARM assembly language, simulating basic mathematical computations.	Simulate arithmetic and logical operation on arm in assembly	4	CO4,5
2	LLO2.1- Students will understand how to implement and simulate soft delays in ARM assembly, using loops and registers for precise timing control.	Simulation of Various timing soft delay in assembly	4	CO4,5
3	LLO3.1- Learners will be able to create a variable-speed LED blinking program in ARM assembly, adjusting blink rates based on dynamic input.	LED blinking variable speed in ASM	4	CO4,5
4	LLO4.1- Understand the basic operation of an LCD, the difference between various types of LCDs (like character and graphical), and how they are used for display in embedded systems.	Interface LCD in 8-bit mode to LPC2148	4	CO4,5
5	LLO5.1 - Learners will be able to interface a DC motor with LPC2148,	Interface DC Motor to LPC2148	4	CO4,5

	controlling its speed and direction via PWM signals.			
6	LLO6.1- Students will learn to interface an LCD in 8-bit mode with the LPC2148, displaying text and numeric data through GPIOs.	Interface Relay to LPC2148	4	CO4,5
7	LLO7.1- Learners will understand how to interface an ultrasound sensor with the LPC2148 for distance measurement applications.	Interface Ultrasound sensor to LPC2148	4	CO4,5
8	LLO8.1- Students will learn to interface a PIR sensor with the LPC2148 for motion detection and triggering actions in embedded systems.	Interface PIR sensor to LPC2148	4	CO4,5
9	LLO9.1- Learners will be able to interface an RFID card reader with LPC2148 for identification and authentication systems.	Interface RFID card to LPC2148	4	CO4,5
10	LLO10.1- Students will learn to interface the LM35 temperature sensor with the LPC2148 and acquire temperature data for processing.	Interface of LM 35 temperature sensor	4	CO4,5
11	LLO11.1- Learners will understand how to interface a touch sensor with the LPC2148 for user input and interaction in embedded systems.	Interface touch sensor to LPC2148	4	CO4,5
12	LLO12.1- Students will learn to interface a gas sensor with LPC2148 for detecting gases Environment.	Interface Gas sensor to LPC2148	4	CO4,5
13	LLO13.1- Learners will be able to interface a sound sensor with LPC2148 for audio-based detection or signal processing applications.	Interface sound sensor to LPC2148	4	CO4,5
14	LLO14.1- Students will learn how to Interface a flame sensor with LPC2148 for fire detection and safety systems.	Interface flame sensor to LPC2148	4	CO4,5
			56	

Note: 10 to 12 experiments should be performed in a term for completion of TW

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): NA

VI. Specification Table:

Unit No.	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Power Semiconductor devices	4	4	4	12
2	SCR Turn ON, Protection circuits and SCR Turn OFF methods	4	6	2	12
3	Controlled Rectifier	4	4	4	12
4	Chopper	4	4	4	12
5	Inverter	4	4	4	12
Total		**20**	**22**	**18**	**60**

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)
Rubrics for continuous assessment based on process and product related performance indicators (25marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Practical performance (50 marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	2	2	-	--	--	--	2	--	1
CO2	1	2	2	3			2	2	2	3
CO3	2	2	3	3	3	2	2	2	2	3
CO4	1	2	3	3	3	2	2	2	2	3
CO5	1	2	2	-	--	--	--	2	--	1

Legends: - High:03, Medium:02, Low:01, No Mapping: --

IX. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year of publication	ISBN
1	LPC 214x User manual (UM10139)	-	-
2	An Engineer's Introduction to the LPC2100 series	Trevor Martin,Hitex (UK) Ltd.	978-0954998813
3	ARM System Developer's Guide – Designing and Optimizing System Software	Andrew Sloss, Dominic Symes, Chris Wright,ELSEVIER	978-1558608740
1	LPC 214x User manual (UM10139)	-	-

X. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Dr Jayant Joshi	Lecturer in Electronics	Government Polytechnic, Nashik
2	Mr Anjum Mujawar	Lecturer in Electronics	Vidyalankar Polytechnic, Mumbai
3	Mr V.Y. Patil	Lecturer in Electronics	Government Polytechnic, Mumbai

