

**DEPARTMENT OF ELECTRONICS ENGINEERING**



**ELECTRONICS ENGINEERING PROGRAMME**

**(SANDWICH PATTERN)**

**CURRICULUM DOCUMENT (REVISION 2019)**

**(Fifth Semester)**

**GOVERNMENT POLYTECHNIC MUMBAI**

**(An Autonomous Institute, Government of Maharashtra)**

**GOVERNMENT POLYTECHNIC MUMBAI**  
(Academically Autonomously Institute, Government of Maharashtra)  
**Teaching and Examination Scheme(P19)**  
**With effect from AY 2019-20**

**Programme: Diploma in Electronics Engineering (Sandwich Pattern)**

**Term / Semester - V**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
EC19304	Project and Seminar.	0	4	0	4	4	0	0	0	0	50*	50	100
EC19408	Consumer Electronics.	3	4	0	7	7	60@	20@	20@	0	50	50	200
EC19409	Advanced Communication.	4	2	0	6	6	60	20	20	0	50*	50	200
EC19411	Automation	3	4	0	7	7	60	20	20	50	0	50	200
EC19410	Elective 2 (VLSI)	3	4	0	7	7	0	0	0	0	50*	50	100
EC19412	Elective 2 Introduction to AI												
EC19413	MOOC (IOT/Latex/Arduino)	0	4	0	4	4	0	0	0	0	0	0	0
<b>Total</b>		<b>13</b>	<b>22</b>	<b>0</b>	<b>35</b>	<b>35</b>	<b>180</b>	<b>60</b>	<b>60</b>	<b>50</b>	<b>200</b>	<b>250</b>	<b>800</b>
<b>Total Contact Hours</b>					<b>35</b>								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

\* Indicates assessment by External Examiner else internal practical skill test, # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour, TH- 2 hours, PR/OR – 3 hours per batch, SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours

Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Co-Ordinator  
Curriculum Development,  
Department of Electronics

Head of Department  
Department of Electronics,

In-Charge  
Curriculum Development Cell

Principal

Programme : <b>Diploma in Electronics Engineering (Sandwich Pattern)</b>										
Course Code: <b>EC19304</b>				Course Title: <b>Project and Seminar</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 Min)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
-	<b>4</b>	-	<b>4</b>	-	-	-	-	<b>50*</b>	<b>50</b>	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 and TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test, # indicates Self, on- line learning Mode, @ indicates on line examination  
**Note:** For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term.

### Rationale:

The basic objective of project work is to ignite potential of student's creative ability by enabling them to develop some model which has social relevance and should provide a taste of real life problem that a diploma holder may encounter as a professional. Projects mainly serve the purpose of inculcating skills like taking initiative, creativity, innovation, planning and decision making, persistence, working as a team, habit of keeping records, presentation and to present a comprehensive report of their work.

**Course Outcomes:** Student should be able to

CO1	Develop skills and innovate ideas to use latest technology to solve real life problems.
CO2	Develop hardware / software project.
CO3	Troubleshoot and test the project.
CO4	Acquire communication skills, leadership qualities, ethics and technical writing skills.
CO5	Assess the impact of the project on society.

### Course Content Details:

Unit No	General Guidelines
1	Project work is conceived as a group work through which the spirit of team building is expected to be developed. Students shall take a project in a group [group size should be of 2-5 students] in the beginning of semester in consultation with project guide and the project must be completed by end of the semester.
2	Students will be required to carry out their project work in groups under the supervision of faculties of their core discipline who will work as project guides. The respective project guide should regularly monitor the progress of project work.

3	The project work must be carried out either in institute (in- house project) or in industry (in case of industry sponsored project)
4	<p>Selection and approval of project topic:</p> <ul style="list-style-type: none"> <li>• Project topic should be related to real life problems or industrial application.</li> <li>• Project topic must be designed and implemented by electronic concept/techniques.</li> <li>• The investigation of practical problems in electronic application field and their proposed solutions can be worked out.</li> <li>• Investigation of latest development in a specific field of electronics is also accepted.</li> <li>• Software development projects related to electronics along with the hardware may be accepted.</li> <li>• Inter-disciplinary project may be encouraged.</li> </ul>
5	<ul style="list-style-type: none"> <li>• The project pre-synopsis/proposal (3-4 pages) must be submitted in the institute at the beginning of the semester. While submitting a project pre-synopsis/proposal care is to be taken that project will be completed within the available time of semester. Project title should be precise and clear.</li> </ul>
6	<p>The project group is expected to complete the following task within 3 weeks from start of semester.</p> <ul style="list-style-type: none"> <li>• Selection of project topic.</li> <li>• Literature survey.</li> <li>• Planning and design of project.</li> <li>• Identification and selection of required hardware components and software.</li> </ul>
7	The project group should maintain a diary of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by project guide in every week.
8	Students should complete project in all respect (fabrication, assembly, development of hardware/software, implementation, testing, and validation).
9	The guides should regularly monitor the progress of the project work.
10	The project work along with project report should be submitted as part of term work before the term end date.
11	Project report must be submitted in the prescribed format only.

Suggested contents of the Project report

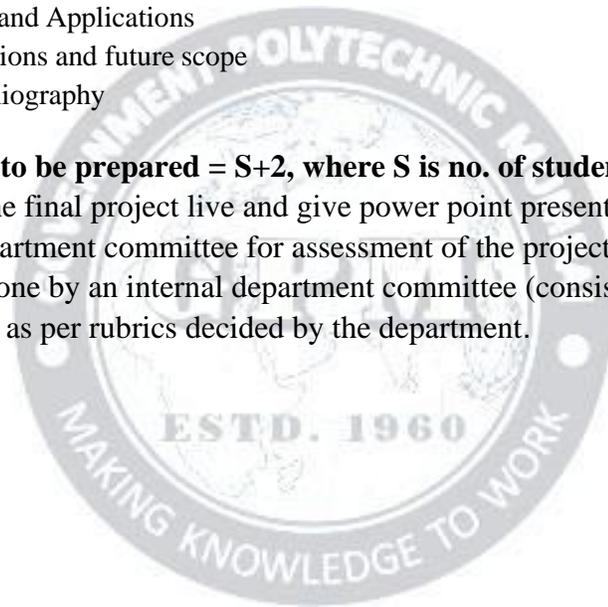
- Title page (Name of team members and Guide)
- Certificate
- Acknowledgements
- Abstract
- Content page.

Chapters

1. Chapter -1 Introduction (User based Problem/task or background of the Industry)
2. Chapter -2 Literature Survey (to finalize and define Problem Statement)
3. Chapter -3 Scope of the Project
4. Chapter -4 Methodology
5. Chapter - 5 Details of designs, working and process
6. Chapter - 6 Results and Applications
7. Chapter - 7 Conclusions and future scope
8. References and Bibliography

**(No. of copies of Project report to be prepared = S+2, where S is no. of students in group).**

The project group shall present the final project live and give power point presentation using LCD projector to the internal department committee for assessment of the project for award of TW marks. Assessment will be done by an internal department committee (consisting of respective guide and two faculty) as per rubrics decided by the department.