Coordinator
Curriculum Development,
Department of Electronics Engineering

Head of Departments
Department of Electronics Engineering

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CDC Co-ordinator
G. P. Mumbai

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai

Programme : Diploma in Electronics Engineering (Sandwich Pattern)													
Course Code: EE23204				Course Title : Electric Vehicles									
Compulsory / Optional: Optional													
Teaching Scheme and Credits						Examination Scheme							
CL	TL	LL	SLH	NLH	Credits	FA-TH		SA-TH (2.30Hrs.)	FA-PR	SA		SLA	Total
						T1	T2			PR	OR		
4	--	4		8	4	20	20	60	25		50#		175

Total IKS Hrs. for course: 00

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents the two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work
4. SA-PR represents the end term practical examination.

I. **Rationale:** The global movement towards sustainable energy has positioned electric vehicle (EV) technology as a crucial field for electrical engineers. This course is designed to provide students with the essential knowledge and skills to understand, test, and work with EV systems. Through a blend of theoretical instruction and hands-on laboratory experiments, students will develop a thorough understanding of EV technology, equipping them for careers in the rapidly expanding electric vehicle industry.

II. **Industry / Employer Expected Outcome:**
Test and use different components of EV systems and compliance of policies & preparing for careers in the electric vehicle industry.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Identify components and subsystems used in electric vehicles.
CO2	Select electrical drives for particular EV application.
CO3	Test the performance of batteries and energy storage systems used for EV applications.
CO4	Apply the concept of converters and charging system in EV.
CO5	Implement Indian and State EV policies for EV applications.

IV. Course Content Details:

Unit No.	Learning Outcome`	Topics / Sub-topics
1	TLO 1.1 Compare electric vehicles and internal combustion engine vehicles on the given points. TLO 1.2 Describe the configuration of given types of EV system. TLO 1.3 Compare given EVs on the basis of given points. TLO 1.4 Describe the function of given EV subsystem	**1. Basics of Electric Vehicles** 1.1 History and evolution of electric vehicles (EV), need of EV, Electric vehicles and internal combustion engine vehicles: Comparison on the basis of environmental impact, power source, maintenance, gear change, noise level, vibrations level, capital cost, and running cost. 1.2 Electric vehicle architecture, Types of EV: Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), Fuel Cell Electric Vehicle (FCEV). 1.3 Comparison of different electric vehicle types on the basis of Driving Component, Energy Source used, Features, Problems and models available in market. 1.4 Block diagram of EV subsystems: energy source subsystem, propulsion subsystem and auxiliary subsystem. **Course Outcome:CO1 Teaching Hours:8hs** **Marks: 8** (R- 2, U- 6, A-0)
2	TLO 2.1 Classify Electric Vehicles. TLO 2.2 Interpret the characteristics of the given electric motor(s) used in EV. TLO 2.3 Distinguish between given EV Motors on the basis of given points. TLO 2.4 Select given electrical drives for EV applications of different control valves.	**2. Electric Vehicle Drives** 2.1 Classification of electric drives used in EV: DC Motor drives, AC Motor drives. 2.2 Brushed DC Motor, Brushless DC Motor (BLDC), Permanent Magnet Synchronous Motor (PMSM), Induction Motor (IM), Switched Reluctance Motor (SRM), PM Assisted Synchronous Reluctance Motor, Axial Flux Ironless Permanent Magnet Motor: Salient features, characteristics, advantages, limitations, and usage of different motor types in EV models.