**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	1	1	1
CO2	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3
CO4	2	3	2	1	2	3	3	1	2	1
CO5	1	2	1	2	3	2	3	1	1	1

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr.Rishikesh Gawade	Director	Electroblaze, Mumbai
2	Mrs N.A.Palaspagar	Sr. Lecturer	VYES Mumbai
4	Mrs S.V.Bannore (Curriculum Content Designer)	Sr. Lecturer	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Electronics

Head of Department  
Department of Electronics

I/C, Curriculum Development Cell

Principal

**Rubric I: Project****TW Max Marks : 50**

Criterion No	Criterion	CO	Max Marks	Not Satisfactory (1-4)	Satisfactory (5-6)	Good (7-8)	Excellent (9-10)
1	Problem Identification		10	Little or no background information is presented to help the audience understand the history and significance of the project.	Background information is provided, an explanation of why the project was undertaken, to help put the presentation in context.	Background information is provided, including references to the work of others and an explanation of why the project was undertaken, to help put the presentation in context.	Insightful and in-depth background information is provided to illuminate the issues through inclusion of history relevant to the presentation, a succinct description of the significance of the project.
2	Literature Review		10	Very few and not relevant	Few and relevant	Relevant information from multiple sources	Information is gathered from multiple, research-based sources.
3	Planning of Project Work And Team Structure		10	Time frame not properly specified, Inappropriate distribution of project work	Time frame properly specified, but not being followed, Distribution of project work un-even	Time frame properly specified and being followed Distribution of project work inappropriate	Time frame properly specified and being followed, Appropriate distribution of project work
4	Testing		10	Testing done not done properly , no correct method of testing	Testing done in single condition , required modification not done after testing	Testing done in multiple condition , required modification not done after testing	Testing demonstrates engineering skill , required modification done after testing
5	Project Report		10	Project report not prepared according to the specified format, References and citations are not appropriate.	Project report is according to the specified format but some mistakes In-sufficient references and citations	Project report is according to the specified format, References and citations are appropriate but not mentioned well	Project report is according to the specified format References and citations are appropriate and well mentioned

**Rubric II: Project****OR Max Marks: 50**

1	Description of Concepts and Technical Details		20	Inappropriate explanation of the key concepts, Poor description of the technical requirements of the project  <b>(1-8)</b>	Explanation of the key concepts In-sufficient description of the technical requirements of the project  <b>(9-12)</b>	Complete explanation of the key concepts, enough description of the technical requirements of the project  <b>(13-16)</b>	Complete explanation of the key concepts, Strong description of the technical requirements of the project  <b>(17-20)</b>
2	Project Demonstration		20	Modules are not in proper working form. Students are unaware of the problem  <b>(1-8)</b>	Modules are not in proper working form. Students are aware of the problem  <b>(9-12)</b>	Each module working well but not properly demonstrated  <b>(13-16)</b>	Each module working well and properly demonstrated  <b>(17-20)</b>
3	Conclusion and Discussion		10	Results are not presented in appropriate manner Project work is not properly summarized and concluded, Future extensions not mentioned  <b>(1-4)</b>	Results are presented in appropriate manner Project work is not properly summarized and concluded, Future extensions in the project not very relevant  <b>(5-6)</b>	Results are presented in very appropriate manner Project work is well summarized and concluded Future extensions in the project not very relevant  <b>(7-8)</b>	Results are presented in very appropriate manner Project work is well summarized and concluded Future extensions in the project are well specified  <b>(9-10)</b>

\*Evaluation of OR, for project will be based on above rubric II



Government Polytechnic, Mumbai  
Department of ELECTRONICS ENGG  
Project  
Weekly diary

**GOVERNMENT POLYTECHNIC, MUMBAI**  
 (AN AUTONOMOUS INSTITUTE OF GOVT. OF MAHARASHTRA)  
**ACADEMIC YEAR (----- )**  
**Odd/Even Term (----- to ----- )**  
 Department of \_\_\_\_\_

**DETAILS OF PROJECT GROUP**

Class: III Yr.

Shift: I/ II

Course: Project

Name of Project: \_\_\_\_\_

Name of Guide Allotted: \_\_\_\_\_

Student's Information:

Sr. No	Enrolment. No	Name of student	Email id	Contact No

**Type of project:**Based on latest technology/ based on research going on/Laboratory requirement/ Institute Requirement/Societal need ( Tick appropriate type)

If Industry sponsored project

Industry Name:

Name of industry guide:

Contact No:

Email id:

**GOVERNMENT POLYTECHNIC, MUMBAI**  
(AN AUTONOMOUS INSTITUTE OF GOVT. OF MAHARASHTRA)

**ACADEMIC YEAR (----- )**

**Odd/Even Term (----- to ----- )**

**Department of \_\_\_\_\_**

**Week-Wise Progress Report**

**Course Title : Project**

**Week No:**

**Activity done \*:**



**Task / Suggestion given by guide:**

**Signature of Guide**

Note: \* activity can be literature survey, market survey, visit to industry/ Exhibition, learning new skill/software, preparation of seminar, seminar document preparation

For week wise progress report, use as many page as required.

*Project and Seminar (EC19304)*

*(Approved Copy)*

*(P19 Scheme)*



Programme : <b>Diploma in Electronics Engineering (Sandwich Pattern)</b>										
Course Code: <b>EC19408</b>				Course Title: <b>Consumer Electronics</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (1 Hr)	TS1 (30min)	TS2 (30min)	PR	OR	TW	Total
<b>03</b>	<b>04</b>	<b>-</b>	<b>07</b>	<b>60@</b>	<b>20@</b>	<b>20@</b>	<b>-</b>	<b>50</b>	<b>50</b>	<b>200</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

**Note:** For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term

### Rationale:

Consumer electronics appliances are increasing day by day. This requires large number of technically trained man power in the relevant industries. Looking towards the present need, in -depth knowledge for maintaining various consumer electronics appliances/equipment is necessary for diploma engineering pass out students. This course will introduce the students with working principles of consumer electronics appliances like audio-video systems, microwave oven, washing machine, air- conditioner, camcorder and others to develop skills to troubleshoot in systematic way. Knowledge so gained would also help in production units of these consumer gadgets or help the students to start their own enterprises.

**Course Outcomes:** Student should be able to

CO1	Troubleshoot audio systems
CO2	Test the working of various colour TV
CO3	Troubleshoot colour TV receivers
CO4	Interpret the working of consumer electronic appliances.

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<b>Audio Systems</b> 1.1 CD player: 1.1.1 Block diagram 1.1.2 Working principle 1.1.3 Types of CD player 1.1.4 Component used for CD mechanism: CD pick-up assembly, gear system, drive motors, CD lens. 1.2 Hi Fi amplifier: 1.2.1 Block diagram 1.2.2 Working principle 1.3 Public address (PA) system: 1.3.1 Block diagram 1.3.2 Working principle

	<p>1.3.3 Speaker impedance matching and characteristics</p> <p>1.5 Home theatre system.</p> <p>1.6 Trouble shooting procedure of audio systems.</p> <p><b>Course Outcome: CO1    Teaching Hours : 6 hrs    Marks: 08 (R- 2, U-4, A-2)</b></p>
2	<p><b>Television Fundamentals and Colour Television.</b></p> <p>2.1 Components of a TV system-Aspect ratio, image continuity, interlace scanning, scanning periods-horizontal and vertical, vertical and horizontal resolution.</p> <p>2.2 Vestigial side band transmission, bandwidth for color signal, characteristics of color signal, compatibility.</p> <p>2.3 Color TV Camera:</p> <p>    2.3.1 Block diagram</p> <p>    2.3.2 Working principle (Vidicon).</p> <p>2.4 Color TV Picture Tube:</p> <p>    2.4.1 Block diagram</p> <p>    2.4.2 Working principle.</p> <p>2.5 Color TV Transmitter:</p> <p>    2.5.1 Block diagram</p> <p>    2.5.2 Function of each block.</p> <p>2.6 Troubleshooting procedure of Color TV Transmitter</p> <p>2.7 Block diagram and operation of Color TV receiver:</p> <p>    2.7.1 Block diagram</p> <p>    2.7.2 Function of each block</p> <p>2.8 Troubleshooting procedure of Color TV Receiver systems.</p> <p><b>Course Outcome: CO2,CO3    Teaching Hours : 08    Marks: 12 (R-2, U- 4, A- 6)</b></p>
3	<p><b>LCD and LED Television and Cable Television.</b></p> <p>3.1 LCD Television:</p> <p>    3.1.1 Basic principle</p> <p>    3.1.2 Working principle</p> <p>3.2 LED Television:</p> <p>    3.2.1 Basic principle</p> <p>    3.2.2 Working principle.</p> <p>3.3 Cable Television:</p> <p>    3.3.1 Concept</p> <p>    3.3.2 Working principle</p> <p>3.4 Direct to Home Receiver (DTH):</p> <p>    3.4.1 Concept</p> <p>    3.4.2 Receiver block diagram</p> <p>    3.4.3 Indoor and outdoor unit.</p> <p>3.5 HDTV :</p> <p>    3.5.1 Development of HDTV</p> <p>    3.5.2 NHK MUSE System and NHK Broadcast.</p> <p>3.6 CCTV :</p> <p>    3.6.1 Working principle</p>