		2.3 Comparison of EV motors based on power to weight ratio, torque-speed characteristic, cost of controllers required and cost of motors. Physical location of motor in EV, Rating of motors, Connections (Mechanical and Electrical), and Selection criteria of various types of EV motors. **Course Outcome: CO2 Teaching Hours:16hs Marks: 16 (R- 0, U- 8, A-8)**
3	TLO 3.1 Describe given terms related to battery parameter. TLO 3.2 Describe the procedure for selection of battery for the given EV. TLO 3.3 Calculate EV battery capacity based on mileage and load. TLO 3.4 Describe the process of given Battery Management System (BMS). TLO 3.5 Compare given type of fuel cells based on given points.	**3. Batteries and Energy Storage Systems** 3.1 Energy storage technology: EV Batteries, Supercapacitors, flywheel energy storage. Battery Parameters: Cell and Battery Voltages, Charge (or Amphour) Capacity, Energy Stored, Specific Energy, Energy Density, Specific Power, Amphour (or Charge) Efficiency, Energy Efficiency, Self-discharge Rates, Battery Geometry, Battery Temperature, Heating and Cooling Needs, Battery Life and Number of Deep Cycles. 3.2 Batteries: Lead-acid, NiMH (Nickel-Metal Hydride), Li-Ion (Lithium-Ion), Ni-Zn (Nickel-Zinc), Ni-Cd (Nickel-Cadmium), Aluminium–Ion batteries (Al–Ion batteries), Aluminium–air Batteries (Al–air batteries)-their basic construction components, life time (cycles), efficiency, advantages and disadvantages. Comparison of various batteries. Factors influencing the operation of battery, and selection of battery. Series and Parallel connection of Batteries, Calculation of battery capacity. 3.3 Battery Management Systems (BMS): Need of BMS, Block diagram of BMS, function of each block, Battery Condition Monitoring, "3R" (Reduce, Reuse, Recycle) process for battery. 3.4 Fuel Cell: Difference between fuel cell and batteries, Fuel Cell Terminology: Anode, Cathode, Electrolyte, Catalyst, Reformer, Direct Fuel Cell, Working principle of fuel cell. Types of Fuel Cells used in EVs: Alkaline Fuel Cell (AFC), Polymer Electrolyte Membrane Fuel Cell (PEMFC), Phosphoric Acid Fuel Cell (PAFC), Molten Carbonate Fuel Cell (MCFC), Solid Oxide Fuel cell (SOFC), Their comparison on the basis of Electrolyte type,

		Cell voltage, Operating temperature, System output (kW), Efficiency (%) and Applications. **Course Outcome: CO3 Teaching Hours:14hs** **Marks : 14 (R- 2, U- 4, A-8)**
4	TLO 4.1Describethe configuration and functions of the given type of converter. TLO 4.2 Describe given type of EV charging method(s). TLO 4.3 Distinguish between given charging systems. TLO 4.4 Describe given type of charging station. TLO 4.5 Calculate charging time based on given data.	**4. Converters and EV Chargers** 4.1 Introduction to power electronics used in EV, Block diagram of typical EV: Description and Functions of DC to DC Converter, DC to AC Converter, AC to DC Converter (Rectifier) and filters. 4.2 Charging methods: Home charging, Trickle charging, Household AC charging, Public charging (DC Fast charging). 4.3 Charging System: Classification-Wireless, Onboard and Off board charging, V1G (Uni-directional smart charging),V2B/V2H (Vehicle-to-Building/ Vehicle-to-Home), V2X (Vehicle-to-Everything), V2G (Vehicle-to-Grid, Bi-directional smart charging). 4.4 Charging Stations: Types of charging station, Public charging station: Selection and sizing, components and, single line diagram. Calculation of charging time and concept of battery swapping. Precautions observed while charging. **Course Outcome: CO4 Teaching Hours:14hs** **Marks: 14 (R- 2, U- 8, A-4)**
5	TLO 5.1 State the given points related to NEMMP. TLO 5.2 Compare incentives policies for the given types of electric vehicle.	**5. Electric Vehicle (EV) Policies** 5.1 Goal of EV30@30 campaign. Goals of electric vehicles initiative in India. National Electric Mobility Mission Plan 2020 (NEMMP): Objectives, Steps taken by Indian Government for faster adoption of electric vehicles, Barriers to adoption of electric mobility, E-mobility strategy, NEMMP 2020 Implementation structure. 5.2 Maharashtra Electric Vehicle Policy 2021: Objectives, Basic demand incentives for electric vehicles, Vehicle segment-wise scrap page incentives, Incentives for charging infrastructure. **Course Outcome: CO5 Teaching Hours:8hs** **Marks: 08 (R- 4, U- 4, A-0)**

V. List of Laboratory Experiments:

The Term work consist of **minimum 10** experiments with approx. number of hours required with corresponding CO's. Care should be taken to include all COs while selecting the practical's.