	<p>3.6.2 Block diagram 3.6.3 Applications 3.6.4 Installation steps.</p> <p>3.7 Smart TV :</p> <p>3.7.1 Block diagram 3.7.2 Working principle.</p> <p><b>Course Outcome: CO2      Teaching Hours : 07      Marks: 12 (R-4 , U- 4, A-4)</b></p>
<b>4</b>	<p><b>Miscellaneous Appliances.</b></p> <p>4.1 UPS :</p> <p>4.1.1 Types 4.1.2 Block diagram 4.1.3 Working Principle 4.1.4 Basic troubleshooting steps for UPS.</p> <p>4.2 SMPS:</p> <p>4.2.1 Types 4.2.2 Block diagram 4.2.3 Working Principle 4.1.4 Basic troubleshooting steps for SMPS</p> <p>4.3 Air Conditioners:</p> <p>4.3.1 Block diagram 4.3.2 Working Principle 4.3.3 Basic troubleshooting steps</p> <p>4.4 Refrigerators:</p> <p>4.4.1 Block diagram 4.4.2 Working Principle 4.4.3 Basic troubleshooting steps</p> <p>4.5 Mixer:</p> <p>4.5.1 Block diagram 4.5.2 Working Principle 4.5.3 Basic troubleshooting steps</p> <p><b>Course Outcome: CO4      Teaching Hours : 08      Marks: 08 (R-4, U-2, A-2 )</b></p>
<b>5</b>	<p><b>Office Gadgets</b></p> <p>5.1 Personnel Computer:</p> <p>5.1.1 Components in the central unit 5.1.2 Computer peripherals.</p> <p>5.2 Printer:</p> <p>5.2.1 Types 5.2.2 Block diagram 5.2.3 Components of Printer 5.2.4 Working principle 5.2.5 Installation Procedure</p> <p>5.3 Scanner:</p> <p>5.3.1 Block diagram 5.3.2 Components of Scanner 5.3.3 Working principle</p>

	<p>5.3.4 Installation Procedure</p> <p>5.4 Mobile systems:</p> <p>5.4.1 Study of parts inside a mobile phone</p> <p>5.4.2 Study of various faults.</p> <p>5.5 FAX Machine:</p> <p>5.5.1 Block diagram</p> <p>5.5.2 Components of FAX Machine</p> <p>5.5.3 Working principle.</p> <p>5.6 EPABX:</p> <p>5.6.1 Block diagram</p> <p>5.6.2 Components of EPABX</p> <p>5.6.3 Working principle.</p>	<b>Course Outcome: CO4</b>	<b>Teaching Hours : 08</b>	<b>Marks: 10 (R-4, U- 4, A- 2 )</b>
<b>6</b>	<p><b>Consumer Electronics Appliances</b></p> <p>6.1 Photocopier:</p> <p>6.1.1 Block diagram</p> <p>6.1.2 Working principle</p> <p>6.2 Microwave Oven:</p> <p>6.2.1 Types</p> <p>6.2.2 Block diagram</p> <p>6.2.3 Wiring and safety instructions and electrical specifications.</p> <p>6.3 Washing Machine:</p> <p>6.3.1 Block diagram of washing machine</p> <p>6.3.2 Electrical specifications</p> <p>6.3.3 Types of washing machine : Automatic, Semi-automatic</p> <p>6.3.4 Trouble shooting procedure.</p> <p>6.4 Digital Camera and Cam coder:</p> <p>6.4.1 Pickup devices</p> <p>6.4.2 Picture processing and picture storage</p> <p>6.4.3 Electrical specifications.</p>	<b>Course Outcome: CO4</b>	<b>Teaching Hours : 08</b>	<b>Marks: 10 (R- 2 , U-4 , A-4 )</b>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	<b>Audio Systems</b>	02	04	02	08
2	<b>Television Fundamentals and colour television.</b>	02	04	06	12
3	<b>LCD and LED Television and cable Television.</b>	04	04	04	12
4	<b>Miscellaneous Appliances.</b>	04	02	02	08
5	<b>Office Gadgets</b>	04	04	02	10
6	<b>Consumer Electronics Appliances</b>	02	04	04	10
<b>Total</b>		<b>18</b>	<b>22</b>	<b>20</b>	<b>60</b>

**List of experiments: Total 10 experiments (Minimum) should be performed.**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	<ul style="list-style-type: none"> <li>Install/Test the CD for given type of data.</li> <li>Suggest the remedy for the created faults and in the given colour TV trainer kit for the following fault a) No colour b) Red colour only, c) Green colour only d) No sound.</li> </ul>	02
	2	CO2		02
2	3	CO3	<ul style="list-style-type: none"> <li>Test the various sections of LED Television receiver.</li> </ul>	04
3	4	CO4	<ul style="list-style-type: none"> <li>Troubleshoot air conditioning or refrigerator.</li> </ul>	04
4	5	CO4	<ul style="list-style-type: none"> <li>Test the various features of the given type of printer.</li> <li>Select exact speed to write a CD for given type of data.</li> </ul>	02
	1	CO1		02
5	6	CO4	<ul style="list-style-type: none"> <li>Interpret the working of automatic washing machine.</li> </ul>	04
6	2	CO2	<ul style="list-style-type: none"> <li>Use multimeter to test various test points at horizontal sections of colour TV receiver.</li> </ul>	04
7	3	CO3	<ul style="list-style-type: none"> <li>Installation of CCTV.</li> </ul>	04
8	4	CO4	<ul style="list-style-type: none"> <li>Troubleshoot UPS or Mixer.</li> </ul>	04
9	5	CO4	<ul style="list-style-type: none"> <li>Demonstration of working of FAX machine</li> <li>Test the various functions of Cam coder.</li> </ul>	02
	6	CO4		02
10	2	CO2	<ul style="list-style-type: none"> <li>Use multimeter to test various test points of colour TV receiver. a) Chroma section b) Picture Tube.</li> </ul>	04
11	2	CO2	<ul style="list-style-type: none"> <li>Use multimeter to test various test points of horizontal section of colour TV receiver.</li> <li>Use multimeter to test voltage at various points of vertical section of colour TV receiver.</li> </ul>	02
	2	CO2		02
12	2	CO2	<ul style="list-style-type: none"> <li>Suggest the remedy for the following faults in colour TV: a) Faults in SYNC separator. B) Faults in video amplifier.</li> <li>Measure voltage levels to sketch composite video signal at different stages of TV receiver.</li> </ul>	02
	2	CO2		02
13	3	CO3	<ul style="list-style-type: none"> <li>Test the various sections of LCD television receiver.</li> <li>Suggest the remedy for the following faults in given colour TV: a) Faults in HSYNC section b) Fault in VSYNC section.</li> </ul>	02
	3	CO3		02
14	6	CO4	<ul style="list-style-type: none"> <li>Demonstration of working of Microwave oven</li> <li>A case study: Compare LED and LCD TV on the basis of specifications, working etc</li> </ul>	02
	3	CO2		02
15	3	CO3	<ul style="list-style-type: none"> <li>Mini Project: Trouble shooting procedure of Smart TV or any topic suggested by teacher.</li> </ul>	04
<b>Total</b>				<b>60</b>