Sr. No	Laboratory Outcomes	Laboratory Experiment	Number of hrs.	Relevant COs
1	LLO 1. 1 Identify components of various types of electric vehicle.	Identification of electric vehicle components.	2	CO1
2	LLO 2. 1 Identify various subsystems of electric vehicles.	Identification of subsystems of electric vehicles.	2	CO1
3	LLO 3.1 Identify the terminals of Permanent Magnet Synchronous Motor. LLO 3.2 Identify the terminals of Three-phase Squirrel cage Induction Motor. LLO 3.3 Identify the terminals of Synchronous Reluctance Motor. LLO 3.4 Identify the terminals of Brushless DC motor.	Identification of terminals of motors used in EVs.	2	CO2
4	LLO 4.1 Determine and compare The characteristics of given EV motors.	Comparison of characteristics of EV motors.	2	CO2
5	LLO 5.1 Control and vary the speed of a DC motor using PWM technique.	DC Motor Speed Control using PWM	2	CO2
6	LLO 6.1 Connect and test BLDC motor to understand its working in EV applications.	Testing of Brushless DC (BLDC) Motor	2	CO2
7	LLO 7.1 Measure open circuit voltage of a given battery using multimeter. LLO 7.2 Identify the charged, discharged and dead battery condition. LLO 7.3 Determine Amphour (Ah) capacity of battery.	Testing of EV batteries.	2	CO3
8	LLO 8.1 Perform Active Lithium-Ion Cell balancing using Plastic Platform Scale.	Battery Cell balancing.	2	CO3
9	LLO 9.1 Design battery pack for specified capacity of EV.	Design of battery for EV.	2	CO3
10	LLO10.1 Demonstrate battery configurations and observe changes in voltage/current output	Series and Parallel Battery Pack Connection	2	CO3

11	LLO11.1 Describe the role of BMS and observe cell balancing and safety functions.	Demonstration of Battery Management System (BMS)	2	CO3
12	LLO12.1 Charge an EV battery using various methods, and record charging times and efficiency.	Charging of EV battery.	2	CO4
13	LLO13.1 Develop a charging station layout. LLO13.2 Select appropriate components of charging station. LLO13.3 Draw a single-line diagram of a charging station. LLO13.4 Simulate the charging process of a charging station using any open-source software.	Public charging station for EV.	2	CO4
14	LLO 14.1 Calculate the charging time for different battery capacities using given formulas.	Calculation of charging time of battery.	2	CO4
15	LLO 15.1 Prepare a report on Indian EV policy. LLO 15.2 Prepare a report on Maharashtra EV Policy, 2021.	Report on EV policy.	2	CO5
16	LLO 16.1 Assemble a basic EV model and understand mechanical and electrical integration.	Construction of a Simple Electric Bicycle Model (Mini Project)		ALL CO'S

Note: 12 TO 14 experiments should be performed in a term for completion of TW

VI. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): NA

VII. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Basics of Electric Vehicles	2	6	0	8
2	Electric Vehicle Drives	0	8	8	16
3	Batteries and Energy Storage Systems	2	4	8	14
4	Converters and EV Chargers	2	8	4	14
5	Electric Vehicle (EV) Policies	4	4	0	8
	Total	10	30	20	60

VIII. Assessment

Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce, Practical performance (50marks)

IX. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CO1	3	-	-	1	3	2	3			
CO2	3	-	-	3	3	2	3			
CO3	3	2	3	3	3	2	3			
CO4	3	-	3	3	3	2	3			
CO5	1	-	-	-	3	2	3			
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

X. Suggested Learning Materials / Books

Sr. No.	Author	Title	Publisher
1	Mehrdad Ehsani, Yimin Gao, Stefano Longo and Kambiz Ebrahimi.	Modern Electric, Hybrid Electric and Fuel Cell Vehicles.	CRC Press, 2019, ISBN 13: 978-0367137465.
2	James Larminie, John Lowry.	Electric Vehicle Technology Explained.	Wiley-Blackwell,2012,ISBN 13: 978-1119942733

3	Dr. Nitesh Tiwari, Dr. Shekhar Yadav.	Electric Vehicle (Green and Sustainable Transportation).	S.K. Kataria & Sons, 2023, ISBN13:987-81-963589-0-7.
4	Ali Emadi, Mehrdad Ehsani, John M. Miller.	Vehicular Electric Power Systems: Land, Sea, Air and Space Vehicles.	CRC Press, 2003, ISBN 13: 978-0824747510.
5	Sunil R. Pawar	Electrical Vehicle Technology: The Future Towards Eco-Friendly Technology.	Notion Press Publication,2021, ISBN 10:1685545610.