**Note: Experiments No. 1 to 5 and 15 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.**

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Consumer Electronics	Bali, S.P. Pearson education, India, Delhi, 2007	9788131717592
2	Audio Video systems principles, maintenance and troubleshooting.	Gupta, R.G. Mc-graw hill, New Delhi, India 2010	9780070699762
3	Audio Video systems: principle practices and troubleshooting.	Bali, Rajeev, Bali, S. P. Khanna book publishing Co.( P) Ltd. Delhi, 2014	9788187522058
4	Trouble shooting electronic equipment	R. S. Khandpur, Tata McGraw hill	9780071477314

**E-References:**

1. <https://www.youtube.com/watch?v=8HG7efTMj78>
2. <https://www.electronicrepairguide.com/led-tv-repair-basic.html>
3. <https://www.computer-pdf.com/tutorials-computer-repair-and-maintenance>
4. <https://www.thespruce.com/refrigerator-repair-guide-4153173>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	-	2	2	3	2
CO2	1	2	2	3	-	-	1	2	2	-
CO3	2	3	2	3	1	-	2	2	3	2
CO4	1	-	-	1	-	3	2	2	1	1

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Santosh Kamble	Director	SaiTronics Mumbai.
2	Prof. Anjum Mujawar	HOD, Electronics Engineering	Vidyalankar Polytechnic, Mumbai.
3	Mr. Sankar Isal	Director	TechAmazon, Navi Mumbai.
4	Dr. H. M. Pardeshi	Lecturer in Electronics Engg	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Electronics Engineering (Sandwich Pattern)</b>										
Course Code: <b>EC19409</b>				Course Title: <b>Advanced Communication Systems</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2hrs 30min)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>4</b>	<b>2</b>	<b>-</b>	<b>6</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>-</b>	<b>50*</b>	<b>50</b>	<b>200</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term.

### Rationale:

Electronic communication plays vital role in our daily life. Now a days modern high capacity telecom networks based on microwave principles satellite communication, mobile communication and radar systems becomes integral part of industry, society and other organizations. This course is useful as a basic to acquire in depth knowledge of advanced communication system and for analysis of these systems.

**Course Outcomes:** Student should be able to

CO1	Use specified waveguides in microwave communication.
CO2	Describe construction and working of microwave devices.
CO3	Illustrate working principle of Satellite communication.
CO4	Interpret Radar based Systems for range detection.
CO5	Explain different spread spectrum techniques.

### Course Content Details:

Unit No	Topics / Sub-topics
1	<p><b>Wave Guide and Components</b></p> <p>1.1 Introduction to basics of microwave transmission:</p> <p>1.1.1 Microwave spectrum, band designations and applications of microwave, Comparison of wave guide with two wire transmission line</p> <p>1.1.2 Rectangular waveguides: Propagation of waves through rectangular wave guide, Reflection of waves from a conducting plane, dominant mode, the parallel plane waveguide, cut off wavelength, cut off frequency, group and phase velocity. (Simple numerical)</p> <p>1.1.3 Rectangular waveguide modes: TE mode, TM mode, TEM mode, field</p>

	<p>patterns of TE<sub>1,0</sub>, TE<sub>2,0</sub>, TE<sub>1,1</sub> modes.</p> <p>1.2 Circular waveguide :</p> <p>1.2.1 Field patterns for dominant mode,</p> <p>1.2.2 Advantages and applications of circular waveguide</p> <p>1.3 Waveguide Passive components</p> <p>1.3.1 Ferrites components: Isolators, circulators and Accessories (Flanges, Rotating coupling, Bends and corners, Taper and Twist).</p> <p>1.3.2 Multiple Junctions - E plane, H- plane and Magic Tee junction.</p> <p>1.3.3 Directional coupler – Working principle and application of Directional coupler.</p> <p><b>Course Outcome: CO1      Teaching Hours :12      Marks: 12 (R-2, U-6, A-4)</b></p>
2	<p><b>Microwave Devices</b></p> <p>2.1 Microwave vacuum tube devices: Construction, working principle and applications of</p> <p>2.1.1 Two cavity Klystron amplifier</p> <p>2.1.2 Reflex Klystron</p> <p>2.1.3 Magnetron</p> <p>2.1.4 TWT.</p> <p>2.2 Microwave semiconductor devices: Construction, working principle and applications of</p> <p>2.2.1 Gunn diode, Gunn diode as an oscillator</p> <p>2.2.2 IMPATT diode</p> <p>2.2.3 PIN diode, PIN diode as an amplifier and oscillator</p> <p>2.2.4 Tunnel diode.</p> <p><b>Course Outcome: CO2      Teaching Hours :14      Marks: 14 (R-4, U-6, A-4)</b></p>
3	<p><b>Satellite Communication System</b></p> <p>3.1 Introduction to satellite communication system:</p> <p>3.1.1 Importance of satellite communication system</p> <p>3.1.2 Uplink &amp; downlink frequencies</p> <p>3.1.3 Satellite frequency bands</p> <p>3.1.4 Applications of Satellite Communication</p> <p>3.2 Basic terminology used in satellite communication:</p> <p>3.2.1 Latitude</p> <p>3.2.2 Longitude</p> <p>3.2.3 Look angle</p> <p>3.2.4 Elevation angle</p> <p>3.2.5 Azimuth angle</p> <p>3.2.6 Altitude</p> <p>3.2.7 Footprint</p> <p>3.2.8 Station keeping</p> <p>3.3 Block diagram and function of satellite earth station, transponder.</p> <p>3.4 Communication Satellite orbit and types:</p> <p>3.4.1 LEO</p> <p>3.4.2 MEO</p>

	<p>3.4.3 GEO.</p> <p>3.5 Subsystems of satellite: Block diagram and working Principle of</p> <p>3.5.1 Power subsystem</p> <p>3.5.2 LNA</p> <p>3.5.3 Attitude control subsystem</p> <p>3.5.4 Thermal control subsystem</p> <p>3.5.5 Repeaters</p> <p>3.5.6 Telemetry tracking and command subsystem</p> <p>3.5.7 Main and auxiliary propulsion subsystem</p> <p>3.5.8 Antenna subsystem</p> <p><b>Course Outcome: CO3 Teaching Hours :12 hrs Marks: 12 (R-4, U-4, A-4)</b></p>
4	<p><b>RADAR Systems</b></p> <p>4.1 Basic block diagram of RADAR system.</p> <p>4.2 RADAR performance factors:</p> <p>4.2.1 RADAR range equation</p> <p>4.2.2 Factors influencing max. Range</p> <p>4.2.3 Effect of noise.</p> <p>4.3 Basic pulse Radar system: Block diagram and working principle</p> <p>4.4 Antenna scanning (Definition, types and principle):</p> <p>4.4.1 Horizontal</p> <p>4.4.2 Vertical</p> <p>4.4.3 Helical</p> <p>4.4.4 Spiral.</p> <p>4.5 Antenna tracking (Types and principle):</p> <p>4.5.1 Sequential</p> <p>4.5.2 Conical</p> <p>4.5.3 Monopulse</p> <p>4.6 Display Methods:</p> <p>4.6.1 A-Scope</p> <p>4.6.2 PPI</p> <p>4.6.3 Automatic target detection</p> <p>4.7 Doppler Effect: Statement</p> <p>4.8 Block diagram and working of :</p> <p>4.8.1 CW Doppler RADAR</p> <p>4.8.2 FM CW Doppler RADAR</p> <p>4.8.3 MTI RADAR.</p> <p>4.9 RADAR Becons</p> <p><b>Course Outcome: CO4 Teaching Hours :12 hrs Marks:14 (R-2, U-8, A-4)</b></p>
5	<p><b>Spread Spectrum Modulation</b></p> <p>5.1 Introduction to Spread Spectrum (SS) modulation: Block diagram, advantages and applications</p> <p>5.2 Pseudo Noise sequence: Definition, Generation and maximum length sequence.</p> <p>5.3 Types of SS modulation: Block diagram, working principle and comparison of</p> <p>5.3.1 Direct sequence spread spectrum (DSSS)</p>

5.3.2 Frequency hopped spread spectrum (FHSS) <b>Course Outcome: CO5    Teaching Hours :10 hrs    Marks:08 (R-4, U-4, A-0 )</b>
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**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Wave Guide and Components	2	6	4	12
2	Microwave Devices	4	6	4	14
3	Satellite Communication System	4	4	4	12
4	RADAR Systems	2	8	4	14
5	Spread Spectrum Modulation	4	4	0	8
<b>Total</b>		<b>16</b>	<b>28</b>	<b>16</b>	<b>60</b>

**List of experiments: Total 10 experiments out of 15 experiments**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Write specifications of Microwave Test Bench and five major Microwave components.	2
2	2	CO2	Demonstrate characteristics of Reflex Klystron.	2
3	3	CO3	Transmit and receive PC data through Satellite link.	2
4	4	CO4	Demonstrate effect of different types of materials on RADAR reception or detection.	2
5	4, 5	CO4, CO5	Case study: Prepare a report on applications of RADAR system in Defence and Air Navigation or any one application of Spread spectrum modulation / any topic provided by faculty.	2
6	1	CO1	Demonstrate characteristics of microwave tees E-plane and H-plane.	2
7	1	CO1	Demonstrate characteristics of microwave tees E-H plane.	2
8	1	CO1	Demonstrate characteristics of Isolators.	2
9	1	CO1	Demonstrate characteristics of circulators.	2
10	1	CO1	Demonstrate properties of Multi hole Directional coupler.	2
11	3	CO3	Write a report on - Transmit and receive Audio and Video signals through Satellite link.	2
12	3	CO3	Conversion of uplink and down link frequencies in digital Satellite communication systems.	2
13	4	CO4	Use freeware/open source simulation tool/virtual lab to perform practical related RADAR communication.	2
14	4	CO4	Mini Project: Write a report on - Determine velocity of moving object with the help of RADAR range / any topic suggested by	2

			faculty.	
15	1,2,3 ,4,5	CO1, CO2, CO3	Visit to a BSNL / MTNL / Earth station / Radio station / Airport /.	2
<b>Total</b>				<b>30</b>

**Note: Experiments No.1 to 5, 14 and 15 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.**

#### References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Microwave Engineering	Gupta, Sanjeev, Khanna Publication, 2015.	978-8174090878
2	Microwave and RADAR Engineering	Gautam A.K., SK Kataria Publication	978-9330141519
3	Microwave and RADAR Engineering	M. Kulkarni, Umesh Publication	978-8188114009
4	Electronic Communication Systems	Kennedy, Davis , Mc-Graw Hill	978-0071077828
5	Satellite Communication	Roddy Dennis, Tata Mc-Graw Hill, 2017	978-0070077850
6	Satellite Communication Concepts & Applications	Rao Raja K N, PHI 2012	978-8120347250

#### E-References:

1. Microwave Components: [www.youtube.com/microwave](http://www.youtube.com/microwave) components and devices
2. Microwave fundamentals: [www.nptlvideos.in/microwave](http://www.nptlvideos.in/microwave) engineering
3. RADAR: [www.youtube.com/RADARs](http://www.youtube.com/RADARs)
4. [www.isro.gov.in](http://www.isro.gov.in)
5. Microwave: [www.learnerstv.com/free-engineering](http://www.learnerstv.com/free-engineering)
6. Waveguide: [www.academia.edu/waveguide](http://www.academia.edu/waveguide)

#### CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	2	3	2	-	2	3	2	2
<b>CO2</b>	2	2	2	3	2	-	2	3	2	2
<b>CO3</b>	3	1	1	3	2	3	2	3	2	3
<b>CO4</b>	3	3	1	3	2	-	2	3	2	3
<b>CO5</b>	2	1	-	1	-	2	2	2	2	1

**Industry Consultation Committee:**

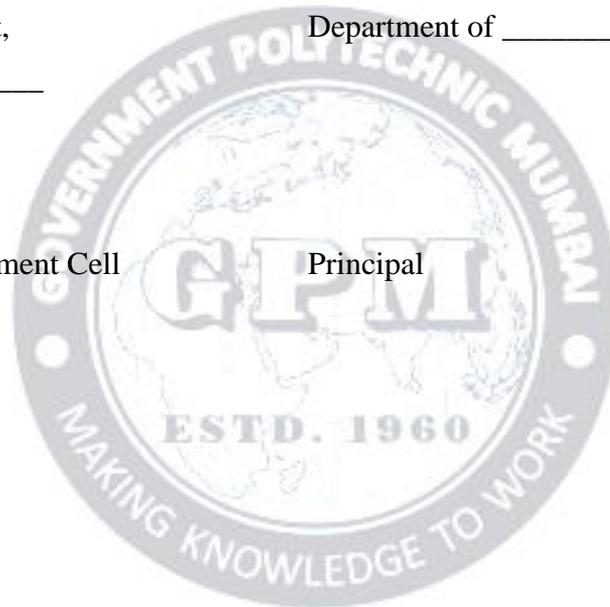
Sr. No	Name	Designation	Institute/Organisation
1	Mr. Milind R. Patil	Sr. Manager	JSW Steel Works Dolvi.
2	Mr. A.D. Vikhandkar	Selection Grade Lecturer	Government Polytechnic Pen.
3	Mrs. Pranali Gahukar	Lecturer	Government Polytechnic Pen.
4	Mrs. Suvidha M. Patil	Lecturer	Government Polytechnic Mumbai.

Coordinator,  
Curriculum Development,  
Department of \_\_\_\_\_

Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Electronics Engineering (Sandwich Pattern)</b>										
Course Code: <b>EC19411</b>				Course Title: <b>Automation</b>						
Compulsory / Optional: <b>Compulsory</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30min)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>3</b>	<b>4</b>	<b>-</b>	<b>7</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>50</b>	<b>—</b>	<b>50</b>	<b>200</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 and TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

**Note:** For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

### Rationale:

Nowadays in most of the industries for automation, monitoring and controlling various industrial operations PLC and SCADA systems are being used. Hence the knowledge of PLC and SCADA system is essential to diploma holder. This course is introduced to the students of Electronics to get familiar with PLC and SCADA systems and their industrial applications. To drive the automation to a next level, IoT is becoming an important aspect of our life . Thus in this course student will get a brief introduction about IoT and its applications.

**Course Outcomes:** Student should be able to

CO1	Understand the basic concepts of PLC.
CO2	Demonstrate the operation of PLC, identifying its elements and using various instructions for various applications.
CO3	Understand the basic concepts and working of SCADA system for various applications.
CO4	Install and configure PLC software.
CO5	Understand the basic concept of Internet of Things.