XI. Learning Websites & Portals

Sr. No.	Link / Portal	Description
1	https://youtu.be/2IgZSDDFW-Y?si=Z1tfZO24ljBppzVA	Identification of terminals of BLDC motor.
2	https://www.niti.gov.in/sites/default/files/2023-02/EV_Handb ook_Final_14Oct.pdf	Handbook of electric vehicle charging infrastructure implementation.
3	https://heavyindustries.gov.in/sites/default/files/2023-07/N EMMP-2020.pdf	National Electric Mobility Mission Plan 2020.
4	https://www.cleanenergyministerial.org/initiatives-campaigns/electric-vehicles-initiative/	Goal of EV30@30 campaign.
5	https://maitri.mahaonline.gov.in/PDF/EV%20Policy%20GR%202021.pdf	Maharashtra Electric Vehicle Policy, 2021.
6	https://www.mdpi.com/1996-1073/10/8/1217	Electric vehicle review paper.
7	https://archive.nptel.ac.in/courses/108/103/108103009/	NPTEL electric vehicle course literature.
8	https://onlinecourses.nptel.ac.in/noc22_ee53/preview	NPTEL electric vehicle course videos.
9	https://www.mdpi.com/1996-1073/15/3/1241	DC-AC converters for electric vehicle review paper.
10	https://www.niti.gov.in/sites/default/files/2022-05/Battery_ swapping_report_09052022.pdf	Battery swapping.

XII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Santosh Patni	Executive Engineer	Executive Engineer, MSEDCL, Prakashgarh, Bandra
2	Shri. Kiran Inamdar	Lecturer in Electrical Engineering	Pilley COE, Rasayani
3	Dr. Sachin S. Bharatkar	Head of Electrical Engineering	G.P. Mumbai
4	Dr. Mahesh S. Narkhede	Lecturer in Electrical Engineering	G.P. Mumbai

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Curriculum Development,
Department of Electronics Engineering

Head of Departments
Department of Electronics Engineering

CDC Co-ordinator
G. P. Mumbai

I/C, Curriculum Development Cell

Principal
Government Polytechnic, Mumbai

Programme : Diploma in Electronics Engineering (Sandwich pattern)													
Course Code: EC23402				**Course Title: Project and Seminar**									
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2:30 Hrs.)**	**FA-PR**	**SA**		**SLA**	**Total**
						T1	**T2**			**PR**	**OR**		
-	-	4	4	-	4	-	-	-	50	-	50#	50	150

Total IKS Hrs. for course: 2hrs.

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-PR represents the term work
2. SA-OR represents the end term practical examination.

I. RATIONALE

Project & Seminar in engineering study are considered important as it allow students to integrate and apply the knowledge and skills acquired throughout their academic program and effectively demonstrating their learning of programme by tackling a real-world problem. ultimately makes them more relevant as well as prepared for the job market.

Project & Seminar is usually the final assignment and plays a vital role in preparing students for the world of work to its practical applications and ability to help hone students' professional knowledge and skills. Normally, capstone projects are developed in collaboration with industries or businesses, providing students with valuable insights.

Project & Seminar has been considered as an integral part of diploma curriculum. It helps learners to perform and demonstrate skills gained due to early courses of Diploma study independent. Therefore, this is considered as a course of final year/semester study.

II. Industry / Employer Expected Outcome:

On completion of course of Project & Seminar student will achieve following industry Expected Outcome;

- **Demonstrate professional skills to apply and execute solutions to real world problems.**

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Demonstrate the ability to define problem statement relevant to field of study.
CO2	Collect relevant information and take appropriate decisions based on the analysis of collected information.
CO3	Demonstrate the presentation skill on selected project (or idea)
CO4	Address a specific challenge or problem in the industry, company, or community through project
CO5	Demonstrate creativity and innovation in developing solutions to complex problems, showing initiative and an ability to think outside the box.
CO6	Develop structured project documentation and perform plagiarism check with appropriate tools.
CO7	Assess the ethical issues that can have a societal impact.
CO8	Incorporate sustainability principles in the chosen project.