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<b>Introduction to PLC</b>
	1.1 Introduction to Automation
	1.1.1 Definition
	1.1.2 Need for Automation
	1.1.3 Levels of Automation process - Supervisor level, control level, field level
1.1.4 Types of Automation Systems – Fixed, Programmable, Flexible, Integrated	

	<p>1.1.5 Advantages and Disadvantages of Automation</p> <p>1.2 Introduction of PLC</p> <p>1.3 Advantages and Disadvantages of PLC.</p> <p>1.4 Block diagram and functions of Elements of PLC</p> <p>1.5 Input-Output Devices - Definition, examples</p> <p>1.6 Basic concept of module</p> <p>1.6.1 Types of modules: Input modules and output modules : DC I/O module, Analog I/O module , block diagram , AC I/O module</p> <p>1.6.2 Types of Instruments: Analog (Valve, motor etc.), Digital (switches, pushbuttons etc.)</p> <p>1.7 Programming devices types</p> <p>1.8 Operation of PLC</p> <p>1.9 Types of PLC: fixed and modular PLC</p> <p>1.10 Programming Languages for PLC (Introductory approach)</p> <p>1.11 Wiring diagram for connection of I/O devices ,concept of sourcing and sinking</p> <p>1.12 Specifications of PLC</p> <p><b>Course Outcome: CO1      Teaching Hours : 12 hrs      Marks: 10 (R-2, U-6, A-2)</b></p>
2	<p><b>PLC Instructions</b></p> <p>2.1 Basic concept of ladder, Rules of ladder</p> <p>2.2 Data files introduction</p> <p>2.3 Classification of PLC instructions</p> <p>2.3.1 Bit type instructions</p> <p>2.3.2 Comparison instructions</p> <p>2.3.3 Logical instructions</p> <p>2.3.4 Timer</p> <p>2.3.5 Counter</p> <p>2.3.6 Maths</p> <p>2.3.7 Advanced maths</p> <p>2.3.8 Sequencer instructions</p> <p>2.3.9 Data transfer instructions</p> <p>2.3.10 PID control instruction</p> <p>2.3.11 Bit shift</p> <p>2.3.12 Branching instructions</p> <p>2.3.13 Input / Output instructions</p> <p>2.4 Simple ladder diagrams on instruction set</p> <p><b>Course Outcome: CO2      Teaching Hours : 10hrs      Marks: 12 (R-2, U-6, A-4)</b></p>

3	<p><b>Applications/ Examples of PLC</b></p> <p>Process Diagram, logic, I/O listing, ladder diagram</p> <p>3.1 Batch process Control</p> <p>3.2 Diesel generator set control</p> <p>3.3 Drum/Bottle Filling System</p> <p>3.4 Traffic light control System</p> <p><b>Course Outcome: CO2      Teaching Hours : 6 hrs      Marks: 10 (R-2, U-2, A-6)</b></p>
4	<p><b>SCADA system</b></p> <p>4.1 Introduction to SCADA</p> <p>4.2 Elements of SCADA: RTU, MTU, COMMUNICATION INTERFACE, HMI and working of SCADA</p> <p>4.3 Benefits of SCADA</p> <p>4.4 Types of SCADA: Single master single remote, single master multiple control, multiple master multiple control</p> <p>4.5 P and ID diagram introduction</p> <p>4.6 Applications of SCADA system : Water distribution system, Batch process control</p> <p>4.7 Mimic diagram ,program, device addressing, animation, alarm generation</p> <p><b>Course Outcome: CO3      Teaching Hours : 8 hrs      Marks: 12 (R-2, U-4, A-6)</b></p>
5	<p><b>PLC software</b></p> <p>5.1 Features of PLC software</p> <p>5.2 Configuration of PLC software</p> <p>5.3 Installing PLC software</p> <p><b>Course Outcome: CO4      Teaching Hours : 3hrs      Marks: 6 (R-2, U- , A-4)</b></p>
6	<p><b>Introduction to IoT</b></p> <p>6.1 Introduction to IoT</p> <p>6.2 Benefits of IoT</p> <p>6.3 IoT Hardware</p> <p>6.4 IoT across various domains</p> <p>6.5 Introduction to Raspberry Pi, Node MCU</p> <p>6.6 IoT Application : Sensing the environment and Notifying</p> <p><b>Course Outcome: CO5      Teaching Hours : 6 hrs      Marks: 10 (R-2, U-4, A-4)</b></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to PLC	2	6	2	10
2	PLC Instructions	2	6	4	12
3	Applications/ Examples of PLC	2	2	6	10
4	SCADA system	2	4	6	12
5	PLC software	2	-	4	6
6	Introduction to IoT	2	4	4	10
<b>Total</b>		<b>12</b>	<b>22</b>	<b>26</b>	<b>60</b>

**List of experiments: Total 12 experiments (or turns) out of 15 experiments (or turns)**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Development of Basic logic functions AND gate, OR gate, NAND gate using ladder logic. Development of basic logic functions NOR gate, X-OR gate using ladder logic.(XIC,XIO,OTE Instruction)	4
2	2	CO2	Develop ladder diagram for Traffic control system and test it through PLC using TON instruction with timing diagram for all CTU/Ton/Toff/CTD/RTO	4
3	3,4	CO2, CO3	Temperature Control with given set-point using PLC. Develop ladder logic and graphics for SCADA applications	4
4	4	CO3	Create graphics display to test I/O Devices with SCADA system.	4
5	5	CO4	Configuration of PLC software	4
6	6	CO5	Control LED using RASPBERRY PI GPIO	4
7	2	CO2	Develop ladder diagram for Traffic control system and test it through PLC using TOFF instruction	4
8	2	CO2	Develop ladder diagram for Traffic control system and test it through PLC using RTO instruction	4
9	2	CO2	Develop the ladder program for counting the objects and test it with the PLC using CTU Instruction	4
10	2	CO2	Develop the ladder program for counting the objects and test it with the PLC using CTD Instruction	4
11	2	CO2	Develop Simple programs on maths instructions ( ADD,SUB,	4

			MUL ,DIV) and Comparison instructions (EQU,NEQ,LES,LEQ, GRT,GERQ,LIM), test it	
12	4	CO3	Creation of analog, digital tags and addressing of these tags.	4
13	4	CO3	Creation and configuration of alarms for analog tags and digital tag.	4
14	3	CO2	Mini project based on PLC (e.g. Motor speed control, Automatic door implementation, Filling system based on PLC, Elevator system etc.)	4
15	5	CO3	Case study of any one SCADA application (e.g. Traffic signal control, water, waste water utilities and sewage, Railway traction etc.)	4
<b>Total</b>				<b>60</b>

**Note: Experiments No. 1 to 5, 14 and 15 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.**

### References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Programmable controllers : Hardware, software and applications	George Batten, Jr., II Edition, New York : McGraw-Hill, 1994.	0070042144
2	Introduction to Programmable logic controllers	Gary Dunning, II Edition, Delmar Thomson Learning, 2001	0766817695, 9780766817692
3	SCADA: supervisory control and data acquisition	Stuart A. Boyer, II Edition, ISA, 1999	1556176600, 9781556176609
4	Programmable Logic Controller	V. R. Jadhav, III Edition, Khanna publishers, 2008	9788174092281
5	A course in Electrical and Electronic Measurements and Instrumentation	A.K.Sawhney, XI Edition, Rai, 1996	NA
6	Instrument Engineers' Handbook, Volume Two: Process Control and Optimization	Bela.G.Liptak, IV Edition, CRC Press, 2018	1420064002, 9781420064001
7	“Getting started with Internet of Things”	Cuno Pfister, I Edition, O'Reilly Media, 2011	978-1449393571, 9781449393571

### E-References:

1. <https://ndl.iitkgp.ac.in/>
2. <https://instrumentationforum.com>
3. <https://instrumentationtools.com>
4. [www.youtube.com](http://www.youtube.com)
5. <https://www.electronicshub.org>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	1	2	2	1
CO2	3	2	3	3	2	2	3	3	3	3
CO3	3	2	3	3	1	3	2	2	2	3
CO4	2	2	2	3	0	1	2	3	2	3
CO5	3	3	3	3	2	3	2	2	3	3

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Suvarna Salunke	Senior Controls Engineer	Vanderlande Industries Software Private Limited, Pune
2	Rushikesh Gawade	Director	Electroblazze Techno Solutions LLP
3	Shaktikumar Shiledar	Asst. Professor (Instrumentation)	Govt.College of Engg. Jalgaon
4	Anagha S. Aghav (Curriculum Content Designer)	Lecturer(Electronics Engineering)	Govt. Polytechnic Mumbai

Coordinator,  
Curriculum Development,  
Department of Electronics Engineering

Head of Department  
Department of Electronics Engineering

I/C, Curriculum Development Cell

Principal

Programme : <b>Diploma in Electronics Engineering (Sandwich Pattern)</b>										
Course Code: <b>EC19410</b>				Course Title: <b>VLSI</b>						
Compulsory / Optional: <b>Optional</b>										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30min)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
<b>3</b>	<b>4</b>	<b>--</b>	<b>7</b>	<b>--</b>	<b>--</b>	<b>--</b>		<b>50*</b>	<b>50</b>	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 and TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

**Note:** For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term

### 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.

**Course Outcomes:** Student should be able to

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

### Course Content Details:

Unit No	Topics / Sub-topics
<b>1</b>	<b>Introduction to CMOS Technology</b> 1.1 Comparison of BJT, NMOS and CMOS parameters. 1.2 Design of basic gates using PMOS, NMOS and CMOS logic. 1.3 Drawing complex logic equations using CMOS logic. 1.4 Fabrication process:

	1.4.1 Overview of wafer processing. 1.4.2 Oxidation. 1.4.3 Epitaxy. 1.4.4 Deposition. 1.4.5 Ion-Implementation 1.4.6 Diffusion. 1.5 P-well, N-well and twin tub process for CMOS Logic.  <b>Course Outcome: CO1</b>	<b>Teaching Hours :12</b>
<b>2</b>	<b>Introduction to VHDL</b> 2.1 Introduction to HDL: History of VHDL, Pro's and Con's of VHDL. 2.2 VHDL Flow elements of VHDL (Entity, Architecture, Configuration, Package, Library Only definition). 2.3 Data types, Operators, Operations. 2.4 Signal Constant and variables (syntax and use).  <b>Course Outcome:CO2</b>	<b>Teaching Hours : 12</b>
<b>3</b>	<b>VHDL Programming</b> 3.1 HDL Front end design flow. 3.2 Concurrent constructs. 3.3 Simple VHDL program to implement combinational and Sequential Circuits such as MUX, DEMUX, ENCODER, DECODER, ALU, Flip Flop, Counter, shift register, MOORE, MEALY Machines. 3.4 Test bench and its applications.  <b>Course Outcome:CO3</b>	<b>Teaching Hours : 12</b>
<b>4</b>	<b>Introduction to ASIC, FPGA, CPLD Architecture.</b> 4.1 ASIC Design flow. 4.2 CPLD-Internal block diagram with explanation. 4.3 FPGA-Internal block diagram with explanation. 4.4 Comparison of ASIC, FPGA and CPLD.  <b>Course Outcome: CO4</b>	<b>Teaching Hours : 9</b>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to CMOS Technology.	12				
2	Introduction to VHDL.	12				
3	VHDL Programming.	12				
4	Introduction to ASIC, EPGA, PLD.	09				
<b>Total</b>		<b>45</b>				

**Legends:** R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

**List of experiments: Total 12 experiments out of 15 experiments.**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1,2,3	1,2,3	Design and simulate CMOS Basic gates using micro wind Tool.	04
			Write VHDL Program for logic Gates.	
2	2.3.4	2.3.4	Write VHDL Program for Half and full-adder and subtractor and Synthesize using FPGA.	04
3	2.3.4	2.3.4	Write VHDL Program 8:1 Multiplexer, 1:8 Demultiplexer and Synthesize using FPGA.	04
4	2.3.4	2.3.4	Write VHDL Program 2:4 Decoder, 8:3 Encoder and Synthesize using FPGA.	04
5	2.3.4	2.3.4	Write VHDL Program for Synchronous Counter and Synthesize using FPGA.	04
			Write VHDL Program for Binary to Grey Code Converter and Synthesize using FPGA.	
6	2.3.4	2.3.4	Write VHDL Program for Interfacing of ADC, DAC and Synthesize using FPGA.	04
7	2.3.4	2.3.4	Write VHDL Program for Implementing 4 bit ALU or sequence Generator and Synthesize using FPGA.	04
8	2.3.4	2.3.4	Write VHDL Program for Scrolling of data on seven segment display and Synthesize using FPGA.	04
9	2.3.4	2.3.4	Write VHDL Program for LCD controller and Synthesize using FPGA.	04
10	2.3.4	2.3.4	Microproject-8-BIT ALU Design. Phase-I. Project Initialization-Specification.	04
11	2.3.4	2.3.4	Microproject-8-BIT ALU Design. Phase-II. System analysis and design.	04
12	2.3.4	2.3.4	Microproject-8-BIT ALU Design. Phase-III. Rapid Proto typing-Testing (Manual testing) and evaluation.	04
13	2.3.4	2.3.4	Microproject-8-BIT ALU Design. Phase-IV. Implementation-Demonstration, deployment and Orientation.	04
14	2.3.4	2.3.4	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.	04
15	2.3.4	2.3.4	Report writing ALU testing using test bench. Collect the data and prepared the report.	04
<b>Total</b>				<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	VHDL Basics of Programming.	Gaganpreet Kaur, Pearson, 2011.	8131732118, 9788131732113
2	Digital Logic: Application and Design.	John M. Yarbrough, Cengage, 2006.	9788131500583

3	An Engineering Approach to Digital Design.	William I. Fletcher, Prentice-Hall of India, 2008.	8120306511, 9788120306516
4	Principals of CMOS VLSI Design: A System Perspective.	Neil H. E. Weste Kamran. Pearson Education, 2015.	9789332542884
5	VHDL Programming by Example.	Douglas Perry, Tata McGraw-Hill, 2002.	9780071409544
6	VISI Design and EDA Tools.	Angsuman Sarkar, Scitech Publication India Ltd. 2011.	8183714528, 9788183714525

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2. <https://www.udemy.com/course/vhdl-programming-with-intel-quartus-prime-tool/>
3. <https://www.intel.com/content/www/us/en/programmable/support/training/course/ohdl1110.html>
4. <https://www.youtube.com/watch?v=mwJ3uMWvJX0>
5. <https://www.youtube.com/watch?v=ht7nEjNydDU>

**CO Vs PO and CO Vs PSO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
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

**Industry Consultation Committee:**

Sr. No	Name	Designation	Institute/Organisation
1	Mr Amol Sakhalkar	Director	Digel System.
2	Dr. J.H.Nirmal	H.O.D	K.J.Somaiya College of Engineering.
3	Mr. Anjum Mujawar	Sr. Lecturer	Vidyalankar Polytechnic.
4	Mr. Vivek Yograj Patil	Lecturer	Government Polytechnic, Mumbai.