IV. Project & Seminar – Scope of learning

The scope of learning in a Project & Seminar encompasses a wide range of academic, technical, professional, and personal skills development. It reflects the breadth of skills and knowledge students gained as they work through the stages of the Project & Seminar . Project & Seminar prepare students for the transition from academic life to the workforce by ensuring they are equipped with the essential skills required for their chosen careers.

The scope of learning for a typical Project & Seminar are;

Problem Identification and Research:
Students develop the ability to identify and analyse problems, conduct literature reviews, and refine their research questions to create a Project & Seminar that addresses real-world issues.
Project Planning and Management
Scope of Learning: Students learn how to define clear goals, set timelines, allocate resources, manage risks, and coordinate tasks to complete a large-scale project.
Teamwork and Collaboration
Scope of Learning: Many Capstone projects require students to work in teams, which provides experience in collaboration, leadership, conflict resolution, and collective decision-making.
Self-Directed Learning and Initiative
Scope of Learning: Since Capstone projects typically involve a significant amount of independent work, students develop self-management and self-directed learning skills, taking ownership of their projects and learning new concepts as needed.

V. Project & Seminar -Stages of planning and execution:
The planning and execution of a Capstone project typically involves several key stages.

Stage 1:-Topic Selection
Choose a relevant and feasible topic within your field of study. This is typically based on your interests, industry needs, or a problem you're passionate about solving.

Stage 2- Preliminary Research
Conduct an initial literature review to understand the background of the industrial or social problem/challenges, existing probable solutions, and gaps in knowledge.

Stage 3- Presentation Skill: Demonstrate a presentation skill by giving seminar on selected project or idea in front of students and faculty(minimum 2 to 3 faculty should be present while delivering seminar

Stage 4- Project & Seminar Objectives OR Research findings
Define clear outcomes/objectives, or goals that will guide your project. These should be specific, measurable, achievable, relevant, and time-bound (SMART).

Stage 5- Scope and Feasibility
Determine the scope of the capstone project and ensure it is feasible within the time and resources available.

Stage 7- Budgeting, risk assessment and Resource Allocation
If necessary, prepare a budget for any costs related to the project, such as materials, software, or travel. Determine how resources will be allocated and used efficiently.

Stage 8 -Report and documentation
Prepare a comprehensive report or presentation that communicates the results and findings of the Capstone project.

VI. Suggested Types Project & Seminar -In general, the capstone projects that the students can take
up could be of the following types;

Design and develop a working prototype for a new product or solution to a problem. This could include hardware or software.

The best practice is that teacher should guide students about the choosing the project

VII. ASSESSMENT OF PROJECT & SEMINAR
Rubrics suggested in **annexure** may be used appropriately

Formative Assessment (FA) criteria

The assessment of the students in the fifth semester Progressive Assessment (PA) for 50 marks is to be done based on following criteria.

Assessment of the team

Sr.No.	Criteria	Marks
1	Project Selection & Problem definition	05
2	Literature survey and data collection/ Gathering	05
3	Demonstrate presentation skill by giving seminar on selected project or idea	05
4	Design / concept of project/ Working - Execution of Project	05
5	Stage wise progress as per Action plan/milestone	05
6	Quality Report Writing	05

Individual Assessment

Sr.No.	Criteria	Marks
1	Contribution as a team member	05
2	Depth of Knowledge	10
3	Presentation	05

B. Summative Assessment Criteria

The summative assessment of the students in the sixth semester End-Semester-Examination (ESE) for 50 marks is to be done based on following criteria. This assessment shall be done by the faculty.