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Head of Department  
Department of \_\_\_\_\_

I/C, Curriculum Development Cell

Principal



Programme : <b>Diploma in Electronics Engineering (Sandwich Pattern)</b>									
Course Code: <b>EC19412</b>				Course Title: <b>Introduction to AI</b>					
Compulsory / Optional: <b>Optional</b>									
Teaching Scheme and Credits				Examination Scheme					
L	P	TU	Total	TH	TS	PR	OR	TW	Total
<b>3</b>	<b>4</b>	--	<b>7</b>	--	--	--	<b>50*</b>	<b>50</b>	<b>100</b>

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , \* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

**Note:** For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

**Rationale:** AI and its techniques are being used in many areas which directly affect human life. Various techniques for encoding knowledge in computer systems such as Predicate Logic, Production rules, Semantic networks find application in real world problems. The fields of AI such as Game Playing, Natural Language Processing, and Connectionist Models are also important. Student should know some programming language for AI.

**Course Outcomes:** Student should be able to

CO1	Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
CO2	Choose an appropriate problem solving method and knowledge representation scheme.
CO3	Analyze the problem (as a state space, graph, etc.) and select the appropriate search method.
CO4	Develop simple intelligent systems or classical toy problems using different AI techniques.

**Course Content Details:**

Unit No	Topics / Sub-topics
1	<p><b>Overview of AI</b></p> <p>1.1 Introduction :Definition, Importance of AI , Difference between symbolic and non-Symbolic Representation.</p> <p>1.2 History of AI-Turning Test, Chinese room.</p> <p>1.3 Applications of AI.</p> <p>1.4 Objective of AI.</p> <p>1.5 Solving problems by searching.</p> <p>1.6 Problem Formulation.</p> <p><b>Course Outcome:CO1</b> <span style="float:right"><b>Teaching Hours:6</b></span></p>
2	<p><b>Intelligent Agents</b></p> <p>2.1 Structure of Intelligent agents.</p> <p>2.2 Types of Agents.</p> <p>2.3 Agent Environments PEAS representation for an Agent.</p> <p><b>Course Outcome:CO1</b> <span style="float:right"><b>Teaching Hours:6</b></span></p>

<b>3</b>	<p><b>Search Techniques and Methods</b></p> <p>3.1 Uniform Search Technique-DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search, Comparing Different Techniques.</p> <p>3.2 Informed Search Methods: Heuristic functions, Hill Climbing, Simulated Annealing, Best First Search, A*, IDA*, SMA*, Crypto Arithmetic Problem, Backtracking for CSP, Performance Evaluation.</p> <p>3.3 Adversarial Search: Game Playing, Min-Max Search, Alpha Beta, Pruning.</p> <p><b>Course Outcome:CO2</b> <span style="float: right;"><b>Teaching Hours:12</b></span></p>
<b>4</b>	<p><b>Knowledge and Reasoning:</b></p> <p>4.1 A Knowledge Based Agent.</p> <p>4.2 WUMPUS.</p> <p>4.3 WORLD Environment.</p> <p>4.4 Propositional Logic.</p> <p>4.5 First Order Predicate Logic.</p> <p>4.6 Forward and Backward Chaining.</p> <p>4.7 Resolution.</p> <p>4.8 Introduction to PROLOG.</p> <p><b>Course Outcome: CO4</b> <span style="float: right;"><b>Teaching Hours:6</b></span></p>
<b>5</b>	<p><b>Planning:</b></p> <p>5.1 Introduction to Planning.</p> <p>5.2 Planning with State Space Search.</p> <p>5.3 Partial Ordered planning, Hierarchical Planning.</p> <p>5.4 Conditional Planning.</p> <p>5.5 Planning with Operators.</p> <p><b>Course Outcome: CO4</b> <span style="float: right;"><b>Teaching Hours:6</b></span></p>
<b>6</b>	<p><b>Learning and AI algorithms:</b></p> <p>6.1 Learning from Observation.</p> <p>6.2 General Model of Learning Agents.</p> <p>6.3 Inductive Learning, Learning Decision Trees.</p> <p>6.4 Rote Learning, Learning by Advice.</p> <p>6.5 Learning in Problem Solving.</p> <p>6.6 Explanation based Learning</p> <p>6.7 Expert Systems: Representing and using Domain Knowledge, Expert System- shell, Explanation, Knowledge Acquisition</p> <p>6.8 Introduction to AI algorithms-Linear and Logistic Regression, Decision tree.</p> <p><b>Course Outcome: CO4</b> <span style="float: right;"><b>Teaching Hours:9</b></span></p>

**Suggested Specifications Table (Theory):**

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Overview of AI	6				
2	Intelligent Agents	6				
3	Search Techniques and Methods	12				

4	Knowledge and Reasoning:	6	
5	Planning	6	
6	Learning	9	
Total		45	

**Legends:** R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

**List of experiments: Total 12 experiments out of 15 experiments.**

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	3	2,3	Implementing Water jug problem using 1. BFS. , 2. DFS ( Un-Informed Search)	04
2	3	2,3	Implementing 8 puzzle problems with Heuristic function using Hill Climbing. ( Informed Search )	04
3	3	2,3	Implementing 8 puzzle problem with Heuristic function – Best First Search ( Informed Search )	04
4	3	2,3	Implementing 8 Queen Problem with Heuristic function ( Informed Search )	04
5	3	2,3	Implementing Tic-Tac-Toe problem to demonstrate Min – Max and Alpha Beta Pruning. ( Adversarial Search )	04
6	4	4	Implementing WUMPUS world problem. ( Knowledge and Reasoning )	04
7	4	4	Introduction to PROLOG – solving Basic problems like Factorial, Fibonacci series.	04
8	4	4	Implementing User Defined String functions etc. ( PROLOG )	04
9	4	4	Implementing Family Information System ( PROLOG )	04
10	4	4	Mini project-Implementing Mini Expert system. ( PROLOG ) Phase-I. Project Initialization-Specification.	04
11	4	4	Phase-II. System analysis and design.	04
12	4	4	Phase-III. Rapid Proto typing-Testing and evaluation.	04
13	4	4	Phase-IV. Implementation-Demonstration, deployment and Orientation.	04
14	1	1	Case studies of real artificial intelligence applications in business, including applications in marketing, finance, security, and other sectors. 1. Defining conceptual and theoretical structure. 2. Conduct pilot test and collect data. 3. Analyze the data.	04
15	1	1	4. Generate the report.	04
<b>Total</b>				<b>60</b>

**References/ Books:**

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Introduction to Artificial Intelligence	Rajendra Akerkar, PHI Learning	978-81-203-4997-

		Pvt. Ltd,2014	1
2	Artificial Intelligence: A Modern Approach.	Stuart Russell, Peter Norvig, Pearson, 2016	1292153962, 9781292153964
3	AI-Structures and Strategies for Complex Problem Solving	George Lugar, Pearson, 2011	0133001733, 9780133001730
4	Artificial Intelligence, 3rd edition	Patrick H. Winston, Pearson, 1992	9788131715055
5	A First Course in Artificial Intelligence	Deepak Khemani, McGraw Hill Publication, 2013	9781259029981 1259029981

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3. [https://www.tutorialspoint.com/artificial\\_intelligence/artificial\\_intelligence\\_agents\\_and\\_environments.htm](https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_agents_and_environments.htm)
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9. <https://www.edx.org/professional-certificate/microsoft-artificial-intelligence>

**CO VsPO and CO Vs PSOMapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	2	2	2	2	2
CO2	2	3	3	3	2	3	1	2	3	3
CO3	2	3	3	3	2	3	1	2	3	3
CO4	2	3	3	3	1	3	2	3	3	3

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