Appropriate **RUBRICS** may be developed by the faculty

Sr.No.	Criteria	Marks
1	Knowledge and skill-set developed	10
2	Quality & Potential level of project	10
3	Creativity, Innovation and Team work	10
4	Project design, development and Execution	10
5	Presentation of project	10

VIII. Suggested COs - POs Matrix Form(Electronics Engineering)

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO- 1	SO-2	PSO-
CO1	3	1	1	1	1	2	2	2	2	2
CO2	3	3	3	3	1	2	2	2	2	2
CO3	3	1	3	3	1	3	1	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	2	1	2	1	2	2	2
CO6	3	1	1	1	1	1	2	2	2	2
CO7	1	1	1	1	3	1	3	2	2	2
CO8	3	2	2	1	3	1	3	2	2	2
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

IX. Typographical instructions/guidelines for Project report writing

Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following.

a. The PROJECT report shall be computer typed (English- British) and printed on A4 size paper.
b. Text Font -Times New Roman (TNR), Size-12 point
c. Subsection heading TNR- 12 point bold normal
d. Section heading TNR- 12 capital bold
e. Chapter Name/ Topic Name – TNR- 14 Capital
f. All text should be justified. (Settings in the Paragraph)
g. The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.
h. The training report must be hardbound/ Spiralbound with cover page in black colour. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover [Refer sample sheet (outer cover)]
i. The training report, the title page [Refer sample sheet (inner cover)] should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.

X . Project Report

On completion of the project work, every student will submit a project report which should contain the following:

1. Cover Page (as per annexure 1)
2. Title page (as per annexure 2)
3. Certificate by the Guide (as per annexure 3)
4. Acknowledgment (The candidate may thank all those who helped in the execution of the project.)
5. Abstract (It should be in one page and include the purpose of the study; the methodology used.)
6. Table of Contents (as per general guidelines): Detailed description of the project (This should be split in various chapters/sections with each chapter/section describing a project activity in totality).
   Chapter–1 Introduction (background of the Industry or User based Problem/Task)
   Chapter–2 Literature Survey (to finalize and define the Problem Statement)
   Chapter–3 Scope of the project
   Chapter–4 Methodology/Approach, if any
   Chapter-5 Details of designs, working and processes
   Chapter-6 Results and Applications
7. Conclusion
8. References (The listing of references should be typed 2 spaces below the heading "REFERENCES" in alphabetical order in single spacing left – justified. It should be numbered consecutively (in square [ ] brackets, throughout the text and should be collected together in the reference list at the end of the report. The references should be numbered in the order they are used in the text. The name of the author/authors should be immediately followed by the year and other details). Typical examples of the referencesare given below:

NOTE: Project report must contain only a relevant and short mention – technology or platform or tools used. It must be more focussed on project work carried out and its implementation

Appendix

Teacher observation Evaluation

on
Project & Seminar

Name of Student:
.....

Name of Programme..... Semester:
.....

Course Title and Code:.....

Title of the Capstone Project:
.....

A. COs achieved through the Project & Seminar

a)
b) .....
c) .....
d) .....

Other learning outcomes achieved/demonstrated through this project

---

B. POs broadly addressed by the Project & Seminar

a) .....
b) .....
c) .....
d) .....

SUGGESTED RUBRIC FOR ASSESSMENT OF PROJECT AND SEMINAR

PROJECT ASSESSMENT

Project Title:

Project Assessment Rubric

Performance Criteria	Excellent	Good	Fair	Poor
	4 pts	3 pts	2 pts	1 pt
	Excellent	Good	Fair	Poor
Project Completion	The project is completed as per tasks described in synopsis.	The project is completed but required minor modifications.	The project is completed but requered several modifications.	The project is not completed as per tasks described in synopsis.
Project related Requirement Analysis & Designing	Effectively contributed in requirement analysis and designing.	Partially Contributed in requirement analysis and designing.	Attempted to contribute in requirement analysis and designing	No contribution in requirement analysis and designing.
Deliver a Seminar on selected Project or idea	Effectively delivered seminar in front of students & faculty	Partially delivered seminar in front of students & faculty	Attempted to deliver in front of students & faculty	No contribution in delivering in front of students & faculty
Developing a Solution with proper justifications	Developed the critical solution modules with optimized c design	Developed some solutions with higher less complexity	Attempted to develop few solutions	No contribution in developing a solution
Teamwork	Worked very well with the team.	Worked well with the team.	Worked with the team.	No contribution as a member in the team.
Project Report Writing	Worked very well to submit an excellent project report.	Worked well to submit the project report with covering all the aspects of a standard report.	Tried to submit the project report but standard of report was not satisfactory.	No contribution in project report writing.
Project Presentation	Presented the project work flawlessly.	Presented the project work very nice.	Presented the project work not so good.	Presentation skill is not up to the mark.

Project Group Members

ROLL NUMBER				
NAME				

Comments (if any)

Annexure-

Project Report

"Project Title----------"

as a partial fulfilment of requirement of the
THIRD YEAR DIPLOMA IN

Submitted by

1)Name Of Student Enrollment Number
2)Name Of Student Enrollment Number
3)Name Of Student Enrollment Number
4)Name Of Student Enrollment Number

Are the bonafide on
FOR THE ACADEMIC YEAR
20-----20---

(H.O.D) **(Principal)**
(Internal Guide) **(External Examiner)**

Institute Name

(An Affiliated Institute of Maharashtra State Board of Technical Education)

Table of Contents

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Sr.No.	**Chapter**	**Page No.**
1.	Chapter–1 Introduction (background of the Project Problem)	1
2.	Chapter–2 Literature Survey (to finalize and define the Problem Statement)	5
3.	Chapter–3 Scope of the project	15
4	Chapter–4 Methodology/Approach, if any	25
5	Chapter-5 Details of designs, working and processes	40
6.	Chapter-6 Results and Applications	50
7.	REFERENCES	52

***Students can add/remove/edit chapter names as per the discussion with their guide**

Annexure

PROJECT DIARY (Weekly/Daily)

Name of the Student : _____

Name of Guide (Faculty) : _____

Enrollment Number : _____ **Semester:** _____**Project**

batch Number : _____

WEEK : _____

Date	Activity carried out (Details)	Achievement of mile stone/step as per plan	Remark of Faculty

Dated Signature of Faculty **Dated Signature of HOD**

Annexure-

Project Assessment /Evaluation – Formative Assessment (suggestive)

Individual Assessment of Students **Max Marks -50**

S.No.	Criteria	Max Marks	Student Name Roll No	Student Name Roll No	Student Name Roll No	Student Name Roll No
1	Contribution as a team member	15				
2	Depth of Knowledge and skills	20				
3	Presentation	15				

Self Learning Assessment **Max Marks -100**

Sr.No.	Criteria	Max Marks	Marks Obtained
1	Project Selection & Problem definition	15	
2	Literature survey and data collection/ Gathering	10	
3	Deliver Seminar and/or presentation skill by giving seminar on selected project or idea	15	
4	Design / concept of project/ Working - Execution of Project	20	
5	Stage wise progress as per Action plan/milestone	20	
6	Quality Report Writing	20	

Project Assessment /Evaluation – Summative Assessment (Suggestive)

Roll No./ Enrol. No.	Name of Student	Criteria				
		Knowledge and skill-set developed Max Marks-10	Quality & Potential level of project Max Marks-10	Creativity, Innovation and Team work Max Marks-10	Project design, development and Execution Max Marks-10	Presentation of project Max Marks-10

INST LOGO <Name of Institute >

Certificate

This is to certify that

Mr./Ms. _____

bearing examination seat No.____has

Satisfactorily completed his/her ***PROJECT*** *entitled*

_____

Along with his/her batchmates in partial fulfilment for the

Diploma Course in

< PROGRAMME NAME>

offered by An Autonomous Institute of Government of Maharashtra, ***Government Polytechnic, Mumbai,*** *during the Academic Year20 -20 .*

The Project is completed by a group consisting of Persons under the guidance of the Faculty Guide _____

Faculty Name and Signature (Internal)	**Faculty Name and Signature (External if applicable)**	**HOD Name and Signature with Department Stamp**

Date and Time

XII. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.S.N.Isal	Director,Techmahoday	Industry Expert Institute Course Expert
2	Dr. Hemant Kasturewale	Hod,Extc and DS,Thakur Engg.college	Academic Expert
3	Mr. R. M. Ingle	SL. Grade Lecturer in Electronics	Institute Course Expert
4	Mr. A.D. Vikhankar	SL. Grade Lecturer in Electronics	Institute Course Expert

Coordinator
Curriculum Development,
Department of Electronics
Engineering

Head of Departments
Department of Electronics
Engineering

APPROVED COPY

CDC Co-ordinator
G. P. Mumbai

I/C, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal
Government Polytechnic, Mumbai